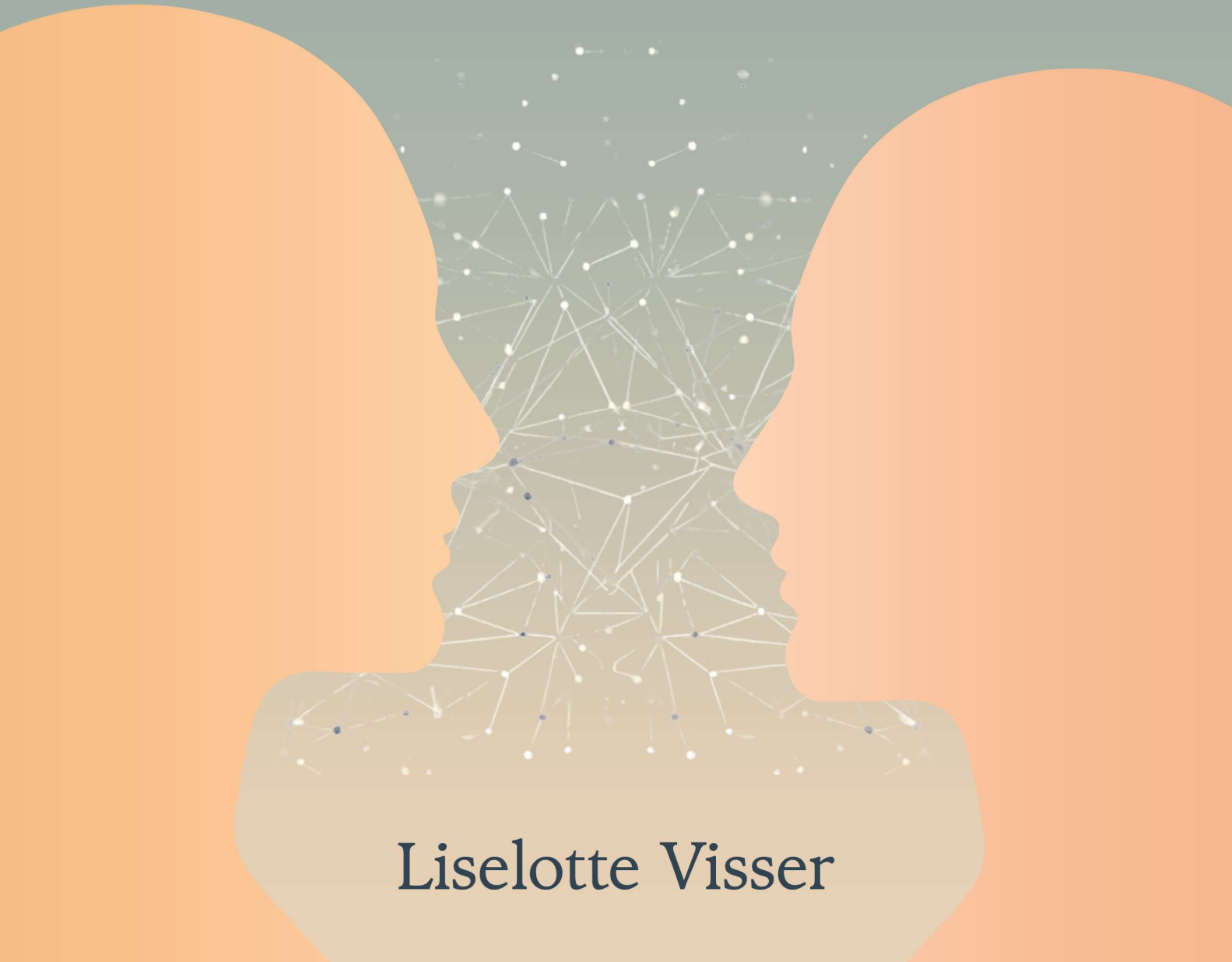


Psychology of Matchmaking

Personality, Self-Esteem, and Attachment as Predictors of Romantic Relationship Formation



Liselotte Visser

This dissertation examines which psychological factors predict romantic relationship formation in the context of professional matchmaking. In contrast to most relationship research, which focuses on self-directed dating environments such as online dating or speed dating, this research investigates partner selection within a structured and professionally guided setting aimed at long-term relationship formation.

Across five empirical studies, the predictive value of personality traits, and implicit and explicit measures of self-esteem and attachment were examined in relation to actual relationship formation following professional matches. The findings suggest that the predictive value of commonly studied psychological characteristics may depend partly on the structure of the dating context. Personality traits, self-esteem, and most implicit measures showed limited predictive value within this matchmaking context, whereas explicit anxious attachment was negatively associated with relationship formation.

By combining naturalistic relationship data with psychological theory, this dissertation contributes to a more nuanced understanding of partner selection and relationship formation in contemporary adult populations.

ISBN: 978-90-830635-4-6

Liselotte Visser

© 2026 Venlo



Open Universiteit

© Liselotte Visser, 2026

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior permission of the author or, where applicable, the copyright-owning journals of previously published chapters.

The research presented in this thesis was conducted at the Open Universiteit, Heerlen, the Netherlands.

The Psychology of Matchmaking

Personality, Self-Esteem, and Attachment as Predictors of Romantic Relationship Formation

PROEFSCHRIFT

ter verkrijging van de graad van doctor aan de Open Universiteit
op gezag van de rector magnificus prof. dr. Th.J. Bastiaens,
ten overstaan van een door het College voor promoties ingestelde commissie,
in het openbaar te verdedigen op vrijdag 18 september 2026 te Heerlen om 13.30 uur precies
door
Liesbeth Visser
geboren op 30 januari 1967 te Amsterdam

Promotores:

Prof. dr. N.E. Jacobs, Open Universiteit

Prof. dr. J.J.D.M. van Lankveld, Open Universiteit

Copromotores:

Dr. J. Lataster, Open Universiteit

Dr. R.J. Pat-El, Open Universiteit

Leden van de promotiecommissie:

Prof. dr. A. Buysse, Universiteit Gent

Prof. dr. J.C.T.M. Karremans, Radboud Universiteit

Prof. dr. T.L. Orbuch, Oakland University

Prof. dr. H.J.A. van Bakel, Open Universiteit

Dr. T.M. Pronk, Tilburg University

Samenvatting

De psychologie van matchmaking: Persoonlijkheid, zelfwaardering en hechting als voorspellers van romantische relatievorming.

In de afgelopen decennia is het aantal alleenstaande volwassenen in Westerse samenlevingen toegenomen, ondanks de brede beschikbaarheid van digitale datingtechnologieën. Vooral singles vanaf middelbare leeftijd ervaren frustratie over het vinden van een passende partner, waarbij oppervlakkige selectiecriteria en een gebrek aan diepgang in contacten vaak worden genoemd als struikelblokken. In reactie hierop groeit de belangstelling voor professionele matchmaking: een begeleide vorm van partnerselectie, waarbij cliënten worden gekoppeld op basis van verschillende, deels psychologisch geïnformeerde criteria.

Hoewel er veel onderzoek bestaat naar partnerkeuze en relatievorming, is dit onderzoek grotendeels gebaseerd op zelfgestuurde datingcontexten, zoals speeddating en online dating, waarin partnerkeuzes vaak tot stand komen op basis van snelle indrukken en eerste evaluaties. Deze dissertatie richt zich daarom op professionele matchmaking als een specifieke context van partnerselectie, waarin keuzes gedeeltelijk extern worden gestuurd en expliciet gericht zijn op het aangaan van een duurzame relatie. Binnen deze context wordt onderzocht welke psychologische factoren — persoonlijkheid (Big Five), eigenwaarde en hechtingsstijl — bijdragen aan het daadwerkelijk ontstaan van een romantische relatie.

In vijf empirische studies is onderzocht in hoeverre deze factoren het ontstaan van een romantische relatie binnen drie maanden na een voorgestelde match voorspellen. De resultaten laten zien dat expliciete angstige hechting — gekenmerkt door wat in deze dissertatie wordt aangeduid als intimiteitsspanning: de spanning die ontstaat wanneer verlangen naar nabijheid samenvalt met onzekerheid en gevoeligheid voor afwijzing — een significante negatieve voorspeller is van relatievorming: personen met een hogere mate van hechtingsangst hebben een aanzienlijk kleinere kans om een relatie aan te gaan. Daarentegen blijken persoonlijkheidstrekken (Big Five), vermijdende hechting en eigenwaarde - zowel expliciet als impliciet gemeten - geen significante voorspellers van relatievorming binnen deze matchmakingcontext.

De studies dragen bij aan de wetenschappelijke literatuur op drie niveaus. Ten eerste wordt het belang van hechtingsprocessen, en met name angstige hechting, in de vroege fase van relatievorming onderstreept, zelfs binnen een gestructureerde en begeleide context. Ten tweede bieden de studies methodologische inzichten in het gebruik van impliciete metingen en discrepantiescores, waaronder de ontwikkeling en toepassing van een impliciete maat voor hechting, die in deze context een beperkte voorspellende waarde blijkt te hebben. Ten derde benadrukken de bevindingen het belang van context: in professionele matchmaking, waar zelfpresentatie en partnerselectie deels extern worden gereguleerd, kunnen voorspellers die in andere datingcontexten, zoals speeddating of online dating, vaak wel voorspellend zijn — zoals extraversie en eigenwaarde — hun verklarende kracht verliezen.

Deze dissertatie benadrukt dat relatievorming mede wordt bepaald door de context en de structuur van het ontmoetingsproces, maar ook door de rol van intimiteitsspanning in de vroege fase van relatievorming. De bevindingen hebben praktische implicaties voor matchmakingprofessionals, maar ook voor singles die een relatie zoeken door inzicht te bieden in welke factoren succesvolle relatievorming kunnen belemmeren. Tegelijkertijd leveren ze een bijdrage aan de theoretische discussie over de interactie tussen individuele eigenschappen en relationele contexten. Daarmee draagt dit onderzoek bij aan zowel de wetenschappelijke als de maatschappelijke kennis over hoe duurzame romantische relaties tot stand komen.

Summary

In recent decades, the number of single adults in Western societies has increased, despite the widespread availability of digital dating technologies. Especially singles from midlife onwards experience frustration in finding a suitable partner, with superficial selection criteria and a lack of depth in interactions often being mentioned as important obstacles. In response, there is a growing interest in professional matchmaking: a guided form of partner selection in which clients are matched on the basis of various, partly psychologically informed criteria.

Although a substantial body of research exists on partner choice and relationship formation, this research is largely based on self-directed dating contexts, such as speed dating and online dating, in which partner choices often emerge on the basis of rapid impressions and initial evaluations. This dissertation therefore focuses on professional matchmaking as a specific context of partner selection, in which choices are partially externally guided and explicitly aimed at entering into a long-term romantic relationship. Within this context, the study examines which psychological factors — personality (Big Five), self-esteem, and attachment style — contribute to the actual formation of a romantic relationship.

Across five empirical studies, it was examined to what extent these factors predict the formation of a romantic relationship within three months after the initial match. The results show that explicit anxious attachment — characterized by what is referred to in this dissertation as intimacy tension: the tension that arises when the desire for closeness coincides with uncertainty and sensitivity to rejection — is a significant negative predictor of relationship formation: individuals with higher levels of attachment anxiety have a substantially lower likelihood of entering into a relationship. In contrast, personality traits (Big Five), avoidant attachment, and self-esteem, measured both explicitly and implicitly, do not appear to be significant predictors of relationship formation within this matchmaking context.

The studies contribute to the scientific literature on three levels. First, they underline the importance of attachment processes, and in particular anxious attachment, in the early phase of relationship formation, even within a structured and guided context. Second, the studies provide methodological insights into the use of implicit measures and discrepancy scores, including the development and application of an implicit measure of attachment, which appears to have limited predictive value in this specific context. Third, the findings emphasize the importance of context: in professional matchmaking, where self-presentation and partner selection are partly externally regulated, predictors that are often found to be relevant in other dating contexts, such as speed dating or online dating — including extraversion and self-esteem — may lose their explanatory power.

This dissertation emphasizes that relationship formation is partly determined by the context and the structure of the encounter process, but also by the role of intimacy tension, a descriptive term used to capture the tension that arises when the desire for closeness coincides with uncertainty and sensitivity to rejection, in the early phase of relationship formation.

The findings have practical implications for matchmaking professionals, but also for singles who are seeking a relationship, by offering insight into which factors may hinder relationship formation.

At the same time, they contribute to the theoretical discussion on the interaction between individual characteristics and relational contexts. In doing so, this research contributes to both scientific and societal knowledge about how sustainable romantic relationships are formed.

Inhoud

The Psychology of Matchmaking	iii
Samenvatting	v
Summary	vii
Chapter 1. Introduction	1
1.1 Societal and Scientific Background	1
1.2 Research Gaps and Core Problem	2
1.3 Theoretical Framework	3
1.4 Methodological Approach	4
1.5 Overview of the Studies	5
References	6
Chapter 2. Big Five Personality Traits	9
Abstract	9
2.1 Introduction	9
2.2 Materials and Methods	12
2.2.1 Participants	12
2.2.2 Procedure	13
2.2.3 Materials	14
2.3 Data Analysis	15
2.4 Results	15
2.4.1 Descriptives	15
2.4.2 Correlations	16
2.4.3 Logistic Regression: main effects	16
2.4.4 Interaction Model and Gender-Specific Effects	17
2.5 Discussion	18
2.6 Strengths, limitations and future research	19
Strengths	19
Limitations	20
2.7 Conclusion	20
References	22
Chapter 3. Implicit Adult Attachment	27

Abstract.....	27
3.1 Introduction	27
3.2 Materials and Methods.....	31
3.2.1 Participants and procedure.....	31
3.2.2 Measures.....	31
3.3 Data analyses	33
3.4 Results.....	34
3.4.1 Descriptives	34
3.4.2 Reliability.....	35
3.4.3 Correlations between measures.....	35
3.4.4 Regression analyses.....	36
3.5 Discussion.....	40
3.6 Limitations.....	42
3.7 Conclusion	43
References.....	44
Chapter 4. Self-esteem, Attachment and Relationship Formation	51
Abstract.....	51
4.1 Introduction	51
4.1.1 The Context of Matchmaking.....	52
4.1.2 Self-esteem and Attachment in Relationship Formation.....	52
4.1.3 Explicit and Implicit Dimensions.....	53
4.1.4 Hypotheses.....	54
4.2 Methods and materials.....	54
4.2.1 Participants.....	54
4.2.2 Procedure	55
4.3 Data analyses	56
4.3.1 Data	56
4.3.2 Analysis strategy.....	57
4.4 Results	57
4.4.1 Descriptives	57
4.4.2 Predicting relationship formation.....	58

4.5 Discussion.....	59
4.5.1 Strengths.....	61
4.5.2 Limitations.....	62
4.5.3 Future research.....	62
4.5.4 Implications.....	63
4.6 Conclusion	63
References.....	64
Chapter 5. Self-Esteem and Attachment in Singles and Partnered Adults.....	70
Abstract.....	70
5.1 Introduction	70
5.1.1 Self-Esteem and Attachment as Key Factors in Relationship Dynamics.....	71
5.1.2 The association between attachment and self-esteem.....	71
5.1.3 Explicit and Implicit Self-Esteem in Relation to Attachment.....	72
5.1.4 Current Study.....	73
5.1.5 Hypotheses.....	73
5.2 Methods	74
5.2.1 Participants.....	74
5.2.2 Study Design.....	74
5.2.3 Measures.....	74
5.3. Data Analysis.....	76
5.3.1 Preliminary Analyses.....	76
5.3.2 Main Analyses.....	76
5.3.3 Exploratory Analyses.....	77
5.4 Results.....	77
5.4.1 Sample Characteristics and Descriptive Statistics.....	77
5.4.2 Regression Analyses in Singles Sample	78
5.4.3 Regression Analyses in Partnered Sample	79
5.5 Discussion.....	79
5.5.1 Patterns of Association.....	79
5.5.2 Interpreting effect sizes and practical relevance.....	81
5.5.3 Strengths and limitations.....	81

5.5.4 Implications for Clinical Practice	82
5.6 Conclusion	82
References.....	84
Chapter 6. Discrepancy-based modelling in attachment and self-esteem research	88
Abstract.....	88
6.1 Introduction	88
6.2 Method	92
6.2.1 Participants.....	92
6.2.2 Materials and Procedure.....	92
6.2.3 Data analyses.....	94
6.3 Results.....	100
6.4 Discussion.....	109
6.4.1 Discussion of results.....	109
6.4.2 Limitations.....	111
6.5 Conclusion	112
References.....	114
Chapter 7. General Discussion.....	118
7.1 Overview of the Main Findings.....	118
7.2 Interpretation of the Findings in the Matchmaking Context.....	119
7.2.1 A Persistent Role of Anxious Attachment?	119
7.2.2 The Differential Predictive Value of Explicit versus Implicit Attachment.....	121
7.2.3 Personality and Self-Esteem: Context-Dependent Buffering.....	122
7.2.4 The Structured Dating Context Model.....	123
7.3 Reflections on the Methodology.....	125
7.3.1 Operationalization of Success	125
7.3.2 Sample Characteristics and Generalizability	125
7.3.3 Measurement Considerations.....	125
7.3.4 Timing and Context Effects.....	126
7.4 Suggestions for Future Research	126
7.4.1 Longitudinal and Dyadic Designs.....	126
7.4.2 Mechanisms of Guided Matchmaking.....	126

7.4.3 Individualized Matching Strategies	127
7.4.4 Broader Populations and Cultural Contexts.....	128
7.4.5 Intervention Studies	128
7.5 Practical and Scientific Relevance	129
7.5.1 Practical Implications for Matchmakers and Coaches	129
7.5.2 Methodological Insights and Model Development	130
7.5.3 Contributions to Psychological Science	130
7.6 Integrative conclusion	131
References.....	132
Acknowledgements	136
Curriculum Vitae.....	137

Chapter 1. Introduction

1.1 Societal and Scientific Background

Romantic relationships are widely recognized as a cornerstone of well-being and psychological health. Individuals in committed partnerships tend to report higher life satisfaction, better mental resilience, and improved physical health compared to those who are unpartnered (Robles et al., 2014; Grundström et al., 2021). These findings are consistent with earlier literature reviews showing that married individuals tend to experience higher levels of personal well-being than their unmarried counterparts (Coombs, 1991). Yet in recent years, the number of adults living without a partner has increased across many Western countries, despite the rise of dating technologies. In the Netherlands, in 2019 approximately 2.8 million adults lived without a romantic partner (SCP). In 2021, 41% of Dutch adults lived without a cohabiting partner (CBS), although this does not necessarily imply the absence of a romantic relationship. While a substantial proportion of the adult population does not have a committed partner, the desire for romantic connection remains widespread. Population-based studies indicate that approximately 80% of single adults are either actively or passively seeking a partner (SCP, 2019). This central role of romantic relationships in human life aligns with the theory proposed by Baumeister and Leary (1995), who argue that humans have a fundamental need to form and maintain close, positive interpersonal bonds.

This discrepancy between relational aspirations and outcomes is especially pronounced in midlife. Many singles in this age group report disillusionment or fatigue in navigating the contemporary dating landscape (Akhter-Khan et al., 2022). Unlike younger adults, they are often more intentional in their search and seek deeper compatibility rather than casual encounters. However, most dating platforms are not designed for these motives. Online dating, while efficient in terms of access, tends to promote rapid, appearance-based selection with limited interpersonal context (Finkel et al., 2012). As a result, it often fails to support reflective partner choice or long-term relational goals.

In response to this, a growing number of adults have turned to professional matchmaking services. These services offer structured introductions based on in-depth psychological profiling, combined with personalized guidance throughout the dating process (Sharabi, 2024). Between 2013 and 2024, the number of professional matchmakers worldwide increased from approximately 10,000 to over 17,000 (Global Love Institute, 2024), reflecting a growing demand for more deliberate, guided forms of romantic connection.

While professional matchmaking may seem like a modern innovation, it also echoes more traditional forms of partner selection. In many non-Western cultures, arranged marriages and community-based partner introductions remain common. These systems—though diverse in structure—share three key features with modern matchmaking: third-party involvement, intentionality, and attention to long-term compatibility. Such forms of partner selection may activate more abstract, future-oriented evaluations than spontaneous encounters, and have been associated with stable and satisfying outcomes (Regan et al., 2012; Eastwick & Finkel, 2008; Fletcher et al., 2000). Studying

guided partner selection in contemporary Western settings, such as professional matchmaking, may thus offer valuable insights into how structured relational processes shape romantic outcomes.

However, this shift toward structured partner selection also raises a fundamental question: to what extent do psychological predictors identified in self-directed dating contexts generalize to environments in which partner selection is externally guided and deliberately structured? If the mechanisms underlying partner choice differ across contexts, established predictors such as personality and self-esteem may not operate in the same way.

1.2 Research Gaps and Core Problem

While structured partner selection approaches show promise, relatively little is known about which individual psychological characteristics may facilitate or hinder success within these guided contexts. Despite the growing societal interest in matchmaking, three key gaps remain in the scientific literature:

- **Target population:** There is a lack of research on adults in midlife who seek long-term relationships via guided matchmaking.
- **Outcome definition:** Most studies do not define successful partner choice in terms of actual relationship formation.
- **Measurement approach:** Psychological predictors are typically assessed using explicit self-report alone, ignoring the potential role of implicit processes.

Existing research on personality and relationship formation has primarily focused on three dating contexts, each with important limitations for understanding matchmaking. Speed-dating studies consistently show that extraversion and physical attractiveness predict initial romantic interest (Back et al., 2011; McClure et al., 2010), but these settings favor rapid, appearance-based judgments rather than the deliberate compatibility assessments characteristic of matchmaking. Online dating research revealed that broad personality traits have limited predictive value for relationship success (Finkel et al., 2012; Joel et al., 2017), though this context still emphasizes self-presentation and photo-based initial selection. Laboratory studies of relationship formation, while methodologically rigorous, typically measure stated preferences rather than actual relationship outcomes (Todd et al., 2007).

Professional matchmaking differs fundamentally from these contexts: it involves third-party selection based on in-depth psychological profiling, photo-free initial introductions, and professional coaching throughout the process. This structured approach may alter the psychological processes underlying partner selection, potentially making different individual characteristics predictive of success. By investigating psychological predictors within this unique context, the current research offers insights into how individual characteristics predict relationship formation when partner selection is externally guided and systematically structured.

These gaps underscore the urgency and relevance of studying guided partner selection in midlife, with clear implications for individual and public well-being. This dissertation aims to bridge these knowledge gaps by studying real-world romantic choices in a structured and naturalistic setting. This raises the question whether psychological predictors identified in other dating contexts retain their

predictive value in such structured matchmaking environments, or whether different mechanisms may be at play when partner selection is externally guided. The central research question is: Which psychological factors predict relationship formation in the context of professional matchmaking?

This research question has both theoretical and practical implications, but it is important to clarify its scope. While motivated by contemporary dating challenges, this dissertation does not investigate societal trends themselves. Rather, it focuses specifically on psychological predictors—examining how individual characteristics like personality, attachment, and self-esteem predict relationship formation within the structured context of professional matchmaking.

1.3 Theoretical Framework

Matchmaking can be understood as part of a broader class of guided partner selection processes, which also includes forms of arranged marriage prevalent in many non-Western cultures. As mentioned above, these systems share three key characteristics: third-party involvement, a deliberate intention to form a long-term bond, and attention to compatibility beyond immediate attraction. Comparative research suggests that, under conditions of voluntariness and cultural congruence, arranged relationships can yield outcomes equal to or even better than self-initiated ones in terms of relationship satisfaction and longevity (Regan et al., 2012). This challenges the commonly held Western assumption that romantic relationships based on spontaneous emotional connection are inherently superior.

From a psychological perspective, matchmaking engages higher-order cognitive processes. According to Construal Level Theory (Trope & Liberman, 2010), indirect partner selection—such as evaluating written profiles or receiving introductions through a third party—activates more abstract thinking, due to increased psychological distance. This form of high-level construal is associated with broader, goal-related evaluations, which may include long-term compatibility. This contrasts with the immediate, appearance-based judgments typical in face-to-face or app-based dating (Eastwick & Finkel, 2008). Such abstract evaluation may foster better alignment with long-term relationship goals and values. Indeed, studies have shown that partner choices made through reflective, profile-based evaluation are more predictive of lasting satisfaction than decisions made in speed dating or app environments (Fletcher et al., 1999; Hunt et al., 2015).

Professional matchmaking provides an ecologically valid context for studying romantic decision-making because it combines real-world relationship outcomes with systematic psychological assessment. This setting allows researchers to examine how personality traits, attachment patterns, and self-esteem relate to actual relationship formation rather than stated preferences or laboratory-based measures. Research consistently shows that what individuals claim to seek in a partner often diverges from their actual partner choices in real-life dating situations (Todd et al., 2007). By studying behavior in naturalistic settings where genuine relationship formation occurs, researchers can better understand the psychological factors that predict romantic success beyond expressed preferences or hypothetical scenarios.

This theoretical perspective implies that the predictive value of individual psychological characteristics may vary depending on the structure of the dating context. However, this assumption

has not yet been empirically tested in real-world settings where relationship formation is the actual outcome.

1.4 Methodological Approach

We conceptualize matchmaking as a structured psychological selection process. Unlike casual dating, it involves deliberate choices informed by psychological profiling. This structured approach may alter how psychological traits relate to relationship formation outcomes.

Three psychological domains are central in this thesis:

- Personality traits (Big Five model) reflect broad behavioral tendencies such as sociability and emotional stability.
- Self-esteem reflects a global, individual evaluation of one's self-worth. Although not inherently relational, it may nonetheless influence how individuals navigate social evaluation and potential rejection in romantic contexts.
- Attachment styles, characterized by anxiety and avoidance, shape the way individuals approach intimacy and autonomy.

Previous research has established links between these factors and relationship outcomes: personality traits predict both initial attraction in speed-dating contexts (extraversion, openness; Back et al., 2011; low neuroticism, high extraversion, agreeableness, and conscientiousness; Luo & Zhang, 2009) and long-term relationship satisfaction and stability (conscientiousness, low neuroticism; Malouff et al, 2010; Mikulincer & Shaver, 2016; Weidmann et al., 2016).

Self-esteem influences romantic confidence, rejection sensitivity, and the ability to balance connection with independence (Murray et al., 2006; Cameron & Granger, 2019). Attachment styles shape dating success and relationship initiation, with anxious attachment consistently predicting poorer outcomes in speed-dating and online dating contexts (McClure et al., 2010; Sharabi & Caughlin, 2017). However, these constructs have not been systematically examined within structured matchmaking contexts, where external guidance may alter their predictive value. These constructs capture both stable individual differences (traits) and dynamic, relationally embedded tendencies (self-concept and relational schemas). This focus allows for a more nuanced understanding of how people navigate early romantic decisions, balancing dispositional tendencies with context-dependent vulnerabilities. Such an integrative perspective also resonates with evolutionary models that conceptualize romantic pair-bonding as an adaptive strategy for long-term cooperation and survival (Fletcher et al., 2015).

The outcome measure across the empirical studies in this dissertation was relationship formation, operationalized as a binary variable (yes/no): whether participants entered a committed romantic relationship within three months of their initial match. This was assessed by contacting both individuals independently and asking whether they wished to continue the relationship. A match was coded as successful (yes) only when both partners independently confirmed their intention to pursue the relationship further. This criterion provides a clear, behavioral indicator of relationship initiation that goes beyond initial attraction or stated preferences, capturing actual commitment decisions in a real-world dating context.

In this dissertation, self-esteem and attachment styles are measured both explicitly (via questionnaires) and implicitly (via reaction-time tasks such as the Implicit Association Test, IAT). This dual-process perspective allows us to study both controlled and automatic influences on relational behavior. Prior research shows that implicit measures can reveal attitudes and tendencies that are not accessible through introspection and may uniquely predict behavior in emotionally charged or ambiguous contexts (Greenwald et al., 2009).

This research adopts an ecological approach by studying psychological predictors within the naturalistic context of professional matchmaking. This methodological choice reflects the theoretical principle that relationship formation processes may operate differently across dating contexts. By examining actual relationship formation as the outcome criterion, capturing the transition from initial contact to committed partnership rather than immediate attraction or platform engagement, this research design prioritizes external validity while enabling rigorous hypothesis testing.

This approach enables not only the examination of individual predictors, but also a comparison of their relative contribution within a structured dating context, allowing for a more precise evaluation of which psychological processes are relevant for relationship formation under guided conditions.

1.5 Overview of the Studies

The following five studies systematically investigated psychological predictors of relationship formation within professional matchmaking contexts. While each study addresses a distinct empirical question, together they clarify how psychological predictors of relationship formation may depend on the structure of the dating context. Rather than starting from a single theoretical model, the project proceeds empirically: Study 1 investigates whether Big Five personality traits show predictive value in professional matchmaking; Study 2 develops and validates implicit attachment measures; Study 3 examines whether self-esteem and attachment styles (both explicit and implicit) predict relationship formation; Study 4 clarifies the relationships between implicit and explicit measures of self-esteem and attachment orientation; and Study 5 addresses methodological questions about analysing implicit-explicit discrepancies.

By examining whether established predictors such as personality, self-esteem, and attachment hold explanatory value in a professionally guided dating context, the studies together offer a basis for the interpretive synthesis developed in the concluding chapter. The concluding chapter develops a tentative integrative framework - the Structured Dating Context Model (SDCM) - derived from the observed findings, which situate these results within a broader theoretical perspective on structured dating environments.

References

- Akhter-Khan, S. C., Prina, M., Wong, G. H.-Y., Mayston, R., & Li, L. (2022). Understanding and Addressing Older Adults' Loneliness: The Social Relationship Expectations Framework. *Perspectives on Psychological Science*, 18(4), 762-777. <https://doi.org/10.1177/17456916221127218>
- Back, M. D., Penke, L., Schmukle, S. C., Sachse, K., Borkenau, P., & Asendorpf, J. B. (2011). Why mate choices are not as reciprocal as we assume: The role of personality, flirting, and physical attractiveness in speed-dating. *European Journal of Personality*, 25(2), 120-132. <https://doi.org/10.1002/per.806>
- Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, 117(3), 497-529. <https://doi.org/10.1037/0033-2909.117.3.497>
- Cameron, J. J., & Granger, S. (2019). Does self-esteem have an interpersonal imprint beyond self-reports? A meta-analysis of self-esteem and objective interpersonal indicators. *Personality and Social Psychology Review*, 23(1), 73-102. <https://doi.org/10.1177/1088868318756532>
- Centraal Bureau voor de Statistiek. (2021). Dashboard Bevolking: Alleenstaanden. <https://www.cbs.nl/nl-nl/visualisaties/dashboard-bevolking/regionaal/alleenstaanden> (retrieved May 10, 2021).
- Coombs, R. H. (1991). Marital status and personal well-being: A literature review. *Family Relations*, 40(1), 97-102. <https://doi.org/10.2307/585665>
- Eastwick, P. W., & Finkel, E. J. (2008). Sex differences in mate preferences revisited: Do people know what they initially desire in a romantic partner? *Journal of Personality and Social Psychology*, 94(2), 245-264. <https://doi.org/10.1037/0022-3514.94.2.245>
- Finkel, E. J., Eastwick, P. W., Karney, B. R., Reis, H. T., & Sprecher, S. (2012). Online dating: A critical analysis from the perspective of psychological science. *Psychological Science in the Public Interest*, 13(1), 3-66. <https://doi.org/10.1177/1529100612436522>
- Fletcher, G. J. O., Simpson, J. A., Thomas, G., & Giles, L. (1999). Ideals in intimate relationships. *Journal of Personality and Social Psychology*, 76(1), 72-89. <https://doi.org/10.1037/0022-3514.76.1.72>
- Fletcher, G. J. O., Simpson, J. A., & Thomas, G. (2000). Ideals, perceptions, and evaluations in early relationship development. *Journal of Personality and Social Psychology*, 79(6), 933-940. <https://doi.org/10.1037/0022-3514.79.6.933>
- Fletcher, G. J. O., Simpson, J. A., Campbell, L., & Overall, N. C. (2015). Pair-bonding, romantic love, and evolution: The curious case of Homo sapiens. *Perspectives on Psychological Science*, 10(1), 20-36. <https://doi.org/10.1177/1745691614561683>
- Global Love Institute. (2024). Global matchmaking industry report: Growth, trends, and client demographics. Unpublished internal report.
- Greenwald, A. G., Poehlman, T. A., Uhlmann, E. L., & Banaji, M. R. (2009). Understanding and using the Implicit Association Test III: Meta-analysis of predictive validity. *Journal of Personality and Social Psychology*, 97(1), 17-41. <https://doi.org/10.1037/a0015575>

- Grundström, J., Konttinen, H., Berg, N., & Kiviruusu, O. (2021). Associations between relationship status and mental well-being in different life phases from young to middle adulthood. *SSM – Population Health*, 14, Article 100774. <https://doi.org/10.1016/j.ssmph.2021.100774>
- Hunt, L. L., Eastwick, P. W., & Finkel, E. J. (2015). Leveling the playing field: Longer acquaintance predicts reduced assortative mating on attractiveness. *Psychological Science*, 26(7), 1046–1053. <https://doi.org/10.1177/0956797615579273>
- Joel, S., Eastwick, P. W., & Finkel, E. J. (2017). Is romantic desire predictable? Machine learning applied to initial romantic attraction. *Psychological Science*, 28(12), 1841–1853. <https://doi.org/10.1177/0956797617714580>
- Luo, S., & Zhang, G. (2009). What leads to romantic attraction: Similarity, reciprocity, security, or beauty? Evidence from a speed-dating study. *Journal of Personality*, 77(4), 933–964. <https://doi.org/10.1111/j.1467-6494.2009.00570.x>
- Malouff, J. M., Thorsteinsson, E. B., Schutte, N. S., Bhullar, N., & Rooke, S. E. (2010). The Five-Factor Model of personality and relationship satisfaction of intimate partners: A meta-analysis. *Journal of Research in Personality*, 44(1), 124–127. <https://doi.org/10.1016/j.jrp.2009.09.004>
- McClure, M. J., Lydon, J. E., Baccus, J. R., & Baldwin, M. W. (2010). A Signal Detection Analysis of Chronic Attachment Anxiety at Speed Dating: Being Unpopular Is Only the First Part of the Problem. *Personality and Social Psychology Bulletin*, 36(8), 1024–1036. <https://doi.org/10.1177/0146167210374238>
- Mikulincer, M., & Shaver, P. R. (2016). Attachment in adulthood: Structure, dynamics, and change (2nd ed.). Guilford Press.
- Murray, S. L., Holmes, J. G., & Collins, N. L. (2006). Optimizing assurance: The risk regulation system in relationships. *Psychological Bulletin*, 132(5), 641–666. <https://doi.org/10.1037/0033-2909.132.5.641>
- Netherlands Institute for Social Research (SCP). (2019). *Living alone in the Netherlands: The social situation of single adults*. The Hague: SCP.
- Regan, P. C., Lakhanpal, S., & Anguiano, C. (2012). Relationship Outcomes in Indian-American Love-Based and Arranged Marriages. *Psychological Reports*, 110(3), 915–924. <https://doi.org/10.2466/21.02.07.PR0.110.3.915-924>
- Robles, T. F., Slatcher, R. B., Trombello, J. M., & McGinn, M. M. (2014). Marital quality and health: A meta-analytic review. *Psychological Bulletin*, 140(1), 140–187. <https://doi.org/10.1037/a0031859>
- Sharabi, L. L., & Caughlin, J. P. (2017). What predicts first date success? A longitudinal study of modality switching in online dating. *Personal Relationships*, 24(2), 370–391. <https://doi.org/10.1111/pere.12188>
- Sharabi, L. L. (2024). Love, (un)automated: Human matchmaking in the era of online dating. *Journal of Social and Personal Relationships*, 41(11), 3293–3315. <https://doi.org/10.1177/02654075241264720>

- Todd, P. M., Penke, L., Fasolo, B., & Lenton, A. P. (2007). Different cognitive processes underlie human mate choices and mate preferences. *Proceedings of the National Academy of Sciences*, 104(38), 15011–15016. <https://doi.org/10.1073/pnas.0705290104>
- Trope, Y., & Liberman, N. (2010). Construal-level theory of psychological distance. *Psychological Review*, 117(2), 440–463. <https://doi.org/10.1037/a0018963>
- Weidmann, T., Ledermann, T., & Grob, A. (2016). Big Five traits and relationship satisfaction: The mediating role of self-esteem. *Journal of Research in Personality*, 65, 119–130. <https://doi.org/10.1016/j.jrp.2016.06.001>

Chapter 2. Big Five Personality Traits

This chapter is published as:

Visser, L., Pat-El, R., Lataster, J., Van Lankveld, J., & Jacobs, N. (2025). The relation between Big Five personality traits and relationship formation through matchmaking. *Psychology International*, 7, 52. <https://doi.org/10.3390/psycholint7020052>

Abstract

Previous research has linked Big Five personality traits—agreeableness, openness to experience, neuroticism, extraversion, and conscientiousness—to relationship initiation in speed dating and relationship quality in long-term relationships. However, little is known about their role in matchmaking, where a matchmaker selects potential partners based on individual preferences and guides the dating process. This study examined whether the Big Five personality traits predict relationship formation in a matchmaking context. The sample included 1704 participants (48.5% men, 51.5% women; mean age = 62.5 years) living in the Netherlands. Personality was measured at baseline using the NEO-FFI questionnaire. Relationship formation success was defined as being in a relationship for at least three months. None of the Big Five traits predicted matchmaking success. Personality traits did not significantly predict relationship success in professionally guided matchmaking, suggesting that personality may play a limited role in this particular dating context.

2.1 Introduction

For heterosexual couples in the United States, online dating became the most common way to form romantic connections, surpassing introductions through friends, (Rosenfeld et al., 2019). The commercial online dating industry is valued at billions of dollars and impacts millions of people each year (Finkel et al., 2012). Matchmaking was historically characterized by real-life interactions and facilitated by religious and community leaders (Finkel et al., 2012; Sprecher et al., 2008). In contemporary contexts, however, it is typically offered as a secular and personalized service. This kind of matchmaking – offline, i.e., in real life, guided by a professional matchmaker, - seems to be on the rise again, largely driven by dissatisfaction with online dating (Hill, 2023; Sharabi, 2024). This resurgence indicates a growing interest in more personalized, human-guided romantic experiences. Unlike algorithmic systems often used in online dating, matchmaking promises compatibility grounded in shared values and intentional selection processes (Golker & Senior, 2021; Knudson, 2017; Sharabi, 2024; Shepherd, 2016). However, research on matchmaking remains relatively underexplored compared to studies on other dating services, such as online dating and speed dating (Knudson, 2017). Specifically, it is unclear which factors predict successful relationship formation through matchmaking. This study focused on personality traits as predictors of matchmaking outcomes.

Matchmaking is a personalized process in which a matchmaker selects potential partners based on individual preferences and needs, rather than relying on algorithmic matching systems. During an initial interview, clients communicate the characteristics they seek in a mate, enabling matchmakers to offer personalized suggestions and guidance (Golker & Senior, 2021; Sharabi, 2024).

Matchmakers prioritize relational values, life goals, and compatibility factors such as family orientation, communication style, and lifestyle preferences. Traits such as shared humor, openness to compromise, and emotional availability are often emphasized as indicators of relational potential, rather than relying solely on standardized personality measures. Moreover, although matchmakers have access to client photographs to assist in the matching process, clients are typically introduced to potential partners without seeing a photograph beforehand. This approach encourages clients to focus more on substantive qualities predictive of long-term relationship success (Buston & Emlen, 2003; Todd et al., 2007). Unlike speed dating, where immediate, observable attributes such as physical attractiveness often dominate partner selection (Chopik & Johnson, 2021; Joel et al., 2017; Todd et al., 2007), matchmaking emphasizes compatibility and deeper relational fit over initial attraction.

Relationship formation through matchmaking differs from both long-term relationships, where shared history and emotional intimacy are already present, and fast-paced dating formats such as speed dating, where partner decisions are often based on immediate impressions. The early phase of dating, particularly the first three months, is considered a critical period in which attachment bonds can begin to form (Heffernan et al., 2012; Fagundes & Schindler, 2012; Watkins et al., 2022). In initial encounters, individuals tend to rely on surface-level cues such as physical appearance and perceived social charisma. This is especially true in speed dating, where decisions must be made within minutes, often amplifying the influence of concrete, perceptual features over more abstract qualities. In contrast, structured dating environments like matchmaking—where the process begins with written profiles, followed by guided communication and face-to-face meetings—may encourage individuals to attend to more enduring characteristics such as shared values, personality fit, and relationship goals earlier in the acquaintance process (Fletcher & Kerr, 2010; Lee et al., 2008). These contextual differences may influence the psychological processes involved in partner evaluation and thus shape the role that broad personality traits play in early relationship formation. This contextual distinction provides a compelling basis for examining whether Big Five traits—extraversion, openness, conscientiousness, agreeableness, and neuroticism—predict success in the unique setting of professional matchmaking. Accordingly, this study investigated whether personality traits assessed at the start of the matchmaking process would predict successful relationship formation after three months of dating.

Personality traits, as defined by the Big Five model (openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism), can influence partner selection, as they are linked to individual differences in perception (Jonason & Sherman, 2020; Serfass & Sherman, 2013). Prior research suggests that personality's role in romantic outcomes is context-dependent (Weidmann et al., 2023). In speed-dating, traits like extraversion and openness to experience predict initial attraction (e.g., Back et al., 2010; Dufner et al., 2013), while in long-term relationships, conscientiousness and low neuroticism are linked to relationship satisfaction and relationship stability (Mikulincer & Shaver, 2016; Sayehmiri et al., 2020; Weidmann et al., 2023). Conversely, studies on online dating show personality traits have limited predictive value for dating success, defined as initial attraction and the intention to pursue a relationship (Finkel et al., 2012; Joel et al., 2017). Given previous mixed findings, we aimed to examine whether broad personality traits predict matchmaking outcomes.

The process of fledgling relationship formation, particularly when guided through matchmaking, involves an interaction between individual dispositions and structural elements. While personality traits shape initial reactions and expectations, the matchmaking format moderates how these traits are expressed and evaluated. In this matchmaking context, demographic factors such as gender and age may influence partner preferences and the interpretation and social relevance of personality signals in early-stage relational dynamics. Previous research suggests that men and women tend to prioritize different characteristics in a partner (Buss, 1989; Zentner & Mitura, 2012), and that personality traits—such as neuroticism or agreeableness—may have different effects depending on gendered expectations and dating behaviors (Eastwick et al., 2011; Finkel et al., 2012; Jonason & Sherman, 2020). To account for these gendered dynamics, we additionally explored whether the predictive value of the Big Five traits differed for men and women.

To summarize, the main aim of the study was to examine whether broad personality traits predict matchmaking outcomes. Drawing on prior research from speed dating and long-term relationship studies, we hypothesized that extraversion, openness to experience, and conscientiousness would be positively associated with matchmaking success, whereas neuroticism would be negatively associated. Agreeableness, given its inconsistent associations across studies, was included as an exploratory predictor. Below, we outline the theoretical rationale for each hypothesis, organized by trait.

Extraversion

Research on speed dating has revealed an impact of Big Five personality traits on initial attraction and partner selection. In particular, extraversion seems to predict dating success. Extraverted individuals are often perceived as attractive and socially adept during speed dating encounters (Back et al., 2010; Dufner et al., 2013). Wilde and Eliason (2022) found that extraversion was positively associated with the number of matches on dating apps, suggesting that this trait may be advantageous in online dating. The openness, enthusiasm, and social skills of extroverts (Costa & McCrae, 1992) might positively influence first impressions.

Hypothesis 1 (H1): Higher levels of extraversion will be positively associated with successful relationship formation in a matchmaking context.

Openness to experience

Openness to experience can lead to engaging conversations and a positive first impression (Shaver & Mikulincer, 2004). Individuals open to new experiences are often perceived as interesting and exciting (Costa & McCrae, 1992). Open individuals' curiosity and adaptability may enhance their receptiveness to diverse partner characteristics and new relational experiences. Openness to experience has been linked to satisfaction in long-term relationships (Sayehmiri et al., 2020; Barelds & Dijkstra, 2011).

Hypothesis 2 (H2): Higher levels of openness to experience will be positively associated with successful relationship formation in a matchmaking context.

Conscientiousness

Although less research has focused on conscientiousness in speed dating, studies suggest that conscientious individuals are often perceived as reliable and responsible (Back et al., 2010). This could create a positive first impression, as these traits are often associated with relationship stability and commitment (Engel et al., 2002; Sternberg, 1986; Sternberg, 1998). Conscientious individuals are often reliable, committed, and loyal (Caspi et al., 2005), which are important qualities for building stable and lasting relationships (Gottman & Gottman, 2017). Indeed, long-term couples high in conscientiousness appeared to be more satisfied with their marital life (Chopik & Lucas, 2019; Sayehmiri et al., 2020).

Hypothesis 3 (H3): Higher levels of conscientiousness will be positively associated with successful relationship formation in a matchmaking context.

Agreeableness

Agreeableness can sometimes be perceived negatively as a lack of assertiveness or as being overly compliant in the speed dating context, particularly in Western cultures (Hornsey et al., 2015; Urbaniak & Kilmann, 2006). However, agreeable individuals are often attentive, understanding, and focused on their partner's needs (Graziano & Tobin, 2009). These qualities contribute to a positive atmosphere and strong emotional bonds in long-term relationships (Mikulincer & Shaver, 2016).

Hypothesis 4 (H4): Higher levels of agreeableness will be positively associated with successful relationship formation in a matchmaking context.

Neuroticism

Individuals high in neuroticism may appear nervous or anxious during speed dating (Caspi et al., 2005), which can negatively impact first impressions (White et al., 2004). Individuals high in neuroticism may struggle with managing stress and conflict in relationships (Shaver & Mikulincer, 2004), leading to dissatisfaction and instability (Chopik & Lucas, 2019; Fisher & McNulty, 2008; Donnellan et al., 2007; Holmberg et al., 2013; Sayehmiri et al., 2020). Neuroticism's association with emotional instability and heightened interpersonal sensitivity may undermine relationship-building.

Hypothesis 5 (H5): Higher levels of neuroticism will be negatively associated with successful relationship formation in a matchmaking context.

In addition to these hypotheses, we explored whether gender moderated the association between personality traits and matchmaking success.

2.2 Materials and Methods

2.2.1 Participants

Sampling procedure

Participants were single individuals living alone who applied to a matchmaking agency intending to find a long-lasting romantic relationship. Recruitment for the study occurred during the regular registration activities of the matchmaking program, which included a home visit by the matchmaker for an in-depth interview. During this interview, clients were informed about the study and

invited to participate. Those who agreed to participate provided verbal consent and later received an email with a link to the computerized questionnaire including an online consent to confirm their participation. Participants without an email address received the questionnaire and consent form by regular mail.

Exclusion criteria for the matchmaking program included age (18 years and younger) and diagnosed mental health conditions that, based on the matchmaker's expertise, would significantly hinder the ability to maintain a healthy relationship. No additional inclusion or exclusion criteria were used to participate in the study.

Participant characteristics

Of the 1,993 individuals who agreed to participate in this study, 1,925 completed the initial questionnaires; 64 participants quit the program prematurely, 154 postponed matchmaking for personal reasons, and 46 dated the proposed partner for less than three months. After excluding participants who did not complete the questionnaires, those who quit or postponed the matching program, and those who had been dating for less than three months (see outcome measure), a total of 1,704 participants were included in the final analysis, of whom 51.5% were women and 48.5% were men. The mean age was 62.5 years ($SD = 12.35$), ranging from 27 to 96 years. Regarding education, 44.8% completed secondary education or lower, 39.0% held an undergraduate degree, and 16.3% had an academic degree or higher. Most participants (87.7%) reported no religious affiliation, 10.3% were active smokers, the mean height was 170.6 cm ($SD = 7.3$ cm), 12.8% had children living at home, and 28.4% had children who had moved out. The majority of participants identified as white (97.7%).

Power Analysis

An a priori power analysis was conducted to determine the required sample size for a logistic regression model with eight predictors (five core predictors: the big five personality traits, and three control variables: age, gender, and educational level). The power analysis was performed using Python's module statsmodels.stats.power (Seabold & Perktold, 2010). Parameters included a medium effect size ($f^2 = 0.10$), a significance level of $\alpha = 0.05$, and a desired power of 80% ($1 - \beta = 0.80$). The results indicated that a minimum sample size of 566 participants was required.

2.2.2 Procedure

Study design

This study assessed the predictive value of the Big Five personality traits for fledgling relationship formation— i.e., early-stage relationships that have not yet fully stabilized or resulted in formal commitment — in a matchmaking context, using a longitudinal design. Participants completed the Big Five Personality questionnaire at the start of the matchmaking program. The outcome measure (successful or unsuccessful relationship formation) was assessed at three months. The researchers did not participate in the matchmaking process to ensure unbiased data collection.

Matching Procedure

The maximum duration of the matchmaking program in this study was 15 months. To find a promising match, the matchmaker regularly consults with other matchmakers in the network. If a match is found, the matchmaker proposes a potential partner to the client and advises them to meet each other three times. After this dating period, the client and matchmaker evaluate the participant's acquaintance with the proposed partner by phone or email. After six weeks of dating, both participants receive an email asking if they like each other or would rather have another match proposal. Three months after the initial introduction, both participants received a follow-up email asking whether they considered themselves to be in a committed relationship with the proposed partner. If both reported being in a relationship, the match was classified as successful. Participants who reported a successful match no longer received new partner proposals. This three-month threshold is supported by research showing that attachment bonds typically begin to form during the early stages of dating (Fagundes & Schindler, 2012; Heffernan et al., 2012; Watkins et al., 2022).

2.2.3 Materials

Big Five Personality

The Big Five Personality dimensions were assessed using the validated Dutch NEO Five-Factor Inventory (NEO-FFI) (Hoekstra et al., 1996). This questionnaire comprises 60 self-descriptive statements—12 per trait—rated on a 5-point Likert scale, ranging from 1 (Strongly disagree) to 5 (Strongly agree), with 28 items reverse-worded. Example items include “I often feel tense and jittery” (Neuroticism) and “I am outgoing and sociable” (Extraversion). The NEO-FFI is a widely validated instrument and was administered in Dutch, using the officially translated and validated version. The NEO-FFI showed high reliability, with Cronbach's alpha ranging from .75 to .83 in the initial validation study (McCrae & Costa, 2010). In the current sample the reliability of the Big Five personality scales, as measured by Cronbach's alpha, was acceptable to good: Neuroticism ($\alpha = 0.75$), Extraversion ($\alpha = 0.76$), Openness to Experience ($\alpha = 0.72$), Agreeableness ($\alpha = 0.74$), and Conscientiousness ($\alpha = 0.77$).

Outcome measurement

The outcome measure in this study was fledgling relationship formation — defined as early-stage relationships that had not yet stabilized or resulted in formal commitment. Success in fledgling relationship formation was assessed via self-report during a follow-up conducted three months after the initial matchmaker introduction, based on whether participants considered themselves to be in a committed relationship. A match was classified as successful if both clients reported being in a committed relationship at follow-up. If one or both clients reported not being in a relationship, the match was classified as unsuccessful. Clients who had been dating for less than three months at the time of follow-up were excluded from analysis, as their outcome status could not yet be determined.

2.3 Data Analysis

To examine whether the Big Five personality traits predicted fledgling relationship formation (coded as 1 = in a relationship after 3 months of dating, 0 = not in a relationship) a logistic regression was performed. The model included three covariates: age (continuous), gender (coded as 0 = male and 1 = female), and education level (coded as 1 = lower secondary or below, 2 = undergraduate degree, and 3 = academic degree). These covariates were included alongside the five standardized Big Five personality traits (agreeableness, openness to experience, neuroticism, extraversion, and conscientiousness).

To explore whether gender moderated the association between personality traits and fledgling relationship formation, a second logistic regression analysis was performed with the covariates, the Big Five personality traits, and interaction terms including each personality trait $\times$ gender (i.e., neuroticism $\times$ gender, extraversion $\times$ gender, etc.), as well as an age $\times$ gender interaction. Interaction terms were computed as product terms between the standardized predictors and the gender variable (for the Big Five traits), and between age and gender for the age $\times$ gender interaction.

Model fit was assessed using the Hosmer-Lemeshow test and Nagelkerke R^2 . All analyses were conducted on complete cases ($N = 1704$). Statistical assumptions, such as normality and homoscedasticity, were checked and met for the variables used in the regression. Analyses were conducted in SPSS version 29, effect sizes were interpreted as recommended by Cohen (1988) and results were interpreted against a significance threshold of 5%. Before the analyses, the data were examined for accuracy of data entry and missing values. Descriptive statistics and correlation analysis were used to explore the data.

2.4 Results

2.4.1 Descriptives

Table 1 shows descriptive statistics of the Big Five personality scores.

Table 1

Descriptive statistics of the Big Five personality scores in the full sample ($N = 1704$)

Predictors	Minimum	Maximum	Mean	Std. Dev.
Agreeableness	31.00	60.00	47.84	5.20
Openness	19.00	57.00	39.35	6.14
Neuroticism	12.00	54.00	28.04	6.04
Extraversion	21.00	58.00	43.31	5.57
Conscientiousness	24.00	60.00	48.40	5.22
Age	27	96	62.54	12.35

Note. Scores range from 12 to 60. Higher scores indicate stronger expression of each trait. No extreme outliers or skewed distributions were observed; descriptive statistics were within expected ranges.

Of the 1704 participants, 826 were men (48.5%) and 878 were women (51.5%). Of these participants, 1355 (79.5%) reported being in a relationship three months after the initial contact. Success rates were 82.2% for men and 77.0% for women.

2.4.2 Correlations

Most Big Five traits were significantly intercorrelated, with Neuroticism showing consistent negative associations with the other traits (see Table 2).

Table 2
Correlations between Big Five Traits, Education Level, and Age

Variable	1	2	3	4	5	6	7
1. Neuroticism	—						
2. Extraversion	-.43**	—					
3. Agreeableness	-.39**	.28**	—				
4. Conscientiousness	-.41**	.43**	.29**	—			
5. Openness	-.20**	.13**	.25**	.02	—		
6. Education Level	-.20**	.05	.15**	.06	.42**	—	
7. Age	-.07**	.02	.03	-.02	.04	.03	—
8. Gender	-.02	.08**	.31**	-.02	.31**	.13**	-.04

Note. Pearson correlations are reported. Correlations involving gender (coded 1 = male, 2 = female) represent point-biserial correlations. Education level was coded as 1 = lower secondary or below, 2 = undergraduate degree, and 3 = academic degree. * $p < .05$. ** $p < .001$.

2.4.3 Logistic Regression: main effects

The model with success in fledgling relationship formation as dependent variable and age, gender, education, and the Big Five personality traits (agreeableness, conscientiousness, extraversion, neuroticism, and openness) as independent variables was not statistically significant, $\chi^2(8) = 12.19$, $p = .143$. The Nagelkerke R^2 was .01, and the Hosmer–Lemeshow test indicated no significant lack of fit, $\chi^2(8) = 6.71$, $p = .568$. See Table 3.

Table 3
Logistic Regression Predicting Matchmaking Success

Predictor	B	SE	Wald	p	Exp(B)
Age	0.01	0.01	1.24	.266	1.01
Education	-0.06	0.09	0.36	.548	0.95
Agreeableness	-0.08	0.07	1.28	.258	0.93
Openness	-0.09	0.07	1.81	.178	0.91
Neuroticism	0.03	0.07	0.12	.730	1.03
Extraversion	0.08	0.07	1.29	.256	1.08
Conscientiousness	0.03	0.07	0.26	.643	1.03
Constant	1.12	0.35	10.44	<.001	3.06

Note. The constant represents the log-odds of matchmaking success when all predictors

None of the Big Five personality traits, nor the covariates (age, gender, and education level), significantly predicted matchmaking success, as indicated by non-significant p-values and odds ratios

(Exp(B)) close to 1.00. The 95% confidence intervals for all predictors include 1.00, suggesting that even if small effects exist, they are unlikely to be practically meaningful. The model accounted for 1% of the variance in relationship outcomes (Nagelkerke $R^2 = .01$).

2.4.4 Interaction Model and Gender-Specific Effects

A second logistic regression analysis was conducted in which all predictors and interaction terms were entered simultaneously. This model included age, gender, education level, the five Big Five traits, and interaction terms between each trait and gender, as well as an age $\times$ gender interaction. The model, including all predictors and interaction terms, was not statistically significant, $\chi^2(14) = 21.43$, $p = .091$. The Nagelkerke R^2 was .02, and the Hosmer–Lemeshow test indicated no significant lack of fit, $\chi^2(8) = 13.00$, $p = .112$.

Among the interaction terms, only the effect of neuroticism $\times$ gender reached statistical significance. The age $\times$ gender interaction was not significant, suggesting that the predictive value of age did not differ substantially between men and women. See Table 4.

Table 4
Logistic Regression Model with Gender Interactions

Predictor	B	SE	Wald	p	Exp(B)	95% CI
Age	-0.01	0.02	0.48	.491	0.99	[0.96; 1.02]
Education	-0.04	0.09	0.18	.672	0.96	[0.80; 1.15]
Gender	-0.90	0.64	1.99	.158	0.41	[0.12; 1.42]
Agreeableness	-0.26	0.23	1.28	.259	0.77	[0.49; 1.21]
Openness	-0.13	0.22	0.34	.558	0.88	[0.58; 1.34]
Neuroticism	-0.47	0.24	3.89	.048	0.63	[0.49; 1.00]
Extraversion	0.18	0.23	0.61	.434	1.20	[0.76; 1.88]
Conscientiousness	0.10	0.24	0.18	.668	1.11	[0.70; 1.76]
Gender $\times$ Agreeableness	0.15	0.15	1.10	.294	1.17	[0.88; 1.55]
Gender $\times$ Openness	0.04	0.13	0.09	.770	1.04	[0.80; 1.34]
Gender $\times$ Neuroticism	0.34	0.15	5.23	.022	1.41	[1.05; 1.89]
Gender $\times$ Extraversion	-0.06	0.14	0.18	.668	0.94	[0.71; 1.24]
Gender $\times$ Conscientiousness	-0.05	0.14	0.13	.719	0.95	[0.72; 1.26]
Age $\times$ Gender	0.01	0.01	1.06	.303	1.01	[0.99; 1.03]
Intercept	2.48	0.99	6.30	.012	11.91	

Note. The Big Five traits were standardized (Z-scores). Gender was coded as 0 = male, 1 = female. Interaction terms were computed as product terms between gender and standardized trait scores.

Stratified analyses showed no significant effects of neuroticism on matchmaking success for either men or women. However, among women, the association was marginally positive ($B = 0.17$, $p = .06$), whereas no such trend was observed among men ($B = -0.13$, $p = .14$).

Overall, within this sample, no significant relationships were found between age, gender, education, the Big Five personality traits, and success in the matchmaking process.

2.5 Discussion

This study investigated whether Big Five personality traits, assessed at the start of a professional matchmaking program, predict fledgling relationship formation. Success in fledgling relationship formation was defined as both partners reporting, three months after the initial matchmaker introduction, that they were in a committed relationship. In contrast to some prior studies on personality and romantic relationship initiation, none of the Big Five traits significantly predicted relationship formation in this real-life context. While small associations were observed, they did not reach statistical significance in the main analyses.

Prior speed-dating research has shown that Big Five traits can predict initial romantic choices, particularly traits like extraversion and openness, which tend to dominate in situations that rely on first impressions and rapid decision-making (Back et al., 2010; Dufner et al., 2013; Todd et al., 2007). In these contexts, individuals evaluate potential partners based on immediately observable characteristics, such as attractiveness, sociability, or self-confidence. Our findings, however, align more closely with studies on online dating and structured matchmaking, which report limited predictive value of personality traits for relationship initiation (Finkel et al., 2012; Joel et al., 2017).

One possible explanation lies in the way different dating contexts shape the evaluation process. According to Construal Level Theory (Trope & Liberman, 2010), individuals adjust their judgments depending on the psychological distance of a decision: when that distance increases, they rely less on concrete features (“low-level construals”) and more on abstract qualities (“high-level construals”), such as long-term compatibility. In speed dating, impressions are formed in person and on the spot, encouraging immediate, surface-level evaluations. By contrast, professional matchmaking introduces a stepwise process: candidates are presented via written profiles, then connected through mediated communication, and only later meet in person. This structure invites high-level construals earlier in the process, which may diminish the relevance of static personality traits in favor of more emergent, context-sensitive impressions. Although matchmakers have access to client photos, participants do not see each other’s pictures before the introduction. As a result, superficial cues may carry less weight than in other dating formats, and actual relational dynamics may become more central to success. This interpretation is supported by recent findings suggesting that personality traits are not expressed uniformly across situations, and that their predictive power diminishes in structured social environments with clear behavioral scripts (Nasello et al., 2024).

A noteworthy finding from the exploratory analyses was the interaction between neuroticism and gender, suggesting that the predictive value of this trait differed between men and women. This finding, while exploratory, aligns with prior research suggesting that emotional traits may be perceived differently depending on gender roles (Jonason & Sherman, 2020). This small interaction effect may tentatively reflect gender differences in how neurotic traits manifest or are perceived in early-stage romantic contexts. For example, higher levels of neuroticism in men may be more likely to evoke perceptions of emotional instability or insecurity, which could reduce their appeal as a long-term partner. Among women, similar levels of neuroticism may be less penalized or differently interpreted. Given the modest effect size and low overall explained variance, this finding should be interpreted with caution.

This study's focus on fledgling relationships may have limited the ability to detect the influence of neuroticism and conscientiousness. These traits are likely to have a stronger impact on relationship quality over time, particularly when couples face stressors like new parenthood, illness, or financial difficulties (Donnellan et al., 2007; Solomon & Jackson, 2014). For instance, a partner high in neuroticism might struggle with emotional regulation during conflict, while a conscientious partner might approach challenges with a proactive and solution-oriented mindset. The effects of these traits might become more pronounced after couples have cohabitated for a longer period and experienced various life challenges.

Our findings align with the conclusions of Finkel et al. (2012) and Joel et al. (2017), who argue that personality traits and self-reported preferences are minimally predictive of success in online dating. Successful dating and relationship formation might be determined more by observable behaviors than by underlying personality structures. According to prior research, relationship initiation and development may involve a partner's willingness to try new activities, tolerate novelty and ambiguity, and explore (Costa & McCrae, 1992; Shaver & Mikulincer, 2004). These behaviors can be exhibited by individuals with diverse personalities, and conversely, people with similar personalities may behave differently due to variations in self-regulation and social skills. For instance, both introverted and extroverted individuals can learn to project confidence, and anyone can develop better listening skills, regardless of personality traits. Stavrova and Ehlebracht's (2015) longitudinal study supports this notion, demonstrating that prosocial behavior increased both the desirability of hypothetical partners and the actual acquisition of romantic partners, even after accounting for personality traits. If applicable to the current context, this suggests that enhancing dating and relationship skills might be a more effective route to relationship formation than focusing on personality traits.

2.6 Strengths, limitations and future research

Strengths

The current study has several important strengths. First, the study was adequately powered to detect even small effects. The fact that the Big Five personality traits did not predict matchmaking success is thus unlikely to be due to insufficient statistical power.

Second, the age range of the participants, with a mean age of 62 years, can be considered a strength of the current study. Given that finding a suitable partner can be particularly challenging for older adults (Ajrouch et al., 2005; McPherson et al., 2001; McWilliams & Barrett, 2012; Rosenfeld & Thomas, 2012), and that most previous research on dating has primarily focused on young adults (McWilliams & Barrett, 2012), this study provides a valuable contribution to the literature on relationship formation in later life.

Another strength is the unambiguous outcome measurement. The success of the matchmaking was measured based on whether the participants had a partner with whom they were together for at least three months and with mutual intentions to stay together. This measure has great practical importance, as it is based on the actual choice of the participant, rather than just their ideal

partner preferences. This is important since previous research showed that ideal partner preferences of individuals are poor predictors of real partner choices (Eastwick et al., 2011; Todd et al., 2007; Valentova et al., 2016).

Limitations

Several limitations of the present study should be noted. To enhance clarity, they are grouped into three thematic domains.

The first limitation concerns measurement limitations. Relationship success was operationalized as both partners reporting, three months after the initial matchmaker introduction, that they were in a committed relationship. While this criterion aligns with prior research on early attachment formation (Heffernan et al., 2012; Fagundes & Schindler, 2012), it does not capture broader indicators such as relational satisfaction, emotional closeness, or communication dynamics. In addition, the study focused exclusively on broad personality traits. Other factors—such as social competence, attachment orientation, dating motivation, or past relationship history—may also play a significant role in early romantic outcomes (Finkel & Eastwick, 2015; Eastwick et al., 2011). Future research would benefit from multidimensional outcome measures and more comprehensive predictor models.

The second limitation concerns design and sample characteristics. The study relied on individual-level data, precluding the examination of dyadic dynamics or partner effects. Compatibility is often shaped by the interplay between both individuals' traits and behaviors (Mikulincer & Shaver, 2016; Klohnen & Luo, 2003). Moreover, while the focus on an older demographic ($M = 62.5$ years) offers a valuable contribution to an underrepresented group in dating research, it may limit generalizability to younger cohorts who may approach dating with different priorities and expectations (Ajrouch et al., 2005; McWilliams & Barrett, 2012).

The third limitation concerns generalizability. The sample was relatively homogeneous: all participants were heterosexual, predominantly white, and based in the Netherlands, with limited religious diversity. Sociocultural background and religious orientation may affect dating behaviors and expectations (Milevsky et al., 2011; Engelberg, 2011). Furthermore, the structured nature of professional matchmaking, with curated introductions, no photos, and guided follow-up, differs markedly from unstructured or app-based dating contexts. Individuals who opt into matchmaking may also differ in motivation and self-awareness. These factors may limit the generalizability of the findings to more diverse or informal dating environments.

2.7 Conclusion

While personality may influence initial attraction and long-term relationships, our study showed no predictive value of the Big Five traits for matchmaking success after three months of dating. These findings have practical implications for modern dating, whether through professional services or informal channels. The way romantic connections are initiated appears to shape how individuals evaluate potential partners. Structured formats like matchmaking may emphasize shared values and long-term compatibility, whereas fast, visually driven settings—such as dating apps or speed dating—

tend to highlight superficial traits. Supporting a shift toward more intentional, value-based partner evaluation—through coaching, platform design, or user guidance—may foster more meaningful and enduring relationships in a culture increasingly shaped by immediacy and an abundance of choice.

Author Contributions:

Conceptualization: LV; Methodology: RP, LV; Formal analysis: LV, RP; Investigation: LV, NJ; Resources: LV, Data curation: LV, RP; Validation: RP, JL, JvL, NJ; Writing original draft: LV; Writing review and editing: RP, JL, JvL, NJ; Supervision: NJ, JL. All authors have read and agreed to the published version of the manuscript.

Funding: There is no external funding

Institutional Review Board Statement: This study design and hypotheses were outlined in a research proposal submitted to the Ethics Review Board, which was approved on May 29, 2015 (U2015/03547/HVM). Participant anonymity was maintained throughout the study, and sensitive data were encrypted and stored securely. Data collection occurred between 15 September 2015 and 12 September 2021.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The NEO Five-Factor Inventory (NEO-FFI), which is used to measure personality traits, is a commercially available instrument. The study design and hypotheses were not preregistered. The data and the data analysis scripts are available at the Open Science Framework (OSF) through the following masked link:

https://osf.io/7mw5f/?view_only=52269e17d5614b4f917ad6523eb686d2

Conflicts of Interest

The authors declare no conflicts of interest.

References

- Ajrouch, K. J., Blandon, A.Y., & Antonucci, T. C. (2005). Social networks among men and women: The effects of age and socioeconomic status. *The Journals of Gerontology: Series B*, 60(6), S311–S317. <https://doi.org/10.1093/geronb/60.6.S311>
- Back, M. D., Schmukle, S. C., & Egloff, B. (2010). Why are narcissists so charming at first sight? Decoding the narcissism–popularity link at zero acquaintance. *Journal of Personality and Social Psychology*, 98(1), 132–145. <https://doi.org/10.1037/a0016338>
- Barelds, D. P. H., & Dijkstra, P. (2011). What do you see in me? Partner personality perception and satisfaction in intimate relationships. *Journal of Personality and Social Psychology*, 101(4), 825–842. <https://doi.org/10.1037/a0024531>
- Buss, D. M. (1989). Sex differences in human mate preferences: Evolutionary hypotheses tested in 37 cultures. *Behavioral and Brain Sciences*, 12(1), 1–49.
- Buston, P. M., & Emlen, S. T. (2003). Cognitive processes underlying human mate choice: The relationship between self-perception and mate preference in Western society. *Proceedings of the National Academy of Sciences*, 100(15), 8805–8810. <https://doi.org/10.1073/pnas.1533220100>
- Caspi, A., Roberts, B. W., & Shiner, R. L. (2005). Personality development: Stability and change. *Annual Review of Psychology*, 56, 453–84. <https://doi.org/10.1146/55.090902.141913>
- Chopik, W. J., & Johnson, D. J. (2021). Modeling dating decisions in a mock swiping paradigm: An examination of participant and target characteristics. *Journal of Research in Personality*, 92, 104076. <https://doi.org/10.1016/j.jrp.2021.104076>
- Chopik, W. J., & Lucas, R. E. (2019). Personality and well-being: Understanding the actor, partner, and similarity effects. *Social Psychological and Personality Science*, 10(3), 394–402. <https://doi.org/10.1016/j.jrp.2018.12.008>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ, Lawrence Erlbaum.
- Costa P.T., & McCrae, R.R. (1992). *NEO PI-R professional manual: Revised NEO Personality Inventory (NEO PI-R) and NEO Five-Factor Inventory (NEO-FFI)*. Odessa, FL: Psychological Assessment Resources.
- Donnellan, M. B., Assad, K. K., Robins, R. W., & Conger, R. D. (2007). Do negative interactions mediate the effects of negative emotionality, communal positive emotionality, and constraint on relationship satisfaction? *Journal of Social and Personal Relationships*, 24, 557–573. <https://doi.org/10.1177/0265407507079249>
- Donnellan, M. B., Conger, R. D., & Bryant, C. M. (2004). The Big Five and enduring marriages. *Journal of Research in Personality*, 38, 481–504. <https://doi.org/10.1016/j.jrp.2004.01.001>
- Dufner, M., Rauthmann, J. F., Czarna, A. Z., & Denissen, J. J. A. (2013). Are narcissists sexy? Zeroing in on the effect of narcissism on short-term mate appeal. *Personality and Social Psychology Bulletin*, 39, 870–882. <https://doi.org/10.1177/0146167213483580>

- Eastwick, P.W., Finkel, E.J., & Eagly, A.H. (2011). When and why do ideal partner preferences affect the process of initiating and maintaining romantic relationships? *Journal of Personality and Social Psychology*, 101, 5, 1012-1032, <https://doi:10.1037/a0024062>
- Engel, G., Olson, K.R., Patrick, C. (2002). The personality of love: Fundamental motives and traits related to components of love. *Personality and Individual Differences*, 32, 893-853. [https://doi:10.1016/S0191-8869\(01\)00090-3](https://doi:10.1016/S0191-8869(01)00090-3)
- Engelberg, A. (2011). Seeking a 'pure relationship'? Israeli religious-zionist singles looking for love and marriage. *Religion*, 41(3), 431–448. <https://doi.org/10.1080/0048721X.2011.583997>
- Fagundes C. P., Schindler I. (2012). Making of romantic attachment bonds: Longitudinal trajectories and implications for relationship stability. *Personal Relationships*, 19, 723–742. <https://doi.org/10.1111/j.1475-6811.2011.01389.x>
- Finkel, E. J., Eastwick, P. W., Karney, B. R., Reis, H. T., & Sprecher, S. (2012). Online dating: A critical analysis from the perspective of psychological science. *Psychological Science in the Public Interest*, 13(1), 3-66. <https://doi.org/10.1177/1529100612436522>
- Finkel, E. J., & Eastwick, P. W. (2015). Interpersonal attraction: In search of a theoretical Rosetta Stone. In M. Mikulincer, P. R. Shaver, J. A. Simpson, & J. F. Dovidio (Eds.), *APA handbook of personality and social psychology*, Vol. 3. Interpersonal relations (pp. 179–210). American Psychological Association. <https://doi.org/10.1037/14344-007>
- Fisher, T. D., & McNulty, J. K. (2008). Neuroticism and the trajectory of marital satisfaction. *Journal of Personality and Social Psychology*, 95(4), 881-893. <https://doi:10.1037/0022-3514.95.4.881>
- Goldberg, L. R., Sweeney, D., Merenda, P. F., & Hughes, J. E. (1998). Demographic variables and personality: The effects of gender, age, education, and ethnic/racial status on self-descriptions of personality attributes. *Personality and Individual Differences*, 24(3), 393–403. [https://doi.org/10.1016/S0191-8869\(97\)00110-4](https://doi.org/10.1016/S0191-8869(97)00110-4)
- Golker, C., & Senior, V. (2021). Dating experiences of Orthodox Jews in the Shidduch system: A thematic analysis. *Mental Health, Religion & Culture*, 24(2), 164–180. <https://doi:10.1080/13674676.2020.1870444>
- Gottman, J., & Gottman, J. (2017). The natural principles of love. *Journal of Family Theory and Review*, 9, 1, 7-26. <https://doi:10.1111/jftr.12182>
- Graziano, W. G., & Tobin, R. M. (2009). Agreeableness. In M. R. Leary & R. H. Hoyle (Eds.), *Handbook of individual differences in social behavior* (pp. 46–61). New York: Guilford Press.
- Heffernan M. E., Fraley R. C., Vicary A. M., Brumbaugh C. C. (2012). Attachment features and functions in adult romantic relationships. *Journal of Social and Personal Relationships*, 29, 671–693. <https://doi-org.ezproxy.elib11.ub.unimaas.nl/10.1177/02654075124434>
- Hill, F. (2023, August 11). The new old dating trend. *The Atlantic*. <https://www.theatlantic.com/family/archive/2023/08/matchmaking-dating-app-era/674989/>
- Hoekstra H.A., Ormel J., & De Fruyt, F. (1996). NEO personality questionnaires NEO-PI-R, NEO-FFI: Manual. Swets & Zeitlinger BV, Lisse
- Holmberg, D., McWilliams, L. A., & Patterson, A. (2013). Conscientiousness and attachment avoidance as moderators of the association between attachment anxiety and neuroticism: An

- interpersonal perspective. *Journal of Social and Personal Relationships*, 30(4), 515–525.
<https://doi.org/10.1177/0265407512461199>
- Hornsey, M. J., Wellauer, R., McIntyre, J. C., & Barlow, F. K. (2015). A critical test of the assumption that men prefer conformist women and women prefer nonconformist men. *Personality and Social Psychology Bulletin*, 41, 755–768.
<https://doi.org/10.1177/0146167215577366>
- Joel, S., MacDonald, G., & Shackelford, T. K. (2017). Is romantic desire predictable? Machine learning applied to initial romantic attraction. *Psychological Science*, 28(10), 1478–1489.
<https://doi.org/10.1177/0956797617714946>
- Joel, S., Eastwick, P. W., Allison, C. J., Arriaga, X. B., Baker, Z. G., Bar-Kalifa, E., ... et al. (2020). Machine learning uncovers the most robust self-report predictors of relationship quality across 43 longitudinal couples studies. *Proceedings of the National Academy of Sciences*, 117(32), 19061–19071. <https://doi.org/10.1073/pnas.1917036117>.
- Jonason, P.K., Sherman, R.A. (2020). Personality and the perception of situations: The Big Five and Dark Triad traits. *Personality and Individual Differences*, 163.
<https://doi.org/10.1016/j.paid.2020.110081>
- Klohn, E. C., & Luo, S. (2003). Interpersonal attraction and personality: What is attractive—self similarity, ideal similarity, complementarity, or attachment security? *Journal of Personality and Social Psychology*, 85(4), 709–722. <https://doi.org/10.1037/0022-3514.85.4.709>
- Knudson, M. L. (2017). Love on the rocks: Navigating romance in a digital age. *Journal of Communication*, 67(4), 652–676. <https://doi.org/10.1093/joc/jqx004>
- Lee, L., Loewenstein, G., Ariely, D., Hong, J., & Young, J. (2008). If I'm not hot, are you hot or not? Physical-attractiveness evaluations and dating preferences as a function of one's own attractiveness. *Psychological Science*, 19(7), 669–677.
<https://doi.org/10.1111/j.1467-9280.2008.02141.x>
- McCrae, R. R., & Costa, P. T., Jr., (2010). *NEO Inventories: Professional manual*. Lutz, FL: Psychological Assessment Resources, Inc.
- McPherson, M., Smith-Lovin, L., Cook, J. M. (2001). Birds of a feather: Homophily in social networks. *Annual Review of Sociology*, 27, 415–444. [10.1146/annurev.soc.27.1.415](https://doi.org/10.1146/annurev.soc.27.1.415)
- McWilliams S., Barrett A.E. (2012). Online dating in middle and later life: Gendered expectations and experiences. *Journal of Family Issues*, 35, 3, 411–436.
<https://doi.org/10.1177/0192513X12468437>
- Mikulincer, M., Shaver, P.R. (2016). *Attachment in adulthood. Structure, dynamics, and change*. The Guilford Press, NY.
- Milevsky, A., Shifra Niman, D., Raab, A., & Gross, R. (2011). A phenomenological examination of dating attitudes in Ultra-Orthodox Jewish emerging adult women. *Mental Health, Religion & Culture*, 14(4), 311–322. <https://doi.org/10.1080/13674670903585105>
- Robins, R. W., Caspi, A., & Moffitt, T. E. (2002). It's not just who you're with, it's who you are: Personality and relationship experiences across multiple relationships. *Journal of Personality*, 70, 925–964. <https://doi.org/10.1111/1467-6494.05028>

- Rosenfeld, M. J., & Thomas, R. J. (2012). Searching for a mate: The rise of the internet as a social intermediary. *American Sociological Review*, 77, 4, 523–547. <https://doi-org.ezproxy.elib11.ub.unimaas.nl/10.1177/0003122412448050>
- Rosenfeld, M. J., Thomas, R. J., & Hausen, S. (2019). Disintermediating your friends: How online dating in the United States displaces other ways of meeting. *Proceedings of the National Academy of Sciences*, 116(36), 17753-17758. <https://doi.org/10.1073/pnas.1908630116>
- Sayehmiri K., Kareem K.I., Abdi K., Dalvand S., Gheshlagh R.G. (2020). The relationship between personality traits and marital satisfaction: A systematic review and meta-analysis. *BMC Psychology*, 8, 1, 15. <https://doi:10.1186/s40359-020-0383-z>.
- Serfass, D.G., Sherman, R.A. (2013). Personality and the perceptions of situations from the thematic apperception test. *Journal of Research in Personality*, 47. <https://doi.org/10.1016/j.jrp.2013.06.007>
- Sharabi, L. L. (2024). Love, (un)automated: Human matchmaking in the era of online dating. *Journal of Social and Personal Relationships*, 41(11), 3293–3315. <https://doi.org/10.1177/02654075241264720>
- Shaver, P.R., Mikulincer, M. (2004). Attachment theory, individual psychodynamics, and relationship functioning. In D. Perlman, & A. Vangelisti (Eds.), *Handbook of personal relationships*. New York: Cambridge University Press.
- Shepherd, H. (2016). Marriage markets and mating markets: Theory and empirical implications for the family. *Sociology Compass*, 10(8), 671-680. <https://doi.org/10.1111/soc4.12397>
- Sprecher, S., Sullivan, Q., & Hatfield, E. (2008). Mate selection preferences: Gender differences examined in a national sample. *Journal of Personality and Social Psychology*, 72(5), 1074-1080. <https://doi.org/10.1037/0022-3514.72.5.1074>
- Solomon, B.C., & Jackson, J. (2014). Why do personality traits predict divorce? Multiple pathways through satisfaction. *Journal of Personality and Social Psychology*, 106, 6, 978–996 <https://doi:10.1037/a0036190>
- Stavrova, O., & Ehlebracht, D. (2015). A longitudinal analysis of romantic relationship formation: The effect of prosocial behavior. *Social Psychological and Personality Science*, 6, 6, 521-527. <https://doi-org.ezproxy.elib11.ub.unimaas.nl/10.1177/1948550614568867>
- Sternberg, R.J. (1986). A triangular theory of love. *Psychological Review* 93, 2, 119-135. <https://doi:10.1037/0033-295X.93.2.119>
- Sternberg, R. J. (1998). *Cupid's arrow: the course of love through time*. London: Cambridge University Press.
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston, MA: Pearson Education.
- Todd, P.M., Penke, L., Fasolo, B., & Lenton A.P. (2007). Different cognitive processes underlie human mate choices and mate preferences. *Proceedings of the National Academy of Sciences*, 104, 38, 15011-15016, [10.1073/pnas.0705290104](https://doi.org/10.1073/pnas.0705290104)
- Trope, Y., & Liberman, N. (2010). Construal-level theory of psychological distance. *Psychological Review*, 117(2), 440–463. <https://doi.org/10.1037/a0018963>

- Urbaniak, G. C., & Kilmann, P. R. (2006). Niceness and dating success: A further test of the nice guy stereotype. *Sex Roles*, 55, 209–224. <https://doi.org/10.1007/s11199-006-9075-2>.
- Valentova, J.V., Štěrbová, Z., Bártová, K., Varella, M.A.C. (2016). Personality of ideal and actual romantic partners among heterosexual and non-heterosexual men and women: A cross-cultural study. *Personality and Individual Differences*, 101, 160-166. <https://doi.org/10.1016/j.paid.2016.05.048>
- Watkins, C. D., Bovet, J., Fernandez, A. M., Leongómez, J. D., Żelaźniewicz, A., Corrêa Varella, M. A., & Wagstaff, D. (2022). Men say “I love you” before women do: Robust across several countries. *Journal of Social and Personal Relationships*, 39, 7, 2134–2153. <https://doi.org/10.1177/02654075221075264>
- Weidmann, M., Purol, M. F., Alabdullah, A., Ryan, S. M., Wright, E. G., Oh, J., & Chopik, W. J. (2023). Trait and facet personality similarity and relationship and life satisfaction in romantic couples. *Journal of Research in Personality*, 104, 104378. <https://doi.org/10.1016/j.jrp.2023.104378>
- White, J. K., Hendrick, S. S., & Hendrick, C. (2004). Big Five personality variables and relationship constructs. *Personality and Individual Differences*, 37, 1519 –1530. <https://doi.org/10.1016/j.paid.2004.02.019>
- Wilde, J., & Eliason, S. R. (2022). Personality and dating app use: Examining the big five and dark triad traits in relation to dating app outcomes. *Personality and Individual Differences*, 192, 111632. <https://doi.org/10.1016/j.paid.2022.111632>
- Zentner, M., & Mitura, K. (2012). Stepping Out of the Caveman’s Shadow: Nations’ Gender Gap Predicts Degree of Sex Differentiation in Mate Preferences. *Psychological Science*, 23(10), 1176-1185. <https://doi-org.ezproxy.elib11.ub.unimaas.nl/10.1177/0956797612441004> (Original work published 2012).

Chapter 3. Implicit Adult Attachment

This chapter is published as:

Visser, L., Lataster, J., Pat-El, R., Van Lankveld, J., & Jacobs, N. (2021). Psychometric Properties of Two Implicit Association Tests measuring Adult Attachment. *Psychologica Belgica*, 61(1), 88–103. <https://doi.org/10.5334/pb.1042>

Abstract

Adult attachment style has consequences for mental health, interpersonal functioning and emotion regulation. This occurs partly deliberately, also referred to as explicit, and partly on an automatic level outside of conscious awareness, also referred to as implicit. Whereas explicit adult attachment can be assessed with self-report instruments, measurement of implicit adult attachment requires indirect methods.

This paper describes the psychometric properties of two Implicit Association Tests measuring general adult attachment in a population sample. The study evaluated the reliability and the validity of the Avoidant Attachment IAT (ANX-IAT) and the Anxious Attachment IAT (AVOID-IAT). Validity was evaluated against self-report measures of adult attachment style (RQ), psychopathology (SQ-48), and well-being (MHC-SF).

The split-half reliabilities of both IATs were good; the test-retest reliability of the ANX-IAT was adequate; however the AVOID-IAT had low test-retest reliability. Both IATs did not explain variance in psychopathology additional to explicit measures. The AVOID-IAT showed added value over explicit measurement of avoidant attachment in explaining variance in well-being, particularly regarding emotional and psychological well-being. The ANX-IAT did not explain variance in any measure of well-being additional to the explicit measure of anxious attachment.

Our findings provide a basis from which more valid IATs measuring general adult attachment can be developed. Furthermore, they suggest that implicit avoidant attachment might be related to well-being, particularly emotional and psychological well-being. However, further research is needed to investigate the role of implicit general adult attachment in mental health and to optimize the two IATs in terms of validity before clinical use is recommended.

3.1 Introduction

Attachment style evolves in childhood as an adaptive response to separation from a primary attachment figure (Bowlby, 1988). The interaction between the caretaker and child provides the child with internal working models of the self and the attachment figure (Ainsworth et al., 1978; Bowlby, 1988). These models show both stability and change over time (Fraley, 2002; Fraley & Roisman, 2019), and are especially, though not exclusively, influenced by experiences in close relationships (Baldwin, 1999; Davila et al., 1999; Leary et al., 1995; Murray et al., 2000). The process of accommodation is most of the time gradual, but occasionally changes are abrupt and radical (Bowlby, 1988), especially in case of major relationship events such as marriage, divorce, or losing a loved one (Baldwin, 1999; Davila et al., 1999). These events might activate psychological protection

mechanisms of which individuals are not or just partly aware, with behavioral or social consequences (Davila & Cobb, 2003; Mikulincer et al., 2004). Though attachment style evolves in childhood, new attachment bonds develop in adolescence and adulthood leading to a pattern of thoughts, emotions, and behavior in the context of relationships, referred to as adult attachment style (Fraley & Roisman, 2019). Studies on adult attachment to a romantic partner revealed that individual differences in attachment style can be measured along two dimensions: anxiety and avoidance (Mikulincer & Shaver, 2016). The individual's position on the anxiety dimension indicates the extent to which one worries about the partner's availability or responsiveness, with a high score leading to dependent behavior. The individual's position on the avoidant dimension indicates the extent to which one trusts the partner's intentions, with a high score corresponding with emotional distance and independence. One's position on these two attachment dimensions predicts affect regulation, adjustment, and relationship quality (Mikulincer & Shaver, 2016). A high score on either of the dimensions, or both, is considered to represent attachment insecurity. More precisely, four prototypes are distinguished. Secure people (low on avoidance, and low on anxiety) feel comfortable with intimacy and autonomy. Preoccupied people (high on anxiety) constantly worry in relationships and are striving to gain respect because of their low self-esteem. Dismissive people (high on avoidance) are autonomous to the detriment of the relationship with others. Fearful people (high on avoidance and on anxiety) feel unlovable and do not trust others: they fear rejection and avoid contact (Griffin & Bartholomew, 1994).

Over the past decades, theoretical frameworks have been developed about two qualitatively different mental systems, labelled with different names, such as two-system, dual-mode, and dual-process. These models have in common that they direct attention to mental states and their implications at the level of processing, representation, and amount of control (Keren & Schul, 2009). They explain how thoughts are the result of two processes, often an automatic and unconscious *implicit* process, and a conscious *explicit* process. This framework may also be applicable to attachment. In a series of six studies Mikulincer, Shaver, Bar-On and Ein-Dor (2010) showed that insecure attached individuals were ambivalent in their relational tendencies, wishing to be close to their relationship partners but also fearing rejection. This attitudinal ambivalence toward the romantic partner was observed using both explicit and implicit measures. Whereas explicit adult attachment style can be assessed with self-report instruments (Mikulincer & Shaver, 2016), the assessment of implicit adult attachment requires indirect measurement procedures that index automatic psychological attributes, termed implicit measures (De Houwer et al., 2009).

Implicit measures have been developed across several domains, including attitude, self-esteem, and stereotypes. Well-known tests are the Stroop Task (Stroop, 1935), the Rorschach inkblot test (Bochner & Halpern, 1942), and the Thematic Apperception Test (Morgan & Murray, 1935). The reliability and validity of these tests however, remain controversial (Uhlmann et al., 2012). More recent examples of implicit measurements are the Extrinsic Affective Simon Task (De Houwer, 2003), the Affect Misattribution Procedure (Payne et al., 2005) and the Implicit Association Test (Greenwald et al., 1998). Though implicit measures are not appropriate for every construct (Uhlmann et al., 2012), including both implicit and explicit measures yields better prediction in domains such as attitudes (Leavitt et al., 2011), personality and self-concept (Johnson & Saboe, 2011), beliefs (Reynolds et al.,

2010) and affect (Johnson & Lord, 2010). De Houwer and De Bruycker (2007) used the Extrinsic Affective Simon Task and the Implicit Association Test for implicit measurement of political attitudes, food preference and homosexuality. The IAT measures consistently outperformed the Extrinsic Affective Simon Task. A meta-analysis by Greenwald et al. (2009) showed that the predictive validity of the IAT in domains such as stereotypes and prejudice outperformed self-report, while self-report measures had a stronger predictive validity in other domains such as political preferences. Although critical comments are formulated that cannot be ignored (Fiedler et al., 2006; Gawronski et al., 2009; Meissner et al., 2019), the IAT is a widely used instrument to assess psychological concepts such as attitudes, especially for socially sensitive topics.

In recent years, several IATs in the field of attachment were developed including an implicit attachment to the self (Dewitte et al., 2008; Venta et al., 2016), to one's mother (Ren et al., 2011; Zayas & Shoda, 2005), one's father (Venta et al., 2016), one's partner (Banse & Kowalick, 2007; Zayas & Shoda, 2005) and to a specific attachment figure (Dewitte et al., 2008). However, to our knowledge, IATs measuring general adult attachment style are lacking. The term 'adult attachment style' refers to a constellation of knowledge, expectations and insecurities that individuals hold about themselves and their relationships (Fraley & Roisman, 2019). General adult attachment represents the way in which individuals approach close relationships in general. First of all, this may differ from how a person thinks and feels about a specific figure such as the mother, father or the romantic partner, but even more important, research has demonstrated that adult attachment style has broad consequences for mental health, interpersonal functioning and emotion regulation (Crowell & Treboux, 1995; Hayden et al., 2017; Pietromonaco & Beck, 2019; Ravitz et al., 2010).

This paper describes the psychometric properties of two newly developed IATs measuring implicit general adult attachment. More precisely, this paper evaluates the psychometric properties of the AVOID-IAT, representing the extent to which an individual implicitly views himself as being relationally avoidant, and the ANX-IAT, representing the extent to which an individual implicitly views himself as being relationally avoidant respectively relationally anxious.

Firstly, the reliability of both the AVOID-IAT and ANX-IAT are examined. The internal consistency of the partner IAT, measuring implicit attitudes towards the romantic partner (Banse & Kowalick, 2007) and the split-half reliability of the IAT measuring relational self-esteem with respect to one specific attachment figure (Dewitte et al., 2008) were found to be adequate to good (respectively α partner IAT = .83 and α relational self-esteem = .80, α relational anxiety IAT = .80). Therefore, we expect the reliability of the developed AVOID-IAT and ANX-IAT to range from acceptable to good. In contrast, the test-retest reliabilities of IATs are in general less satisfactory (with a median of .56 across different studies) (Nosek et al., 2007). We thus anticipate lower test-retest reliabilities for both the AVOID-IAT and the ANX-IAT.

Secondly, we expect that implicit avoidant attachment and implicit anxious attachment are two related, but different dimensions of implicit adult attachment. The correlation between the aforementioned IATs for attachment to a specific attachment figure (Dewitte et al., 2008; Ren et al., 2011) varied between $r = .26$ and $r = .49$. Therefore, we hypothesize the correlation between the AVOID-IAT and the ANX-IAT to be of moderate size.

Thirdly, as previous research has demonstrated that adult attachment styles have broad consequences for mental health, we expect significant associations between both IATs and measures of psychopathology and well-being, the last two representing the two continua of mental health (Keyes, 2005; Westerhof & Keyes, 2010). Although Mikulincer and Shaver stated that adult attachment insecurities per se are unlikely to be sufficient causes of mental disorders (Mikulincer & Shaver, 2012), they represent major risk factors for psychopathology. Previous studies showed that subjects with an explicit insecure attachment style tend to report more psychopathology such as more depressive symptoms (Dagan et al., 2018; Wei et al., 2005), more anxiety (Davis et al., 2016; Kafetsios & Sideridis, 2006), more sleep disturbances (Belfiore & Pietrowsky, 2017) and exhibit less resilience in the face of distress (Maunder et al., 2006; Mikulincer et al., 2011). Findings relating implicit measures of adult attachment with psychopathological outcomes are scarce. Dewitte and colleagues (2008) found that the relational anxiety IAT, designed to capture the anxiety component of the relational self-concept was significantly associated with negative feelings. More anxiously attached individuals felt more negative about the imagined separation from the attachment figure. Additionally, Venta and colleagues (2016) found some evidence for an association between the mother-IAT, representing the extent of endorsement of the implicit view that mother is available, and self-report measures of interpersonal problems, in particular with the self-sacrificing subscale. Based on these findings, we expect both the AVOID-IAT and the ANX-IAT to be associated with psychopathology.

Lane and Fink (2015) observed in emerging adults significant associations between explicit attachment anxiety and well-being, comprised of subjective life satisfaction and psychological well-being. This supported earlier studies such as Wei, Liao, Ku and Shaffer (2011) showing a significant negative association between attachment anxiety and subjective well-being, and Lavy and Litmann-Ovadia (2011) who observed a significant negative association between the avoidant and anxious explicit attachment orientations and satisfaction with life. Karreman and Vingerhoets (2012) showed that attachment anxiety was related to lower psychological well-being in a community sample. In addition, Felton and Jowett (2013) found significant correlations between the avoidant and anxious dimensions of explicit attachment and vitality, referring to perceptions of mental and physical aliveness and energy in general terms, as well as with well-being variables such as positive affect. These studies suggest significant associations between explicit adult attachment and well-being, more precisely with psychological and emotional well-being. The few studies examining implicit adult attachment and well-being seem to support these findings. Ren and colleagues (Ren et al., 2011) found a significant association between the implicit measures of adult attachment to mothers and subjective well-being. Banse and Kowalick (2007) showed that in stressful conditions the implicit attitude towards the romantic partner was associated with psychological well-being. Based on these studies, we expect both the AVOID-IAT and the ANX-IAT to be associated with well-being, more precisely with psychological and emotional well-being.

3.2 Materials and Methods

3.2.1 Participants and procedure

Participants for this study were recruited via convenience sampling within the social networks of psychology students of the Open University of the Netherlands. Inclusion criteria were age (≥ 18 years) and sufficient understanding of the Dutch language. Participants first completed online questionnaires, then completed computerized measures of implicit avoidant attachment and of implicit anxious attachment. The implicit attachment tests were administered again after two weeks. The study was approved by the Research Ethics Committee of the Open University of the Netherlands. Participation in the study was voluntary and participants gave digital informed consent after being fully informed about the study and having had the opportunity to have any questions answered.

3.2.2 Measures

Implicit attachment. Two Single-Target Implicit Association Tests (IATs) were developed for this study to measure implicit attachment style: an Avoidant Attachment IAT (AVOID-IAT) and an Anxious Attachment IAT (ANX-IAT). The purpose of an IAT is to indirectly measure a construct by using the relative strength of the association between two pairs of concepts related to the construct (Greenwald et al., 1998). Participants were asked to sort stimuli representing four concepts into two response categories (termed ‘target’ categories and ‘attribute’ categories), each of which included two of the four concepts. When two concepts, sharing the same response key, are strongly associated, the sorting task is assumed to be easier than when the two concepts are either weakly associated or bipolar-opposites (Greenwald et al., 2003) and consequently the pertinent reaction time is assumed to be lower. The difference in response time reveals the automatic reaction towards a target object, in this case the self. The Single-Target Implicit Association Test (ST-IAT) measures the evaluation of a target object without the need to simultaneously evaluate a counter-category as in the original Implicit Association Test (Seagel et al., 2020).

A pilot study was conducted to select stimulus words representing the concepts. Based on the literature (Bartholomew & Horowitz, 1991; Mikulincer & Shaver, 2016), 43 adjectives were selected by the authors and categorized by 18 psychologists and 5 professional match-makers into “relationally avoidant,” “not relationally avoidant,” “relationally anxious,” “not relationally anxious,” or “not suitable”. The stimuli that were rated as most representative for these categories were subsequently selected (Nosek et al., 2005). The attribute categories in the ANX-IAT were “relationally anxious” and “not relationally anxious” (respectively shown in the left and right upper corners of the computer screen on which the IAT was presented). The attribute categories in the AVOID-IAT were “relationally avoidant” (left upper corner) and “relationally not avoidant” (right upper corner). Table 1 shows the used items in English equivalents of the Dutch words.

Table 1*The attributes and target items of the AVOID-IAT and ANX-IAT.*

	Negative Attribute items	Positive attribute items	Target category
AVOID-IAT	Distant	Contact seeking	Me
	Closed	Warm	Myself
	Absent	Accessible	I
	Insensitive	Available	Mine
ANX-IAT	Dependent	Strong	Me
	Emotional	Open	Myself
	Unpredictable	Confident	I
	Weak	Credible	Mine

Following Greenwald et al. (1998), participants had to categorize words that were shown in the centre of a computer screen, by pressing a left (z) or right (m) response key. The IATs in the current study consisted of five blocks. The blocks were administered in random order. The response time on each trial was determined by measuring the time elapsed between stimulus onset and key press.

Explicit attachment. The Relationship Questionnaire (RQ) (Bartholomew & Horowitz, 1991) consists of four short paragraphs describing four prototypical adult attachment styles: (1) Secure, (2) Preoccupied, (3) Dismissing, and (4) Fearful. Respondents rated the extent to which each of these four paragraphs described them on a Likert scale ranging from 1 (“does not at all apply to me”) to 7 (“fully applies to me”). RQ scores showed medium test-retest stability in previous research (Scharfe & Bartholomew, 1994), were demonstrated to be independent from self-deceptive biases (Leak & Parsons, 2001), and were highly correlated with other self-report measures and interview-based assessments of attachment style (Schmitt et al., 2004). Secure attachment is characterized by low levels of attachment-related anxiety and low levels of attachment-related avoidance, and fearful attachment is characterized by high anxiety and high avoidance. Preoccupied attachment is characterized by high anxiety (and low avoidance). Dismissive attachment is characterized by high avoidance (and low anxiety).

Psychopathology. The Symptom Questionnaire (SQ-48) (Carlier et al., 2012) is a validated screening tool for psychopathology. Four subscales are used to measure different aspects of psychopathology: depression, anxiety, somatization and agoraphobia. In addition, five subscales assess specific aspects of problems in behavior and/or functioning: aggression, cognitive problems, social phobia, work and vitality/optimism. Examples items are “I struggled to get the day started”, “I felt jittery and nervous” and “I struggled to control my anger”.

Respondents were asked to indicate what answer best applied to them, taking the past week as the reference period. Each item was rated by the respondent on a 5-point Likert-scale from 0 (“never”) to 4 (“very often”). Scores were added to form a sum-score representing the amount of psychopathology.

Well-being. The Mental Health Continuum Short Form (MHC-SF) (Lamers et al., 2011) was developed to measure the experience of positive feelings (emotional well-being, 3 items), positive functioning in individual life (psychological well-being, 6 items) and community life (social well-being, 5

items). Each item represents a feeling of well-being, of which the frequency in the last month is rated on a 6-point scale (0 = never to 5 = every day). Examples items are “During the past month, how often did you feel happy?” for emotional well-being, “During the past month, how often did you feel that your life has a sense of direction or meaning to it?” for psychological well-being and “During the past month, how often did you feel that you belonged to a community (like a social group, or your neighbourhood)?” for social well-being. Sum scores were computed for emotional well-being, social well-being, psychological well-being and total well-being. The total scale as well as the subscales of the Dutch MHC-SF version have high reliability and validity (Lamers et al., 2011) The Cronbach’s α ’s in the study by Lamers et al. (2011) for the subscales were 0.74 for social well-being, 0.83 for psychological well-being, 0.83 for emotional well-being and for total well-being $\alpha = 0.97$.

3.3 Data analyses

IAT scores were calculated using the D600 scoring algorithm recommended by Greenwald, Nosek, and Banaji (2003). The data of blocks 2 and 4 (practice blocks, each 12 trials) and the data of block 3 and 5 (test blocks, each 36 trials) were used. Only reaction times (RTs) in the range of 400-2500 ms were accepted. RTs between 2500 and 10,000 ms were replaced by 2500 ms. RTs above 10,000 ms were coded as missing data. After this first phase of replacement and deletion, the RTs from error trials were replaced with the mean RT of the correct responses in the same block plus a 600 ms penalty. The D600 index score was calculated as the difference between the mean RTs of the blocks “Myself + Relationally Not Avoidant” and the “Myself + Relationally Avoidant” combination, divided by the standard deviation calculated across all blocks, with the exception of the attribute practice block. A similar procedure was applied to compose implicit anxious attachment scores. Thus, positive IAT scores reflected high avoidant, respectively, high anxious attachment style.

The internal consistency was determined by calculating the split-half reliability, in which RTs of the even trials were compared with those of the odd trials within each block. Considering how using the split-half reliability estimate halves the test length we stepped up the ‘halved reliability’ estimates to the full test length with the Spearman-Brown prediction formula. The test scores of the IATs are expressed as D600 scores, which are difference scores. One important problem associated with the use of difference scores is that component scores are practically never perfectly independent, which means that measurement error in one component also contaminates the second component. This attenuation of measurement error increases (rapidly) when the correlation between the component scores increases. Since it is likely that the scores on congruent and incongruent blocks are correlated we computed reliability estimates in which we correction for difference-score related error-attenuation, using the equation for difference-score attenuation-correction (Cohen et al., 2013). The test-retest reliability was estimated as the Pearson correlation between the baseline measurement and the second measurement two weeks later.

For the evaluation of the validity of the IATs, Pearson correlations (two-tailed) between explicit measures of attachment and implicit measures of attachment, psychopathology, and well-being were examined. Additionally, regressions were performed. In previous studies age, level of education, and gender were found to be associated with psychopathology (Gariépy & Elgar, 2016) as well as with

well-being (Seedat et al., 2009). Furthermore it has been suggested that gender, age, and education might correlate with attachment style (Mikulincer & Shaver, 2016). Therefore, age, level of education and gender were added as covariates first in all regression analyses. To investigate whether the implicit attachment measure was able to explain additional variance of psychopathology, respectively well-being beyond the variance accounted for by the explicit attachment measure, regression analyses were performed with age, gender and education (first step), explicit attachment (second step), and implicit and explicit attachment (third step) as independent variables and respectively psychopathology, well-being and the subscales of well-being as dependent variables. Separate regressions were performed for implicit avoidant attachment and implicit anxious attachment.

Prior to the analyses, the data were examined for accuracy of data entry, missing values and fit between their distributions and the assumptions of multivariate analysis. Missing values were distributed at random across variables. Variables measured on a continuous scale were standardized before being entered into the analyses. Analyses were performed using IBM SPSS version 24.0 (IBM Corp, 2016), effect sizes were interpreted as recommended by Cohen (2013) and results were interpreted against a significance threshold of 5%.

3.4 Results

3.4.1 Descriptives

The sample ($N = 132$) consisted of 60 male (46%) and 71 female participants; demographic data of one participant were missing. Age ranged from 19 to 77 years ($M = 44.37$, $SD = 11.43$). Forty-two participants completed secondary education or lower (31.8 %), 42 completed undergraduate education (31.8%), and 47 had an academic degree or higher (36.0%). Most participants ($N = 108$) were in a relationship, with a mean duration of 16.38 years ($SD = 12.42$), and 109 participants were employed. Table 2 presents descriptive statistics of the study variables.

Table 2

Descriptive statistics and reliability indices for measures of implicit and explicit attachment, psychopathology and well-being.

Variable	N	Mean	Min	Max	SD	Reliability	Items
AVOID-IAT	132	-0.32	-1.14	0.70	0.39	$r = .84$	72
ANX-IAT	132	-0.21	-1.18	0.92	0.40	$r = .73$	72
RQ Secure	116	5.41	1	7	1.52	n.a.	1
Dismissive	112	3.26	1	7	1.80	n.a.	1
Preoccupied	115	2.76	1	6	1.44	n.a.	1
SQ48 Psychopathology	104	35.44	0.00	96	21.46	$\alpha = .93$	48
MHC Total	116	41.87	4	70	13.18	$\alpha = .92$	14
Emotional well-being	119	10.49	2	15	3.60	$\alpha = .89$	3
Social well-being	120	12.18	0	25	5.29	$\alpha = .76$	5
Psychological well-being	120	19.43	1	30	6.10	$\alpha = .87$	6

Note. α = Cronbach's alpha; r = correlation coefficient; n.a. = not applicable.

3.4.2 Reliability

The data of blocks 2 and 4 (practice blocks, each 12 trials) and the data of blocks 3 and 5 (test blocks, each 36 trials) were used to examine internal consistency reliability and test-retest reliability. The split-half and test-retest reliability of the IATs, as well as the attenuation-corrected reliabilities of the combined practice, test and total trials are presented in table 3.

Table 3

Reliability scores for the AVOID-IAT and for the ANX-IAT. Split-half reliabilities were corrected using the Spearman-Brown predication formula to account for using half of the test. The reliabilities for practice, test and total trials were corrected for attenuation in difference scores.

Measure	Type	Block 2	Block 3	Block 4	Block 5	Practice trials	Test trials	Total trials
AVOID-IAT	Split-half (r)	0.91**	0.96**	0.92**	0.96**	0.80	.91	.92
ANX-IAT	Split-half (r)	0.94**	0.97**	0.91**	0.96**	0.82	.91	.87
AVOID-IAT	Test-retest (r)	0.27**	0.27**	0.07	0.23**			
ANX-IAT	Test-retest (r)	0.72**	0.67**	0.59**	0.71**			

Note. ** $p < 0.01$

3.4.3 Correlations between measures

A significant positive Pearson correlation (two-tailed) was found between AVOID-IAT and ANX-IAT scores ($r = .20$, $p = .02$; see table 4). Furthermore, for implicit avoidant attachment (AVOID-IAT) a significant association was found with emotional well-being ($r = -.27$, $p = .003$) and psychological well-being ($r = -.22$, $p = .02$). The association between implicit avoidant attachment and total well-being was close to significant ($r = -.18$, $p = .051$). For implicit anxious attachment (ANX-IAT) no significant association was found neither between ANX-IAT and psychopathology nor between ANX-IAT and measures of well-being. However, a significant association was found between psychopathology and explicit secure attachment ($r = -.40$, $p = .001$), respectively explicit preoccupied attachment ($r = .30$, $p = .003$) and explicit fearful attachment ($r = .30$, $p = .003$). Correlations are presented in table 4.

Table 4

Correlations between measures of psychopathology (SQ), well-being and the subscales of well-being (MHC), implicit attachment (IAT) and explicit attachment (RQ).

	AVOID-IAT	ANX-IAT	RQ Secure	RQ Dismissive	RQ preoccupied	RQ Fearful
AVOID-IAT	-	-	-	-	-	-
ANX-IAT	.20*	-	-	-	-	-
RQ Secure	.06	.03	-	-	-	-
RQ Dismissive	-.04	.15	-.14	-	-	-
RQ Preoccupied	.12	.07	-.16	-.06	-	-
RQ Fearful	.02	.09	-.56*	.06	.18	-
SQ Psychopathology	.10	.05	-.40**	-.08	.30**	.30**
MHC Total	-.18	-.14	.20*	-.01	-.12	-.10
MHC Emotional	-.27**	-.14	.23*	.07	-.16	-.11
MHC Social	-.07	.07	.17	-.01	-.15	-.10
MHC Psychological	-.22*	-.16	.18	-.04	-.05	-.07

Note. * $p < .05$; ** $p < .01$.

3.4.4 Regression analyses

Avoidant attachment and psychopathology

The results of the regression analysis with psychopathology as criterion variable did not show a significant association between psychopathology and age, gender and education (table 5, step 1). Adding explicit dismissive attachment to the model (table 5, step 2) did not explain additional variance in psychopathology, nor did implicit avoidant attachment (table 5, step 3). Implicit avoidant attachment was not significantly associated with psychopathology ($\beta = .10$, $p = .37$).

Anxious attachment and psychopathology

Adding explicit preoccupied attachment to the regression model comprising age, gender and education, explained a significant amount of additional variance in psychopathology ($\Delta R^2 = .08$, $p = .005$; table 5, step 2). The tested model was significant ($F(4, 93) = 2.48$, $p = .049$), indicating that higher explicit preoccupied attachment was associated with higher psychopathology ($\beta = .30$, $p = .005$). Adding implicit anxious attachment (table 5, step 3) did not explain additional variance in psychopathology compared to the model comprising explicit preoccupied attachment. Implicit anxious attachment was not significantly associated with psychopathology ($\beta = .03$, $p = .78$).

Table 5

Regression analysis using respectively AVOID-IAT, ANX-IAT as independent variable and psychopathology total score as criterion variable.

	Step 1		Step 2		Step 3	
Variable	B(SE)	β	B(SE)	β	B(SE)	β
Psychopathology (AVOID-model)						
	$R^2 = .02$		$R^2 = .02$	$\Delta R^2 = .00$	$R^2 = .03$	$\Delta R^2 = .01$
Gender ¹	.11 (0.21)	.05	.09 (0.21)	.05	.09 (0.21)	.04
Age	-.14 (0.11)	-.13	-.13 (0.11)	-.12	-.13 (0.11)	-.12
Education ²	.00 (0.08)	.00	.00 (0.08)	.00	-.01 (0.08)	-.02
RQ Dismissive ³			-.05 (0.11)	-.05	-.04 (0.11)	-.04
AVOID-IAT					.10 (0.11)	.10
Psychopathology (ANX-model)						
	$R^2 = .02$		$R^2 = .10$	$\Delta R^2 = .08^{**}$	$R^2 = .10$	$\Delta R^2 = .00$
Gender ¹	.17 (0.21)	.09	.07 (0.20)	.04	.07 (0.21)	.04
Age	-.08 (0.11)	-.07	-.06 (0.10)	-.06	-.06 (0.11)	-.05
Education ²	-.02 (0.08)	-.03	.02 (0.07)	.03	.02 (0.08)	.03
RQ Preoccupied ⁴			.30 (0.10)	.30 ^{**}	.30 (0.11)	.30 ^{**}
ANX-IAT					.03 (0.11)	.03

Note. * $p < .05$; ** $p < .01$

1 1 = male, 2 = female; 2 ranging from 1 = first stage of basic education, to 8 = Master's degree;
3 Relationship Questionnaire Dismissive Attachment 4 Relationship Questionnaire Preoccupied Attachment

Avoidant attachment and well-being

The results of the regression analysis with total well-being as criterion variable did not show a significant association between total well-being and age, gender and education (table 6, step 1). Adding explicit dismissive attachment to the model (table 6, step 2) did not explain additional variance in total well-being. However, adding implicit avoidant attachment (table 6, step 3) did explain additional variance in total well-being compared to the model comprising only explicit dismissive attachment, age gender and education. Implicit avoidant attachment was significantly associated with total well-being ($\beta = -.22$, $p = .03$). More implicit avoidant attachment was significantly associated with less total well-being (table 6, step 3).

The results of the regression analysis with emotional well-being as criterion variable did not show a significant association between emotional well-being and age, gender and education (table 6, step 1). Adding explicit dismissive attachment to the model (table 5, step 2) did not explain additional variance in emotional well-being. However, adding implicit avoidant attachment (table 6, step 3) did explain additional variance in emotional well-being compared to the model comprising only explicit dismissive attachment, age gender and education. Implicit avoidant attachment was significantly associated with emotional well-being ($\beta = -.26$, $p = .01$). More implicit avoidant attachment was significantly associated with less emotional well-being.

The results of the regression analysis with social well-being as criterion variable showed a significant association between social well-being and age (table 6, step 1). Higher age was significantly associated with more social well-being ($\beta = .20$, $p = .048$). Adding explicit dismissive attachment to the model (table 6, step 2) did not explain additional variance in social well-being, nor

did implicit avoidant attachment (table 6, step 3). Implicit avoidant attachment was not significantly associated with social well-being ($\beta = -.1$, $p = .29$).

The results of the regression analysis with psychological well-being as criterion variable did not show a significant association between psychological well-being and age, gender and education (table 6, step 1). Adding explicit dismissive attachment to the model (table 6, step 2) did not explain additional variance in psychological well-being. However, adding implicit avoidant attachment (table 6, step 3) did explain additional variance in psychological well-being compared to the model comprising only explicit dismissive attachment, age gender and education. Implicit avoidant attachment was significantly associated with psychological well-being ($\beta = -.24$, $p = .01$). More implicit avoidant attachment was significantly associated with lower psychological well-being.

Table 6.

Regression analysis using implicit avoidant attachment and explicit dismissive attachment as independent variables and well-being total score and well-being subscales as criterion variable.

	Step 1		Step 2		Step 3	
Variable	B(SE)	β	B(SE)	β	B(SE)	β
Total well-being (AVOID-model)						
	$R^2 = .04$		$R^2 = .05$		$R^2 = .09$	
			$\Delta R^2 = .00$		$\Delta R^2 = .05^*$	
Gender ¹	-.23 (0.19)	-.12	-.25 (0.20)	-.13	-.26 (0.19)	-.13
Age	.14 (0.10)	.14	.16 (0.11)	.15	.16 (0.10)	.15
Education ²	-.05 (0.07)	-.06	-.05 (0.07)	-.07	-.02 (0.07)	-.03
RQ Dism ³			-.06 (0.10)	-.06	-.07 (0.10)	-.08
AVOID-IAT					-.22 (0.10)	-.22*
Emotional well-being (AVOID-model)						
	$R^2 = .03$		$R^2 = .03$		$R^2 = .10$	
			$\Delta R^2 = .00$		$\Delta R^2 = .07^{**}$	
Gender ¹	-.17 (0.19)	-.09	-.16 (0.20)	-.08	-.17 (0.19)	-.09
Age	.09 (0.10)	.09	.08 (0.11)	.08	.08 (0.10)	.08
Education ²	-.08 (0.07)	-.12	-.08 (0.07)	-.12	-.05 (0.07)	-.08
RQ Dism ³			.03 (0.10)	.03	.02 (0.10)	.02
AVOID-IAT					-.27 (0.10)	-.26**
Social well-being (AVOID-model)						
	$R^2 = .05$		$R^2 = .05$		$R^2 = .06$	
			$\Delta R^2 = .00$		$\Delta R^2 = .01$	
Gender ¹	-.15 (0.19)	-.08	-.16 (0.19)	-.08	-.17 (0.19)	-.09
Age	.21 (0.10)	.20*	.22 (0.11)	.21*	.22 (0.11)	.21*
Education ²	-.02 (0.07)	-.03	-.02 (0.07)	-.03	-.01 (0.07)	-.01
RQ Dism ³			-.05 (0.10)	-.05	-.06 (0.10)	-.06
AVOID-IAT					-.11 (0.10)	
Psychological well-being (AVOID-model)						
	$R^2 = .03$		$R^2 = .04$		$R^2 = .10$	
			$\Delta R^2 = .01$		$\Delta R^2 = .06^*$	
Gender ¹	-.26 (0.19)	-.14	-.29 (0.19)	-.15	-.30 (.19)	-.16
Age	.10 (0.10)	.10	.12 (0.10)	.11	.12 (.10)	.11
Education ²	-.03 (0.07)	-.05	-.04 (0.07)	-.05	-.01 (.07)	-.01
RQ Dism ³			-.09 (0.10)	-.09	-.10 (.09)	-.11
AVOID-IAT					-.25 (.10)	-.24*

Note. * $p < .05$; ** $p < .01$

¹ 1 = male, 2 = female

² ranging from 1 = first stage of basic education, to 8 = Master's degree ³ Relationship Questionnaire Dismissive Attachment

Anxious attachment and well-being

The results of the regression analysis with total well-being as criterion variable did not show a significant association between total well-being and age, gender and education (table 7, step 1). Adding explicit preoccupied attachment to the model (table 7, step 2) did not explain additional variance in total well-being, nor did implicit anxious attachment (table 7, step 3). Implicit anxious attachment was not significantly associated with total well-being ($\beta = -.11, p = .25$).

The results of the regression analysis with emotional well-being as criterion variable did not show a significant association between emotional well-being and age, gender and education (table 7, step 1). Adding explicit preoccupied attachment to the model (table 7, step 2) did not explain additional variance in emotional well-being, nor did implicit anxious attachment (table 7, step 3). Implicit anxious attachment was not significantly associated with emotional well-being ($\beta = -.12, p = .22$).

The results of the regression analysis with social well-being as criterion variable did not show a significant association between social well-being and gender and education. Age, however, was found to be positively associated with social well-being (table 7, step 1). Adding explicit preoccupied attachment to the model (table 7, step 2) did not explain additional variance in social well-being, nor did implicit anxious attachment (table 7, step 3). Implicit anxious attachment was not significantly associated with social well-being ($\beta = -.03, p = .73$).

The results of the regression analysis with psychological well-being as criterion variable did not show a significant association between psychological well-being and age, gender and education (table 7, step 1). Adding explicit preoccupied attachment to the model (table 7, step 2) did not explain additional variance in psychological well-being, nor did implicit anxious attachment (table 7, step 3). Implicit anxious attachment was not significantly associated with psychological well-being ($\beta = -.13, p = .19$).

Table 7

Regression analysis using implicit anxious attachment and explicit preoccupied attachment as independent variables and well-being total score and well-being subscales as criterion variable.

	Step 1		Step 2		Step 3	
Variable	B(SE)	β	B(SE)	β	B(SE)	β
Total well-being (ANX-model)						
	$R^2 = .04$		$R^2 = .05$	$\Delta R^2 = .01$	$R^2 = .06$	$\Delta R^2 = .01$
Gender ¹	-.20 (0.19)	-.10	-.17 (0.19)	-.09	-.18 (0.19)	-.10
Age	.15 (0.10)	.15	.15 (0.10)	.15	.13 (0.10)	.13
Education ²	-.01 (0.07)	-.02	-.03 (0.07)	-.04	-.02 (0.07)	-.03
RQ Preoccupied ³			-.11 (0.10)	-.11	-.10 (0.10)	-.10
ANX-IAT					-.11 (0.10)	-.11
Emotional well-being (ANX-model)						
	$R^2 = .02$		$R^2 = .04$	$\Delta R^2 = .03$	$R^2 = .06$	$\Delta R^2 = .01$
Gender ¹	-.13 (0.19)	-.07	-.09 (0.19)	-.05	-.10 (0.19)	-.05
Age	.12 (0.10)	.11	.11 (0.10)	.11	.09 (0.10)	.08
Education ²	-.02 (0.07)	-.03	-.04 (0.07)	-.05	-.03 (0.07)	-.04
RQ Preoccupied ³			-.16 (0.10)	-.16	-.15 (0.10)	-.16
ANX-IAT					-.12 (0.10)	-.12
Social well-being (ANX-model)						
	$R^2 = .05$		$R^2 = .07$	$\Delta R^2 = .02$	$R^2 = .07$	$\Delta R^2 = .00$
Gender ¹	-.16 (0.19)	-.08	-.12 (0.19)	-.06	-.12 (0.19)	-.06
Age	.20 (0.10)	.19*	.19 (0.10)	.19 *	.19 (0.10)	.18
Education ²	.01 (0.07)	.01	-.01 (0.07)	-.01	-.01 (0.07)	-.01
RQ Preoccupied ³			-.14 (0.10)	-.14	-.13 (0.10)	-.14
ANX-IAT					-.03 (0.10)	-.03
Psychological well-being (ANX-model)						
	$R^2 = .03$		$R^2 = .03$	$\Delta R^2 = .00$	$R^2 = .04$	$\Delta R^2 = .02$
Gender ¹	-.20 (0.18)	-.11	-.19 (0.19)	-.10	-.20 (0.18)	-.10
Age	.11 (0.09)	.11	.10 (0.10)	.11	.08 (0.10)	.08
Education ²	-.02 (0.07)	-.03	-.03 (0.07)	-.04	-.02 (0.07)	-.02
RQ Preoccupied ³			-.03 (0.09)	-.03	-.02 (0.09)	-.02
ANX-IAT					-.12 (0.09)	-.13

Note. * $p < .05$, ** $p < .01$

¹ 1 = male, 2 = female

² ranging from 1 = first stage of basis education, to 8 = Master's degree

³ Relationship Questionnaire Preoccupied Attachment

3.5 Discussion

Although previous studies already stressed the crucial role of attachment-related automatic processes in human behaviour, little is known about implicit general attachment and its association with mental health. As implicit measures of general adult attachment were lacking, two IATs, namely the AVOID-IAT and the ANX-IAT, were developed to complement existing IATs measuring attachment to a specific attachment figure such as the mother, the father or the romantic partner. This study set out to describe the psychometric of two instruments measuring implicit IAT adult attachment style in the general population. IAT measures typically show high internal consistency ($\alpha \approx .80$ and often higher estimates) (Schnabel et al., 2008). The split-half reliabilities for the AVOID-IAT and the ANX-

IAT are in line with these findings, showing adequate internal consistency for both. In contrast, the test-retest reliabilities of IATs are in general less satisfactory and show a median of $r = .56$ across different studies (Nosek et al., 2007). The test-retest reliability of the ANX-IAT ($.59 \geq r \geq .72$) outperformed this median test-retest reliability and was found to be acceptable. The test-retest reliability of the AVOID-IAT underperformed and was observed to be poor. The discrepancy between satisfactory internal consistencies and smaller retest reliabilities indicates that IATs capture both stable and situational variance (Schnabel et al., 2008). Pre-IAT exposure to different kinds of information appears to influence participants' construal of the category labels involved in the IAT (Fazio & Olson, 2003). According to Payne, Vuletic and Lundberg (2017) implicit evaluations reflect accessibility of a thought, evaluation, stereotype, trait or other information. This accessibility can vary chronically and situationally. In different situations, different representations may be activated and produce inconsistency in implicit measures: "Chocolate lovers love chocolate most of the time, but not all of the time" (Schimmack, 2019). The poor test-retest reliability of the AVOID-IAT might suggest that the measurement of implicit avoidant general adult attachment may be sensitive to situational changes or manipulations. Another explanation for the poor test-retest reliability of the AVOID-IAT may be found in the stimulus selection. In selecting stimuli for a new IAT, it is important that they are familiar and unambiguously fall into one of two categories (Brunel et al., 2004). Although the IAT effect is fairly robust across relatively wide variations in item familiarity (Brunel et al., 2004), and our stimuli were carefully selected based on literature and input from professionals in the field, further examination and elaboration of the stimuli selected for the AVOID-IAT may be advised.

The correlation between the AVOID-IAT and the ANX-IAT Attachment was significant, but only of medium size, suggesting that both IATs measure related, but different constructs. Correlations between IATs and explicit self-reports are in general low (Hofmann et al., 2005; Kurdi et al., 2019). Implicit measures are not just 'explicit measures without bias' (Brunel et al., 2004). Implicit measures such as IATs and explicit measures such as self-report questionnaires assess different constructs (Bar-Anan & Vianello, 2018; Nosek & Smyth, 2007). There is evidence that the processing of implicit and explicit evaluations activate different regions of the brain (Cunningham et al., 2003). The non-significant correlations between respectively AVOID-IAT and the RQ dismissive, and between ANX-IAT and the RQ preoccupied, are in line with this perspective.

Results of the regression analyses with psychopathology as criterion variable showed no significant association between psychopathology, AVOID-IAT nor ANX-IAT. This was not expected. After all, attachment insecurity can be viewed as a general vulnerability to psychopathology with the specific symptomatology depending on genetic and environmental factors (Mikulincer & Shaver, 2012). However, Mikulincer and Shaver (2012) also stated that attachment insecurities per se are unlikely to be sufficient causes of psychopathology. As this study was performed in a general population sample, it is possible that the extent to which individuals implicitly showed to be avoidant and/or anxious attached was simply not high enough to elicit psychopathological complaints, or was an insufficient cause for psychopathology. Further examination of the two IATs in clinical samples can shed light on this assumption. Furthermore, as the association between insecure attachment and psychopathology may be moderated by e.g. life events, or mediated by e.g. self-representations or

problems in interpersonal relations (Mikulincer & Shaver, 2012), it may be worthwhile to examine the newly developed IATs and their association with psychopathology, taking these moderating and mediating variables into account. However, as stated above, implicit and explicit measures do not necessarily tap into the same construct. Findings that seem to be valid for explicit measures can therefore not be generalized to implicit measures. It might thus also be possible that implicit general adult attachment is simply not associated with psychopathology. Replication studies can help to clarify this.

As expected, the association between implicit avoidant attachment and well-being was significant. The more implicitly avoidant participants were, the lower their emotional and psychological well-being was. Implicit avoidant attachment was not associated with social well-being. Previous research revealed that individuals experienced some difficulties answering the items of the social well-being subscale of the MHC-SF (Köhle, 2010). They expressed to have difficulties in grasping the meaning of the words 'community', 'society', and 'something important to contribute to society'. In addition, the items of the social well-being scale seem to assess a broader and more abstract societal sense of belonging that might be less or not influenced by relational attachment. Furthermore, a general population sample such as the current one, may mainly consist of individuals within a non-pathological range of implicit attachment. Their strategies to avoid attachment are likely to be functional, in the sense that they adequately avoid close social contact and more important, are happy with it. They do not experience this diminished attachment as detrimental for their social well-being (Seagel et al., 2020). These findings may therefore be interpreted as preliminary support for the validity of the developed AVOID-IAT in the field of well-being.

In contrast, implicit anxious general attachment, as measured with the ANX-IAT was not associated with well-being in general nor with emotional, psychological and social well-being. As described above, it is possible that the extent to which individuals in this general population sample were implicitly anxiously attached was not pronounced enough to provoke a decrease in well-being or that the association between ANX-IAT and well-being measures might be dependent of specific contexts such as the presence of a threat (Mikulincer & Shaver, 2016). Further examination in clinical samples and in different contexts can help to elucidate this. However, as our findings are not in favour of validity of the developed ANX-IAT, re-examination of the development and the selection of the stimuli of this specific IAT is also recommended.

3.6 Limitations

First, this study has a cross-sectional design, and therefore no conclusions can be drawn concerning the causal direction of the observed associations. Literature shows that insecure attachment can be seen as a risk factor for the development of psychological problems, but there is also evidence showing that psychological problems can increase attachment insecurity (Mikulincer & Shaver, 2016). The second limitation is that, although the results of the current study show that the AVOID-IAT appears to measure different aspects of attachment style than self-report measures of explicit avoidant attachment, we cannot conclude that what is measured with the IAT is indeed implicit. Schimmack (2019) argues that although the IAT was a major breakthrough as indirect measurement,

with relatively high reliability compared to other indirect methods, it is overbearing to consider it a window into people's unconscious feelings, cognitions, or attitudes. However there is no disagreement about the validity of the IATs 'as a general method for measuring relative association strength' (Greenwald et al., 2015; Schimmack, 2019). The third limitation concerns the generalizability of the findings to a broader population: the majority of the participants in the recruited convenience sample were involved in a relationship. Romantic adult attachment-related thoughts, affects and behavior are influenced by experiences in the relationship and take place in the context of a specific partner (Mikulincer & Shaver, 2016). Hence, findings might be different among single adults.

3.7 Conclusion

In sum, the split-half reliabilities of the AVOID-IAT and the ANX-IAT were good; the test-retest reliability of the ANX-IAT was adequate, whereas the test-retest reliability of the AVOID-IAT was low. The medium-sized correlation between the AVOID-IAT and the ANX-IAT suggested that both IATs measure related, but different constructs. Both IATs did not explain variance in psychopathology additional to explicit measures. The AVOID-IAT showed added value over explicit measurement of avoidant attachment in explaining variance in well-being, particularly in emotional and psychological well-being, whereas the ANX-IAT did not.

To conclude, our findings provide a basis from which more valid IATs measuring general adult attachment can be developed. Furthermore, they give a first insight in how implicit general adult attachment may influence our mental health as our results suggest that especially implicit avoidant attachment might be related to well-being, particularly emotional and psychological well-being. However, future research is needed investigate the role of implicit general adult attachment in mental health and to optimize the two IATs in terms of validity before clinical use of the tools is recommended.

Acknowledgement

The authors wish to thank Anna van der Stok, Ingrid Pertou, Irina van Dam, Marianne Vergeer, Nellie Lievense, Gesina Smoes, Sven Aspers, Veronique Tjihuis, Wendy Celis for their help with the data collection.

References

- Ainsworth, M. D. S., Blehar, M. C., Waters, E., & Wall, S. (1978). *Patterns of attachment: A psychological study of the strange situation*. Lawrence Erlbaum.
- Baldwin, M. W. (1999). *Relational schemas: Research into social-cognitive aspect of interpersonal experience*. In D. Cervone & Y. Shoda (Eds.), *The coherence of personality: Social-cognitive bases of consistency, variability, and organization* (p. 127–154). Guilford Press.
- Banse, R., & Kowalick, C. (2007). Implicit attitudes towards romantic partners predict well-being in stressful life conditions: Evidence from the antenatal maternity ward. *International Journal of Psychology*, 42(3), 149–157. <https://doi.org/10.1080/00207590601067037>
- Bar-Anan, Y., & Vianello, M. (2018). A multi-method multi-trait test of the dual-attitude perspective. *Journal of Experimental Psychology: General*, 147(8), 1264–1272. <https://doi.org/10.1037/xge0000383>
- Bartholomew, K., & Horowitz, L. M. (1991). Attachment styles among young adults: a test of a four-category model. *Journal of Personality and Social Psychology*, 61(2), 226–244. <https://doi.org/10.1037//0022-3514.61.2.226>
- Belfiore, L. A., & Pietrowsky, R. (2017). Attachment styles and nightmares in adults. *Dreaming*, 27(1), 59–67. <https://doi.org/10.1037/drm0000045>
- Bluemke, M., & Frieze, M. (2008). Reliability and validity of the Single-Target IAT (ST-IAT): Assessing automatic affect towards multiple attitude objects. *European Journal of Social Psychology*, 38(6), 977–997. <https://doi.org/10.1002/ejsp.487>
- Bochner, R., & Halpern, F. (1942). *The clinical application of the Rorschach test*. Grune & Stratton.
- Bowlby, J. (1988). *A Secure Base. Parent-Child Attachment and Healthy Human Development*. New York: Basic Books.
- Brunel, F. F., Tietje, B. C., & Greenwald, A. G. (2004). Is the Implicit Association Test a Valid and Valuable Measure of Implicit Consumer Social Cognition? *Journal of Consumer Psychology*, 14(4), 385–404. https://doi.org/10.1207/s15327663jcp1404_8
- Carlier, I., Schulte-Van Maaren, Y., Wardenaar, K., Giltay, E., Van Noorden, M., Vergeer, P., & Zitman, F. (2012). Development and validation of the 48-item Symptom Questionnaire (SQ-48) in patients with depressive, anxiety and somatoform disorders. *Psychiatry Research*, 200(2-3), 904–910. <https://doi.org/10.1016/j.psychres.2012.07.035>
- Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. Academic press.
- Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2013). *Applied multiple regression/correlation analysis for the behavioral sciences*. Routledge.
- Crowell, J. A., & Treboux, D. (1995). A review of adult attachment measures: Implications for theory and research. *Social Development*, 4(3), 294–327. <https://doi.org/10.1111/j.1467-9507.1995.tb00067.x>
- Cunningham, W. A., Johnson, M. K., Gatenby, J. C., Gore, J. C., & Banaji, M. R. (2003). Neural components of social evaluation. *Journal of Personality and Social Psychology*, 85(4), 639–649. <https://doi.org/10.1037/0022-3514.85.4.639>

- Dagan, O., Facompré, C. R., & Bernard, K. (2018). Adult attachment representations and depressive symptoms: A meta-analysis. *Journal of Affective Disorders*, 236, 274–290. <https://doi.org/10.1016/j.jad.2018.04.091>
- Davila, J., & Cobb, R. J. (2003). Predicting change in self-reported and interviewer-assessed adult attachment: tests of the individual difference and life stress models of attachment change. *Personality and Social Psychology Bulletin*, 29(7), 859-870. <https://doi.org/10.1177/0146167203029007005>
- Davila, J., Karney, B. R., & Bradbury, T. N. (1999). Attachment change processes in the early years of marriage. *Journal of Personality and Social Psychology*, 76(5), 783-802. <https://doi.org/10.1037//0022-3514.76.5.783>
- Davis, T. J., Morris, M., & Drake, M. M. (2016). The moderation effect of mindfulness on the relationship between adult attachment and wellbeing. *Personality and Individual Differences*, 96, 115–121. <https://doi.org/10.1016/j.paid.2016.02.080>
- De Houwer, J. (2003). The Extrinsic Affective Simon Task. *Experimental Psychology*, 50(2), 77-85. <https://doi.org/10.1026//1618-3169.50.2.77>
- De Houwer, J., Teige-Mocigemba, S., Spruyt, A., & Moors, A. (2009). Implicit measures: A normative analysis and review. *Psychological Bulletin*, 135(3), 347-368. <https://doi.org/10.1037/a0014211>
- Dewitte, M., De Houwer, J., & Buysse, A. (2008). On the role of the implicit self-concept in adult attachment. *European Journal of Psychological Assessment*, 24(4), 282–289. <https://doi.org/10.1027/1015-5759.24.4.282>
- Fazio, R. H., & Olson, M. A. (2003). Implicit measures in social cognition. research: their meaning and use. *Annual Review of Psychology*, 54, 297-327. <https://doi.org/10.1146/annurev.psych.54.101601.145225>
- Felton, L., & Jowett, S. (2013). Attachment and well-being: The mediating effects of psychological needs satisfaction within the coach–athlete and parent–athlete relational contexts. *Psychology of Sport and Exercise*, 14(1), 57-65. <https://doi.org/10.1016/j.psychsport.2012.07.006>
- Fiedler, K., Messner, C., & Bluemke, M. (2006). Unresolved problems with the "I", the "A", and the "T": A logical and psychometric critique of the Implicit Association Test (IAT). *European Review of Social Psychology*, 17, 74–1147. <https://doi.org/10.1080/10463280600681248>
- Fraley, R. C. (2002). Attachment stability from infancy to adulthood: Meta-analysis and dynamic modeling of developmental mechanisms. *Personality and Social Psychology Review*, 6(2), 123–151. https://doi.org/10.1207/S15327957PSPR0602_03
- Fraley, R. C., & Roisman, G. I. (2019). The development of adult attachment styles: four lessons. *Current Opinion in Psychology*, 25, 26-30. <https://doi.org/10.1016/j.copsyc.2018.02.008>
- Gariépy, G., & Elgar, F. J. (2016). Trends in psychological symptoms among Canadian adolescents from 2002 to 2014: Gender and socioeconomic differences. *The Canadian Journal of Psychiatry*, 61(12), 797-802. <https://doi.org/10.1177/0706743716670130>

- Gawronski, B., LeBel, E. P., Peters, K. R., & Banse, R. (2009). Methodological issues in the validation of implicit measures: Comment on De Houwer, Teige-Mocigemba, Spruyt, and Moors (2009). *Psychological Bulletin*, 135(3), 369-372.
<https://doi.org/10.1037/a0014820>
- Greenwald, A. G., Banaji, M. R., & Nosek, B. A. (2015). Statistically small effects of the Implicit Association Test can have societally large effects. *Journal of Personality and Social Psychology*, 108(4), 553–561. <https://doi.org/10.1037/pspa0000016>
- Greenwald, A. G., McGhee, D. E., & Schwartz, J. L.K. (1998). Measuring individual differences in implicit cognition: the implicit association test. *Journal of Personality and Social Psychology*, 74(6), 1464-1480. <https://doi.org/10.1037//0022-3514.74.6.1464>
- Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the Implicit Association Test: I. An improved scoring algorithm. *Journal of Personality and Social Psychology*, 85(2), 197–216. <https://doi.org/10.1037/0022-3514.85.2.197>
- Greenwald, A. G., Poehlman, T. A., Uhlmann, E. L., & Banaji, M. R. (2009). Understanding and using the Implicit Association Test: III. Meta-analysis of predictive validity. *Journal of Personality and Social Psychology*, 97(1), 17–41. <https://doi.org/10.1037/a0015575>
- Griffin, D. W., & Bartholomew, K. (1994). Models of the self and other: Fundamental dimensions underlying measures of adult attachment. *Journal of Personality and Social Psychology*, 67(3), 430–445. <https://doi.org/10.1037/0022-3514.67.3.430>
- Hayden, M. C., Müllauer, P. K., & Andreas, S. (2017). A systematic review on the association between adult attachment and interpersonal problems. *Journal of Psychology & Psychotherapy*, 7(2), 296. <https://doi.org/10.4172/2161-0487.1000296>
- Hofmann, W., Gawronski, B., Gschwendner, T., Le, H., & Schmitt, M. (2005). A meta-analysis on the correlation between the Implicit Association Test and explicit self-report measures. *Personality and Social Psychology Bulletin*, 31(10), 1369-1385. <https://doi.org/10.1177/0146167205275613>
- IBM Corp. (2016). *IBM SPSS Statistics for Windows* (Version 24.0) [Computer software]. IBM Corp.
- Johnson, R. E., & Saboe, K. N. (2011). Measuring implicit traits in organizational research: Development of an indirect measure of employee implicit self-concept. *Organizational Research Methods*, 14(3), 530–547. <https://doi.org/10.1177/1094428110363617>
- Kafetsios, K., & Sideridis, G. D. (2006). Attachment, social support and well-being in young and older adults. *Journal of Health Psychology*, 11(6), 863-875.
<https://doi.org/10.1177/1359105306069084>
- Karreman, A., & Vingerhoets, A. J. J. M. (2012). Attachment and well-being: The mediating role of emotion regulation and resilience. *Personality and Individual Differences*, 53(7), 821–826. <https://doi.org/10.1016/j.paid.2012.06.014>
- Keren, G., & Schul, Y. (2009). Two is not always better than one: A critical evaluation of two-system theories. *Perspectives on Psychological Science*, 4(6), 533–550. <https://doi.org/10.1111/j.1745-6924.2009.01164.x>

- Keyes, C. L. M. (2005). Mental illness and/or mental health? Investigating axioms of the complete state model of health. *Journal of Consulting and Clinical Psychology*, 73(3), 539. <https://doi.org/10.1037/0022-006X.73.3.539>
- Köhle, N. (2010). 'Mag ik vragen, wat ik u moet vragen?' Een onderzoek naar de zwakheden van het *Mental Health Continuum Short Form met behulp van het Three-Step Test-Interview* [Bachelor Thesis, Universiteit Twente]. <http://essay.utwente.nl/59879/>
- Kurdi, B., Seitchik, A. E., Axt, J. R., Carroll, T. J., Karapetyan, A., Kaushik, N., Tomezsko, D., Greenwald, A. G., & Banaji, M. R. (2019). Relationship between the Implicit Association Test and intergroup behavior: A meta-analysis. *American Psychologist*, 74(5), 569–586. <https://doi.org/10.1037/amp0000364>
- Lamers, S. M., Westerhof, G. J., Bohlmeijer, E. T., ten Klooster, P. M., & Keyes, C. L.M. (2011). Evaluating the psychometric properties of the Mental Health Continuum-Short Form (MHC-SF). *Journal of Clinical Psychology*, 67(1), 99-110. <https://doi.org/10.1002/jclp.20741>
- Lane, J. A., & Fink, R. S. (2015). Attachment, social support satisfaction, and well-being during life transition in emerging adulthood. *The Counseling Psychologist*, 43(7), 1034–1058. <https://doi.org/10.1177/0011000015592184>
- Lavy, S., & Littman-Ovadia, H. (2011). All you need is love? Strengths mediate the negative associations between attachment orientations and life satisfaction. *Personality and Individual Differences*, 50(7), 1050-1055. <https://doi.org/10.1016/j.paid.2011.01.023>
- Leak, G. K., & Parsons, C. J. (2001). The susceptibility of three attachment style measures to socially desirable responding. *Social Behavior and Personality: An International Journal*, 29(1), 21–30. <https://doi.org/10.2224/sbp.2001.29.1.21>
- Leary, M. R., Tambor, E. S., Terdal, S. K., & Downs, D. L. (1995). Self-esteem as an interpersonal monitor: The sociometer hypothesis. *Journal of Personality and Social Psychology*, 68(3), 518–530. <https://doi.org/10.1037/0022-3514.68.3.518>
- Leavitt, K., Fong, C. T., & Greenwald, A. G. (2011). Asking about well-being gets you half an answer: Intra-individual processes of implicit and explicit job attitudes. *Journal of Organizational Behavior*, 32(4), 672-687. <https://doi.org/10.1002/job.746>
- Maunder, R. G., Lancee, W. J., Nolan, R. P., Hunter, J. J., & Tannenbaum, D. W. (2006). The relationship of attachment insecurity to subjective stress and autonomic function during standardized acute stress in healthy adults. *Journal of Psychosomatic Research*, 60(3), 283-290. <https://doi.org/10.1016/j.jpsychores.2005.08.013>
- Meissner, F., Grigutsch, L. A., Koranyi, N., Müller, F., & Rothermund, K. (2019). Predicting behavior with implicit measures: Disillusioning findings, reasonable explanations, and sophisticated solutions. *Frontiers in Psychology*, 10, 2483. <https://doi.org/10.3389/fpsyg.2019.02483>
- Mikulincer, M., Dolev, T., & Shaver, P. R. (2004). Attachment-related strategies during thought suppression: ironic rebounds and vulnerable self-representations. *Journal of Personality and Social Psychology*, 87(6), 940-956. <https://doi.org/10.1037/0022-3514.87.6.940>
- Mikulincer, M., Ein-Dor, T., Solomon, Z., & Shaver, P. R. (2011). Trajectories of attachment insecurities over a 17-year period: A latent growth curve analysis of the impact of war captivity

- and posttraumatic stress disorder. *Journal of Social and Clinical Psychology*, 30(9), 960–984. <https://doi.org/10.1521/jscp.2011.30.9.960>
- Mikulincer, M., & Shaver, P. R. (2016). *Attachment in adulthood: Structure, dynamics, and change*. Guilford Press.
- Mikulincer, M., & Shaver, P. R. (2012). An attachment perspective on psychopathology. *World Psychiatry*, 11(1), 11–15. <https://doi.org/10.1016/j.wpsyc.2012.01.003>
- Mikulincer, M., Shaver, P. R., Bar-On, N., & Ein-Dor, T. (2010). The pushes and pulls of close relationships: attachment insecurities and relational ambivalence. *Journal of Personality and Social Psychology*, 98(3), 450–468. <https://doi.org/10.1037/a0017366>
- Morgan, C. D., & Murray, H. A. (1935). A method for investigating fantasies: The Thematic Apperception Test. *Archives of Neurology & Psychiatry*, 34(2), 289–306. <https://doi.org/10.1001/archneurpsyc.1935.02250200049005>
- Murray, S. L., Holmes, J. G., & Griffin, D. W. (2000). Self-esteem and the quest for felt security: how perceived regard regulates attachment processes. *Journal of Personality and Social Psychology*, 78(3), 478–498. <https://doi.org/10.1037//0022-3514.78.3.478>
- Nosek, B. A., Greenwald, A. G., & Banaji, M. R. (2005). Understanding and using the Implicit Association Test: II. Method variables and construct validity. *Personality and Social Psychology Bulletin*, 31(2), 166–180. <https://doi.org/10.1177/0146167204271418>
- Nosek, B. A., Greenwald, A. G., & Banaji, M. R. (2007). *The Implicit Association Test at Age 7: A Methodological and Conceptual Review*. In J. A. Bargh (Ed.), *Frontiers of social psychology. Social psychology and the unconscious: The automaticity of higher mental processes* (p. 265–292). Psychology Press.
- Nosek, B. A., & Smyth, F. L. (2007). A multitrait-multimethod validation of the Implicit Association Test: Implicit and explicit attitudes are related but distinct constructs. *Experimental Psychology*, 54(1), 14–29. <https://doi.org/10.1027/1618-3169.54.1.14>
- Payne, B. K., Cheng, C. M., Govorun, O., & Stewart, B. D. (2005). An inkblot for attitudes: affect misattribution as implicit measurement. *Journal of Personality and Social Psychology*, 89(3), 277–293. <https://doi.org/10.1037/0022-3514.89.3.277>
- Payne, B. K., Vuletic, H. A., & Lundberg, K. B. (2017). The bias of crowds: How implicit bias bridges personal and systemic prejudice. *Psychological Inquiry*, 28(4), 233–248. <https://doi.org/10.1080/1047840X.2017.1335568>
- Pietromonaco, P. R., & Beck, L. A. (2019). Adult attachment and physical health. *Current Opinion in Psychology*, 25, 115–120. <https://doi.org/10.1016/j.copsyc.2018.04.004>
- Ravitz, P., Maunder, R., Hunter, J., Sthankiya, B., & Lancee, W. (2010). Adult attachment measures: A 25-year review. *Journal of Psychosomatic Research*, 69(4), 419–432. <https://doi.org/10.1016/j.jpsychores.2009.08.006>
- Ren, Z., Wang, D., Yang, A., Li, M., & Higgins, L. T. (2011). Implicit and explicit measures of adult attachment to mothers in a Chinese context. *Social Behavior and Personality: An International Journal*, 39(5), 701–712. <https://doi.org/10.2224/sbp.2011.39.5.701>

- Reynolds, S. J., Leavitt, K., & DeCelles, K. A. (2010). Automatic ethics: the effects of implicit assumptions and contextual cues on moral behavior. *Journal of Personality and Social Psychology*, 95(4), 752-760. <https://doi.org/10.1037/a0019411>
- Scharfe, E., & Bartholomew, K. I. M. (1994). Reliability and stability of adult attachment patterns. *Personal Relationships*, 1(1), 23-43. <https://doi.org/10.1111/j.1475-6811.1994.tb00053.x>
- Schimmack, U. (2019). The Implicit Association Test: A Method in Search of a Construct. *Perspectives on Psychological Science*, 1745691619863798. <https://doi.org/10.1177/1745691619863798>
- Schmitt, D. P., Alcalay, L., Allensworth, M., Allik, J., Ault, L., Austers, I., Bennett, K. L., Bianchi, G., Boholst, F., Cunen, M. A. B., Braeckman, J., Brainerd, E. G., Jr., Caral, L. G. A., Caron, G., Casullo, M. M., Cunningham, M., Daibo, I., De Backer, C., De Souza, E., . . . Zupančič, A. (2004). Patterns and Universals of Adult Romantic Attachment Across 62 Cultural Regions: Are Models of Self and of Other Pancultural Constructs? *Journal of Cross-Cultural Psychology*, 35(4), 367-402. <https://doi.org/10.1177/0022022104266105>
- Schnabel, K., Asendorpf, J. B., & Greenwald, A. G. (2008). Assessment of individual differences in implicit cognition: A review of IAT measures. *European Journal of Psychological Assessment*, 24(4), 210-217. <https://doi.org/10.1027/1015-5759.24.4.210>
- Seagel, H., Lifshin, U., & Hirschberger, G. (2020). Diehard singles: Bachelorhood as a terror management strategy among avoidant men. *Personal relationships*, 27(1), 27-46. <https://doi.org/10.1111/pere.12306>
- Seedat, S., Scott, K. M., Angermeyer, M. C., Berglund, P., Bromet, E. J., Brugha, T. S., Demyttenaere, K., de Girolamo, G., Haro, J. M., Jin, R., Karam, E. G., Kovess-Masfety, V., Levinson, D., Mora, M. E. M., Ono, Y., Ormel, J., Pennell, B.-E., Posada-Villa, J., Sampson, N. A., . . . Kessler, R. C. (2009). Cross-national associations between gender and mental disorders in the World Health Organization World Mental Health Surveys. *Archives of General Psychiatry*, 66(7), 785-795. <https://doi.org/10.1001/archgenpsychiatry.2009.36>
- Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology*, 18(6), 643-662. <https://doi.org/10.1037/h0054651>
- Uhlmann, E. L., Leavitt, K., Menges, J. I., Koopman, J., Howe, M., & Johnson, R. E. (2012). Getting explicit about the implicit: A taxonomy of implicit measures and guide for their use in organizational research. *Organizational Research Methods*, 15(4), 553-601. <https://doi.org/10.1177/1094428112442750>
- Venta, A., Jardin, C., Kalpakci, A., & Sharp, C. (2016). The development and preliminary psychometric evaluation of an attachment Implicit Association Task. *Bulletin of the Menninger Clinic*, 80(3), 255-280. <https://doi.org/10.1521/bumc.2016.80.3.255>
- Wei, M., Liao, K. Y. H., Ku, T. Y., & Shaffer, P. A. (2011). Attachment, self-compassion, empathy, and subjective well-being among college students and community adults. *Journal of Personality*, 79(1), 191-221. <https://doi.org/10.1111/j.1467-6494.2010.00677.x>
- Wei, M., Shaffer, P. A., Young, S. K., & Zakalik, R. A. (2005). Adult Attachment, Shame, Depression, and Loneliness: The Mediation Role of Basic Psychological Needs Satisfaction. *Journal of Counseling Psychology*, 52(4), 591-601. <https://doi.org/10.1037/0022-0167.52.4.591>

- Westerhof, G. J., & Keyes, C. L. (2010). Mental Illness and Mental Health: The Two Continua Model Across the Lifespan. *Journal of Adult Development*, 17(2), 110-119.
<https://doi.org/10.1007/s10804-009-9082-y>
- Zayas, V., & Shoda, Y. (2005). Do Automatic Reactions Elicited by Thoughts of Romantic Partner, Mother, and Self Relate to Adult Romantic Attachment? *Personality and Social Psychology Bulletin*, 31(8), 1011–1025. <https://doi.org/10.1177/0146167204274100>

Chapter 4. Self-esteem, Attachment and Relationship Formation

This chapter is published as:

Visser, L., Lataster, J., Pat-El, R., Van Lankveld, J., & Jacobs, N. (2026). The role of self-esteem and attachment in relationship formation. *Social Sciences & Humanities*, 13.

<https://doi.org/10.1016/j.ssaho.2026.102724>

Abstract

Diverse dating methods, including speed dating, online dating, and matchmaking services, provide distinct environments that impact partner selection and relationship development. This study examined the role of explicit and implicit self-esteem and explicit and implicit attachment style in predicting successful relationship formation among single adults (N = 183) enrolled in a matchmaking program with personal coaching. Baseline assessments included the Rosenberg Self-Esteem Scale, the Relationship Questionnaire, and Single-Target Implicit Association Tests (IATs) to measure both explicit and implicit self-esteem and attachment. Outcome success was defined as maintaining a relationship for at least three months. The results showed that explicit anxious attachment was a significant, negative predictor of relationship formation, whereas self-esteem (both explicit and implicit) and implicit attachment did not predict relationship formation. These findings suggest that addressing attachment anxiety may improve relationship formation success, with implications for both matchmaking professionals and their clients seeking long-term partnerships.

4.1 Introduction

Being single, defined as not having an intimate partner, is increasingly prevalent in Western societies (Cherlin, 2009). Despite many individuals viewing singlehood as a transient state, around 40% of singles report challenges in finding a partner or establishing a relationship (Apostolou et al., 2019; Apostolou & Tsangari, 2022). Research has explored relationship formation in various contexts, each with unique dynamics influencing partner selection and relationship development. Speed dating represents one approach to relationship formation, characterized by brief, rapid-fire interactions that often prioritize initial attraction and physical appearance in quick decision-making (Kurzban & Weeden, 2005). Research has shown that stated preferences for an ideal partner often do not translate to actual choices in these face-to-face interactions (Buston & Emlen, 2003; Todd et al., 2007). While this format allows for immediate chemistry assessment, this may not be the best predictors of long-term relationship success. Online dating platforms offer a contrasting approach by providing users with detailed profiles and opportunities for virtual interaction before meeting in person (Finkel et al., 2012; Whitty, 2008). This environment allows for more deliberate evaluation of potential partners, though the emphasis may still be on initial attraction due to the prominent role of photos and first impressions. However, as Joel et al. (2017) highlighted, the algorithms employed by these platforms have not demonstrated the ability to predict unique romantic desire or 'relationship variance.' Matchmaking

services represent a third distinct approach that leverages detailed profiles and the matchmaker's personal knowledge of candidates to facilitate pairings based on deeper compatibility. By presenting potential partners with profile sketches without photos, matchmaking encourages more deliberate and informed evaluation than speed dating or online dating, focusing on factors beyond initial attraction that contribute to lasting relationships. Given the unique context of matchmaking services, which differ from other dating contexts like online dating in their emphasis on in-depth compatibility assessments (Finkel et al., 2012; Whitty, 2008), it is important to consider how individual characteristics might influence relationship formation in this specific setting. Similar to research on online dating, which highlights the role of individual differences in navigating specific dating stages (Sharabi & Caughlin, 2017), understanding how these factors operate within the matchmaking context is crucial. For example, self-esteem, linked to relationship satisfaction and the ability to balance connection and independence (Murray et al., 2006, 2008; Patrick et al., 2007), and attachment style, known to influence dating success and relationship quality (Poulsen et al., 2012; Mikulincer & Shaver, 2016), could be particularly relevant factors to explore.

4.1.1 The Context of Matchmaking

Matchmaking services create a psychologically distinct environment that differs fundamentally from self-directed dating approaches. Unlike online dating where individuals make autonomous partner selections, or speed dating where snap judgments predominate, matchmaking involves professional intermediaries who control the partner selection process. This agency-driven approach may reduce some of the self-presentation pressures and rejection fears that characterize other dating contexts (Finkel et al., 2012; Sharabi & Caughlin, 2017). The matchmaker's role extends beyond simple introductions to include coaching, feedback, and ongoing support throughout the dating process. This professional guidance may buffer against some of the attachment-related anxieties and self-esteem threats that typically emerge during relationship initiation. Furthermore, the deliberate, photo-free profile presentations used in matchmaking encourage focus on compatibility factors rather than immediate physical attraction (Buston & Emlen, 2003; Eastwick & Finkel, 2008a), potentially creating conditions where deeper psychological characteristics become more salient predictors of success.

Individual psychological characteristics may have varying impacts on relationship formation success across contexts. Given this unique matchmaking environment, certain individual psychological characteristics may be particularly influential. Self-esteem, linked to relationship satisfaction and the ability to balance connection and independence (Murray et al., 2006, 2008; Patrick et al., 2007), and attachment style, known to influence dating success and relationship quality (Poulsen et al., 2012; Mikulincer & Shaver, 2016), warrant specific examination in this context.

4.1.2 Self-esteem and Attachment in Relationship Formation

Self-esteem, defined as the outcome of an individual's global self-evaluation (Rosenberg, 1965), significantly impacts relationship formation. Individuals with low self-esteem often experience difficulties in both initiating and maintaining relationships, frequently fearing rejection and

misinterpreting their partner's behavior (Cameron & Granger, 2019; Erol & Orth, 2016; Robinson & Cameron, 2012). Conversely, high self-esteem has been associated with greater relationship satisfaction and the ability to connect with partners while maintaining independence (Murray et al., 2006, 2008; Patrick et al., 2007). These findings suggest that self-esteem may play a crucial role in the partner selection and relationship initiation processes characteristic of matchmaking contexts.

Another factor in relationship formation is attachment, which helps explain how early experiences with caregivers—as well as later relationship experiences—shape relationship patterns from adolescence into adulthood. While self-esteem influences how individuals approach relationships, attachment style determines the specific patterns of behavior and expectations they bring to romantic interactions. Research has consistently demonstrated that secure attachment, characterized by positive views of self and others, is associated with greater success in dating, increased relationship commitment (Poulsen et al., 2012), and higher relationship satisfaction over time (Mikulincer & Shaver, 2016). In contrast, insecure attachment styles, such as anxious attachment (marked by fear of rejection) and avoidant attachment (characterized by discomfort with closeness), can hinder relationship formation and satisfaction. For example, in online dating, where detailed profiles and virtual communication are emphasized (Finkel et al., 2012), anxious individuals may prematurely seek offline meetings due to fear of rejection, while avoidant individuals may have difficulty transitioning from online interactions to real-world dates (Sharabi & Caughlin, 2017). McClure et al. (2010) found that people with higher attachment anxiety tended to have fewer successful matches in a speed-dating event. This effect was especially noticeable for men. McClure (2014) replicated and extended these findings, showing that attachment anxiety predicted negative interpersonal outcomes in the context of speed dating, video introductions, and face-to-face interactions with a confederate. These effects were mediated by the anxious person's displays of anxiety and social disengagement. In McClure et al.'s study (2010), people high in attachment avoidance did not self-select into speed-dating events. Birnie et al. (2009) found that people high in attachment avoidance expected new relationships to fail due to their negative expectations about commitment. Summarizing, individuals with an anxious attachment style may exhibit behaviors that hinder initial attraction, while those with an avoidant attachment style may struggle with deeper connection if the relationship proceeds.

4.1.3 Explicit and Implicit Dimensions

These conscious relationship orientations, however, may not fully capture the unconscious processes that also influence romantic behavior. Previous research has shown that insecure attachment, particularly attachment anxiety, can evoke ambivalent feelings and behaviors in relationship partners, often at an implicit level, especially in the context of established relationships (Mikulincer et al., 2010). Additionally, individuals with avoidant attachment styles may consciously desire relationships but unconsciously sabotage them due to fear of intimacy, again primarily observed in existing relationships (Mikulincer et al., 2010; Mikulincer & Shaver, 2016). However, the influence of these unconscious patterns on the *formation* of new relationships, particularly within the unique context of matchmaking, thusfar remains underexplored.

The investigation of implicit processes in matchmaking contexts is theoretically justified based on several considerations. First, dating and relationship formation represent inherently socially desirable domains where individuals may be motivated to present themselves favorably, potentially compromising the validity of explicit self-reports (Greenwald et al., 1998). Research has consistently shown that implicit measures are less susceptible to conscious control and social desirability bias compared to self-report measures (De Houwer et al., 2009; Nosek & Smyth, 2007), and may therefore capture authentic psychological processes that influence behavior. Moreover, implicit and explicit measures often assess different psychological constructs, with evidence suggesting they activate different brain regions during processing (Cunningham et al., 2003). This dual-process framework indicates that including both explicit and implicit measures may yield better prediction across various domains, including attitudes, personality, and interpersonal behavior (Hofmann et al., 2005; Johnson & Saboe, 2011; Leavitt et al., 2011). Second, the matchmaking context, with its emphasis on professional guidance and reduced anonymity, may create conditions where implicit attitudes become particularly relevant. Unlike online dating platforms where individuals can carefully curate their self-presentation, matchmaking involves ongoing interaction with a professional who may detect discrepancies between stated preferences and underlying psychological orientations. Third, previous research has demonstrated that implicit measures often predict behavior in contexts involving interpersonal evaluation and social threat (Greenwald et al., 2009), both of which are inherent in relationship formation. The unique structure of matchmaking—involving third-party evaluation, profile-based selection, and subsequent face-to-face meetings—may create conditions where implicit self-esteem and attachment orientations influence outcomes beyond what explicit measures reveal.

The present study aims to address this gap by exploring the predictive value of both explicit and implicit self-esteem and attachment in the context of matchmaking. We hypothesize that implicit measures, capturing unconscious processes and motivations, may offer additional insights into relationship formation beyond what is revealed by explicit self-reports alone. By considering both conscious and unconscious factors, we hope to gain a more comprehensive understanding of how individual characteristics contribute to the success of relationship formation initiated through matchmaking.

4.1.4 Hypotheses

Based on previous research and the unique characteristics of the matchmaking context, we hypothesize that higher explicit self-esteem, lower explicit anxious attachment, lower explicit avoidant attachment, higher implicit self-esteem, lower implicit anxious attachment, and lower implicit avoidant attachment will predict successful relationship formation.

4.2 Methods and materials

4.2.1 Participants

A total of 399 Dutch participants were initially recruited for this study by the matchmaker during an in-home visit, after they met the agency's standard inclusion criteria: age 21 or older, no

current severe mental illness. Mental health screening was conducted through standardized questions during the initial matchmaker home visit, assessing current treatment for severe mental health conditions and current functioning that might impair relationship capacity. Age verification was based on self-report during the intake interview. All participants provided informed consent.

Of these 399 participants, 267 completed all baseline measurements. However, 84 participants were subsequently excluded from the final analysis for the following reasons: 13 participants quit the program prematurely, 57 participants postponed the matchmaking period, and 14 participants were dating for less than three months at the time of data collection. To assess potential systematic bias due to participant attrition, we compared available demographic characteristics between included ($n = 183$) and excluded ($n = 84$) participants. Analyses revealed no systematic differences, suggesting attrition was not related to participant profiles.

The final sample consisted of 183 participants (51.4% male) ranging in age from 29 to 86 years ($M = 58.23$, $SD = 12.14$). Most participants were White (97.5%) and not affiliated with a religion (87.4%). Education levels varied considerably: 35.5% had secondary education or lower, 44.3% had higher vocational or undergraduate education, and 20.2% held academic degrees or higher. This demographic profile is consistent with typical users of professional matchmaking services in the Netherlands, who tend to be established professionals seeking serious relationships (Statista, 2024).

4.2.2 Procedure

Study design

The research team conducted baseline assessments online (questionnaires) and in-person (IATs). All baseline measures were completed within two weeks for each participant, with online questionnaires typically completed a few days before the in-person IAT sessions. This timing ensured baseline assessments occurred before any matchmaker interventions or partner introductions. This was followed by the matchmaker's pairing process, which proceeded without researcher intervention.

Baseline measurements

Explicit Self-Esteem. Explicit self-esteem was measured using the 10-item Rosenberg Self-Esteem Scale (Rosenberg, 1965). Participants responded to each item on a 4-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). Higher scores indicate higher self-esteem. The RSES is widely used and has demonstrated good reliability across numerous studies (Schmitt & Allik, 2005). In the current sample, the RSES demonstrated excellent internal consistency (Cronbach's $\alpha = .849$), consistent with previous research across diverse populations.

Implicit Self-Esteem. A Single-Target Implicit Association Test (ST-IAT; Greenwald et al., 1998; Visser et al., 2021) was administered via computerized presentation to measure implicit self-esteem. The test consisted of five blocks: Block 1 (20 practice trials), Block 2 (15 practice trials), Block 3 (45 test trials), Block 4 (15 practice trials), and Block 5 (45 test trials). Dutch stimulus words were selected and validated for appropriateness as described in Visser et al. (2021). The order of compatible versus incompatible trial blocks was counterbalanced across participants to control for sequence effects. Participants categorized words as quickly and accurately as possible using designated response keys. Response times between 400-2500ms were accepted, with longer times

truncated to 2500ms and a 600ms penalty added for incorrect responses. Faster response times when pairing "self" with "positive" (relative to "self" with "negative") indicated higher implicit self-esteem. Raw data were processed using R software, and D-scores were calculated using the improved D600 scoring algorithm (Greenwald et al., 2003), with higher positive scores indicating stronger implicit self-esteem.

Explicit Attachment. The Relationship Questionnaire (RQ; Bartholomew & Horowitz, 1991) was used to measure explicit attachment style. Participants chose the paragraph that best described their feelings about close relationships. In this study, explicit 'anxious attachment' refers to the fearful attachment category as operationalized using the RQ, with secure attachment as the reference group. The RQ is a validated measure of attachment style with high correlations to other self-report and interview-based assessments (Bartholomew & Horowitz, 1991; Brennan et al., 1998).

Implicit Attachment. Two Single-Target IATs (Visser et al., 2021) measured implicit anxious and avoidant attachment. Each test consisted of five blocks (16, 12, 36, 12, 36 trials respectively), with practice blocks containing 12 trials each and test blocks containing 36 trials each. The same response time parameters and counterbalancing procedures were used as for the self-esteem IAT. The anxious attachment IAT measured associations between self and "relationally anxious" versus "relationally secure" categories, while the avoidant attachment IAT measured associations between self and "relationally avoidant" versus "relationally comfortable" categories. Higher positive D-scores indicated lower implicit attachment anxiety and avoidance, respectively.

Outcome measurement.

The outcome measure was successful relationship formation, defined as both partners reporting their intention to continue the relationship three months after the initial matchmaker introduction. After six weeks of dating, both participants received an email asking about their interest in continuing. At three months, both received a follow-up email asking whether they considered themselves to be in a committed relationship. Participants were required to inform the matchmaker of their relationship status, with follow-up contact maintained until clear responses were obtained from both partners. A match was classified as successful only when both partners confirmed relationship continuation. This three-month threshold aligns with research showing that attachment bonds typically begin to form during early dating stages (Fagundes & Schindler, 2012; Heffernan et al., 2012; Watkins et al., 2022). Participants have no advantage in falsely reporting success since successful matches result in no further partner proposals, adding credibility to the outcome measure.

4.3 Data analyses

4.3.1 Data

Analyses were conducted using complete case analysis (listwise deletion). Participants were only included if they had complete data on all study measures, resulting in a final analytical sample of 183 participants. Standardization was applied selectively based on measurement scale characteristics. The Rosenberg Self-Esteem Scale (range 4-30) was standardized to z-scores to facilitate coefficient interpretation, while IAT D-scores were retained in their original metric as they are

already approximately standardized measures (typical range -2 to +2, similar to z-score distributions). Analyses were conducted in IBM SPSS 24.0 (IBM Corp., 2016). Effect sizes followed Cohen's (1988) guidelines, and significance was evaluated at $\alpha = .05$. The data and the data analysis scripts are available at: https://osf.io/m74ph/?view_only=169d01217ea74287b76fabdb17616b2c

4.3.2 Analysis strategy

The hypothesis that successful relationship formation is predicted by explicit self-esteem, explicit anxious attachment, and lower explicit avoidant attachment, implicit self-esteem, implicit anxious attachment, and implicit avoidant attachment was tested with binary logistic regression analysis.

Age, gender, and education were included as covariates given their established links with relationship outcomes. Older adults often emphasize different relationship qualities and show distinct attachment patterns (Chopik et al., 2013), gender differences have been observed in self-esteem and attachment trajectories (Bleidorn et al., 2013; Del Giudice, 2009), and education serves as a proxy for socioeconomic status that can shape both self-esteem and relationship expectations (Körük, 2017).

Logistic regression assumptions were examined, including multicollinearity and sample size adequacy. Variance Inflation Factors (all VIF < 1.34) indicated no problematic multicollinearity among predictors. With 183 participants and 10 predictors, the sample provided adequate power with 18.3 observations per predictor, exceeding the commonly recommended minimum of 10-15 cases per predictor for logistic regression (Peduzzi et al., 1996).

Binary logistic regression was carried out to assess significant associations between the predictors and the outcome of successful relationship formation. The likelihood ratio test shows whether the model provides a significant improvement over the null model. A p -value less than .05 shows that the Block 1 model is a significant improvement to the Block 0 model (Beacom, 2023). The Nagelkerke R square value assesses the proportion of the variance explained by the regression model. A low Nagelkerke R -square value suggests that the model may not fit well with the data, while a p -value greater than .05 resulting from the Hosmer and Lemeshow chi-square test assumes that the model is an adequate fit for the data (Beacom, 2023). In interpreting binary logistic regression results, we examined individual variable results, including the $\text{Exp}(\beta)$ (odds ratio), associated confidence intervals, and significance values.

4.4 Results

4.4.1 Descriptives

Attachment style distribution in the final sample ($N = 183$) was as follows: 32 participants (17.6%) were anxiously attached, 50 (27.3%) preoccupied, 31 (16.9%) avoidantly attached, and 70 (38.3%) securely attached. At the conclusion of the matching program, 138 participants (75.4%) chose to continue their relationship after three months of dating following the matchmaker's proposal, while 45 participants (24.6%) did not continue.

Descriptive statistics for explicit self-esteem and implicit measures are presented in Table 1.

Table 1*Descriptive statistics for Explicit and Implicit Measures of Self-Esteem and Attachment (N = 183).*

	Minimum	Maximum	Mean	Std. Deviation
Explicit Self-esteem	4.00	30.00	23.14	4.24
Implicit Self-esteem	-.86	1.45	.38	.48
Implicit Anxious Attachment	-1.40	1.20	-.31	.49
Implicit Avoidant Attachment	-1.50	1.22	-.40	.53

Note. RSES: Rosenberg Self-Esteem Scale; higher scores indicate higher self-esteem.

IAT: Single-Target Implicit Association Test; D600 scoring algorithm used for interpretation.

Data collected between September 2015 and January 2018.

4.4.2 Predicting relationship formation

To examine whether explicit and implicit measures of self-esteem and attachment predicted successful relationship formation, binary logistic regression was conducted. The likelihood ratio test showed that the full model significantly improved fit compared to the null model ($\chi^2 = 18.898$, $df = 10$, $p = .042$). The model achieved a Nagelkerke R^2 of .146, indicating that approximately 15% of the variance in relationship formation was explained by the predictors. The Hosmer-Lemeshow test was not significant ($\chi^2(8) = 7.240$, $p = .511$), indicating adequate model fit. Only explicit anxious attachment significantly predicted relationship formation ($OR = 0.30$, $p = .021$), indicating that individuals high in attachment anxiety were approximately 70% less likely to maintain a relationship for three months compared to securely attached participants.

Other predictors, including explicit self-esteem, explicit avoidant attachment, explicit preoccupied attachment, implicit self-esteem, implicit anxious attachment, implicit avoidant attachment, age, gender, and education, were not significantly associated with relationship formation. There was a nonsignificant trend toward lower odds of success for explicit avoidant attachment ($OR = 0.40$, $p = .070$) and implicit avoidant attachment ($OR = 0.50$, $p = .075$).

The model explained approximately 15% of the variance in relationship outcomes (Nagelkerke $R^2 = .146$) and achieved an overall classification accuracy of 76.5%. At the conventional cutoff of .50, sensitivity was high (97.8%) but specificity was low (11.1%), indicating that the model primarily classified cases as successful relationships.

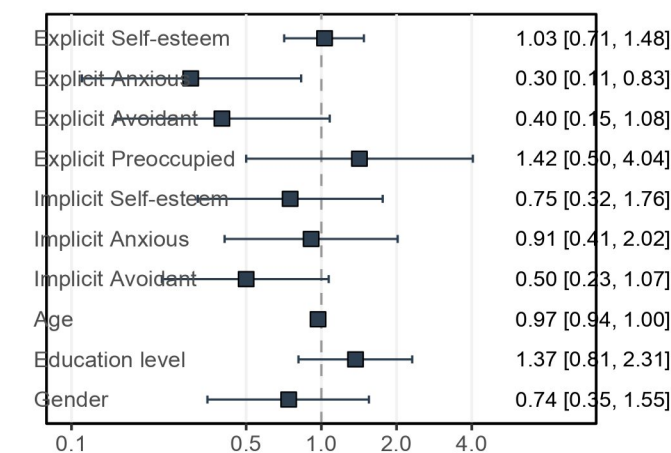
Table 2*Logistic Regression Analysis Predicting Relationship Formation (N = 183)*

	B	E	Wald	Sign	OR (95% CI)
Explicit Self-esteem	0.02	0.19	0.02	.90	1.03 (0.71-1.48)
Explicit Anxious *	-1.21	0.53	5.31	.02	0.30 (0.11-0.83)
Explicit Avoidant	-0.91	0.50	3.29	.07	0.40 (0.15-1.08)
Explicit Preoccupied	0.35	0.53	0.43	.51	1.42 (0.50-4.04)
Implicit Self-esteem	-0.29	0.43	.44	.51	0.75 (0.32-1.76)
Implicit Anxious	-0.09	0.41	0.05	.82	0.91 (0.41-2.02)
Implicit Avoidant	-0.69	0.39	3.18	.08	0.50 (0.23-1.07)
Age	-0.03	0.02	2.86	.09	0.97 (0.94-1.00)
Education level	0.32	0.27	1.41	.24	1.37 (0.81-2.31)
Gender	-0.31	0.38	0.65	.42	0.74 (0.35-1.55)
Constant *	2.76	.29	4.59	.03	15.832

Note. * $p < .05$. Explicit attachment styles are dummy coded with Secure attachment as the reference category. Anxious, Avoidant, and Preoccupied represent the three insecure attachment styles from the RQ.

Figure 1

Forest plot of odds ratios (OR) with 95% confidence intervals from the logistic regression model predicting relationship formation.



4.5 Discussion

This study investigated whether explicit and implicit self-esteem and explicit and implicit attachment predicted successful relationship formation. We hypothesized that the formation of fledgling relationships in the matchmaking context would be influenced by both explicit and implicit self-esteem and attachment.

Contrary to expectations, self-esteem did not predict relationship formation in our sample. This might be explained by findings from previous research showing that social threats during relationship initiation can lead to self-protective behavior in those with low self-esteem (Cameron et al., 2010), further heightened by tendencies to misinterpret potential rejection (Stinson et al., 2015). However, this effect disappeared when the social threat was experimentally eliminated (Cameron et al., 2010; Stinson et al., 2015). The matchmaking process and matchmaker-provided information might serve to reduce such threats, potentially explaining our counterintuitive finding. The effect of low self-esteem on relationship formation might be mitigated in these contexts.

The differential predictive patterns observed between explicit and implicit measures provide important theoretical insights. The lack of predictive validity for implicit measures may reflect several factors unique to the matchmaking context. First, the professional guidance and structured nature of matchmaking may reduce the spontaneous, automatic responses typically captured by IATs, instead promoting more deliberate, controlled behavioral responses that align with explicit self-concepts.

Second, the matchmaker's role as an intermediary may buffer the direct impact of implicit biases on partner selection and early relationship dynamics. Unlike speed dating or app-based

matching where implicit attitudes might immediately influence choice behavior, matchmaking involves professional filtering that may neutralize these automatic processes.

The absence of significant findings for implicit anxious attachment particularly suggests that in the matchmaking context, conscious awareness and explicit acknowledgment of attachment concerns may be more influential than unconscious attachment orientations for relationship formation success. This finding supports the hypothesis that the structured nature of matchmaking emphasizes deliberate decision-making over automatic processes.

While not statistically significant, the numerical trends toward lower relationship success for both explicit avoidant attachment (60% lower odds, $p = .070$) and implicit avoidant attachment (50% lower odds, $p = .075$) suggest that avoidant tendencies may pose challenges for relationship formation across both conscious and unconscious levels. These consistent patterns across measurement modalities indicate that avoidant attachment may represent a more pervasive barrier to relationship formation, though larger samples would be needed to detect these effects reliably.

The robust finding for explicit anxious attachment (operationalized as the fearful attachment category in the RQ) aligns with attachment theory's prediction that conscious relationship fears and expectations significantly impact relationship formation. The absence of significant findings for implicit measures suggests that in professionally mediated dating contexts, explicitly acknowledged attachment concerns characterized by attachment concerns characterized by both anxiety and avoidance may be more influential than unconscious attachment orientations, potentially due to the structured nature of matchmaking that emphasizes deliberate decision-making. In matchmaking contexts, where clients openly discuss relationship goals and concerns with professionals, explicit attachment representations may become particularly salient and influential in shaping outcomes.

Our results showed that explicit anxious attachment negatively predicted relationship formation. This finding aligns with those of studies showing that anxious attachment style negatively affected a potential partner's attractiveness (McClure & Lydon, 2014; Pepping et al., 2017; Poulsen et al. 2012), dating behavior on a first acquaintance (Eastwick & Finkle, 2008b; McClure, et al., 2010; McClure & Lydon, 2014), and passion and commitment in a long-term romantic relationship (Hudson & Fraley, 2017; Mikulincer & Shaver, 2016; Simpson et al., 2007). In addition, results suggest that individuals with higher levels of explicit avoidant attachment and implicit avoidant attachment may be less likely to form successful relationships. Although this effect did not reach statistical significance ($p = .070$ respectively $p = .075$), it aligns with previous research indicating that avoidant individuals may struggle with deeper connection and commitment (Birnie et al., 2009).

The modest explained variance (15%) indicates that psychological characteristics alone provide limited predictive power for relationship formation in matchmaking contexts. The classification imbalance—high sensitivity but low specificity—likely reflects both the high success base rate (75.4%) and suggests that failure may be driven by factors not captured in our psychological measures, such as situational incompatibilities or external circumstances. This pattern indicates the measured variables may function more as protective factors for success rather than reliable predictors of failure.

The current study's focus on matchmaking offers a unique lens through which to examine the dynamics of relationship formation. In contrast to speed dating, where snap judgments based on initial

attraction often prevail (Buston & Emlen, 2003; Todd et al., 2007), matchmaking provides a context for more deliberate and informed partner selection. The matchmaker's personal knowledge of candidates and the emphasis on detailed profiles, devoid of photographs, encourage a focus on deeper compatibility factors, aligning with the principles of algorithmic matchmaking that prioritize long-term compatibility over initial attraction (Joel et al., 2017). While research suggests that individuals can accurately assess compatibility in profile-based evaluations when given ample time and information (Eastwick & Finkel, 2008a), the matchmaking context may further enhance this process by incorporating the matchmaker's insights and guidance. However, in this matchmaking context, self-esteem did not predict success, while explicit anxious attachment style did. The unique nature of matchmaking (with the personal involvement of matchmakers) might create a distinct environment where attachment-related concerns become more salient than self-esteem issues.

Furthermore, our findings raise two questions. First, does the specific context of matchmaking, with its emphasis on conscious decision-making and explicit preferences, overshadow the influence of implicit attitudes? In addition, the emphasis placed by matchmakers on fostering secure connections may inadvertently elevate the importance of explicit attachment styles in determining relationship outcomes. Past research suggested that secure attachment might benefit from exercises encouraging reflection on positive relational experiences (e.g., Mikulincer et al., 2005). However, this approach might backfire for those with anxious attachment, potentially fuelling internal conflicts (Mikulincer et al., 2010). Second, is the Implicit Association Test (IAT) the most suitable measure for capturing implicit processes related to relationship formation, or might alternative measures be more effective in this context? For instance, Mikulincer et al. (2010) utilized a modified approach-avoidance task (Chen & Bargh, 1999) and a lexical decision task to assess implicit motivational and attitudinal ambivalence. They found significant associations between attachment anxiety and implicit relational ambivalence. The findings of Mikulincer and Shaver (2016) highlight the importance of considering both explicit and implicit processes in understanding the complex dynamics of attachment and relationship formation and suggest that further exploration of different implicit measures warrant future research.

4.5.1 Strengths

An innovative aspect of this research is the combined use of explicit and implicit measurements of self-esteem and attachment in a prospective design. In addition, an important strength of the study is its ecological validity of the outcome measurement. The participant's actual behavioral choices were measured. The outcome of the current study was whether or not participants decided to continue the relationship after three months of dating. Measuring behavior avoids biases often seen with self-reported preferences, especially regarding dating (Eastwick & Finkel, 2008a; Park et al., 2015). Participants who reported that the matching had been successful no longer received new partner proposals. A client, therefore, had no advantage in calling the match successful if that were not the case, which adds to the credibility of the outcome measure. Another strength of this study is the age of the sample. While research on dating has tended to focus on young adults, this study focused on middle-aged and older individuals. This is an often overlooked but important group as the number of dating older adults is rising (McWilliams & Barrett, 2014).

4.5.2 Limitations

However, this study also faces several limitations. First, the matchmaking context itself presents unique characteristics that might influence the results. The time- and resource-intensive nature of matchmaking likely attracts individuals with a high motivation for relationship success, potentially influencing their self-esteem and attachment-related behaviors. Additionally, the involvement of a matchmaker and the emotional rollercoaster inherent in the dating process might create a distinct environment compared to relationships formed independently or other dating contexts. Future research should investigate the mechanisms by which matchmaking influences the interplay of self-esteem and attachment in relationship formation, potentially through comparative studies across dating contexts, assessing matchmaker impact, and exploring the interplay of these factors.

Cultural considerations also limit the generalizability of our findings. Dutch dating culture emphasizes directness and egalitarian relationship values, which may moderate the expression and impact of attachment styles compared to cultures with different romantic relationship norms. Specifically, religious beliefs (e.g. Langlais & Schwanz, 2017) and sexual orientation (e.g. Mohr, & Fassinger, 2006) can significantly influence relationship dynamics, limiting the generalizability of our findings to other populations. Additionally, the decision to seek professional matchmaking services in the Netherlands, where online dating is widely accepted, represents a particular cultural choice that may attract individuals with specific relationship orientations or past dating difficulties. The substantial financial investment required for professional matchmaking services may further select for individuals with high relationship motivation and financial resources, potentially creating a sample that differs systematically from the general dating population in commitment levels and relationship priorities.

Third, dyadic analyses were not possible within the scope of this study, as the research design did not include collecting data from all proposed partners.

Fourth, the IAT measures used in this study, while validated, have inherent limitations including modest test-retest reliability and context dependency (Greenwald et al., 2009). Specifically, while the self-esteem IAT and the anxious attachment IAT (ANX-IAT) have shown adequate reliability in previous validation studies, the avoidant attachment IAT (AVOID-IAT) exhibited poor test-retest reliability (Visser et al., 2021). This methodological limitation may have contributed to the lack of significant findings for implicit avoidant attachment in the current study, as the measure may be capturing situational rather than stable individual differences in avoidant attachment orientations.

Fifth, the naturalistic matchmaking process entails that matching criteria and potential matchmaker biases represent uncontrolled factors that could influence outcomes beyond the psychological variables measured in this study.

4.5.3 Future research

Future research should address these limitations through several specific directions. First, comparative studies across dating contexts (matchmaking, online dating, speed dating) using identical measures would clarify whether our findings are context-specific or generalizable. Second, dyadic data

collection including both partners' psychological characteristics and relationship perceptions would provide more comprehensive understanding of relationship formation processes.

Third, longitudinal studies tracking relationships beyond three months (6 months, 12 months, cohabitation, marriage) would determine whether early relationship formation predictors differ from longer-term relationship success predictors. Future investigations might focus on behavioral competencies, situational compatibility factors, and dyadic interaction patterns rather than individual psychological characteristics.

Fourth, investigation of alternative implicit measures, such as approach-avoidance tasks or lexical decision paradigms, might capture attachment and self-esteem processes more relevant to relationship contexts than traditional IATs. Finally, intervention studies testing whether addressing attachment anxiety through coaching or therapy improves matchmaking outcomes would establish causal relationships and practical applications of these findings.

4.5.4 Implications

The findings of the current study underscore the detrimental impact of insecure attachment, particularly explicit anxious attachment, on successful relationship formation within a matchmaking context. This highlights the importance of addressing attachment-related concerns in coaching or counseling for individuals seeking long-term partnerships through matchmaking services. While this study does not directly inform the development of specific interventions, tailoring interventions to individual attachment styles may be crucial. Individuals with high levels of explicit anxious attachment may benefit from interventions that foster self-compassion and address underlying anxieties related to intimacy and rejection (Peterson, 2014; Lemay et al., 2007; Gillath et al., 2005; Ding & Xu, 2021). On the other hand, interventions targeting avoidant attachment may need to focus on increasing emotional awareness, building trust, and challenging negative relationship expectations (Taylor et al., 2015). By integrating attachment-informed interventions into the matchmaking process, it may be possible to enhance the likelihood of successful relationship formation. This could involve providing tailored coaching or counseling to address specific attachment-related challenges, as well as educating matchmakers about the impact of attachment on relationship dynamics. Ultimately, a more nuanced understanding of the role of attachment in matchmaking could lead to more effective and personalized support for individuals seeking lasting love and connection.

4.6 Conclusion

This study extends existing research on relationship formation by investigating the roles of self-esteem and attachment in the context of matchmaking. Explicit anxious attachment style appears to pose challenges for successful relationship formation, whereas self-esteem did not predict matchmaking outcomes. The findings not only highlight the differential impact of these factors in a setting where deliberate partner selection and professional guidance are emphasized but also offer valuable insights for developing interventions to improve relationship outcomes for individuals seeking long-term partnerships through matchmaking services, particularly for clients high in attachment anxiety.

References

- Apostolou, M., Matogian, I., Koskeridou, G., Shialos, M., & Georgiadou, P. (2019). The price of singlehood: Assessing the impact of involuntary singlehood on emotions and life satisfaction. *Evolutionary Psychological Science*, 5, 416–425. <https://doi.org/10.1007/s40806-019-00199-9>
- Apostolou, M., & Tsangari, S. (2022). Why people are single: The Big Five as predictors of involuntary singlehood. *Personality and Individual Differences*, 186, A. <https://doi.org/10.1016/j.paid.2021.111375>
- Bartholomew, K., & Horowitz, L. (1991). Attachment styles among young adults: A test of a four-category model. *Journal of Personality and Social Psychology*, 61, 226–244. <https://doi.org/10.1037/0022-3514.61.2.226>
- Beacom, E. (2023). Considerations for running and interpreting a binary logistic regression analysis – a research note. *DBS Business Review*, 5. <https://doi.org/10.22375/dbr.v5i.85>
- Birnie, C., McClure, M. J., Lydon, J. E., & Holmberg, D. (2009). Attachment avoidance and commitment aversion: A script for relationship failure. *Personal Relationships*, 16(1), 79–97. <https://doi.org/10.1111/j.1475-6811.2009.01211.x>
- Bleidorn, W., Arslan, R. C., Denissen, J. J. A., Rentfrow, P. J., Gebauer, J. E., Potter, J., & Gosling, S. D. (2016). Age and gender differences in self-esteem—A cross-cultural window. *Journal of Personality and Social Psychology*, 111(3), 396–410. <https://doi-org.ezproxy.elib11.ub.unimaas.nl/10.1037/pspp0000078>
- Brennan, K.A., Clark, C.L., & Shaver, P.R. (1998). Self-report measurement of adult romantic attachment: An integrative overview. In J.A. Simpson and W.S. Rholes (Eds.), *Attachment theory and close relationships* (pp.46–76). New York: Guilford.
- Buston, P., Emlen, & S.T. (2003). Cognitive processes underlying human mate choice: The relationship between self-perception and mate preference in Western society. *Proceedings of the National Academy of Sciences of the United States of America*. 100. 8805–10. [10.1073/pnas.1533220100](https://doi.org/10.1073/pnas.1533220100).
- Cameron, J. J., Stinson, D. A., Gaetz, R., & Balchen, S. (2010). Acceptance is in the eye of the beholder: Self-esteem and motivated perceptions of acceptance from the opposite sex. *Journal of Personality and Social Psychology*, 99, 513–529. <https://doi.org/10.1037/a0018558>
- Cameron, J. J., & Granger, S. (2019). Does self-esteem have an interpersonal imprint beyond self-reports? A meta-analysis of self-esteem and objective interpersonal indicators. *Personality and Social Psychology Review*, 23, 73–102. <http://doi.org/10.1177/1088868318756532>
- Cherlin, A. J. (2009). *The Marriage-go-round*. New York: Alfred A. Knopf.
- Chopik, W. J., Edelstein, R. S., & Fraley, R. C. (2013). From the cradle to the grave: Age differences in attachment from early adulthood to old age. *Journal of Personality*, 81(2), 171–184. <https://doi.org/10.1111/j.1467-6494.2012.00793.x>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ, Lawrence Erlbaum.

- Cunningham, W. A., Johnson, M. K., Gatenby, J. C., Gore, J. C., & Banaji, M. R. (2003). Neural components of social evaluation. *Journal of Personality and Social Psychology*, 85(4), 639–649. <https://doi.org/10.1037/0022-3514.85.4.639>
- De Houwer, J., Teige-Mocigemba, S., Spruyt, A., & Moors, A. (2009). Implicit measures: A normative analysis and review. *Psychological Bulletin*, 135(3), 347–368. <https://doi.org/10.1037/a0014211>
- Del Giudice M. (2009). Sex, attachment, and the development of reproductive strategies. *Behavioral and Brain Sciences*, 32(1). <https://doi.org/10.1017/S0140525X09000016>
- Ding, N., & Xu, Z. (2021). Attachment, self-esteem, and subjective well-being among people in China aged 50 and over: The role of self-compassion. *Social Behavior and Personality: An international journal*, 49, 5, <https://doi.org/10.2224/sbp.10160>
- Eastwick, P. W., & Finkel, E. J. (2008a). Sex differences in mate preferences revisited: Do people know what they initially desire in a romantic partner? *Journal of Personality and Social Psychology*, 94, 245–264. <https://doi.org/10.1037/0022-3514.94.2.245>
- Eastwick, P. W., & Finkel, E. J. (2008b). The attachment system in fledgling relationships: An activating role for attachment anxiety. *Journal of Personality and Social Psychology*, 95(3), 628–647. <https://doi.org/10.1037/0022-3514.95.3.628>
- Erol, R. Y., & Orth, U. (2016). Self-esteem and the quality of romantic relationships. *European Psychologist*, 21, 4, 274–283. <https://doi.org/10.1027/1016-9040/a000259>
- Fagundes C. P., & Schindler I. (2012). Making of romantic attachment bonds: Longitudinal trajectories and implications for relationship stability. *Personal Relationships*, 19, 723–742. <https://doi.org/10.1111/j.1475-6811.2011.01389.x>
- Finkel, E. J., Eastwick, P. W., Karney, B. R., Reis, H. T., & Sprecher, S. (2012). Online Dating: A Critical Analysis From the Perspective of Psychological Science. *Psychological Science in the Public Interest*, 13(1), 3–66. <http://www.jstor.org/stable/23484637>
- Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, 41, 1149–1160. <https://doi.org/10.3758/BRM.41.4.1149>
- Gillath, O., Shaver, P. R., Mikulincer, M., Nitzberg, R. E., Erez, A., & Van IJzendoorn, M. H. (2005). Attachment, caregiving, and volunteering: Placing volunteerism in an attachment-theoretical framework. *Personal Relationships*, 12, 425–446. <https://doi.org/10.1111/j.1475-6811.2005.00124.x>
- Heffernan M. E., Fraley R. C., Vicary A. M., & Brumbaugh C. C. (2012). Attachment features and functions in adult romantic relationships. *Journal of Social and Personal Relationships*, 29, 671–693.
- Hofmann, W., Gawronski, B., Gschwendner, T., Le, H., & Schmitt, M. (2005). A meta-analysis on the correlation between the Implicit Association Test and explicit self-report measures. *Personality and Social Psychology Bulletin*, 31(10), 1369–1385. <https://doi.org/10.1177/0146167205275613>

- Joel, S., MacDonald, G., & Shackelford, T. K. (2017). Is romantic desire predictable? Machine learning applied to initial romantic attraction. *Psychological Science*, 28(10), 1478-1489.
doi:10.1177/0956797617714946
- Johnson, R. E., & Saboe, K. N. (2011). Measuring implicit traits in organizational research: Development of an indirect measure of employee implicit self-concept. *Organizational Research Methods*, 14(3), 530–547. <https://doi.org/10.1177/1094428110363617>
- Körük, S. (2017). The Effect of Self-Esteem on Student Achievement. In: Karadag, E. (eds) *The Factors Effecting Student Achievement*. Springer, Cham. https://doi-org.ezproxy.elib11.ub.unimaas.nl/10.1007/978-3-319-56083-0_15
- Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology*, 74, 6, 1464–1480. <http://doi:10.1037/0022-3514.74.6.1464>
- Greenwald, A., Nosek, B., & Banaji, M. (2003). Understanding and using the implicit association test: I. An improved scoring algorithm. *Journal of Personality and Social Psychology*, 85, 2, 197-216. <http://dx.doi.org/10.1037/0022-3514.85.2.197>
- Hudson, N.W., & Fraley R.C. (2017) Adult attachment and perceptions of closeness. *Journal of the International Association for Relationship Research*, 24, 17-26.
<https://doi.org/10.1111/pere.12166>
- Kurzban, R., & Weeden, J. (2005). HurryDate: Mate preferences in action. *Evolution and Human Behavior*, 26(3), 227–244. <https://doi.org/10.1016/j.evolhumbehav.2004.08.012>.
- Langlais, M., & Schwanz, S. (2017). Religiosity and relationship quality of dating relationships: Examining relationship religiosity as a mediator. *Religions*, 8(9):187.
<https://doi.org/10.3390/rel8090187>
- Leavitt, K., Fong, C. T., & Greenwald, A. G. (2011). Asking about well-being gets you half an answer: Intra-individual processes of implicit and explicit job attitudes. *Journal of Organizational Behavior*, 32(4), 672–687. <https://doi.org/10.1002/job.746>
- Lemay, E. P., Clark, M. S., & Feeney, B. C. (2007). Projection of responsiveness to needs and construction of satisfying communal relationships. *Journal of Personality and Social Psychology*, 92, 834–853. <https://doi.org/10.1037/0022-3514.92.5.834>
- McClure, M.J., Lydon, J.E., Baccus, J.R., & Baldwin M.W. (2010). A signal detection analysis of chronic attachment anxiety at speed dating: Being unpopular is only the first part of the problem. *Personality and Social Psychology Bulletin*.
<https://doi.org/10.1177/0146167210374238>
- McClure, M.J., & Lydon, J.E. (2014). Anxiety doesn't become you: How attachment anxiety compromises relational opportunities. *Journal of Personality and Social Psychology*, 106, 1, 89-111. <https://doi.org/10.1037/a0034532>
- McWilliams, S., & Barrett, A. E. (2014). Online dating in middle and later life: Gendered expectations and experiences. *Journal of Family Issues*, 35, 3, 411–436. <https://doi-org.ezproxy.elib11.ub.unimaas.nl/10.1177/0192513X12468437>

- Mikulincer, M., Shaver, P. R., Gillath, O., & Nitzberg, R. A. (2005). Attachment, Caregiving, and altruism: Boosting attachment security increases compassion and helping. *Journal of Personality and Social Psychology*, 89(5), 817–839. <https://doi-org.ezproxy.elib11.ub.unimaas.nl/10.1037/0022-3514.89.5.817>
- Mikulincer, M., Shaver, P.R., Bar-on, D.N., & Ein-Dor, T. (2010). The pushes and pulls of close relationships: Attachment insecurities and relational ambivalence. *Journal of Personality and Social Psychology*, 98, 3, 450-468. <https://doi.org/10.1037/a0017366>
- Mikulincer, M., & Shaver, P.R. (2016). *Attachment in adulthood. Structure, dynamics, and change*. The Guilford Press, NY.
- Mohr, J. J., & Fassinger, R. E. (2006). Sexual orientation identity and romantic relationship quality in same-sex couples. *Personality and Social Psychology Bulletin*, 32(8), 1085-1099. <https://doi.org/10.1177/0146167206288281>
- Murray, S. L., Holmes, J. G., & Collins, N. L. (2006). Optimizing assurance: The risk regulation system in relationships. *Psychological Bulletin*, 132, 641-666. <https://doi.org/10.1037/0033-2909.132.5.641>
- Murray, S. L., Derrick, J. L., Leder, S., & Holmes, J. G. (2008). Balancing connectedness and self-protection goals in close relationships: A levels-of-processing perspective on risk regulation. *Journal of Personality and Social Psychology*, 94, 429–459. <https://doi.org/10.1037/0022-3514.94.3.429>
- Nosek, B. A., & Smyth, F. L. (2007). A multitrait-multimethod validation of the Implicit Association Test: Implicit and explicit attitudes are related but distinct constructs. *Experimental Psychology*, 54(1), 14–29. <https://doi.org/10.1027/1618-3169.54.1.14>
- Park, L. E., Young, A. F., & Eastwick, P. W. (2015). (Psychological) distance makes the heart grow fonder effects of psychological distance and relative intelligence on men's attraction to women. *Personality and Social Psychology Bulletin*, 41, 1459–1473. <https://doi.org/10.1177/0146167215599749>
- Patrick, H., Knee, C. R., Canevello, A., & Lonsbary, C. (2007). The role of need fulfillment in relationship functioning and well-being: A self-determination theory perspective. *Journal of Personality and Social Psychology*, 92, 434–457. <https://doi.org/10.1037/0022-3514.92.3.434>
- Peduzzi, P., Concato, J., Kemper, E., Holford, T. R., & Feinstein, A. R. (1996). A simulation study of the number of events per variable in logistic regression analysis. *Journal of Clinical Epidemiology*, 49(12), 1373-1379. [https://doi.org/10.1016/S0895-4356\(96\)00236-3](https://doi.org/10.1016/S0895-4356(96)00236-3)
- Pepping, C.A., Taylor, R., Koh, K., & Halford, W.K. (2017). Attachment, culture and initial romantic attraction: A speed-dating study. *Personality and Individual Differences*, 108, 79-85. <https://doi.org/10.1016/j.paid.2016.11.056>
- Peterson, J.L. (2014). Explicit thoughts of security activate implicit self-doubt in anxiously attached participants. *Personal Relationships*, 21, 206-224. <https://doi.org.ezproxy.elib11.ub.unimaas.nl/10.1111/pere.12027>

- Poulsen, F.O., Holman, T.B., Busby, D.M., & Carroll, J.S. (2012). Physical attraction, attachment styles, and dating development. *Journal of Social and Personal Relationships*, 30, 3, 301-319. <https://doi.org/10.1177/0265407512456673>
- Robinson, K.J., & Cameron, J.J. (2012). Self-esteem is a shared relationship resource: Additive effects of dating partners' self-esteem levels predict relationship quality. *Journal of Research in Personality*, 46, 2, 227-230. <https://doi.org/10.1016/j.jrp.2011.12.002>.
- Rosenberg, M. (1965). *Society and the adolescent self-image* (Vol. 11, p. 326). Princeton, NJ: Princeton University Press.
- Schmitt, D.P., & Allik, J. (2005). Simultaneous administration of the Rosenberg Self-Esteem Scale in 53 nations: Exploring the universal and culture-specific features of global self-esteem. *Journal of Personality and Social Psychology*, 89, 4, 623-642. <http://dx.doi.org/10.1037/0022-3514.89.4.623>
- Sharabi, L. L., & Caughlin, J. P. (2017). What predicts first date success? A longitudinal study of modality switching in online dating. *Personal Relationships*, 24(2), 370-391. <https://doi.org/10.1111/pere.12188>
- Simpson, J.A., Collins, W.A., Tran, S., & Haydon, K.C. (2007). Attachment and the experience and expression of emotions in romantic relationships: A developmental perspective. *Journal of Personality and Social Psychology*, 92, 2, 355-367. <https://doi.org/10.1037/0022-3514.92.2.355>
- Statista. (2024). Matchmaking - Netherlands. Statista Market Forecast. Retrieved in august 2025 from <https://www.statista.com/outlook/dmo/eservices/dating-services/matchmaking/netherlands>
- Stinson, D.A., Cameron, J.J., Hoplock, L.B., & Hole, C. (2015). Warming up and cooling down: Self-esteem and behavioral responses to social threat during relationship initiation. *Self and Identity*, 14, 2, 189-213. <https://doi.org/10.1080/15298868.2014.969301>
- Taylor, P., Rietzschel, J., Danquah, A., & Berry, K. (2015). Changes in attachment representations during psychological therapy. *Psychotherapy Research*, 25, 222-238. doi:10.1080/10503307.2014.886791
- Todd, P.M., Penke, L., Fasolo, B., & Lenton A.P. (2007). Different cognitive processes underlie human mate choices and mate preferences. *Proceedings of the National Academy of Sciences*, 104, 38, 15011-15016, 10.1073/pnas.0705290104
- Visser, L., Lataster, J., Pat-El, R., van Lankveld, J., & Jacobs, N. (2021). Psychometric properties of two implicit associations tests measuring adult attachment. *Psychologica Belgica*, 61(1), 88-103. <http://doi.org/10.5334/pb.1042>
- Visser, L., Pat-El, R., Lataster, J., Van Lankveld, J. & Jacobs, N. (2024) 'Beyond Difference Scores: Unlocking insights with polynomial regression in studies on the effects of implicit-explicit congruency', *Psychologica Belgica*, 64(1), p. 5-23. <https://doi.org/10.5334/pb.1246>.
- Watkins, C. D., Bovet, J., Fernandez, A. M., Leongómez, J. D., Żelaźniewicz, A., Corrêa Varella, M. A., & Wagstaff, D. (2022). Men say "I love you" before women do: Robust across several countries. *Journal of Social and Personal Relationships*, 39, 7, 2134-2153. <https://doi.org/10.1177/02654075221075264>

- Wilson, T. D., Lindsey, S., & Schooler, T. Y. (2000). A model of dual attitudes. *Psychological Review*, 107, 101–126. <http://dx.doi.org/10.1037/0033-295X.107.1.101>
- Whitty, M.T. (2008). Revealing the 'real' me, searching for the 'actual' you: Presentations of self on an internet dating site, *Computers in Human Behavior*, 24, 4. <https://doi.org/10.1016/j.chb.2007.07.002>

Chapter 5. Self-Esteem and Attachment in Singles and Partnered Adults

This chapter is published as:

Visser, L., Lataster, J., Pat-El, R., Van Lankveld, J., & Jacobs, N. (2026). Associations Between Explicit and Implicit Self-Esteem and Attachment in Singles and Partnered Adults. *Psychology International*, 8(1), 12. <https://doi.org/10.3390/psycholint8010012>

Abstract

Self-esteem and attachment are core constructs in adult relational functioning, yet their interrelations across levels of cognitive processing have remained understudied. This study investigated how explicit and implicit attachment styles relate to self-esteem in individuals seeking a romantic partner ($N = 399$) and in a partnered sample ($N = 108$). Participants completed explicit attachment and self-esteem scales, along with three single-target Implicit Association Tests (IATs) assessing implicit self-esteem and avoidant and anxious attachment styles. Regression analyses were conducted using explicit and implicit attachment as predictors of explicit and implicit self-esteem, controlling for covariates. In singles, explicit anxious attachment was negatively associated with explicit self-esteem, while implicit anxious attachment and implicit avoidant attachment were negatively associated with implicit self-esteem. No cross-level associations were found, supporting a parallel-level interpretation in which explicit and implicit variables relate primarily within, rather than across, processing levels. The same regression models applied to the partnered sample showed generally similar trends, although the associations observed in singles for explicit anxious and implicit avoidant attachment were not detected in the partnered group. The inclusion of implicit measures provides new insight into non-conscious relational insecurity, with both implicit anxious and avoidant attachment showing negative associations with implicit self-esteem.

5.1 Introduction

Attachment and self-esteem are two foundational constructs in adult relational functioning, and both have been extensively studied. However, the relationship between these constructs - especially when considering both implicit and explicit cognitive processing levels - was thus far empirically underexplored. While explicit self-esteem and attachment have been investigated in many studies, implicit measures - especially of general adult attachment - are understudied. Moreover, little is known about whether these associations manifest similarly across different relational contexts, such as singlehood and committed partnership.

5.1.1 Self-Esteem and Attachment as Key Factors in Relationship Dynamics

Self-esteem has long been recognized as a determinant of interpersonal functioning. Individuals with chronically low self-worth often display heightened vigilance to signs of rejection and may interpret ambiguous social cues in disproportionately negative ways (Erol & Orth, 2016; Harris & Orth, 2020). Such tendencies can interfere with the formation and maintenance of close relationships by promoting withdrawal, self-protective behavior, or difficulty trusting positive feedback (e.g. Murray et al., 2000). In contrast, individuals with a more stable and positive sense of self typically approach relational situations with greater confidence and flexibility, which may facilitate emotional closeness and more adaptive regulation of intimacy and distance (e.g. Mikulincer & Shaver, 2016).

Attachment theory provides a framework for understanding how individuals organize expectations about closeness, support, and personal worth in intimate relationships. Adult attachment styles are generally captured along two orthogonal dimensions (e.g. (Bartholomew & Horowitz, 1991; Fraley & Shaver, 2000). The anxiety dimension reflects concerns about rejection and amplified needs for reassurance, whereas the avoidance dimension captures discomfort with dependency and a preference for emotional distance. Higher levels on either dimension have been linked to reduced comfort with intimacy, greater relational strain, and lower relationship satisfaction across a variety of contexts (Hudson & Fraley, 2017; Mikulincer & Shaver, 2016).

Prior research has consistently shown that both low self-esteem and attachment insecurity can undermine emotional closeness, trust, and responsiveness in relationships (Murray et al., 1996, 2000; 2008). These two processes - self-evaluation and relational expectation - are thought to interact, with numerous studies reporting moderate correlations between self-esteem and attachment (e.g., Mikulincer & Shaver, 2016; Pinquart, 2023; Schmidt et al., 2005).

5.1.2 The association between attachment and self-esteem

A comprehensive review by Mikulincer and Shaver (2016) summarized findings from over 100 empirical studies conducted between 1987 and 2015, investigating links between attachment and global self-worth. Across this body of research, secure attachment was consistently associated with higher self-esteem, regardless of the specific attachment or self-esteem measure. A meta-analysis by Gorrese and Ruggieri (2013) confirmed this robust association, reporting an average correlation of $r = .27$ between secure peer attachment and self-esteem.

In contrast, attachment anxiety and avoidance show diverging patterns of association with self-esteem. Anxious attachment has been consistently and strongly negatively related to self-esteem in both cross-sectional and longitudinal studies (e.g., Dewitte et al., 2008; Mikulincer et al., 2009; Peterson, 2014). Avoidant attachment, by comparison, shows weaker and less consistent associations. Several large-scale studies even report no significant correlation between avoidance and global self-worth (e.g., Schmitt & Allik, 2005). These differences are theoretically meaningful: anxious individuals depend on others for approval and tend to internalize rejection, whereas avoidant

individuals suppress closeness needs and protect fragile self-views by emotionally distancing themselves (Mikulincer & Shaver, 2016).

While these findings support a conceptual link, most studies have relied on self-report measures, potentially overlooking automatic, unconscious processes. Research using implicit measures reveals important distinctions between anxious and avoidant attachment patterns.

Anxiously attached individuals exhibit more negative self-evaluations on Implicit Association Tests (IATs), in narrative representations, and in memory-based tasks (e.g., Dewitte et al., 2008; Mikulincer et al., 2011). Avoidantly attached individuals, by contrast, may suppress or compartmentalize negative self-views, obscuring such associations unless defensive strategies are bypassed (Edelstein & Gillath, 2008; Mikulincer et al., 2004; Mikulincer & Shaver, 2016). Given these differential findings in the literature, it is important to model anxious and avoidant styles as distinct dimensions when investigating how attachment relates to self-esteem across explicit and implicit levels of processing.

5.1.3 Explicit and Implicit Self-Esteem in Relation to Attachment

While the association between attachment and explicit self-esteem is well-established as measured through self-report questionnaires, less is known about how these constructs relate at the implicit level. Implicit self-esteem has been conceptualized as a relatively stable evaluative bias that may operate outside of conscious awareness and influence affective responses and social behavior (Greenwald & Farnham, 2000; Bosson et al., 2000).

Implicit associations are less subject to volitional self-control (McNally, 1995), and are considered less susceptible to social desirability demands (Riketta, 2005). In contrast to explicit self-esteem, which reflects deliberate and consciously accessible self-evaluations, implicit self-esteem captures spontaneous affective responses toward the self that are activated under conditions of limited cognitive control. Because these automatic evaluations are not fully accessible to introspection, they cannot be reliably assessed through standard self-report measures and may also remain invisible to external observers, particularly when defensive strategies are active.

Explicit self-esteem refers to consciously accessible self-evaluations, whereas implicit self-esteem reflects automatic self-associations, typically assessed with indirect measures such as the Implicit Association Test (Greenwald & Banaji, 1995; De Houwer et al., 2009).

Research has shown that implicit and explicit self-esteem are often only weakly correlated (Mikulincer & Shaver, 2016; De Jong et al., 2012; Hofmann et al., 2005), and may independently predict behavior (Greenwald et al., 2009). Nevertheless, these weak associations are theoretically meaningful, as they are in line with the dual-process view that implicit and explicit self-esteem reflect partly independent evaluative systems that operate under different cognitive conditions. This distinction is postulated, for example, in the dual-process model of Strack and Deutsch (2004), which posits that human cognition operates as two interacting systems: a reflective system (deliberate, conscious processing) and an impulsive system (automatic, unconscious processing), where the two systems function optimally under different cognitive conditions.

5.1.4 Current Study

Despite growing interest in dual-process models and implicit measures of self-evaluation (e.g., Strack & Deutsch, 2004; Greenwald & Farnham, 2000; Jordan & Zeigler-Hill, 2020), few studies have examined how implicit and explicit self-evaluations relate to adult attachment styles. The present study addresses this gap by including both processing levels in a single design.

We conducted a cross-sectional study in two independent samples: single adults seeking a romantic partner and partnered individuals in ongoing relationships. Because self-esteem is partly sustained by ongoing relational feedback (Murray et al., 2000), attachment-self-esteem associations may manifest differently in individuals currently in relationships compared to those seeking one. Prior research has shown that relationship status is positively associated with self-esteem levels (Luciano & Orth, 2017) and that attachment patterns can shift across relationship transitions (Kirkpatrick & Hazan, 1994; Chopik, Edelstein, & Grimm, 2019). Testing whether similar patterns emerge across these relational contexts provides insight into the generalizability of these associations.

Prior research has shown that age and gender can affect self-esteem (Bleidorn et al., 2016) and attachment styles (Chopik et al., 2013; Del Giudice, 2009). Additionally, self-esteem and education level have been found to be associated (e.g., Körük, 2017). Because we were mainly interested in the associations between self-esteem and attachment styles as key constructs, age, education level, and gender were included as covariates in the analyses to control for potential confounding effects.

The primary objective of the present study was to examine whether associations between attachment and self-esteem occur primarily within or across levels of cognitive processing. We further examined whether these patterns generalize across relational contexts (i.e., singles seeking a partner and partnered individuals).

5.1.5 Hypotheses

Based on the literature reviewed above, we formulated the following hypotheses. First, we expect that explicit anxious attachment and explicit avoidant attachment are negatively associated with explicit self-esteem, controlling for age, gender, and education (H1). Second, we expect that implicit anxious attachment and implicit avoidant attachment are negatively associated with implicit self-esteem (H2).

In line with dual-process perspectives, cross-level associations between implicit and explicit constructs may be less pronounced than within-level associations. Meta-analytic and empirical work indicates that implicit and explicit measures of the same evaluative construct are typically only modestly correlated, with reported correlations ranging from approximately $r = .24$ to $r = .37$ (Hofmann et al., 2005; Nosek, 2005). These modest associations suggest that implicit and explicit measures partly reflect distinct evaluative processes operating under different cognitive conditions. Accordingly, when examining relations between different constructs across processing levels (e.g., implicit attachment and explicit self-esteem), strong associations are theoretically less likely than within-level associations.

In line with the dual-process framework (Strack & Deutsch, 2004), these hypotheses assume parallel-level associations between constructs measured at the same level of cognitive processing. Cross-level associations (e.g., implicit attachment predicting explicit self-esteem or explicit attachment predicting implicit self-esteem) were included in the analysis on an exploratory basis and were not formally hypothesized.

5.2 Methods

5.2.1 Participants

The first sample ($N = 399$) consisted of single adults who had recently enrolled in a Dutch matchmaking program including individualized coaching. During their intake process, participants were informed about the study and invited to participate. Those who agreed provided informed consent and completed an online survey assessing explicit self-esteem and explicit attachment. Next, they completed Implicit Association Tests (IATs) to measure implicit self-esteem and implicit attachment.

The second sample of partnered individuals was included for exploratory comparison. This sample ($N = 108$) was recruited within the social networks of psychology students of [*blinded for review*]. Inclusion criteria were age (≥ 18 years), being in a romantic relationship, and sufficient understanding of the Dutch language. In both samples, informed consent was obtained prior to participation, and all data were anonymized. Participants were informed of their right to withdraw at any time without consequences.

5.2.2 Study Design

This study used a cross-sectional design with two independent samples: singles seeking a partner and individuals in relationships. Including both groups allowed us to examine whether attachment-self-esteem associations generalize across relational contexts, consistent with recommendations for testing boundary conditions (Anderson & Maxwell, 2016). In the analyses, attachment styles were modeled as predictor variables and self-esteem as the criterion variable.

5.2.3 Measures

Explicit self-esteem was assessed using the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965), a widely used 10-item questionnaire measuring global self-worth (e.g., “On the whole, I am satisfied with myself”). Responses were given on a 4-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). The internal consistency in the present study was good, with Cronbach’s $\alpha = 0.87$ in singles and $\alpha = 0.85$ in partnered individuals.

Implicit self-esteem was assessed using an indirect evaluative task designed to capture automatically activated self-associations. During the task, participants made rapid judgments involving self-related and valenced content, enabling the assessment of spontaneous positive or negative self-evaluations under conditions of limited deliberation. The task assessed global evaluative self-associations rather than domain-specific self-esteem content. Stimuli consisted of self-related words (e.g., ‘me’, ‘myself’) and valenced attributes (positive vs. negative adjectives). The implicit self-esteem

score is based on the difference in reaction times between trials in which self-related words are paired with positive attributes and trials in which they are paired with negative attributes; faster responses in the former relative to the latter indicate a more positive implicit self-evaluation (Greenwald et al., 2003). D-scores were computed using the D600 algorithm (Greenwald et al., 2003) and used as an index of implicit global self-evaluation. This measure captures automatic self-evaluative associations and is intended as the implicit counterpart of explicit global self-esteem. Internal consistency was acceptable, with split-half reliabilities of $r = .76$ in the singles sample and $r = .73$ in the partnered sample.

Explicit attachment style was assessed using the Relationship Questionnaire (RQ; Bartholomew & Horowitz, 1991), which captures general adult attachment. This questionnaire was designed to classify individuals into one of four attachment styles: secure, anxious, avoidant, and fearful-avoidant, based on participants' self-perceptions of their ways of interacting with others in close relationships. Participants selected the description that best matched their experiences. For the regression analyses, attachment was coded into two dummy variables representing anxious and avoidant attachment styles, with secure attachment as the reference category.

In this study, adult attachment was modeled categorically rather than dimensionally. This decision followed directly from the research question. Our aim was not to test whether attachment anxiety or avoidance is linearly related to self-esteem, but to examine whether insecure attachment orientations, relative to secure attachment, are associated with differences in self-esteem. A categorical representation is well suited to this aim because it allows for the examination of threshold effects and qualitative differences between attachment patterns. Such differences are central to attachment theory, which conceptualizes attachment as organized patterns of affect regulation and interpersonal behavior (Bartholomew & Horowitz, 1991; Mikulincer & Shaver, 2016; Ravitz et al., 2010). Although categorical classifications are grounded in underlying dimensional models of self and other (Griffin & Bartholomew, 1994), they remain appropriate when research questions focus on prototypical patterns rather than subtle dimensional variation (Fraley et al., 2015). These qualitative contrasts are more apparent when attachment is modeled as prototypes rather than only as continuous anxiety and avoidance dimensions.

Implicit attachment anxiety and avoidance were assessed using two indirect associative tasks designed to capture automatically activated relational tendencies. Existing implicit attachment measures have primarily focused on attachment to specific figures, such as parents or romantic partners. While informative, implicit measures targeting specific attachment figures are less suited to capturing general adult attachment orientations in a way that can be directly compared across relational contexts, such as singles seeking a partner versus partnered individuals. The present study therefore employed two Single-Target Implicit Association Tests (ST-IATs) designed to assess general adult attachment styles independent of a specific attachment figure. This approach enabled the assessment of implicit attachment-related tendencies in both singles and partnered individuals and allowed for direct comparison across relational contexts.

In each task, participants made rapid evaluations involving self-related stimuli and attachment-relevant content, allowing the task to detect spontaneous activation of anxious or avoidant styles

under conditions of limited deliberation. The resulting indices represent the relative accessibility of attachment-related concerns or distancing tendencies at an automatic level. The tasks followed standard principles for implicit assessment and were implemented uniformly across participants.

A pilot study was conducted to select stimulus words representing relational anxiety and avoidance. Based on the attachment literature (Bartholomew & Horowitz, 1991; Mikulincer & Shaver, 2016), 43 candidate adjectives were generated and independently categorized by 18 psychologists and 5 professional matchmakers as “relationally avoidant,” “not relationally avoidant,” “relationally anxious,” “not relationally anxious,” or “not suitable.” Stimuli rated as most representative of each target category were subsequently selected, following established procedures for stimulus selection in implicit tasks (Nosek et al., 2005; see Visser et al., 2021).

In the partnered sample, the IATs had been administered twice with 4 weeks in between, but only the first measurement was used for the present study to maintain consistency with the singles sample, which had only one measurement occasion.

Further psychometric details regarding the development and validation of these implicit attachment measures can be found in Visser et al. (2021).

5.3. Data Analysis

5.3.1 Preliminary Analyses

Prior to the regression analyses, the assumptions of linear regression were evaluated. Normality of residuals was assessed through visual inspection of histograms and normal Q–Q plots of standardized residuals. Although normality tests were sensitive in this sample, visual inspection indicated approximately normal residual distributions across models.

Homoscedasticity was examined using scatterplots of standardized residuals against standardized predicted values, which showed no systematic patterns or evidence of heteroscedasticity.

Multicollinearity was assessed using variance inflation factors (VIFs) and tolerance values. All VIFs were low (range ≈ 1.03 – 1.22), indicating no concerns regarding multicollinearity.

Potential outliers and influential cases were evaluated using standardized residuals, Mahalanobis distance, Cook’s distance, and leverage values. Although a small number of cases showed standardized residuals exceeding ± 3 , Cook’s distances remained low (maximum = 0.14) and leverage values were minimal, indicating that no individual cases exerted undue influence on the regression estimates. All cases were therefore retained.

5.3.2 Main Analyses

All analyses were performed using IBM SPSS version 24.0 (IBM Corp, 2016), with a significance threshold of 5%. Continuous variables were standardized before analysis. Explicit attachment was recoded into binary dummy variables representing anxious and avoidant attachment style, with secure attachment as the reference category.

Hypotheses were tested using multiple regression analyses. Two models were specified: one predicting explicit self-esteem and one predicting implicit self-esteem, with attachment styles (explicit and implicit anxious and avoidant) entered as predictor variables, and with age, gender, and education entered as covariates. All predictors were entered simultaneously.

5.3.3 Exploratory Analyses

In the partnered sample, the same regression models and correlation analyses were conducted as in the single sample. Descriptive comparisons between the two samples were also conducted to contextualize any observed differences.

5.4 Results

5.4.1 Sample Characteristics and Descriptive Statistics

Of the 399 participants in the singles sample, 356 completed the explicit self-esteem measure, and 270 completed all three IATs. The reduction in sample size for the implicit measures was due to technical issues during online administration and participants who did not complete the full assessment battery. Only participants with complete data on all implicit measures were included in the regression analyses.

Table 1 presents descriptive statistics for the key variables in both samples.

Table 1

Descriptive statistics and reliabilities for explicit and implicit measures in singles and partnered individuals

Variable	Singles M	Singles SD	Singles α / r	Partnered M	Partnered SD	Partnered α / r
Explicit self-esteem	21.47	4.86	.87	21.79	4.93	85
Implicit self-esteem	0.31	0.36	.76	0.28	0.34	73
Explicit anxious attachment	2.89	0.94	—	2.71	0.88	
Explicit avoidant attachment	2.64	0.91	—	2.58	0.87	
Implicit anxious attachment	-0.18	0.41	—	-0.21	0.38	
Implicit avoidant attachment	-0.29	0.39	—	-0.33	0.37	
Age	34.62	11.28	—	45.16	12.42	

Note. For implicit measures, split-half reliabilities (r) are reported. Cronbach's alpha (α) is reported for explicit self-esteem. Higher scores indicate higher levels of self-esteem or attachment-related insecurity. Age is reported in years.

Explicit self-esteem scores showed a relatively normal distribution with a mean above the scale midpoint. Implicit self-esteem scores clustered around zero (the IAT midpoint), while both implicit

attachment dimensions showed negative mean D-scores, indicating weaker associations with insecure attachment characteristics.

5.4.2 Regression Analyses in Singles Sample

Two multiple regression analyses were conducted to test the study hypotheses. Table 2 presents the results for the regression models predicting explicit and implicit self-esteem in the singles (and partnered samples).

Table 2
Multiple regression analyses predicting explicit and implicit self-esteem in singles and partnered individuals

Predictor	Singles – Explicit SE β	Singles – Implicit SE β	Partnered – Explicit SE β	Partnered – Implicit SE β
Explicit anxious attachment	-.226***	.110	-.183	.010
Explicit avoidant attachment	.024	.006	-.050	-.125
Implicit anxious attachment	.029	-.180**	.151	-.252*
Implicit avoidant attachment	-.068	-.228***	-.191	-.177
Age	.021	-.061	.132	-.410**
Gender	.152*	-.027	—	—
Relationship duration	—	—	.111	.216
Education	.091	.102	.095	-.147
R ²	.087	.140	.131	.214
F	3.57***	5.97***	2.14*	3.84**

Note. $p < .05$, $p < .01$, $p < .001$.

Standardized beta coefficients (β) are reported. Explicit anxious and avoidant attachment were dummy-coded with secure attachment as the reference category. Implicit attachment variables reflect IAT-based D-scores and were entered as continuous predictors. Gender was coded as 0 = male, 1 = female (singles sample only). Age, education, and relationship duration (partnered sample only) were included as covariates.

The overall model was statistically significant, $F(7, 262) = 3.57$, $p = .001$, $R^2 = .087$.

Explicit anxious attachment was significantly negatively associated with explicit self-esteem ($\beta = -.226$, $p < .001$). Explicit avoidant attachment did not show a significant association ($\beta = .024$, $p = .696$). Neither implicit anxious attachment ($\beta = .029$, $p = .661$) nor implicit avoidant attachment ($\beta = -.068$, $p = .309$) were significantly associated with explicit self-esteem. Among the covariates, only gender emerged as a significant predictor, with women reporting higher explicit self-esteem than men ($\beta = .152$, $p = .013$). As shown in Table 2, the model predicting implicit self-esteem was statistically significant, $F(7, 262) = 5.97$, $p < .001$, $R^2 = .140$.

Both implicit attachment dimensions showed significant associations with implicit self-esteem. Implicit anxious attachment was negatively associated with implicit self-esteem ($\beta = -.180$, $p = .005$), as was implicit avoidant attachment ($\beta = -.228$, $p < .001$). None of the explicit attachment styles were

significantly associated with implicit self-esteem (anxious: $\beta = .110$, $p = .071$; avoidant: $\beta = .006$, $p = .915$). None of the covariates reached statistical significance.

5.4.3 Regression Analyses in Partnered Sample

To examine whether the observed associations would generalize to individuals in ongoing relationships, the same regression models were tested in the partnered sample ($N = 108$). Table 2 presents the regression results for explicit self-esteem in the partnered sample. The overall model was statistically significant, $F(7, 100) = 2.14$, $p = .046$, $R^2 = .131$. Explicit anxious attachment was not significantly associated with explicit self-esteem ($\beta = -.183$, $p = .084$). None of the other attachment styles or covariates were significantly associated with explicit self-esteem. Table 2 also shows the results for the model predicting implicit self-esteem in the partnered sample. This model was also significant, $F(7, 100) = 3.84$, $p = .001$, $R^2 = .214$. Implicit anxious attachment was negatively associated with implicit self-esteem ($\beta = -.252$, $p = .014$), while implicit avoidant attachment did not reach significance ($\beta = -.177$, $p = .087$). Age emerged as a significant covariate ($\beta = -.410$, $p = .006$), with older participants showing lower implicit self-esteem. No cross-level associations were observed.

To facilitate interpretation, Table 3 provides a concise overview of the study hypotheses and whether they were supported by the regression analyses.

Table 3.
Overview of hypotheses and outcomes

Hypothesis	Description	Outcome
H1a	Explicit attachment orientation is associated with explicit self-esteem	Supported
H1b	Explicit attachment orientation is associated with implicit self-esteem	Not supported
H2a	Implicit attachment orientation is associated with implicit self-esteem	Supported
H2b	Implicit attachment orientation is associated with explicit self-esteem	Not supported
H3	Patterns of association are comparable across singles and partnered individuals	Largely supported

Note. Outcomes are based on the regression analyses reported in Table 2. “Supported” indicates statistically significant associations in the hypothesized direction; “Not supported” indicates non-significant associations. “Largely supported” reflects consistent patterns across groups, despite minor variations in specific effects.

Across analyses, explicit attachment was positively associated with explicit self-esteem, and implicit attachment was positively associated with implicit self-esteem. Cross-level associations were small and not consistently observed across relational contexts.

5.5 Discussion

5.5.1 Patterns of Association.

This study examined associations between explicit and implicit self-esteem and attachment in singles seeking a partner and in partnered individuals. The results supported a parallel-level interpretation, with associations occurring primarily within processing levels rather than across them.

In the singles sample, explicit anxious attachment was negatively associated with explicit self-esteem, consistent with extensive previous research documenting that attachment anxiety undermines self-esteem (Mikulincer & Shaver, 2016; Foster et al., 2007). At the implicit level, both anxious and avoidant attachment were negatively associated with implicit self-esteem. The absence of significant cross-level associations aligns with dual-process models distinguishing between associative and propositional processes (Gawronski & Bodenhausen, 2006; Strack & Deutsch, 2004).

The partnered sample showed a broadly similar pattern, although the association between explicit anxious attachment and explicit self-esteem did not reach significance. This difference between samples may reflect reduced statistical power, but it might also suggest that relationship status plays a role in these associations. Research has shown that relationship transitions can influence both self-esteem (Lehnart et al., 2010; Luciano & Orth, 2017) and attachment patterns (Chopik et al., 2019). The ongoing relational feedback available to partnered individuals may provide a buffer against attachment-related self-esteem vulnerabilities (Murray et al., 2000; Erol & Orth, 2016).

At the implicit level, anxious attachment was negatively associated with implicit self-esteem in both samples. This finding aligns with research showing that automatic relational schemas shape self-evaluations outside conscious awareness (Dewitte et al., 2008; Zayas & Shoda, 2005).

Implicit avoidant attachment showed a different pattern across samples. While it was negatively associated with implicit self-esteem in the singles sample, this association was not significant in the partnered sample. Although this difference may simply reflect reduced statistical power, it could also suggest that defensive strategies characteristic of avoidant attachment operate differently across relational contexts. Avoidantly attached individuals engage in defensive exclusion of attachment-related information, suppressing negative self-views to maintain a positive self-image (Mikulincer & Shaver, 2016; Fraley et al., 1998). Research has shown that they limit self-disclosure and distrust partner feedback, which prevents partners from truly knowing them (Emery et al., 2018). These defensive processes operate particularly at the implicit level, where avoidant individuals show positivity biases and decreased accessibility of negative self-representations (Edelstein & Gillath, 2008).

For singles seeking a partner, the absence of an established relationship may create more variable defensive patterns. Without a consistent relational context, their defensive strategies may fluctuate between self-protective distancing and the competing need to engage for potential connection, making negative self-associations more detectable through implicit measures. In contrast, partnered individuals have likely established stable defensive routines within their relationships. This stability in defensive processing may create more consistent suppression of negative self-views, potentially reducing the variability that IAT methodology can detect (Mikulincer et al., 2004).

In addition to these attachment-related patterns, age and gender emerged as significant covariates in specific models and merit brief consideration. Age-related differences in implicit self-esteem may reflect developmental and relational processes that unfold across adulthood, including cumulative relational experiences and changing self-evaluations over the life course. Prior research suggests that self-esteem and attachment-related representations continue to evolve in midlife and

older adulthood, particularly in response to long-term relational contexts (e.g., Chopik et al., 2018; Luciano & Orth, 2017).

Gender differences in explicit self-esteem, observed in the singles sample, are consistent with earlier findings indicating systematic variation in self-evaluative processes between men and women in adulthood (Bleidorn et al., 2016). Importantly, in the present study, age and gender functioned as covariates rather than primary predictors, and their effects should therefore be interpreted as contextual influences operating alongside attachment-related processes rather than as focal explanatory mechanisms.

The overall pattern of results—with associations occurring primarily within rather than across processing levels—extends previous work on implicit attachment processes by examining general adult attachment rather than attachment to specific figures (Zayas & Shoda, 2005). This parallel-level pattern underscores that explicit and implicit measures tap into distinct but related aspects of attachment and self-esteem, highlighting the value of assessing both levels to fully understand these constructs in relational contexts.

5.5.2 Interpreting effect sizes and practical relevance

Before turning to limitations, it is important to contextualize the effect sizes observed in the present models. The R^2 values across models ranged from 9% to 21%, indicating that attachment accounts for a systematic but limited proportion of variance in self-esteem. Several study-specific features may contribute to this pattern, including the use of categorical attachment representations, which collapse within-category variation, and the modest split-half reliability of the implicit measures ($r = .73-.76$), both of which can attenuate observed associations.

Beyond measurement considerations, self-esteem is shaped by multiple factors—such as personality traits, relational context, and life experiences—most of which were not captured in the present models, which included only attachment styles and basic demographic covariates. As a result, the findings describe group-level associations rather than providing accurate predictions for individual outcomes. They characterize how attachment-related self-evaluations differ across levels of cognitive processing, but cannot support individual-level prediction or clinical decision-making.

5.5.3 Strengths and limitations

This study has several strengths. First, explicit and implicit attachment styles were included in the same regression models, allowing for a direct comparison of their unique contributions to explicit and implicit self-esteem. Second, the inclusion of two independent samples (singles and partnered individuals) enabled an initial examination of whether patterns generalize across relational contexts.

This study also has several limitations. First, although the analytic structure was identical across samples, statistical power was lower in the partnered group, which limits the strength of cross-sample comparisons. This is particularly relevant given that explicit anxious attachment was significantly associated with explicit self-esteem in the singles sample, but not in the partnered sample, and implicit avoidant attachment was significantly associated with implicit self-esteem in singles but

not in partnered individuals. Second, the cross-sectional design precludes any directional conclusions regarding how attachment and self-esteem influence one another.

Third, although implicit and explicit variables were measured in parallel, the analyses relied on observed scores rather than latent modeling approaches such as structural equation modeling. Future studies could use SEM to test more refined models of parallel and cross-level processes. Lastly, the operationalization of implicit attachment relied on a relatively novel adaptation of the IAT. While the IAT demonstrated internal consistency and theoretical convergence with self-esteem measures, its construct validity remains an area for further examination. Replication studies using alternative implicit measures (e.g., affect misattribution, priming tasks) might help to establish robustness.

As with all cross-sectional designs, the present findings do not allow for conclusions about the directionality of the observed associations.

5.5.4 Implications for Clinical Practice

Although causal conclusions cannot be drawn from these cross-sectional findings, the observed associations suggest that the association between anxious attachment and explicit self-esteem might be moderated by relationship status, which could have implications for intervention strategies. For singles with anxious attachment styles, the observed link with lower self-esteem suggests that cognitive-behavioral interventions targeting self-esteem may be particularly beneficial. Such interventions could include self-compassion training (Neff & McGehee, 2010), cognitive restructuring of negative self-schemas (Beck et al., 1979), and behavioral experiments to challenge self-critical beliefs. Building a more stable sense of self-worth before entering a relationship may help these individuals develop more secure relationship patterns (Stinson et al., 2015).

In contrast, for individuals with self-esteem or attachment issues who are currently in a relationship, different therapeutic approaches may be more appropriate. The buffering effect of the relationship suggests that interventions could leverage this existing resource rather than focusing primarily on individual self-esteem. Evidence-based approaches such as Emotionally Focused Therapy (Johnson, 2019), which directly addresses attachment insecurities within the relational context, or mindfulness-based interventions that improve emotion regulation in attachment-related distress (Pepping et al., 2017), may be more effective. These approaches recognize that for partnered individuals with anxious attachment, the relationship itself serves a regulatory function that can be therapeutically enhanced rather than bypassed.

The parallel-level pattern observed in our study also has implications for assessment and intervention planning. Given that explicit and implicit measures showed only modest correlations, relying solely on self-report measures may miss important aspects of relational functioning that operate outside conscious awareness, regardless of relationship status.

5.6 Conclusion

This study examined how explicit and implicit attachment styles relate to self-esteem across two samples differing in relationship status. Three key findings emerged:

First, the results support a parallel-level framework, with associations occurring primarily within rather than across processing levels. Explicit attachment styles were associated with explicit self-esteem, while implicit attachment styles were associated with implicit self-esteem, with no significant cross-level associations observed.

Second, the different patterns observed between singles and partnered individuals suggest that relationship status may play a role in these associations. Explicit anxious attachment showed a robust negative association with explicit self-esteem in the singles sample, but this association was not significant in the partnered sample. While the cross-sectional design and separate samples preclude causal conclusions, this pattern suggests that being in a relationship may buffer against the self-esteem vulnerabilities associated with attachment anxiety.

Third, by incorporating both explicit and implicit measures across two relational contexts, this study provides preliminary evidence for the importance of considering relational context when examining attachment-self-esteem associations. The differential patterns observed between singles and partnered individuals, though requiring replication in larger samples, offer preliminary insights that may inform both theoretical understanding and clinical approaches to attachment-related difficulties.

Ethics Statement

While the study design and hypotheses were not formally pre-registered, the method, research questions, and design were submitted to and approved by the Ethics Review Board before data collection commenced. The study received approval on May 29, 2015 (U2015/03547/HVM)."

Consent

Informed consent was obtained from all participants prior to participation. All data were anonymized and sensitive data were encrypted and securely stored in compliance with ethical guidelines. Participants were informed of their right to withdraw at any time without consequences.

Disclosure

The manuscript has not been previously published in any form. It is neither under consideration nor in press with another publication. It has been seen and reviewed by all authors, and all authors agree to the submission of the manuscript in its current form.

Conflict of interest

The authors declare no conflicts of interest

Data Availability Statement

The data and analysis scripts are available at https://osf.io/n9fcb/?view_only=dbbdf8ab070c4800ab7ddeb3099bff03.

References

- Anderson, S. F., & Maxwell, S. E. (2016). There's more than one way to conduct a replication study: Beyond statistical significance. *Psychological Methods*, 21(1), 1–12.
<https://doi.org/10.1037/met0000051>
- Bartholomew, K., & Horowitz, L. (1991). Attachment styles among young adults: A test of a four-category model. *Journal of Personality and Social Psychology*, 61, 226–244.
<https://doi.org/10.1037/0022-3514.61.2.226>
- Beck, A. T., Rush, A. J., Shaw, B. F., & Emery, G. (1979). *Cognitive therapy of depression*. Guilford Press.
- Bleidorn, W., Arslan, R. C., Denissen, J. J. A., Rentfrow, P. J., Gebauer, J. E., Potter, J., & Gosling, S. D. (2016). Age and gender differences in self-esteem—A cross-cultural window. *Journal of Personality and Social Psychology*, 111(3), 396–410. <https://doi.org/10.1037/pspp0000078>
- Bosson, J. K., Swann, W. B., & Pennebaker, J. W. (2000). Stalking the perfect measure of implicit self-esteem: The blind men and the elephant revisited. *Journal of Personality and Social Psychology*, 79(4), 631–643. <https://doi.org/10.1037/0022-3514.79.4.631>
- Chopik, W. J., Edelstein, R. S., & Fraley, R. C. (2013). From the cradle to the grave: Age differences in attachment from early adulthood to old age. *Journal of Personality*, 81(2), 171–183.
<https://doi.org/10.1111/j.1467-6494.2012.00793.x>
- Chopik, W. J., Edelstein, R. S., & Grimm, K. J. (2019). Longitudinal changes in attachment orientation over a 59-year period. *Journal of Personality and Social Psychology*, 116(4), 598–611.
<https://doi.org/10.1037/pspp0000167>
- De Houwer, J., Teige-Mocigemba, S., Spruyt, A., & Moors, A. (2009). Implicit measures: A normative analysis and review. *Psychological Bulletin*, 135(3), 347–368.
<https://doi.org/10.1037/a0014211>
- Del Giudice, M. (2009). Sex, attachment, and the development of reproductive strategies. *Behavioral and Brain Sciences*, 32(1), 1–21. <https://doi.org/10.1017/S0140525X09000016>
- Dewitte, M., De Houwer, J., & Buysse, A. (2008). On the role of the implicit self-concept in adult attachment. *European Journal of Psychological Assessment*, 24(4), 282–289.
<https://doi.org/10.1027/1015-5759.24.4.282>
- Edelstein, R. S., & Gillath, O. (2008). Avoiding interference: Adult attachment and emotional processing biases. *Personality and Social Psychology Bulletin*, 34(2), 171–181.
<https://doi.org/10.1177/0146167207310024>
- Emery, L. F., Gardner, W. L., Carswell, K. L., & Finkel, E. J. (2018). You can't see the real me: Attachment avoidance, self-verification, and self-concept clarity. *Personality and Social Psychology Bulletin*, 44(8), 1133–1146. <https://doi.org/10.1177/0146167218760799>
- Erol, R. Y., & Orth, U. (2014). Development of self-esteem and relationship satisfaction in couples: Two longitudinal studies. *Developmental Psychology*, 50(9), 2291–2303.
<https://doi.org/10.1037/a0037370>
- Erol, R. Y., & Orth, U. (2016). Self-esteem and the quality of romantic relationships. *European Psychologist*, 21(4), 274–283. <https://doi.org/10.1027/1016-9040/a000259>

- Feeney, B. C., & Collins, N. L. (2015). A new look at social support: A theoretical perspective on thriving through relationships. *Personality and Social Psychology Review*, 19(2), 113–147. <https://doi.org/10.1177/1088868314544222>
- Finkel, E. J., Eastwick, P. W., Karney, B. R., Reis, H. T., & Sprecher, S. (2012). Online dating: A critical analysis from the perspective of psychological science. *Psychological Science in the Public Interest*, 13(1), 3–66. <https://doi.org/10.1177/1529100612436522>
- Foster, J. D., Kernis, M. H., & Goldman, B. M. (2007). Linking adult attachment to self-esteem stability. *Self and Identity*, 6(1), 64–73. <https://doi.org/10.1080/15298860600832139>
- Fraley, R. C., Hudson, N. W., Heffernan, M. E., & Segal, N. (2015). *Are adult attachment styles categorical or dimensional? A taxometric analysis of romantic attachment*. *Journal of Personality and Social Psychology*, 109(2), 354–368. <https://doi.org/10.1037/pspp0000027>
- Fraley, R. C., & Roisman, G. I. (2019). The development of adult attachment styles: Four lessons. *Current Opinion in Psychology*, 25, 26–30. <https://doi.org/10.1016/j.copsyc.2018.02.008>
- Fraley, R. C., & Shaver, P. R. (2000). Adult romantic attachment: Theoretical developments, emerging controversies, and unanswered questions. *Review of General Psychology*, 4(2), 132–154. <https://doi.org/10.1037/1089-2680.4.2.132>
- Funder, D. C., & Ozer, D. J. (2019). Evaluating effect size in psychological research: Sense and nonsense. *Advances in Methods and Practices in Psychological Science*, 2(2), 156–168. <https://doi.org/10.1177/2515245919847202>
- Gawronski, B., & Bodenhausen, G. V. (2006). Associative and propositional processes in evaluation: An integrative review of implicit and explicit attitude change. *Psychological Bulletin*, 132(5), 692–731. <https://doi.org/10.1037/0033-2909.132.5.692>
- Greenwald, A. G., & Banaji, M. R. (1995). Implicit social cognition: Attitudes, self-esteem, and stereotypes. *Psychological Review*, 102(1), 4–27. <https://doi.org/10.1037/0033-295X.102.1.4>
- Greenwald, A. G., & Farnham, S. D. (2000). Using the Implicit Association Test to measure self-esteem and self-concept. *Journal of Personality and Social Psychology*, 79(6), 1022–1038. <https://doi.org/10.1037/0022-3514.79.6.1022>
- Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The Implicit Association Test. *Journal of Personality and Social Psychology*, 74(6), 1464–1480. <https://doi.org/10.1037/0022-3514.74.6.1464>
- Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the implicit association test: An improved scoring algorithm. *Journal of Personality and Social Psychology*, 85(2), 197–216. <https://doi.org/10.1037/0022-3514.85.2.197>
- Greenwald, A. G., Poehlman, T. A., Uhlmann, E. L., & Banaji, M. R. (2009). Understanding and using the Implicit Association Test: III. Meta-analysis of predictive validity. *Journal of Personality and Social Psychology*, 97(1), 17–41. <https://doi-org.ezproxy.elib11.ub.unimaas.nl/10.1037/a0015575>

- Griffin, D., & Bartholomew, K. (1994). Models of self and other: Fundamental dimensions underlying measures of adult attachment. *Journal of Personality and Social Psychology*, 67(3), 430–445. <https://doi.org/10.1037/0022-3514.67.3.430>
- Harris, M. A., & Orth, U. (2020). The link between self-esteem and social relationships: A meta-analysis of longitudinal studies. *Journal of Personality and Social Psychology*, 119(6), 1459–1477. <https://doi.org/10.1037/pspp0000265>
- Hofmann, W., Gawronski, B., Gschwendner, T., Le, H., & Schmitt, M. (2005). A Meta-Analysis on the Correlation Between the Implicit Association Test and Explicit Self-Report Measures. *Personality and Social Psychology Bulletin*, 31(10), 1369–1385. <https://doi-org.ezproxy.elib11.ub.unimaas.nl/10.1177/0146167205275613>
- Hudson, N. W., & Fraley, R. C. (2017). Adult attachment and perceptions of closeness. *Personal Relationships*, 24, 17–26. <https://doi.org/10.1111/pere.12166>
- Johnson, S. M. (2019). Attachment theory in practice: Emotionally focused therapy (EFT) with individuals, couples, and families. Guilford Press.
- Jordan, C. H., & Zeigler-Hill, V. (2020). Implicit self-esteem. In M. H. Bornstein et al. (Eds.), *Encyclopedia of personality and individual differences* (pp. 2180–2183). Springer.
- Kirkpatrick, L. A., & Hazan, C. (1994). Attachment styles and close relationships: A four-year prospective study. *Personal Relationships*, 1(2), 123–142. <https://doi.org/10.1111/j.1475-6811.1994.tb00058.x>
- Lehnart, J., Neyer, F. J., & Eccles, J. (2010). Long-term effects of social investment: The case of partnering in young adulthood. *Journal of Personality*, 78(2), 639–670. <https://doi.org/10.1111/j.1467-6494.2010.00629.x>
- Luciano, E. C., & Orth, U. (2017). Transitions in romantic relationships and development of self-esteem. *Journal of Personality and Social Psychology*, 112(2), 307–328. <https://doi.org/10.1037/pspp0000109>
- Luke, M. A., Maio, G. R., & Carnelley, K. B. (2004). Attachment models of the self and others: Relations with self-esteem, humanity-esteem, and parental treatment. *Personal Relationships*, 11(3), 281–303. <https://doi.org/10.1111/j.1475-6811.2004.00083.x>
- Maxwell, S. E., & Cole, D. A. (2007). Bias in cross-sectional analyses of longitudinal mediation. *Psychological Methods*, 12(1), 23–44. <https://doi.org/10.1037/1082-989X.12.1.23>
- McClure, M. J., Lydon, J. E., Baccus, J. R., & Baldwin, M. W. (2010). A signal detection analysis of chronic attachment anxiety at speed dating: Being unpopular is only the first part of the problem. *Personality and Social Psychology Bulletin*, 36(8), 1024–1036. <https://doi.org/10.1177/0146167210374238>
- McNally, R.J. (1995). Automaticity and the anxiety disorders. *Behav Res Ther*, 33, 7, 747–754. [http://dx.doi.org/10.1016/0005-7967\(95\)00015-P](http://dx.doi.org/10.1016/0005-7967(95)00015-P)
- Mikulincer, M., Dolev, T., & Shaver, P. R. (2004). Attachment-related strategies during thought suppression: Ironic rebounds and vulnerable self-representations. *Journal of Personality and Social Psychology*, 87(6), 940–956. <https://doi.org/10.1037/0022-3514.87.6.940>

- Mikulincer, M., & Shaver, P. R. (2016). Attachment in adulthood: Structure, dynamics, and change (2nd ed.). Guilford Press.
- Murray, S. L., Derrick, J. L., Leder, S., & Holmes, J. G. (2008). Balancing connectedness and self-protection goals in close relationships: A levels-of-processing perspective on risk regulation. *Journal of Personality and Social Psychology*, 94(3), 429–459. <https://doi.org/10.1037/0022-3514.94.3.429>
- Murray, S. L., Holmes, J. G., & Griffin, D. W. (1996). The self-fulfilling nature of positive illusions in romantic relationships: Love is not blind, but prescient. *Journal of Personality and Social Psychology*, 71(6), 1155–1180. <https://doi.org/10.1037/0022-3514.71.6.1155>
- Murray, S. L., Holmes, J. G., & Griffin, D. W. (2000). Self-esteem and the quest for felt security: How perceived regard regulates attachment processes. *Journal of Personality and Social Psychology*, 78(3), 478–498. <https://doi.org/10.1037/0022-3514.78.3.478>
- Neff, K. D., & McGehee, P. (2010). Self-compassion and psychological resilience among adolescents and young adults. *Self and Identity*, 9(3), 225–240.
- Nosek, B. A. (2005). Moderators of the relationship between implicit and explicit evaluation. *Journal of Experimental Psychology: General*, 134(4), 565–584. <https://doi.org/10.1037/0096-3445.134.4.565>
- Orth, U., & Robins, R. W. (2014). The development of self-esteem. *Current Directions in Psychological Science*, 23(5), 381–387. <https://doi.org/10.1177/0963721414547414>
- Pepping, C. A., MacDonald, G., & Davis, P. J. (2017). Toward a deeper understanding of the connection between adult attachment and mindfulness: A systematic review of the literature. *Mindfulness*, 8(6), 1432–1455. <https://doi.org/10.1007/s12671-017-0733-y>
- Pinquart, M. (2023). Associations of self-esteem with attachment to parents: A meta-analysis. *Psychological Reports*, 126(5), 1–26. <https://doi.org/10.1177/00332941221079732>
- Riketta, M. (2005). Gender and socially desirable responding as moderators of the correlation between implicit and explicit self-esteem. *Current Research in Social Psychology*, 11(2), 14–28.
- Stinson, D. A., Cameron, J. J., Hoplock, L. B., & Hole, C. (2015). Warming up and cooling down: Self-esteem and behavioral responses to social threat during relationship initiation. *Self and Identity*, 14(1), 1–24. <https://doi.org/10.1080/15298868.2014.969301>
- Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review*, 8(3), 220–247. https://doi.org/10.1207/s15327957pspr0803_1
- Visser, L., Lataster, J., Pat-El, R., van Lankveld, J., & Jacobs, N. (2021). Psychometric properties of two implicit associations tests measuring adult attachment. *Psychologica Belgica*, 61(1), 88–103. <https://doi.org/10.5334/pb.1042>
- Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton University Press.
- Zayas, V., & Shoda, Y. (2005). Do automatic reactions elicited by thoughts of romantic partner, mother, and self relate to adult romantic attachment? *Personality and Social Psychology Bulletin*, 31(8), 1011–1025. <https://doi.org/10.1177/0146167204274100>

Chapter 6. Discrepancy-based modelling in attachment and self-esteem research

This chapter is published as:

Visser, L., Pat-el, R., Lataster, J., Van Lankveld, J. and Jacobs, N. (2024) 'Beyond Difference Scores: Unlocking Insights with Polynomial Regression in Studies on the Effects of Implicit-Explicit Congruency', *Psychologica Belgica*, 64(1), p. 5–23. <https://doi.org/10.5334/pb.1246>.

Abstract

The aim of our study was to investigate whether theories of congruence are better tested using polynomial regression analysis, rather than expressing discrepancy between implicit and explicit measures as continuous or categorical difference scores. This paper also aims to make knowledge more accessible by providing a step-by-step explanation of both methods, illustrating differences between them, and making materials openly available for other researchers. In this paper, implicit and explicit measures of self-esteem are used as predictors for depressive symptoms, anxiety, and aggression in a general population sample ($N = 135$). Explicit self-esteem was measured using the Rosenberg Self-Esteem Scale, implicit self-esteem was measured using the Implicit Association Test, and the Symptom Questionnaire was used to measure depressive symptoms, anxiety, and aggression. The results show those difference score models all imply that the discrepancy between implicit and explicit self-esteem explains depression and anxiety, but not aggression. However, polynomial regression analysis shows that depression and anxiety are not accounted for by the explicit-implicit discrepancy as such, but are foremost explained by explicit self-esteem. Polynomial regression has the potential to evaluate more complex and more detailed hypotheses than what would be possible using statistical approaches based on discrepancy scores. It is therefore recommended for future research aimed at disentangling the roles of explicit and implicit self-esteem in psychological outcomes.

6.1 Introduction

Individuals with low self-esteem think and behave in ways that diminish their quality of life (Swann Jr et al., 2007), whereas high self-esteem predicts success and well-being in life domains of relationships, work, and health (Orth & Robins, 2014). Positive psychology, building on Maslov's conception of self-actualization has long posited that the self-valuing process is dependent on the quality of the self-concept (Ryan & Deci, 2000). Central to positive psychology's paradigm is the position of Rogers who believed that for a person to achieve self-actualization they must be in a state of congruence (Rogers, 1957). The idea is that self-actualization occurs when a person's "ideal self" (i.e., whom they would like to be) is congruent with their actual behavior (self-image). The closer self-image and ideal self are to each other, the more consistent or congruent the person is which increases self-esteem.

The interplay between implicit and explicit manifestations of one's own self-esteem is often explained from the perspective of dual-process theory. Dual-process theory (Evans, 2008; Kahneman & Frederick, 2005) states that information is processed along two distinct pathways, a deliberate (explicit) and an automatic (implicit) pathway. The implication of this theory in the context of self-esteem would be the existence of two different self-esteem dimensions that play distinct roles in controlled and automatic behaviors: explicit self-esteem and implicit self-esteem (Buhrmester et al., 2011; Gawronski & Bodenhausen, 2006; Spalding & Hardin, 1999; Strack & Deutsch, 2004). Explicit self-esteem is thought to represent a conscious, cognitive and controllable reflection on one's own self-worth (Schröder-Abé et al., 2007). Implicit self-esteem, on the other hand, prevails in situations in which the individual does not have particular goals, has little time to think, and/or is not aware of the outcome of the cognitive process (De Houwer et al., 2009). Implicit does not necessarily mean unconscious: participants may be aware of the attribute being assessed, but they have minimal control over the measurement outcome (Steffens, 2004). Kernis (2003) hypothesized that when implicit and explicit self-esteem differ, the direction of the discrepancy changes its meaning. When low implicit self-esteem concurs with high explicit self-esteem it is referred to as fragile self-esteem, whereas the combination of high implicit self-esteem with low explicit self-esteem is referred to as damaged self-esteem. Several studies that explored the effects of the discrepancy between explicit and implicit self-esteem have shown associations of discrepancy-size with depression (Creemers et al., 2013; Creemers et al., 2012; Franck et al., 2007; Leeuwis et al., 2014; Valiente et al., 2011), anxiety (Rudman & Ashmore, 2007; Schreiber et al., 2012; van Tuijl et al., 2014) and aggression (Jordan et al., 2005; Sandstrom & Jordan, 2008; Schröder-Abé et al., 2007).

Dual-process theory has met with well-reasoned critique in the past decade, mainly because of concerns with the idea that the two systems are sufficiently independent. Keren & Schul (2009) provide a thorough summary of key critical points, and assert that testing the theory of dual-process requires a re-evaluation of research methodologies used in studies that assume dual-processes take place. These critical points are sufficiently meaningful to warrant our attention. For example, in the above-mentioned studies, implicit and explicit pathways were operationalized as a discrepancy score. The discrepancy score was operationalized as a difference score between explicit and implicit self-esteem, representing the degree and direction of congruence between explicit and implicit self-esteem. However, difference scores are rife with methodological problems, often resulting in misleading conclusions. Edwards (2001) outlined many of the problems with difference-scores, like reliability issues, reduced effect sizes and an increased risk of errors. One such problem is the attenuation of error in difference scores; the reliability of each component part is attenuated by the correlation between them (Cohen & Cohen 1983), which means that the reliability of a difference score measure is usually less than the reliability of each component.

One primary concern associated with difference scores is their tendency to reduce true score variance (May and Hittner, 2003). True score variance reflects the variability in scores attributable to actual differences in ability or attitudes, while error variance encompasses variability introduced by random factors, such as measurement error. When calculating a difference score like d_{600} , the true score variance is diminished by an amount corresponding to the square of the correlation between the

pretest and posttest scores. This reduction occurs because the difference score is sensitive only to changes in ability or attitudes that are shared between the pretest and posttest measurements. Consequently, the reliance on the common variance may compromise the reliability of difference scores compared to the individual reliability of pretest and posttest scores. In addition, as in the above mentioned studies, implicit and explicit self-esteem are fundamentally differenced constructs and the method of their measurement necessarily imply that they are conceptualized and operationalized in different ways, which affects reliability and content validity, especially when these two constructs are directly compared to each other. Self-report scales of Self-Esteem often show a higher test-retest correlation and a lower situational variability compared to implicit measures, which means that explicit measures tend to be more stable over time compared to implicit measures. (Dentale et al., 2019). The IAT variable is susceptible to errors due to its reliance on reaction times, which can be affected by various factors like fatigue, concentration, and motivation. In contrast, the Rosenberg Self-esteem is a questionnaire specifically crafted to yield a dependable and valid assessment of explicit self-esteem. Dentale et al.'s (2019) findings imply the presence of residual noise in the discrepancy score between explicit and implicit self-esteem. This is attributed to the inherent error-proneness of the IAT variable, whereas the Rosenberg Self-esteem, being an explicit measurement, is not prone to such errors.

Perhaps most importantly, the use of difference scores implies an intuitive, but specific, and restrictive hypothesis, namely that the components of the difference have equal but opposite effects (Edwards, 1994). This model might be a poor reflection of the underlying reality, and several alternative models for difference scores that are often better able to describe the relationship between components have been proposed (Humberg et al., 2018; Mota et al., 2020). One important problem with the model underlying the classic use of difference scores is that it obfuscates the relative weight of each component in relation to a criterion variable, i.e. it hides whether both factors pull equal weight, or if one variable is doing most of the legwork. For example, a significant association between a difference score (such as the difference between explicit and implicit self-esteem) and an outcome measure (such as depression) may reflect only a main effect of one of the core variables (explicit self-esteem or implicit self-esteem) and not per se the effect of the degree of discrepancy. In the extreme case that one of these variables has zero effect on the criterion, the use of a difference score amounts to little more than centering the main effect to zero with a random residual deviation, turning the difference score into a worse predictor than the main effect would have been in itself.

To address methodological challenges, alternative approaches have been proposed in the literature. Edwards (1993) drew inspiration from surface response methodology and advocated for the utilization of polynomial regression equations to explore the intricate interplay between component parts in a difference score concerning a criterion variable. Edwards's (1993) method involves eschewing the use of difference scores altogether and constructing polynomial regression models with each component as a separate predictor. This enables the assessment of the relative importance of each component. The incorporation of polynomials facilitates the depiction of a curved surface, describing the relationship between components and the criterion. This approach allows for the examination of more complex relationships that are beyond the scope of traditional difference scores.

In a subsequent work, Edwards (1994) delves into two specific congruency hypotheses within the realm of RSA, articulated as the $X = Y$ and $X = -Y$ lines. The $X = Y$ line epitomizes perfect congruence, signifying an ideal alignment between two constructs. Conversely, the $X = -Y$ line represents the extreme of incongruence, where the two constructs are diametrically opposed, leading to maximal incongruence and potential negative outcomes such as job dissatisfaction, stress, and turnover. These extremes serve as crucial benchmarks for testing congruency-related hypotheses directly through RSA.

For instance, if the observed congruence score aligns closer to the $X = Y$ line than the $X = -Y$ line, it implies a positive relationship between congruence and the outcome. In this scenario, an increase in congruence corresponds to an increased likelihood of a positive outcome. Conversely, if the observed congruence score is closer to the $X = -Y$ line than the $X = Y$ line, it suggests a negative relationship between congruence and the outcome. Here, an increase in congruence is associated with a decrease in the expected outcome.

Rather than solely examining the effect of the difference on a criterion, the combination of polynomial regression with response surface methods enables the testing of more nuanced hypotheses. By analyzing the curvature along the $X = Y$ and $X = -Y$ lines, one can empirically test (instead of assuming) classic difference score hypotheses, such as whether (a) each component part carries equal weight, (b) the criterion is optimized at a constant value when the two components are equal, and (c) the criterion changes systematically when deviating from these congruency lines. Therefore, the primary advantages of polynomial regression lie in its ability to test a priori hypotheses derived from theory, its resistance to attenuated reliability, and its capacity to determine the contribution of each component part in predicting a criterion.

In short, these equations get around many problems that come along with the use of difference scores and at the same time allow to draw valid conclusions about congruence effects. Nevertheless, polynomial regression in lieu of difference scores is not common practice, probably because the results of such equations are not so easy to interpret. The polynomial models and their constraints can be quite arcane to anyone not already familiar with advanced calculus, and disentangling the unique and joint effects expressed by main effects, squared main effects and interaction terms is challenging. It is more practical to plot the polynomial model as a 3-D plot, a response surface, either accompanied by a contour plot or by using colours to express the height of the surface. In addition, polynomial regression is not without limitations. This approach is only useful when the differences between variables are the predictors, and a different approach is needed when discrepancy is the dependent variable (Edwards, 1995). Polynomial regression is susceptible to outliers given that it squares the main effects, which has an exponential effect on outliers, requiring rigorous data screening.

There are two research questions here that need to be addressed. The first question is: Should implicit and explicit self-esteem be merged in one variable (difference scores) or not? The second question is: Should the effect of self-esteem (either difference scores, either the two original variables) be modelled as polynomial? The main goal of this study is to demonstrate polynomial regression as an approach that allows to investigate the associations between explicit self-esteem,

implicit self-esteem and respectively depression, anxiety and aggression through specific hypotheses derived from fit patterns. We will provide an empirical example to demonstrate the differences between the approaches, and how to interpret their results. In the first approach, numerical congruence as expressed in a difference score between explicit and implicit self-esteem will be used. In the second approach, polynomial regression equations will be applied in order to analyse fit patterns based on the relative importance of each predictor, but also the shape of the curved surface, and meaningful axes along these shapes. The overall aim of this paper is to illustrate the difference in results and conclusions, depending on the approach that is used, and why it is important to move away from numerical congruence (i.e. difference scores) as predictors, especially in research concerning the congruence between explicit and implicit constructs. This paper also aims to make knowledge more accessible by providing a step by step explanation of both methods, illustrating differences between them, and making materials openly available for other researchers.

In the method section the empirical example will first be introduced and explained. In the Analysis subsection a more detailed explanation will be given regarding Polynomial Regression, such as the specific hypotheses that can be tested, how to interpret the 3D representation of the model, the most important axes in the model and their interpretation. The results section will demonstrate the outcomes from the two approaches and their differences will be discussed in the discussion section. The purpose of this paper was to be easy to understand for researchers who have little background in advanced calculus or linear algebra. For this reason both the methods and the introduction include little to no equations and proofs, unless absolutely necessary. We also offer the R-code that was used to conduct the polynomial regression analyses, as well as a mathematical explanation for those interested in it.

6.2 Method

6.2.1 Participants

Convenience sampling was used to recruit participants within the social networks of psychology students of the Open University of the Netherlands. Participants were included if they were over 18 years of age and were fluent in the national language. The sample ($N = 135$) consisted of 60 male (44.4%) and 74 female participants (54.8%) with an age range of 19 to 77 years ($M = 44.6$; $SD = 11.45$). Of one participant no demographic data were available. Forty three participants (31.9%) had completed secondary education or lower, 44 (32.6%) had completed undergraduate education, and 47 (34.8%) had completed an academic degree or higher. Most participants ($n = 111$, 82.2%) were employed, and 111 participants (82.2%) were in a relationship. This sample meets the power requirement for second-order polynomial regressions with seven parameters (Khamis & Kepler, 2020).

6.2.2 Materials and Procedure

The constructs were measured in several phases. First participants were asked to complete online questionnaires in which the dependent variables and explicit self-esteem were measured. After

completion participants completed the implicit self-esteem measurement which was repeated two weeks later.

Depressive symptoms, anxiety and aggression

The Symptom Questionnaire (Carlier et al., 2012) is a validated screening tool for psychopathology. Four subscales cover different aspects of psychopathology: depression, anxiety, somatization and agoraphobia. In addition, five subscales assess specific aspects of problems in behaviour and/or functioning: aggression, cognitive problems, social phobia, work and vitality/optimism. Respondents were asked to indicate what answer best applied to them, taking the past week as the reference period. Each item was rated by the respondent on a 5-point Likert-scale from 0 ("never") to 4 ("very often"). Scores were added to form a sum-score for each subscale. For the current study, the Depression subscale (MOOD), the Anxiety subscale (ANXI) and the Aggression subscale (AGGR) were selected. Depressive symptoms were measured using 6 items (e.g. "I struggled to get the day started"), anxiety was measured using 6 items (e.g. "I felt jittery and nervous") and aggression was measured using 4 items (e.g. "I struggled to control my anger"). Internal consistencies of the items per subscales were high with Cronbach's $\alpha = .87$ (MOOD), and $.89$ (ANXI), to Cronbach's $\alpha = .76$ (AGGR), which were similar to the reliabilities reported by Carlier et al. (2012).

Explicit self-esteem

The Rosenberg Self-Esteem Scale (Rosenberg, 2015) was used to measure explicit self-esteem operationalized as global self-esteem using 10 items. Responses were given on a 4-point scale ranging from 0 ("strongly disagree") to 3 ("strongly agree"). The questionnaire contains five positively worded items (e.g. "On the whole, I'm satisfied with myself") and five negatively worded items (e.g. "At times I think I am no good at all"). The scores on the latter items were recoded such that higher scores reflected higher self-esteem. The scores were summed to represent explicit self-esteem. The reliability of the RES was high with Cronbach's $\alpha = .89$.

Implicit self-esteem

A Single-Target Implicit Association Test (IAT) was used to measure implicit-self-esteem. The purpose of an IAT is to indirectly measure a construct by using the relative strength of the association between two pairs of concepts related to the construct (Greenwald et al., 1998). Participants were asked to sort stimuli representing four concepts into two response categories (termed 'target' categories and 'attribute' categories), each of which included two of the four concepts. When two concepts, sharing the same response key, are strongly associated, the sorting task is assumed to be easier than when the two concepts are either weakly associated or bipolar-opposites (Greenwald et al., 2003), and consequently the pertinent reaction time is assumed to be lower. The difference in response time reveals the automatic reaction towards a target object, in this case the self. The Single-Target Implicit Association Test (ST-IAT) measures the evaluation of a target object without the need to simultaneously evaluate a counter-category as in the original Implicit Association Test (Bluemke & Friese, 2008).

Following Greenwald et al. (1998) the Self-Esteem IAT in the current study consisted of five blocks in which participants had to categorize words into different categories – of which the labels

were continuously presented in the left and right upper corners of the screen - by pressing a left (z) or right (m) response button. To represent the “Myself” target, the Dutch words for “me,” “myself,” “I,” and “mine” were used. Stimulus words for low self-esteem were the Dutch equivalents of “bad,” “inferior,” “failed,” and “dissatisfied”. Stimulus words for high self-esteem were the Dutch equivalents of “good,” “successful,” “equal,” and “valuable”. Block 1 consisted of 20 trials using the left key for “low self-esteem” and the right key for “high self-esteem”. Block 2 consisted of 15 trials using the left key for “myself” and “low self-esteem” and the right key for “high self-esteem”. Block 3 consisted of 45 trials using the left key for “myself” and “low self-esteem” and the right key for “high self-esteem”. Block 4 consisted of 15 trials using the left key for “low self-esteem” and the right key for “myself” and “high self-esteem”. Block 5 consisted of 45 trials using the left key for “low self-esteem” and the right key for “myself” and “high self-esteem”. The response time for each trial was determined by measuring the elapsed time between stimulus onset and keypress.

Implicit self-esteem was operationalized through the IAT using the D600 scoring algorithm recommended by Greenwald et al. (2003). The experiment consisted five blocks, the first of which was a tutorial block, and block 2 and 4 were practice blocks. The data of block 3 and 5 (test trial blocks) were used in the analysis. As recommended by Greenwald et al. (2003), only reaction times in the range of 400-2500ms were kept in the study. All reaction times (RT) in the range of 2500 – 10,000ms were replaced with a RT of 2500ms (to wit, in block two 46 of the 2025 values, in block three 46 of the 6075 values, in block four 36 of the 2025 values and in block five 34 of the 6075 values).

Latencies above 10,000 ms were excluded before any further computations (to wit, 1 of the 2025 values in block two, 5 of the 6075 values in block three, 1 of the 2025 values in block 4 and 0 of the 6075 values in block 5), following Greenwald et al. (2003). After this first phase of replacement and deletion the reaction times for error trials were replaced with the mean RT of the correct responses in the same block plus a 600ms penalty, also following Greenwald et al. (2003).

For the implicit measurement of self-esteem, the D600 index score was calculated as the difference between the mean RTs to the “myself + low self-esteem” and the “myself + high self-esteem” combination blocks, divided by the standard deviation calculated across all blocks except the attribute practice block. Thus, positive IAT scores reflected high implicit self-esteem, whereas negative scores reflected low implicit self-esteem.

The internal consistency was calculated by measuring the split-half reliability by correlating IAT D600 scores of the even trials with the odd trials within each block. The test-retest reliability was established with the Pearson correlation between the baseline measurement and the second measurement two weeks later. The split-half reliabilities of the first measurement of block 1 to 5 of the IAT were respectively $R_s = .94$, $R_s = .90$, $R_s = .94$, $R_s = .91$, $R_s = .94$. The test-retest reliability coefficients of blocks 1 to 5 of the IAT for the first and second measurement were respectively $r = .63$, $r = .67$, $r = .78$, $r = .55$, and $r = .77$ (all $ps < .01$).

6.2.3 Data analyses

Four different approaches were used to demonstrate the accordance and discordance in the results and conclusions between the different approaches. Regardless of the approach, in order to

examine the associations between implicit and explicit self-esteem on the one hand, and depressive symptoms, anxiety and aggression on the other, hierarchical multiple regression analyses were performed. Prior to analyses the implicit and explicit self-esteem scores were standardized to help their interpretation. The four analyses will be outlined in the next subsections.

Analysis 1: Continuous Difference Scores

The self-esteem discrepancy was first computed as the difference between the standardized scores of explicit and implicit self-esteem. The difference score was calculated by subtracting the implicit (IAT) score from the standardized explicit (Rosenberg SE) score, and entered into a linear regression model. The regression model can be expressed as:

$$(1) \hat{Y} = \beta_0 + \beta_1 X + \epsilon$$

Here, $\hat{Y}$ is the predicted dependent variable, β_0 is the intercept, β_1 is the coefficient for the self-esteem discrepancy, X , and ϵ represents the error term.

In a linear difference score model it is possible to add polynomials such as quadratic terms to model more complex patterns of difference scores. An example quadratic relationship can be expressed as:

$$(2) \hat{Y} = \beta_0 + \beta_1 X + \beta_2 X^2 + \epsilon$$

Where β_2 is the coefficient for the square of the difference score X^2 , which models the effect of the difference score on the dependent variable as a parabola.

In the continuous approach it is difficult to test specific hypotheses regarding the exact effect of the type of difference (negative or positive) on the dependent variable. Rather, the direction and strength of the association are used to ascertain whether a positive or negative difference score is positively related to the outcome variables and to what degree.

Analysis 2: Categorical Difference Scores

Some researchers believe that the problems with continuous difference scores can be solved by reducing the measurement-level of the difference score by creating subgroups based on the congruence between two component measures (e.g. Mersman & Donaldson, 2000). This belief is wrong (e.g., Edwards, 2001) and subgroup Polynomial regression's foremost goal is to test hypotheses derived from congruenceing adds new problems to the difference score measure without alleviating the old ones, such as the attenuation of error in difference scores, the proneness of the implicit measurement to contextual factors, residual noise in the difference scores and the obfuscating of the relative weight of each component in relation to a criterion variable. The main problem with subgrouping is that it still remains a difference score, albeit one which now carries less information and reduced explained variance.

To demonstrate the subgrouping approach the difference score between explicit and implicit self-esteem was split into three groups based on Kernis (2003) classification. Respondents with difference scores 0.5 SD below zero were classified as *fragile* (combination of low implicit self-esteem with high explicit self-esteem) and respondents with difference scores 0.5 SD above zero were classified as *damaged* (high implicit self-esteem combined with low explicit self-esteem). The remaining respondents were classified as *congruent* in explicit and implicit self-esteem. These three

groups were subsequently split into two dummy variables representing fragile and damaged self-esteem, in order to compare their regression weights to the congruent group. These dummies were entered into a linear regression model. In the categorical approach it is slightly easier than in the continuous case to test specific hypotheses regarding the effect of the type of difference (negative or positive) on the dependent variable. The regression equation for this model is expressed as:

$$(3) \hat{Y} = \beta_0 + \beta_1 X_{damaged} + \beta_2 X_{fragile} + \epsilon$$

Here, $\hat{Y}$ is the predicted dependent variable, β_0 is the intercept, β_1 and β_2 are the coefficients for the dummy variables $X_{damaged}$ and $X_{fragile}$ respectively, and ϵ represents the error term. In this model the intercept takes on the value of the mean of the 'congruent' category, and the coefficient for the dummy variables denote the deviation from this mean.

One critique of the continuous approach can be that even though the explained variance is retained by using the high measurement-level, the interpretation of the regression weights amounts to a subgrouping approach without a congruent group, i.e. everyone is classified as incongruent in some way. In contrast, the categorical approach involves a user-defined range of difference scores that are deemed congruent scores, with tails in the distributions of the difference score serving as incongruent scores. Incongruency in the continuous and categorical approach in effect are modelled differently, as the categorical approach foregoes the less extreme deviances from perfect congruity. The categorical approach, by categorizing a range of scores as congruent and focusing on relatively extreme departures, introduces a trade-off between increased power for detecting extreme incongruencies and potential loss of sensitivity to smaller departures from congruence.

Just like in the continuous approach, the direction and strength of the association of the dummy variables are used to ascertain whether a positive or negative difference score is positively related to the outcome variables and to what degree. The regression weights are the mean differences of the subgroups relative to the intercept, which is the mean of the congruent group.

Analysis 3: Mixed Categorical and Continuous

In addition to the classical difference score approaches outlined above we will demonstrate the mixed approach followed by Creemers et al. (2012), who propose a method that splits a continuous difference score into two variables: (1) The absolute difference between the standardized score on implicit and explicit self-esteem, to indicated the size of discrepancy, i.e. a continuous difference score with only positive values; and (2) a dichotomous variable that indicates the direction of the discrepancy between implicit and explicit self-esteem (implicit < explicit or implicit > explicit). Their method makes no explicit allowance for respondents with congruent implicit and explicit scores. The size of the discrepancy (continuous) and the direction of the discrepancy (dichotomous) were entered in a hierarchical regression in step 1 and their interaction in step 2. The regression model is expressed as:

$$(4) \hat{Y} = \beta_0 + \beta_1 X_{fragile} + \beta_2 X_2 + \beta_3 X_{fragile} X_2 + \epsilon$$

Here, $\hat{Y}$ is the predicted dependent variable, β_0 is the intercept, β_1 is the coefficient for the dummy variable $X_{fragile}$, which functions as a direction variable which is attained through dummy

coding: a value of 0 for damaged self-esteem and 1 for fragile self-esteem. β_2 is the coefficient for continuous dependent variable X_2 , which represents the size of the difference. $\beta_3 X_{fragile} X_2$ represents the interaction between the direction and size, and ϵ represents the error term. In this model the intercept takes on the value of the mean of the 'damaged' category, and the coefficient for the dummy variable denotes the deviation from this mean.

Analysis 4: Response Surface Analysis and Polynomial Regression

RSA (Response Surface Analysis) is a statistical technique used to study relationships between multiple independent variables and a response variable. RSA often involves modeling the response surface using mathematical models, and these models may include polynomial terms to capture non-linearities. Polynomial Regression is a specific type of regression analysis focused on modeling relationships using polynomial functions.

Difference score theories have some key similarities to this original goal of RSA. The theory behind difference scores is that congruent values on the variables (i.e., no difference between explicit and implicit) optimize a response. For example, one could hypothesize that individuals are most happy, or are least depressed when implicit and explicit self-esteem are perfectly congruent. The problem, which RSA solves, is that the theory underlying difference scores is severely restrictive. Most important among its many restrictions, is the assumption that perfect congruence optimizes the response. 'Optimize' here implies a global optimum (the best of all possible solutions, e.g., highest possible happiness, or lowest possible sadness) rather than a local optimum (the best in a particular neighbourhood of solutions). By visualizing the 3D response surface the researcher is able to visually determine the way in which the implicit and explicit measures affect the response variable, if, and if so where, it optimizes the response. To make these determinations it is important to be familiar with the following key terms in RSA.

Stationary Point. The global optimum, either the overall minimum or maximum, of the surface is called the stationary point. It is the point where the slope of the surface (Z) (its derivative) is zero.

Principal Axes. These are the axes on which the surface is said to rotate. Simply put: the lines of steepest and least steep ascend. The principal axes are the perpendicular lines that intersect at the stationary point and where at least one of the principal axes optimizes the amount of explained variance along its axis. The other principal axis subsequently, sometimes, minimizes the explained variance. If the surface is convex (peaks downward) the greatest ascend occurs along the first principal axis and the least occurs along the second principal axis. The reverse is true for concave surfaces (peaks upwards). In the case of a saddle point, both axes indicate paths of greatest ascend.

X=Y line. The points where two independent variables have equal value, i.e. perfect congruence. An important part of RSA is to examine the size of the slope on the surface along either the principal axes or the X=Y line and how close the principal axes and the X=Y line are to each other. For example, when perfect congruence between explicit and implicit self-esteem minimizes depression, and any incongruence adversely affects depression, the X=Y line and the principal axis would be identical. Finding the principal axes in a response surface can be difficult if one is unfamiliar with eigenbases. In the case of quadratic polynomial regression, which will be discussed in this paper, the easiest way to determine them is given in Edwards (1993).

RSA goes beyond linear regression. In linear regression, the mean of the dependent variable is modelled to be conditional on a linear set of independent variables. In its most basic form it constitutes an addition of main effects, which takes the form of:

$$(5) \hat{Y} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 \cdots + \beta_n X_n + \varepsilon$$

Y being the value of the dependent variable, X representing the set of independent variables, Beta representing the regression weight with Beta-zero representing the intercept and epsilon to indicate normally distributed $\sim \mathcal{N}(0, \sigma^2)$.

Sometimes linear regression contains a combination of main- and interaction effects. The addition of an interaction-term allows for the modelling of nonparallel lines when used with a categorical predictor, or for rotated flat surfaces when used on solely numerical predictors. Interaction implies that two variables have a multiplicative effect, which is why it is added to a regression model in the form of the multiplication between two variables, with a regression weight to determine the strength and direction of the multiplier. For example:

$$(6) \hat{Y} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_1 X_2 + \varepsilon$$

In polynomial regression, this regression model is expanded to allow for curved surfaces, which adds a new layer of complex ways in which variables are allowed to interact. The most basic polynomial regression is one in which the squared main effects are added to a model. It is possible to add higher-order polynomials to a model, and just like with standard linear regression the user is free to choose the form of the regression equation. In response surface methodology however the most parsimonious and widely used form is a variation of model (2):

$$(7) \hat{Y} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_1^2 + \beta_4 X_1 X_2 + \beta_5 X_2^2 + \varepsilon$$

Response surface analysis (RSA) was originally developed by Box and Wilson (1951) to determine optimal conditions for experimentation in a chemical investigation. Contrary to what social scientists usually call response, i.e. the score of a respondent on some variable, the *response* in response surface methodology refers to the set predicted scores on the criterion variable. The idea behind this was to optimize (to find the maximum or minimum) a set of responses, such as yield, purity or cost of the product, based on factors that influenced these responses, such as temperature and pressure. The advantage of modelling the interplay of the influential factors on the responses as a curved surface expressed by a simplified regression equation is that the region where changes in the factors would have the most pronounced effect can be efficiently determined.

In Figure 1, six visualizations are employed to elucidate key points of interest and patterns, arranged from left-to-right and top-to-bottom.

Figure 1
Six visualizations to explain RSA graphically

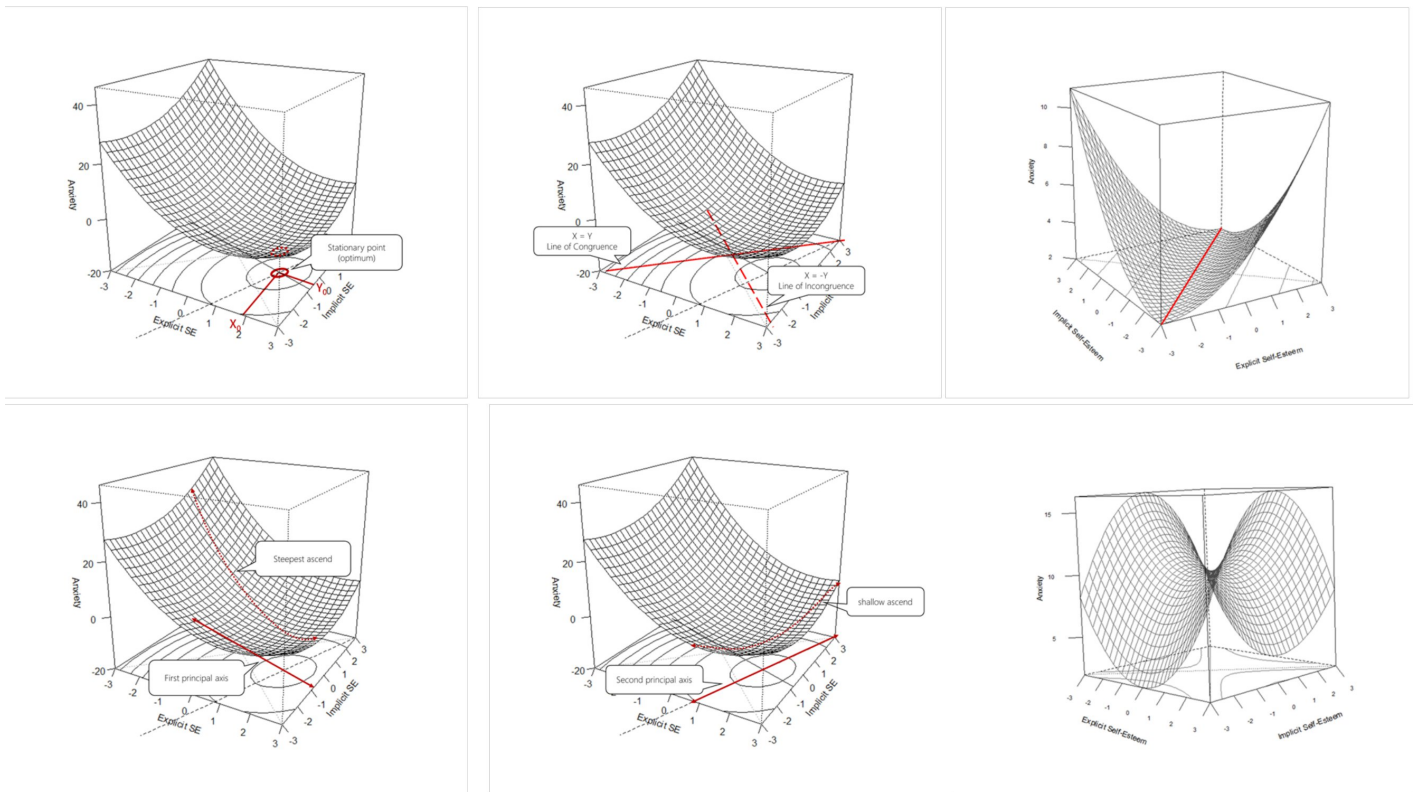


Figure a depicts a stationary point representing the optimum, where the values of implicit and explicit self-esteem converge to yield the lowest predicted anxiety.

Moving to Figure b, the congruence line ($X = Y$) and the incongruence line ($X = -Y$) are presented. In a hypothesis positing that congruency between predictors optimizes a given variable, one would anticipate the optimal anxiety value aligning with the $X=Y$ line, with the least favorable values occurring along its inverse, the $X = -Y$ line.

Figure c illustrates a hypothetical scenario of perfect congruence, where anxiety consistently is lowest when values of implicit and explicit self-esteem are congruent, accompanied by a rapid increase in anxiety when incongruence arises.

Figure d visualizes the relationship between the first principal axis and the steepest ascent, where movement along this axis at the base of the graph corresponds to a substantial change in anxiety. Figure e demonstrates how the second principal axis aligns with the second-largest change in anxiety, which is more gradual than the change along the first principal axis.

The final Figure f showcases a pattern known as a saddle point, challenging to interpret due to its stationary nature (it has a stationary point at the center of its 'saddle') without a clear optimum (lowest or highest value). Saddle points denote complex relationships; for instance, in Figure f,

steepest increases in anxiety occur when implicit self-esteem is high and explicit self-esteem is low. Conversely, the direction of steepest descent points to low implicit self-esteem and high explicit self-esteem, suggesting that individuals with high implicit self-esteem and low explicit self-esteem are more prone to anxiety, while those with low implicit self-esteem and high explicit self-esteem are less likely to experience anxiety.

To demonstrate an RSA approach to difference score analysis, polynomial regression analysis was performed in R (version 3.6.1) with respectively depression, anxiety and aggression as dependent variables. Hierarchically explicit self-esteem, implicit self-esteem were added to the model. In step 1 the main effects were entered. In step 2 the quadratic terms were added, and the interaction between the main effects were added in step 3. Even though standardizing the predictors avoids multicollinearity in the interaction term, to avoid further multicollinearity between polynomials we calculated orthogonal polynomials with the `poly()` option in the `lm()` function in base-R (v4.2.2; R core team, 2022), which means that these parameters were scaled so that the second-order polynomial is orthogonal (i.e., uncorrelated) to the first-order polynomial. This has the advantage that it can be tested whether adding a second-order polynomial significantly improves the regression over the lower order.

6.3 Results

Prior to analysis, scores for depression, anxiety, aggression, explicit and implicit self-esteem were examined for accuracy of data entry, distributions, univariate and multivariate outliers. Two cases with extremely high z-scores ($z > 3.29$) on depression and one case with an extremely low z-score ($z < -3.29$) on explicit self-esteem were found to be univariate outliers. No cases were identified as multivariate outliers based on their Mahalanobis distance ($p < .001$). All three univariate outliers were winsorized, meaning that they were replaced with the first non-outlying value above or below it. Thirteen missing values in depression and anxiety, eleven in aggression, and nine in explicit self-esteem were found and imputed with predictive mean matching with the `mice` package (Van Buuren, 2011) (with ten mutations) based on the following variables: depression, anxiety, aggression, explicit self-esteem, and implicit self-esteem (D600 all, D600 practice, D600 trial).

Table 1

Means, standard deviations, and correlations with confidence intervals of all research variables after data imputation, $N = 135$

Variable	M	SD	1	2	3	4	5	6
1. Depression	4.22	3.77						
2. Anxiety	5.48	5.02	.78** [.71, .84]					
3. Aggression	2.79	2.42	.48** [.34, .60]	.57** [.45, .68]				
4. Explicit SE	21.20	5.06	-.61** [-.71, -.49]	-.57** [-.68, -.45]	-.24** [-.39, -.07]			
5. Implicit SE	0.28	0.37	.02 [-.15, .19]	.09 [-.08, .26]	-.05 [-.22, .12]	.01 [-.16, .18]		
6. contDif	-0.00	10.41	.45** [.30, .57]	.47** [.33, .59]	.13 [-.04, .29]	.70** [-.78, -.61]	.70** [.61, .78]	
7. CreemersDif	1.11	0.87	.26** [.09, .41]	.29** [.13, .44]	.18* [.01, .34]	-.15 [-.31, .02]	-.07 [-.24, .10]	.05 [-.12, .22]

Note. M and SD are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014).

* indicates $p < .05$. ** indicates $p < .01$.

Table 2

Frequency counts for the two categorical difference score variables: categorical difference (congruent, damaged and fragile SE), and the dummy variable used in Creemer's method (damaged and fragile). $N = 135$

	Congruent	Damaged	Fragile
Categorical	39	47	49
Creemer's dummy	NA	67	68

The completed data from the research variables are summarized in Table 1 and 2. Shapiro-Wilk's tests for normality of distributions indicated that depression, anxiety, and aggression deviated from the normal distribution and were positively skewed ($p < .001$). Correlations between implicit self-esteem and other measures were close to zero and not significant ($p > .05$). Correlations between explicit self-esteem and other measures were negative and ranged from moderate (Depression $r = -0.61$, $p < .01$; Anxiety $r = -0.57$, $p < .01$) to weak (Aggression $r = -0.24$, $p < .01$).

Analysis 1: Continuous Difference Scores

Three hierarchical multiple regressions were used to test the effect of the continuous difference score (implicit – explicit self-esteem) on standardized scores for depression, anxiety, and aggression. The results of the regression analyses are summarized in Table 3. The continuous discrepancy score between implicit and explicit self-esteem showed a positive and significant association with depression and anxiety. The difference score explained about 22.4% in depression, 22.6%, in anxiety, but only 2.6% in aggression. The discrepancy between implicit and explicit self-esteem, expressed as a continuous difference score indicates that depressive symptoms and anxiety increase change by circa one-third of a standard deviation when the discrepancy between implicit and explicit self-esteem increases by a whole point.

Table 3.

The continuous difference score (z-implicit - z-explicit) and its quadratic term as orthogonal predictors of standardized depression, anxiety, and aggression. In block one the main effect is modelled; in the second block the quadratic term is added.

	Depression		Anxiety		Aggression	
	(1)	(2)	(3)	(4)	(5)	(6)
Difference (implicit – explicit SE)	0.339*** (0.055)	5.482*** (0.847)	0.340*** (0.055)	5.498*** (0.843)	0.115* (0.061)	1.851* (0.978)
Difference ²		3.045*** (0.847)		3.146*** (0.843)		2.085** (0.978)
Intercept	0.000 (0.076)	-0.000 (0.073)	0.000 (0.076)	0.000 (0.073)	0.000 (0.085)	0.000 (0.084)
R ²	.224	.293	.226	.299	.026	.058
Adjusted R ²	.218	.283	.220	.289	.018	.044

Note. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

In a second step of the regression analysis, we added a quadratic term for the difference score. These quadratic terms were found to be statistically significant ($p < 0.01$), indicating curvilinear relationships. The models with quadratics terms showed markedly higher R^2 , namely 29.3% in depression, 29.9% in anxiety, and 5.8% in aggression.

For standardized depression, the positive coefficient of 3.045 suggests that as the difference score increases, reflecting a shift from lower explicit to higher implicit self-esteem, the rate of change in standardized depression initially rises until reaching a minimum point at -0.90. Subsequently, the rate of change decreases.

Similarly, in the case of standardized anxiety, the quadratic term yielded a positive coefficient of 3.146, signifying an analogous curvilinear relationship with a minimum point at -0.87. This suggests that the transition from lower to higher implicit self-esteem is associated with an initial increase in anxiety, peaking at -0.87 on the difference score.

Additionally, for standardized aggression, the positive coefficient of 2.085 indicates a curvilinear association with the difference score, peaking at -0.44. This implies that the shift from lower to higher implicit self-esteem is linked to an initial increase in aggression, reaching its minimum point at -0.44 on the difference score.

Analysis 2: Categorical Difference Scores

Three hierarchical multiple regressions were used to test the effect of the categorical difference score (implicit – explicit self-esteem) on standardized scores for depression, anxiety, and aggression. The results of the regression analyses are summarized in Table 4. The three types of difference were split into two dummy variables. Kernis' terms for these dummy variables (Kernis, 2003) were used for labelling the categories as damaged ($I > E$) and fragile ($E > I$) so that congruency was expressed as the intercept to test the two types of discrepancy against. Similar to continuous discrepancy, the categorical difference score shows a positive, albeit weaker relationship with,

respectively, depression and anxiety. The categorical difference score explained about 16.6% in depression, 18.3% in anxiety, but only 1.9% in aggression.

Table 4.

The categorical difference score (z-implicit - z-explicit) as predictor of standardized depression, anxiety, and aggression. Fragile (SD < -0.5) and damaged (SD > 0.5) are entered as dummy variables with congruent self-esteem (0.5SD) as the intercept

	Depression (1)	Anxiety (3)	Aggression (5)
Damaged (I > E)	0.804*** (0.198)	0.856*** (0.196)	0.320 (0.214)
Fragile (E > I)	-0.093 (0.196)	-0.075 (0.194)	0.063 (0.212)
Intercept	-0.241* (0.144)	-0.265* (0.142)	-0.131 (0.156)
R2	.166	.183	.019
Adjusted R2	.154	.170	.004

Note. *p < 0.1; **p < 0.05; *** p < 0.01

The effect of the discrepancy between implicit and explicit self-esteem, expressed as three categories, i.e. damaged, congruent and fragile, differs from the effect of the continuous difference score. The overall pattern of a positive linear relationship is maintained, but indicates that the effect is mostly, if not only due to the positive effect of damaged self-esteem on depressive symptoms ($\beta = 0.80$; $p < 0.001$) and anxiety ($\beta = 0.86$; $p < 0.001$). Fragile self-esteem had no significant effect on the three outcome variables. Neither fragile nor damaged self-esteem had a significant effect on aggression. A damaged self-esteem (high implicit self-esteem combined with low explicit self-esteem) increased mean depression and anxiety by around two thirds of a standard deviation and fragile self-esteem (combination of low implicit self-esteem with high explicit self-esteem) decreased mean depression by almost a quarter of a standard deviation. The results suggest that a damaged self-esteem might be associated with a higher mean depression and anxiety, but that the mean is still below average, and that the effect of the discrepancy is largely linear, meaning that congruent self-esteem is associated with both higher and lower depression and anxiety than incongruent self-esteem, with fragile self-esteem ($E > I$) seeming most beneficial.

Analysis 3: Mixed Categorical and Continuous Scores

The approach demonstrated by Creemers et al. (2012) was tested by using three hierarchical multiple regressions on standardized scores for depression, anxiety, and aggression. The absolute value of the difference between implicit and explicit self-esteem (I-E) and the direction of the difference (negative vs. positive) were added to the models. The results of the regression analyses are summarized in Table 5. Comparable to the categorical approach, this approach labels the continuous discrepancy as either damaged (difference is positive, i.e., $I > E$) or fragile (difference is negative, i.e., $E > I$), but instead of a congruent group it defines two incongruent groups who differ in strength of incongruency (with a strength of zero for a perfect congruency). So the definitions differ a little from the categorical and continuous approach, and tries to offer what Creemers (2012) considers the best of both models. Without an interaction between size and direction (models 1, 3, and 5), the direction of

the difference was only significantly related to depression and anxiety. None of these effects remained significant after adding the interaction between size and discrepancy. The interaction between size and direction was significant for depression and anxiety, but not for aggression. The positive interaction term (Table 5, Model 2, 4, and 6) coupled with the negative main effect of the direction of the discrepancy indicates that the effect of the discrepancy on depressive symptoms and anxiety is stronger in the damaged group, than in the fragile group. The mixed difference score explained about 30.2 % in depression, 31.0 % in anxiety, and 4.4 % in aggression.

Table 5.

Creemers method for handling difference scores. The absolute value of the difference is entered as a continuous predictor, and the direction of the difference as a dummy variable (z-implicit - z-explicit), with fragile when < 0 and damaged when > 0. The two variables are predictors of standardized depression, anxiety, and aggression.

	Depression		Anxiety		Aggression	
	(1)	(2)	(3)	(4)	(5)	(6)
Size of SE discrepancy	0.341*** (0.088)	0.657*** (0.115)	0.338*** (0.087)	0.627*** (0.114)	0.183* (0.098)	0.284** (0.134)
Direction of SE discrepancy*	0.705*** (0.154)	0.031 (0.234)	-0.768*** (0.151)	-0.095 (0.233)	-0.188 (0.170)	0.046 (0.274)
Size x Direction		0.671*** (0.167)		0.614*** (0.166)		0.214 (0.196)
Intercept	-0.019 (0.146)	-0.368** (0.163)	0.016 (0.144)	-0.303* (0.162)	-0.106 (0.162)	-0.218 (0.191)
R ²	0.216	0.302	0.238	0.310	0.035	0.044
Adjusted R ²	0.204	0.286	0.226	0.294	0.020	0.022

Note. Direction of SE discrepancy: 1 = Fragile, 0 = Damaged. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Analysis 4: Polynomial Regression

The results of the regressions are summarized in Table 6 and visualizes in Figures 2, 3, and 4.

Table 6.

Polynomial regression of orthogonal factors based on the standardized predictors explicit and implicit self-esteem as predictors of standardized depression, anxiety and aggression. For each dependent variable three models are shown; the first contains only main effects, the second adds polynomial terms, and the final, third model adds an interaction term.

	Dependent variable:								
	Depression			Anxiety			Aggression		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Explicit self-esteem	-0.660*** (0.065)	-7.660*** (0.741)	-7.638*** (0.731)	-0.591*** (0.070)	-6.625*** (0.799)	-6.863*** (0.785)	-0.266** (0.083)	-3.169*** (0.974)	-3.149*** (0.969)
Implicit self-esteem	0.019 (0.065)	0.167 (0.739)	0.310 (0.733)	0.089 (0.070)	1.254 (0.801)	1.173 (0.787)	-0.037 (0.084)	-0.426 (0.972)	-0.291 (0.971)
Explicit self-esteem ²		2.149*** (0.739)	2.232*** (0.731)		1.634 (0.799)	1.854** (0.785)		-0.009 (0.972)	0.069 (0.968)
Implicit self-esteem ²		0.387 (0.741)	0.420 (0.731)		1.254 (0.800)	0.711 (0.785)		1.297 (0.974)	1.328 (0.969)
Explicit self-esteem * Implicit self-esteem			-0.135** (0.064)			-0.170** (0.069)			-0.127 (0.085)
Intercept	0.000 (0.065)	0.000 (0.064)	0.003 (0.063)	0.000 (0.070)	0.001 (0.069)	0.004 (0.067)	-0.000 (0.084)	-0.000 (0.084)	0.003 (0.083)
<i>R</i> ²	0.435	0.471	0.488	0.355	0.380	0.410	0.073	0.085	0.101
Adjusted <i>R</i> ²	0.426	0.454	0.468	0.345	0.366	0.387	0.059	0.057	0.066

Note. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

The relationship between explicit, and implicit self-esteem, and depression, respectively anxiety, and aggression is complex and non-linear. The numbers in Table 6 provide quantitative insights into this relationship, while Figure 2, respectively 3, and 4 visualizes it graphically. Figure 2 displays the regression equation for the relationship between explicit and implicit self-esteem on depression. The first principal axis can be understood as the path where the dependent variable changes the most, has its steepest ascend/descend. In Figure 2 the first principle axis is denoted by a thick black line at the floor of the graph. The shape of the surface is convex, with the steepest ascends running parallel to the x-axis, indicating that depression increases at an increasing rate when explicit self-esteem decreases, but is almost unaffected by changes in implicit self-esteem. The stationary point is located at $X = 1.78$ $Y = -0.22$, which indicates that depressive symptoms are lowest when explicit self-esteem is about one and a three quarters standard deviations above average, and

increases slightly when explicit self-esteem increases beyond that point. Overall the surface indicates three effects. First, depressive symptoms decrease sharply when explicit self-esteem increases, but begins to increase again when explicit self-esteem exceeds about 1.75 SD. Second, depressive symptoms are relatively unaffected by implicit self-esteem, and are lowest when explicit self-esteem is high, and implicit self-esteem is around zero (the mean), and increase only lightly (and not-significantly) whenever implicit self-esteem is either high or low. Third, depressive symptoms are highest when explicit self-esteem is very low, and implicit self-esteem is very high (damaged), but close to the stationary point (lowest point) when explicit self-esteem is very high and implicit self-esteem is very low (fragile). Taken together with the regression coefficients in Table 6 the effects of the discrepancy between implicit and explicit self-esteem on depression seem almost solely driven by the significant main polynomial effect of explicit self-esteem, contrary to the conclusions of the earlier approaches.

Figure 2.

Response surface plot representing the regression equation for the relationship between explicit and implicit self-esteem on depression.

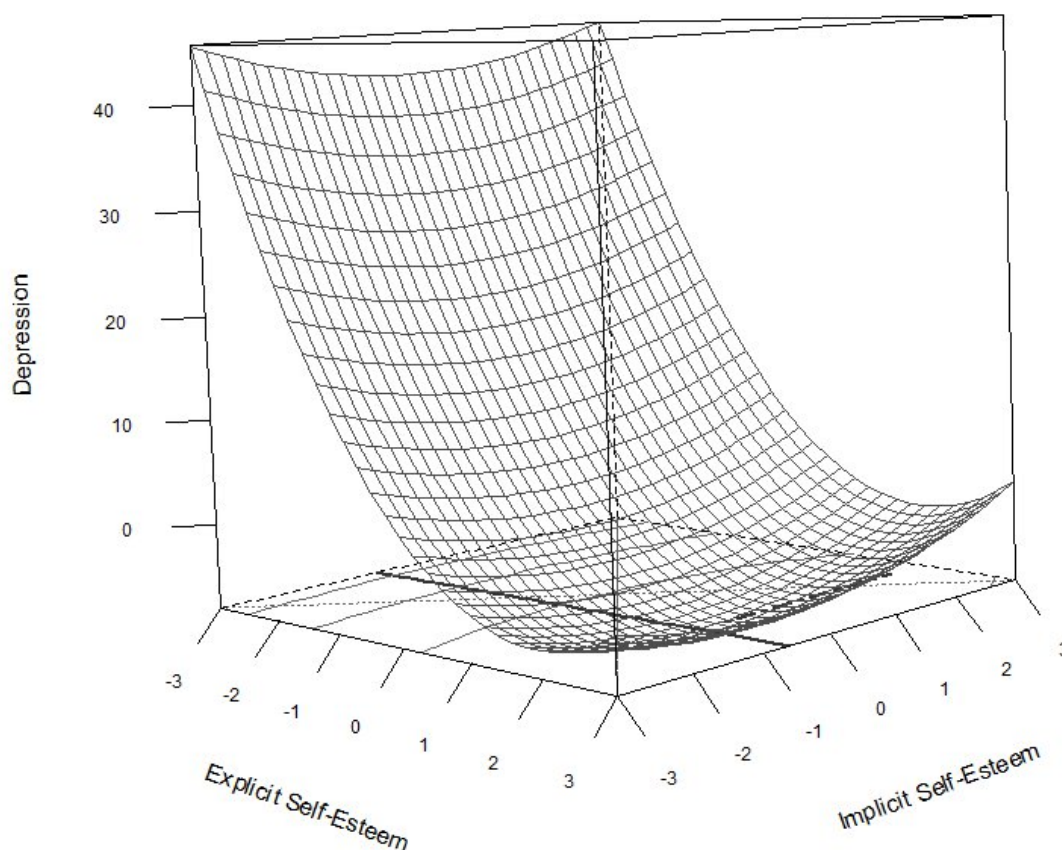


Figure 2 visualizes the relationship between explicit, implicit self-esteem, and depression as response surfaces. The response surface for the model with only main effects is a plane, suggesting a

linear relationship. As polynomial terms are introduced, the response surfaces become curved, indicating a non-linear relationship. The interaction term further enhances the curvature, representing the complexity of the relationship.

Figure 3 displays the regression equation for the relationship between explicit and implicit self-esteem and anxiety. The shape was convex with its stationary point located at $X = 1.82$ $Y = -0.61$, which indicates that anxiety was lowest when explicit self-esteem was just close to two standard deviations above average, and increases slightly when explicit self-esteem increases beyond that point. The slope of the first principal axis (steepest ascent) ($p_{11} = -0.07$) is close to zero, indicating that anxiety increases at an increasing rate when explicit self-esteem decreases, but is almost unaffected by changes in implicit self-esteem. The slope of the second principal axis was greater than 1 ($p_{21} = 13.48$) almost parallel to the Y-axis.

Overall the surface indicates three effects. First, anxiety decreases sharply when explicit self-esteem increases, but begins to increase again when explicit self-esteem exceeds about 1.8 SD. Second, anxiety is not-significantly affected by implicit self-esteem, and is lowest when explicit self-esteem is high, and implicit self-esteem is low, and increases only lightly (and not-significantly) whenever implicit self-esteem is either high or low. Third, anxiety is highest when explicit self-esteem is very low, and implicit self-esteem is very high (damaged), but close to the stationary point (lowest point) when explicit self-esteem is very high and implicit self-esteem is very low (fragile). Taken together with the regression coefficients in Table 6, the effects of the discrepancy between implicit and explicit self-esteem on anxiety seem primarily driven by the significant main polynomial effect of explicit self-esteem, which is contrary to the conclusions of the earlier approaches. Additionally, severely damaged self-esteem, i.e. a combination of extremely high implicit self-esteem and extremely low explicit self-esteem does seem to result in much higher anxiety than when there is a congruent extremely low explicit and explicit self-esteem, indicating that a discrepancy between explicit and implicit self-esteem has a stronger effect when explicit self-esteem is low, than when explicit self-esteem is high.

Figure 3.

Response surface plot representing the regression equation for the relationship between explicit and implicit self-esteem on anxiety.

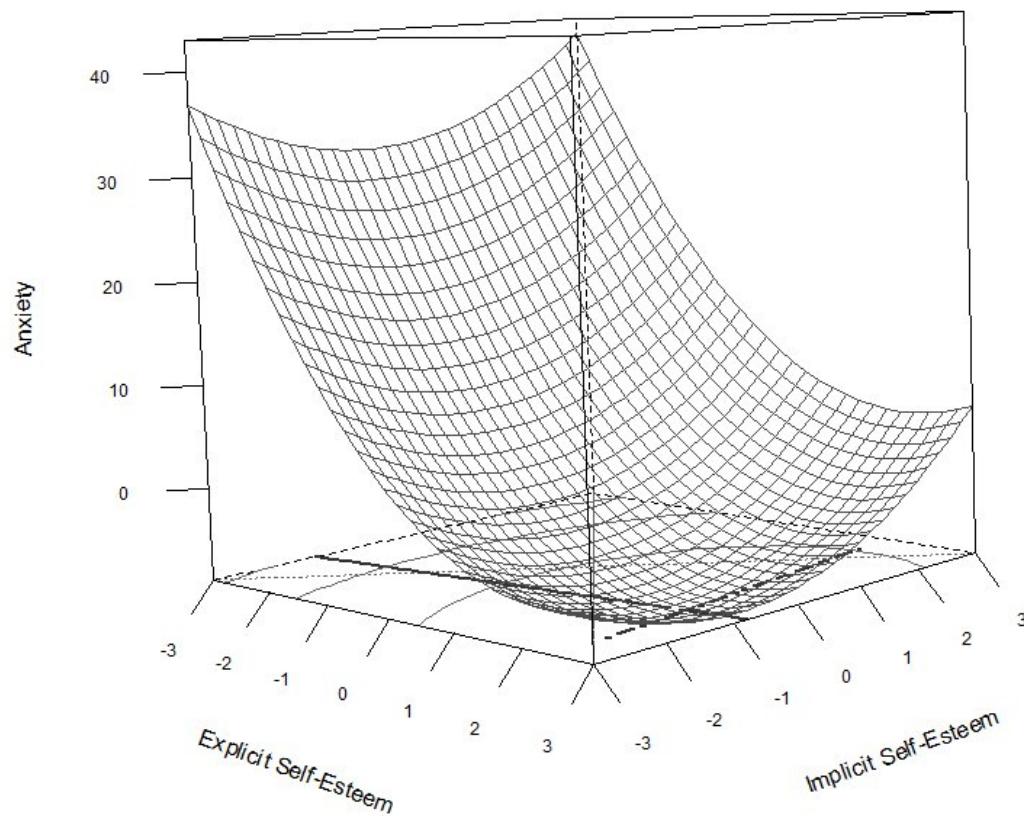
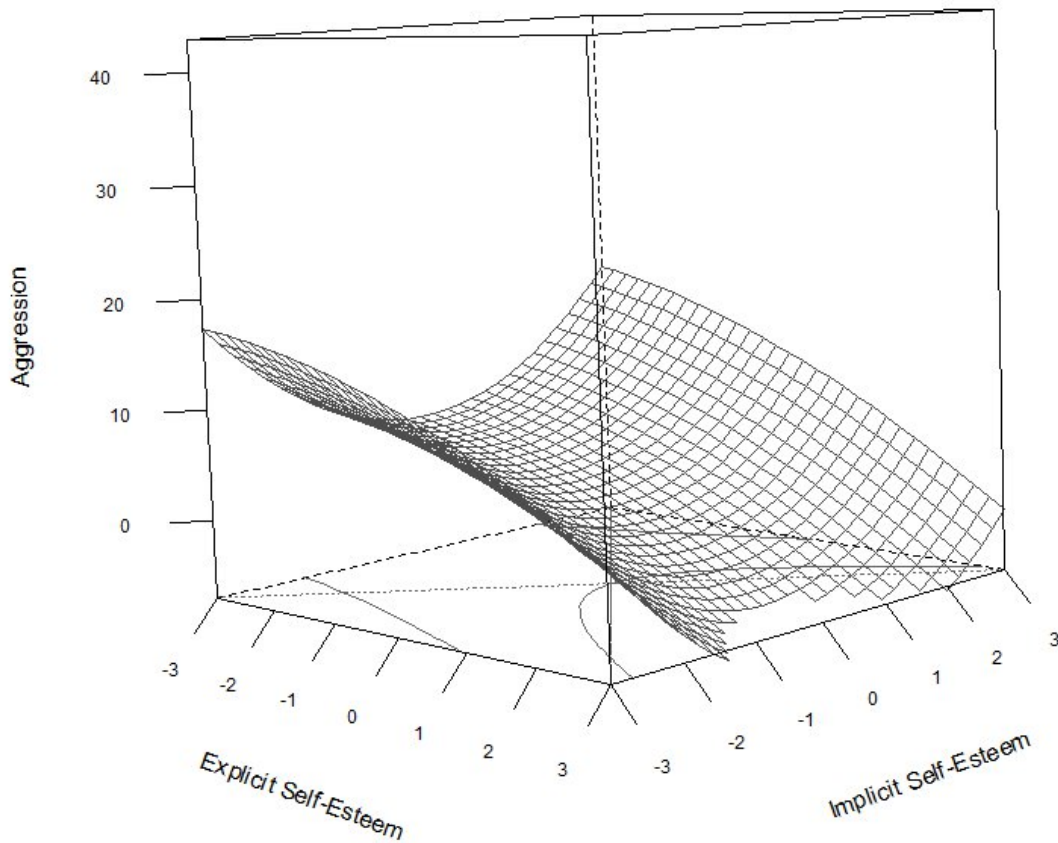


Figure 4 displays the regression equation for the relationship between explicit and implicit self-esteem on aggression. The only significant predictor of aggression in this model is explicit self-esteem. Overall the surface indicates two effects. First, aggression decreases very slightly and linearly when explicit self-esteem increases. Second, aggression is not significantly affected by implicit self-esteem, and is zero when explicit self-esteem is close to zero (average), and increases when it deviates negatively from zero. When considering the regression coefficients presented in Table 6 alongside the findings related to the incongruence between implicit and explicit self-esteem, notable parallels emerge with the results observed in method 1. In the latter, quadratic terms were introduced to the continuous difference scores, revealing significant relationships across all three dependent variables. However, the Response Surface Analysis introduces a nuanced perspective, suggesting that the continuous difference effect identified in method 1 is primarily explained by a significant main effect of explicit self-esteem, rather than implicit self-esteem or any interaction between the two.

Figure 4.

Response surface plot representing the regression equation for the relationship between explicit and implicit self-esteem on aggression.



6.4 Discussion

6.4.1 Discussion of results

The overall goal of this paper was to demonstrate the difference in results and associated conclusions between several frequently used approaches for testing theories of congruence between implicit and explicit measures. More specifically we contrasted three analyses based on discrepancy scores between implicit and explicit self-esteem (respectively a continuous discrepancy score, a categorical discrepancy score and a mixed categorical and continuous discrepancy score) with a polynomial regression approach (i.e., response surface analysis), and tested the association with respectively depressive symptoms, anxiety and aggression in a general population sample.

Findings of the three analyses based on discrepancy scores resulted in conclusions that supported the theory that the incongruence between explicit and implicit self-esteem was associated

with both depressive symptoms and anxiety. Furthermore, the analysis based on a categorical discrepancy score (analysis 2) and the analysis based on a mixed categorical and continuous discrepancy score (analysis 3) offered a more detailed conclusion, showing that damaged self-esteem (in which one experiences more implicit than explicit self-esteem) was associated with depressive symptoms and anxiety whereas fragile self-esteem (in which one experiences more explicit than implicit self-esteem) was not. As such, the implications of these results are that depressive symptoms and anxiety increase when the discrepancy between explicit and implicit self-esteem increases and in particular when explicit self-esteem is high and implicit self-esteem is low. Based on these findings one might conclude that measuring both explicit and implicit self-esteem in individuals seeking help for depressive symptoms and anxiety problems might be a good strategy to determine the specific focus of the psychological treatment in order to effectuate congruence between implicit and explicit self-esteem.

However, the findings of the polynomial regression approach pointed toward a different conclusion and implication. In general, the polynomial regression showed that the relationship between depressive symptoms and anxiety was foremost driven by explicit self-esteem. Implicit self-esteem accounted for little of the variation in depressive symptoms and anxiety, and incongruence between explicit and implicit self-esteem seemed to become only relevant in extremes of explicit self-esteem. The latter conclusion though must be taken with caution as the number of individuals with extremes of explicit self-esteem was limited in this general population sample (see limitations). The overall conclusion of the polynomial regression approach that mainly explicit self-esteem and not implicit self-esteem is associated with depressive symptoms and anxiety suggests that measuring explicit self-esteem can offer relevant insights for the psychological treatment for individuals with depressive symptoms and anxiety problems. If explicit self-esteem is low, the main goal of the psychological treatment might be then to strengthen explicit self-esteem.

All approaches were in agreement on the non-significance effect of congruency between implicit and explicit self-esteem on aggression. This might however leave one with the false impression that aggression was unaffected by either of the component elements of the difference score. Polynomial regression however showed a significant negative association between explicit self-esteem and aggression, but neither an association between implicit self-esteem and aggression, nor between the self-esteem discrepancy and aggression was observed. This suggests that explicit self-esteem rather than implicit self-esteem is important in explaining inter-individual variation in aggression.

In sum, this study showed that conclusions regarding the role of implicit and explicit self-esteem and their discrepancy in outcomes such as psychopathological symptoms, can be misleading when congruency is modelled as a difference score between explicit and implicit measures. We would interpret the results as supporting the discrepancy hypothesis, whereas in fact there is only an effect of explicit self-esteem on depressive symptoms and anxiety. The results of the analyses based on the discrepancy scores basically reflect the main effect of explicit self-esteem. This was revealed by the results of the polynomial regression analyses. The combination of polynomial regression with response surface methods provided a more complete picture of the complex relationship between

explicit and implicit self-esteem, leading to more precise and possibly more effective treatment suggestions. These findings are in concordance with previous work outlining the methodological issues associated with the use of discrepancy scores and proposing polynomial regression analysis and response surface methods as an alternative approach (Cafri et al., 2010; Humberg et al., 2018).

6.4.2 Limitations

Several limitations must be considered when interpreting the present results. Firstly, the study employed a cross-sectional design and therefore no conclusions can be drawn concerning the causal direction of the associations between the different forms of self-esteem and depressive symptoms, anxiety and aggression. Secondly, participants were recruited within the social networks of psychology students and, apart from variation in age, gender and education, most participants were in a job, study or retired, and involved in a relationship, limiting the generalizability of study findings to other groups, including individuals with disabilities, or patients diagnosed with a mental illness. Thirdly, implicit self-esteem was operationalized through the IAT using the D600 scoring algorithm recommended by Greenwald et al. (2003). However, Greenwald's studies provide limited descriptions of the samples involved. It remains unclear how much the proposed thresholds by Greenwald et al. (2003) are valid in different populations, and it is likely that alternative thresholds should be explored for a new population. Since our study's objective was to provide a practical example of employing polynomial analysis we have chosen to adhere to Greenwald (2003) as closely as possible to provide a starting point in comparing methods. This decision means that the theoretical implications of the findings discussed here are contingent upon whether our sample was sufficiently similar to the one used by Greenwald (2003) and what impact any differences might have on the results themselves.

Finally, this manuscript explores different ways to examine the effects of implicit and explicit self-esteem. Beyond just looking at the details, the differences among these approaches also affect how we think about and measure implicit and explicit self-esteem, which in turn influences how reliable and valid our analyses are. Implicit measures like the Implicit Association Test (IAT), dig into the spontaneous, context-dependent side of self-esteem by capturing automatic associations influenced by the immediate surroundings. Even though the IAT is less consistent over time compared to explicit measurements, it's important to note that this doesn't mean it's not valid. The IAT is considered capable of genuinely capturing an aspect that is distinct from explicit measurement instruments, revealing parts of self-esteem that we might not consciously think about. In contrast, explicit measures, like the Rosenberg Self-Esteem Scale, involve a more intentional and reflective process similar to structured self-evaluation. The explicit approach relies on intentional, conscious introspection, which is quite different from the automatic, context-dependent nature of implicit measures. However, when we're calculating difference scores we're making assumptions about what self-esteem really means. The difference between the intentional, conscious nature of explicit measures and the automatic, context-dependent nature of implicit measures needs careful thought. This difference in assumptions highlights the importance of interpreting the results cautiously, especially when it comes to understanding how a gap between explicit and implicit self-esteem might

affect things like depression, anxiety, or aggression. The main goal of the study is to show the effects of different analysis choices rather than providing a definite answer to these complex questions.

The data in this study reflect an important limitation regarding the interpretation of the polynomial regression plots: surface response models become poor descriptors of data when it is high on measurement error and when meaningful effects are only present in the tails of the data-distribution. All regression models become increasingly unstable nearer the tails of the distributions and polynomial regression is no exception. In our demonstration this limitation is exacerbated by the illusion of precision in the visualization of the 3d-surface. Even though explained variance was high, explained variance in the range of 20% still leaves the model with a lot of residual variance; error which increasingly expands closer to the extremes. The plots are visualized in such a way to optimise comparisons between plots. The scale of $-3 < z < 3$ is sufficient for implicit self-esteem (min $z = -2.19$; max $z = 2.82$), but leaves much to extrapolation for the high end of explicit self-esteem (min $z = -2.59$; max $z = 1.71$). This leaves the conclusions regarding effects on the extremes of explicit self-esteem ($z > 2$) as an extrapolated possibility.

But, this is part of the *raison d'être* of response surface modelling as advanced by Box and Wilson (1951). The strength of this approach lies in determining the optimal areas for further experimentation and was not intended as a way towards a theoretical model in and of itself. The implications for this study are that in order to test the theory of congruence, further research should aim to find a sample of respondents who are high to extremely high on explicit self-esteem. Our models suggest that if congruency effects are to be found, they are likely (statistically) to be found in a subset of the population extremely high on explicit self-esteem for depressive symptoms and anxiety, but probably not for aggression. Effects on depression and anxiety, for people with explicit self-esteem within two standard deviations of the mean, seem mostly driven by their explicit experience of self-esteem.

One final remark can be made towards the use of the IAT as the operationalization of implicit self-esteem. Although the IAT is by far the most used method to capture implicit processes, there are some criticisms about the validity, the sensitivity to experimental manipulations and contextual factors and the susceptibility to faking (see e.g., Fiedler et al., 2006; Gawronski et al., 2007). The IAT has generally been found to be valid when the implicit construct being measured has been subject to experimental manipulation (Perugini et al., 2007). In this study the IAT was used to measure implicit self-esteem without any manipulation of it. Polynomial regression has been shown to be very effective to test the dual systems congruency hypothesis, and it would be worthwhile to test the congruency hypothesis with either (a) methods of measuring implicit self-esteem that are valid outside of experimental manipulation (e.g. Creemers et al., 2012), or (b) to replicate this study, but administer the IAT after manipulating implicit self-esteem. It is therefore recommended to replicate these findings as soon as better indirect measures of self-esteem are available (Buhrmester et al., 2011).

6.5 Conclusion

To conclude, this paper demonstrated the difference in results and conclusions between the use of discrepancy scores and polynomial regression in testing associations between explicit and

implicit self-esteem and outcomes of psychopathology. The combination of polynomial regression with response surface methods has the potential to evaluate more complex and more detailed hypotheses which are simply not possible using statistical approaches based on discrepancy scores and is therefore recommended for future research disentangling the role of explicit and implicit self-esteem in psychological outcomes.

Additional supplements

Information regarding all procedures applied and all measures assessed in this study as well as the data, the data analysis scripts and the appendix code needed to reproduce the results are openly accessible: <https://osf.io/q7c5f/>

Ethics and consent

The study is not preregistered. This study involved an analysis of existing data rather than new data collection. All simulations and other analyses conducted are reported. Participation in the study was voluntary and participants gave digital informed consent after being fully informed about the study, and having had the opportunity to have any questions answered. The study was carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for medical research involving humans.

Competing Interests

The authors have no competing interests to declare.

References

- Bluemke, M., & Frieze, M. (2008). Reliability and validity of the single-target iat (st-iat): Assessing automatic affect towards multiple attitude objects. *European Journal of Social Psychology*, 38(6), 977–997. <https://doi.org/10.1002/ejsp.487>
- Box, G. E. P., & Wilson, K. B. (1951). On the experimental attainment of optimum conditions. *Journal of the Royal Statistical Society: Series B (Methodological)*, 13(1), 1–38. <https://doi.org/10.1111/j.2517-6161.1951.tb00067.x>
- Buhrmester, M. D., Blanton, H., & Swann, W. B. (2011). Implicit self-esteem: Nature measurement, and a new way forward. *Journal of Personality and Social Psychology*, 100(2), 365–385. <https://doi.org/10.1037/a0021341>
- Cafri, G., Van Den Berg, P., & Brannick, M. T. (2010). What have the difference scores not been telling us? A critique of the use of self—ideal discrepancy in the assessment of body image and evaluation of an alternative data-analytic framework. *Assessment*, 17(3), 361–376. <https://doi.org/10.1177/1073191109357028>
- Carlier, I., Maaren, Y. S.-V., Wardenaar, K., Giltay, E., Noorden, M. V., Vergeer, P., & Zitman, F. (2012). Development and validation of the 48-item symptom questionnaire (sq-48) in patients with depressive anxiety and somatoform disorders. *Psychiatry Research*, 200(2-3), 904–910. <https://doi.org/10.1016/j.psychres.2012.07.035>
- Cohen, J., & Cohen, P. (1983). Applied multiple regression/correlation analysis for the behavioral sciences (2nd edition). Hillsdale, NJ: Erlbaum.
- Creemers, D. H. M., Scholte, R. H. J., Engels, R. C. M. E., Prinstein, M. J., & Wiers, R. W. (2012). Implicit and explicit self-esteem as concurrent predictors of suicidal ideation depressive symptoms, and loneliness. *Journal of Behavior Therapy and Experimental Psychiatry*, 43(1), 638–646. <https://doi.org/10.1016/j.jbtep.2011.09.006>
- Creemers, D. H. M., Scholte, R. H. J., Engels, R. C. M. E., Prinstein, M. J., & Wiers, R. W. (2013). Damaged self-esteem is associated with internalizing problems. *Frontiers in Psychology*, 4. <https://doi.org/10.3389/fpsyg.2013.00152>
- Cumming, G. (2014). *The new statistics: Why and how*. New York, NY: Routledge.
- De Houwer, J. D., Teige-Mocigemba, S., Spruyt, A., & Moors, A. (2009). Implicit measures: A normative analysis and review. *Psychological Bulletin*, 135(3), 347–368. <https://doi.org/10.1037/a0014211>
- Dentale, F., Vecchione, M., Ghezzi, V., & Barbaranelli, C. (2019). Applying the latent state-trait analysis to decompose state, trait, and error components of the Self-Esteem Implicit Association Test. *European Journal of Psychological Assessment*, 35(1), 78–85. <https://doi-org.ezproxy.elib11.ub.unimaas.nl/10.1027/1015-5759/a000378>
- Edwards, J. R. (1993). Problems with the use of profile similarity indices in the study of congruence in organizational research. *Personnel Psychology*, 46(3), 641–665. <https://doi.org/10.1111/j.1744-6570.1993.tb00889.x>

- Edwards, J. R. (1994). The study of congruence in organizational behavior research: Critique and a proposed alternative. *Organizational Behavior and Human Decision Processes*, 58(1), 51–100. <https://doi.org/10.1006/obhd.1994.1029>
- Edwards, J. R. (1995). Alternatives to difference scores as dependent variables in the study of congruence in organizational research. *Organizational Behavior and Human Decision Processes*, 64(3), 307–324. <https://doi.org/10.1006/obhd.1995.1108>
- Edwards, J. R. (2001). Ten difference score myths. *Organizational Research Methods*, 4(3), 265–287. <https://doi.org/10.1177/109442810143005>
- Evans, J. S. B. T. (2008). Dual-processing accounts of reasoning judgment, and social cognition. *Annual Review of Psychology*, 59(1), 255–278. <https://doi.org/10.1146/annurev.psych.59.103006.093629>
- Fiedler, K., Messner, C., & Bluemke, M. (2006). Unresolved problems with the “I”, the “a”, and the “t”: A logical and psychometric critique of the implicit association test (iat). *European Review of Social Psychology*, 17(1), 74–147. <https://doi.org/10.1080/10463280600681248>
- Franck, E., De Raedt, R., Dereu, M., & Den Abbeele, D. (2007). Implicit and explicit self-esteem in currently depressed individuals with and without suicidal ideation. *Journal of Behavior Therapy and Experimental Psychiatry*, 38(1), 75–85. <https://doi.org/10.1016/j.jbtep.2006.05.003>
- Gawronski, B., & Bodenhausen, G. V. (2006). Associative and propositional processes in evaluation: An integrative review of implicit and explicit attitude change. *Psychological Bulletin*, 132(5), 692–731. <https://doi.org/10.1037/0033-2909.132.5.692>
- Gawronski, B., LeBel, E. P., & Peters, K. R. (2007). What do implicit measures tell us?: Scrutinizing the validity of three common assumptions. *Perspectives on Psychological Science*, 2(2), 181–193. <https://doi.org/10.1111/j.1745-6916.2007.00036.x>
- Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology*, 74(6), 1464–1480. <https://doi.org/10.1037/0022-3514.74.6.1464>
- Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the implicit association test: I. an improved scoring algorithm. *Journal of Personality and Social Psychology*, 85(2), 197–216. <https://doi.org/10.1037/0022-3514.85.2.197>
- Humberg, S., Dufner, M., Schönbrodt, F. D., Geukes, K., Hutteman, R., Van Zalk, M. H. W., ... Back, M. D. (2018). Enhanced versus simply positive: A new condition-based regression analysis to disentangle effects of self-enhancement from effects of positivity of self-view. *Journal of Personality and Social Psychology*, 114(2), 303–322. <https://doi.org/10.1037/pspp0000134>
- Jordan, C. H., Spencer, S. J., & Zanna, M. P. (2005). Types of high self-esteem and prejudice: How implicit self-esteem relates to ethnic discrimination among high explicit self-esteem individuals. *Personality and Social Psychology Bulletin*, 31(5), 693–702. <https://doi.org/10.1177/0146167204271580>
- Kahneman, D., & Frederick, S. (2005). A model of intuitive judgment. *The Cambridge Handbook of Thinking and Reasoning*, 267–293.

- Keren, G., & Schul, Y. (2009). Two is not always better than one: A critical evaluation of two-system theories. *Perspectives on Psychological Science*, 4(6), 533–550.
<https://doi.org/10.1111/j.1745-6924.2009.01164.x>
- Kernis, M. H. (2003). Toward a conceptualization of optimal self-esteem. *Psychological Inquiry*, 14(1), 1–26. https://doi.org/10.1207/s15327965pli1401_01
- Khamis, H. & Kepler, M. (2010). Sample size in multiple regression: 20 + 5k. *Journal of Applied Statistical Science*, 17, 505-517.
- Leeuwis, F. H., Koot, H. M., Creemers, D. H. M., & Van Lier, P. A. C. (2014). Implicit and explicit self-esteem discrepancies victimization and the development of late childhood internalizing problems. *Journal of Abnormal Child Psychology*, 43(5), 909–919.
<https://doi.org/10.1007/s10802-014-9959-5>
- May, K., & Hittner, J. B. (2003). On the relation between power and reliability of difference scores. *Perceptual and Motor Skills*, 97(3), 905-908.
- Mersman, J. L., & Donaldson, S. I. (2000). Factors affecting the convergence of self-peer ratings on contextual and task performance. *Human Performance*, 13, 299-322.
https://doi.org/10.1207/S15327043HUP1303_4
- Mota, S., Humberg, S., Krause, S., Fatfouta, R., Geukes, K., Schröder-Abé, M., & Back, M. D. (2019). Unmasking narcissus: A competitive test of existing hypotheses on (agentic antagonistic, neurotic, and communal) narcissism and (explicit and implicit) self-esteem across 18 samples. *Self and Identity*, 1–21. <https://doi.org/10.1080/15298868.2019.1620012>
- Orth, U., & Robins, R. W. (2014). The development of self-esteem. *Current Directions in Psychological Science*, 23(5), 381–387. <http://doi:10.1177/0963721414547414>
- Perugini, M., O’Gorman, R., & Prestwich, A. (2007). An ontological test of the iat: Self-activation can increase predictive validity. *Experimental Psychology*, 54(2), 134–147.
<https://doi.org/10.1027/1618-3169.54.2.134>
- R Core Team (2022). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <https://www.R-project.org/>.
- Rogers, C. R. (1957). The necessary and sufficient conditions of therapeutic personality change. *Journal of Consulting Psychology*, 21(2), 95–103. <https://doi.org/10.1037/h0045357>
- Rosenberg, M. (2015). *Society and the adolescent self-image*. Princeton: university press.
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68-78.
<https://doi.org/10.1037/0003-066X.55.1.68>
- Rudman, L. A., & Ashmore, R. D. (2007). Discrimination and the implicit association test. *Group Processes & Intergroup Relations*, 10(3), 359–372.
<https://doi.org/10.1177/1368430207078696>
- Sandstrom, M. J., & Jordan, R. (2008). Defensive self-esteem and aggression in childhood. *Journal of Research in Personality*, 42(2), 506–514. <https://doi.org/10.1016/j.jrp.2007.07.008>
- Schreiber, F., Bohn, C., Aderka, I. M., Stangier, U., & Steil, R. (2012). Discrepancies between implicit and explicit self-esteem among adolescents with social anxiety disorder. *Journal of Behavior*

Therapy and Experimental Psychiatry, 43(4), 1074–1081.

<https://doi.org/10.1016/j.jbtep.2012.05.003>

- Schröder-Abé, M., Rudolph, A., & Schätz, A. (2007). High implicit self-esteem is not necessarily advantageous: Discrepancies between explicit and implicit self-esteem and their relationship with anger expression and psychological health. *European Journal of Personality*, 21(3), 319–339. <https://doi.org/10.1002/per.626>
- Spalding, L. R., & Hardin, C. D. (1999). Unconscious unease and self-handicapping: Behavioral consequences of individual differences in implicit and explicit self-esteem. *Psychological Science*, 10(6), 535–539. <https://doi.org/10.1111/1467-9280.00202>
- Steffens, M. C. (2004). Is the implicit association test immune to faking? *Experimental Psychology*, 51(3), 165–179. <https://doi.org/10.1027/1618-3169.51.3.165>
- Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review*, 8(3), 220–247. https://doi.org/10.1207/s15327957pspr0803_1
- Swann, W. B., Chang-Schneider, C., & McClarty, K. L. (2007). Do peoples self-views matter? Self-concept and self-esteem in everyday life. *American Psychologist*, 62(2), 84–94. <https://doi.org/10.1037/0003-066x.62.2.84>
- Tuijl, L. A. van, Jong, P. J. de, Sportel, B. E., De Hullu, E., & Nauta, M. H. (2014). Implicit and explicit self-esteem and their reciprocal relationship with symptoms of depression and social anxiety: A longitudinal study in adolescents. *Journal of Behavior Therapy and Experimental Psychiatry*, 45(1), 113–121. <https://doi.org/10.1016/j.jbtep.2013.09.007>
- Valiente, C., Cantero, D., Vázquez, C., Álvaro Sanchez, P. M., & Espinosa, R. (2011). Implicit and explicit self-esteem discrepancies in paranoia and depression. *Journal of Abnormal Psychology*, 120(3), 691–699. <https://doi.org/10.1037/a0022856>
- Van Buuren, S. Groothuis-Oudshoorn, K. (2011). mice: Multivariate Imputation by Chained Equations in R. *Journal of Statistical Software*, 45, 3, 1-67. <https://doi.org/10.18637/jss.v045.i03>.

Chapter 7. General Discussion

Despite the extensive body of research on romantic relationships, relatively little is known about which individuals actually succeed in forming a sustained relationship, particularly within real-life, high-investment contexts. Much of the existing literature relies on self-initiated dating environments, such as online dating or speed dating, where dynamics differ substantially from guided partner selection. This dissertation addresses this gap by examining psychological predictors of relationship formation within the structured context of professional matchmaking.

7.1 Overview of the Main Findings

This dissertation set out to investigate which psychological factors predict relationship formation within the context of professional matchmaking. Across five empirical studies, we examined the role of personality traits, self-esteem, and attachment styles, measured both explicitly and implicitly. The research was conducted among adults who engaged in a structured matchmaking process with the explicit intention of forming a long-term romantic relationship.

Study 1 (chapter 2) examined whether the Big Five personality traits predicted relationship formation. None of the five traits—extraversion, agreeableness, conscientiousness, neuroticism, and openness—significantly predicted the success of matchmaking outcomes. This result suggests that broad personality dimensions, as typically measured by self-report, may have limited utility in predicting romantic success in guided partner selection contexts.

Study 2 (chapter 3) examined the psychometric properties of two Implicit Association Tests measuring general adult attachment in a population sample: the Anxious Attachment IAT (ANX-IAT) and the Avoidant Attachment IAT (AVOID-IAT). Both IATs showed adequate psychometric properties, especially in terms of internal consistency. The avoidant attachment IAT explained additional variance in emotional and psychological well-being beyond explicit measures, whereas the anxious attachment IAT did not. The study demonstrated that the implicit assessment of general adult attachment is feasible. Furthermore, the findings provide a foundation for the development of more valid IATs measuring general adult attachment.

Study 3 (chapter 4) investigated the predictive value of self-esteem and attachment, both explicitly and implicitly measured, in relationship formation. The only significant predictor of relationship formation was explicitly measured anxious attachment: individuals scoring higher on this dimension were less likely to form a successful relationship after being matched. Neither implicit nor explicit self-esteem were predictive of matchmaking success, and no predictive value was found for the implicit attachment measures of attachment and self-esteem. This finding suggests that in structured dating contexts, explicit attachment representations may be more relevant for relationship formation than implicit processes, and highlights anxious attachment as a key vulnerability that persists even when external support and guidance are provided.

Study 4 (chapter 5) focused on the associations between self-esteem and attachment, within and across explicit and implicit measurement levels. The results showed strong within-domain associations (e.g., explicit self-esteem with explicit attachment anxiety), but no significant cross-

domain correlations (e.g., explicit self-esteem with implicit attachment). This finding supports dual-process models that distinguish between conscious and automatic relational processing and helps to clarify the internal structure of these psychological constructs.

Study 5 (chapter 6) explored the theoretical relevance and limitations of discrepancy-based models, which compute the difference between implicit and explicit measures (e.g., implicit minus explicit self-esteem). In a general population sample, large discrepancies were weakly associated with lower well-being and higher psychological vulnerability. However, polynomial regression analysis revealed that these apparent "discrepancy effects" were actually driven primarily by the original variables themselves rather than by their incongruence. Due to limited theoretical clarity and potential measurement confounds—such as the masking of important information when component scores are both high or both low—traditional discrepancy scores offer limited utility as predictors of psychological well-being. In contrast, polynomial regression demonstrated that the original implicit and explicit variables remained significant predictors when analysed appropriately, supporting this analytical approach as preferable for future research.

What emerges most clearly from these studies is that explicit anxious attachment negatively predicts relationship formation, even in a structured and supported dating environment such as matchmaking. In contrast, Big Five personality traits and self-esteem—both explicit and implicit—did not predict relationship formation in matchmaking. While not prediction studies themselves, Studies 4 and 5 provide additional theoretical grounding by clarifying the distinct roles of implicit and explicit processes in relational functioning. Study 4 confirms that implicit and explicit measures capture distinct psychological processes, validating the theoretical rationale for including both measurement approaches. Study 5 demonstrates important methodological limitations of combining implicit and explicit measures through difference scores, supporting the decision to analyse these measures as independent predictors in regression models.

7.2 Interpretation of the Findings in the Matchmaking Context

The central research question of this dissertation was: *Which psychological factors predict relationship formation in the context of professional matchmaking?* The answer that emerges across the empirical studies is: of all the constructs examined, only explicit anxious attachment showed consistent predictive value. Individuals with higher levels of explicit anxious attachment had approximately 70% lower odds of relationship formation, indicating a substantial negative impact on matchmaking outcomes. This finding raises several theoretical and practical questions: Why does anxious attachment matter? Why were personality traits and implicitly measured self-esteem and attachment not predictive?

7.2.1 A Persistent Role of Anxious Attachment?

In study 3 (Chapter 4) we found that explicit anxious attachment predicted lower likelihood of relationship formation, with anxiously attached individuals having approximately 70% lower odds of

successfully forming a romantic relationship within three months after the initial match compared to those without anxious attachment. This finding aligns with patterns observed in other dating contexts: speed-dating studies demonstrate that anxiously attached individuals receive fewer romantic interest ratings and experience less mutual attraction (McClure et al., 2010; Pepping et al., 2017); online dating research reveals that anxious individuals are more prone to ruminate over digital communication, misinterpret ambiguous messages, and experience greater distress during early relationship development (Finkel et al., 2012; Sharabi & Caughlin, 2017); and longitudinal research confirms that individuals high in attachment anxiety face systematic difficulties progressing from initial dates to committed relationships (Poulsen et al., 2012). The current study demonstrates that this negative effect persists even within the structured, supportive environment of professional matchmaking—a context specifically designed to facilitate relationship formation through pre-screening, compatibility matching, and ongoing guidance.

The consistency of these findings across vastly different dating contexts—from rapid speed-dating encounters to algorithm-mediated online platforms to professionally guided matchmaking—suggests that anxious attachment represents a fundamental vulnerability in romantic relationship initiation that operates independently of contextual structure. Tu et al. (2022) found that participants perceived as anxiously attached in speed-dating sessions were not only rated less favorably by potential partners but also rated their own partners less positively, indicating bidirectional disengagement patterns that emerge early in romantic evaluation.

Anxious attachment may differ from other psychological vulnerabilities examined in this dissertation due to its apparent resistance to contextual buffering. While the matchmaking structure may have neutralized disadvantages typically associated with low extraversion or self-esteem (discussed in section 7.2.3), it did not similarly mitigate the relational fears characteristic of anxious attachment. A possible explanation is that anxious attachment operates through mechanisms less susceptible to external scaffolding and professional support. Theoretically, anxious attachment involves chronic fears of rejection and abandonment, hypervigilance to signs of relational threat, and excessive reassurance-seeking that can overwhelm potential partners (Mikulincer & Shaver, 2016). These patterns reflect deeply ingrained relational expectations—what Bowlby (1988) termed "internal working models"—that shape how individuals interpret ambiguous social cues and respond to relational uncertainty. Even when matchmakers provide reassurance, frame matches positively, and coach clients through the process, anxiously attached individuals may interpret neutral signals as evidence of impending rejection or doubt the sincerity of their match's interest.

The neurobiological literature offers additional context, though the current studies did not include neurophysiological measures. Research suggests that attachment anxiety is associated with heightened stress reactivity in relational contexts, involving rapid embodied responses to perceived threats to connection (Gillath et al., 2005; Simpson & Rholes, 2017). These responses may operate partly outside the conscious control that structured matchmaking seeks to support through deliberate evaluation and professional guidance.

Critically, the predictive value of anxious attachment in this dissertation emerged specifically at the explicit measurement level, while implicit attachment measures showed no predictive value. This

pattern—discussed in detail in section 7.2.2—suggests that in the deliberate, reflective context of matchmaking, explicitly measured attachment anxiety becomes the primary driver of relationship formation outcomes.

7.2.2 The Differential Predictive Value of Explicit versus Implicit Attachment

One of the most theoretically significant findings of this dissertation is that explicit anxious attachment predicted relationship formation outcomes, while implicit attachment measures showed no predictive value. This pattern requires explanation, as it challenges assumptions about the role of automatic processes in romantic decision-making.

The dual-process framework (Strack & Deutsch, 2004) provides a theoretical lens for understanding this pattern. According to this model, human cognition operates through two interacting systems: a reflective system governing deliberate, conscious processing, and an impulsive system governing automatic responses. These systems exert differential influence depending on situational demands. Implicit processes—which are automatic but not necessarily unconscious—dominate when individuals face time pressure, cognitive load, ambiguous stimuli, or degraded processing conditions. Conversely, explicit processes prevail when individuals have sufficient time, clear information, and enough cognitive resources to engage in deliberate evaluation.

The matchmaking context systematically optimizes conditions that favor explicit over implicit processing. Participants receive comprehensive written profiles highlighting compatibility factors and shared values. They have ample time to reflect before meeting their match. The matchmaker provides coaching and emotional preparation, creating supportive conditions for thoughtful decision-making. These structural features directly counter the conditions under which implicit processes typically exert their strongest influence.

Moreover, the intake process itself may function as an attachment-priming mechanism that heightens conscious awareness of relational patterns. During intake, clients engage in detailed reflection on their relationship history, articulate what they value in a partner, and formulate explicit relationship goals. For the anxiously attached, this process might activate conscious awareness of rejection fears and abandonment concerns, which brings attachment-related fears into conscious awareness in a way that completing an implicit reaction-time task might not. The result may be that explicitly measured attachment anxiety—now salient and accessible to conscious reflection—shapes how individuals approach subsequent romantic encounters within the matchmaking process. They may second-guess their responses to the match, catastrophize ambiguous signals, or withdraw prematurely due to consciously experienced fear of rejection.

This interpretation finds support in Study 4 (Chapter 5), which demonstrated that implicit and explicit measures of both attachment and self-esteem captured largely independent constructs. The weak correlations between implicit and explicit attachment ($r = .18$ for anxious attachment) indicate that these measurement approaches tap into distinct psychological processes rather than alternative assessments of the same underlying construct. This relative independence supports the theoretical proposition that reflective and impulsive systems can operate in parallel, with situational factors

determining which system most strongly guides behavior. According to dual-process frameworks (Evans & Stanovich, 2013; Strack & Deutsch, 2004), implicit processes typically dominate under conditions of time pressure, ambiguity, or cognitive load, while explicit processes prevail when individuals have sufficient time and clear information for deliberate evaluation—conditions that the structured matchmaking context systematically provides.

Critically, this context-dependent shift toward explicit processing appears specific to anxious attachment. Other psychological factors measured explicitly—including personality traits, self-esteem, and avoidant attachment—showed no predictive value for relationship formation. This indicates that the matchmaking structure does not universally privilege explicit measures over implicit ones. Rather, explicit anxious attachment emerges as uniquely predictive in this context, possibly because conscious fears of rejection and abandonment remain salient even within a supportive environment.

The finding that personality traits and self-esteem lost their predictive power in matchmaking while anxious attachment retained its negative influence suggests different psychological factors may respond differently to contextual support. However, the specific mechanisms underlying these differential effects remain to be empirically tested.

This finding has important theoretical implications. While no cross-context comparison was conducted here, the within-context results are discussed in relation to prior findings from other dating settings, to consider how guidance and structure might relate to the observed pattern

7.2.3 Personality and Self-Esteem: Context-Dependent Buffering

The absence of predictive effects for Big Five personality traits and self-esteem (Studies 1 and 3) requires explanation, particularly given that these factors predict romantic outcomes in other dating contexts. In speed-dating research, extraversion and physical attractiveness consistently predict initial romantic interest (Back et al., 2011; McClure et al., 2010), while self-esteem influences rejection sensitivity and withdrawal behaviors in early romantic encounters (Cameron et al., 2010; Stinson et al., 2015). Why do these factors lose predictive power in matchmaking?

The answer might be found in how the matchmaking structure redistributes the psychological demands of partner selection. In spontaneous dating contexts, individuals must independently manage multiple challenging tasks: identify potential partners, initiate contact, present themselves attractively, interpret ambiguous social signals, and cope with potential rejection. These demands favor individuals high in extraversion (who excel at self-presentation and social initiation) and self-esteem (who tolerate rejection risk more readily). Conversely, introverted or low-self-esteem individuals face systematic disadvantages in contexts requiring assertive self-promotion.

Professional matchmaking can be hypothesized to fundamentally alter this dynamic through three mechanisms. First, selection is externalized: the matchmaker identifies and pre-screens potential partners based on compatibility criteria, eliminating the need for clients to navigate crowded social environments or approach strangers. Second, presentation is mediated: clients receive structured partner descriptions emphasizing shared values and compatibility rather than having to make rapid judgments based on physical appearance or brief interaction. Third, evaluation is scaffolded:

matchmakers provide coaching, expectation management, and emotional support throughout the process, reducing the psychological burden of self-directed dating.

These structural features specifically address the challenges that typically disadvantage less extraverted or lower-self-esteem individuals. Research demonstrates that social support buffers against stress and enhances coping (Lakey & Orehek, 2011; Thoits, 2011), while external guidance and structured feedback enhance self-efficacy and performance in evaluative contexts (Schunk & DiBenedetto, 2016; Vancouver & Kendall, 2006). By reducing cognitive load, diffusing personal responsibility for success or failure, and providing professional validation, matchmaking creates conditions under which personality-based advantages become less relevant.

This interpretation aligns with the broader finding that matchmaking shifts the basis of evaluation from immediate attraction and social performance toward deliberate compatibility assessment. According to Construal Level Theory (Trope & Liberman, 2010), psychologically distant events—such as future relationships introduced through third-party mediation—activate more abstract, value-oriented thinking. When individuals evaluate potential partners through written profiles rather than face-to-face encounters, they engage higher-order cognitive processes focused on long-term compatibility rather than immediate social impressiveness (Eastwick et al., 2011; Joel et al., 2017). Under these conditions, being highly extraverted or confident offers less advantage than in contexts where rapid social performance determines outcomes.

It is important to note that these null findings do not imply personality and self-esteem are irrelevant to relationship success more broadly. Longitudinal research demonstrates that traits such as agreeableness and conscientiousness predict long-term relationship satisfaction and stability (Malouff et al., 2010; Robins et al., 2000), while self-esteem influences relationship quality, conflict resolution, and resilience over time (Erol & Orth, 2016; Murray et al., 2006). However, these effects emerge during relationship maintenance—the phase involving daily interaction, conflict negotiation, and mutual adaptation—rather than during the initial three-month period of relationship formation in externally mediated contexts.

The matchmaking context appears to function as an equalizer: it removes barriers for individuals who struggle with spontaneous social initiation while maintaining the opportunity for relationship formation. This has both theoretical and practical significance. Theoretically, it demonstrates that psychological predictors of romantic success are context-dependent rather than universal. Practically, it suggests that structured dating approaches may benefit individuals whose dispositional characteristics disadvantage them in conventional dating environments, while those same characteristics remain important once relationships transition from formation to maintenance.

7.2.4 The Structured Dating Context Model

The structured environment of professional matchmaking appears to differentially affect psychological processes: buffering certain dispositional disadvantages (such as low extraversion or self-esteem), while leaving attachment-based fears relatively persistent and, in some cases, potentially amplifying their salience.

Building on these observations, two explanatory patterns can be derived that form the basis of the Structured Dating Context Model (SDCM).

Pattern 1: External mediation alters which psychological factors predict outcomes

Within professional matchmaking, the matchmaker provides psychological scaffolding by managing partner selection, framing compatibility narratives, and reducing cognitive load through logistical and emotional support. By reducing social-evaluative threat and perceived decision pressure, this scaffolding may limit the behavioral expression of broad dispositional traits. Traits that typically predict success in self-directed dating contexts—such as extraversion and self-esteem—may therefore lose their predictive value when the environment provides alternative pathways to relationship initiation. Although this explanation is consistent with the observed pattern, it remains a post-hoc interpretation, as these mechanisms were not directly measured.

Pattern 2: Explicit anxious attachment emerges as a context-sensitive and potentially amplified predictor

In contrast to these buffered traits, explicitly measured anxious attachment remained a significant negative predictor of relationship formation. Notably, implicit attachment measures did not predict outcomes, nor did avoidant attachment or self-esteem. This pattern suggests that consciously accessible fears of rejection and abandonment represent a primary psychological barrier during this phase of relationship formation within structured matchmaking contexts.

Importantly, this persistence may not only reflect resistance to contextual buffering, but may also be related to features of the matchmaking process itself. The structured and information-rich nature of guided partner selection—characterized by repeated evaluation, anticipation, and interpretation of partner responses—may maintain or even amplify attachment-related concerns. Under these conditions, individuals may become more attuned to potential signs of rejection or mismatch, increasing the behavioral salience of anxious attachment.

This suggests that the structured matchmaking context does not uniformly buffer psychological processes, but may differentially attenuate some characteristics while maintaining or even amplifying others. Although this interpretation is consistent with the observed pattern, it remains speculative, as the present studies did not directly assess process-level mechanisms such as perceived uncertainty, cognitive load, or emotional regulation.

While these two patterns can be understood in terms of contextual structure, they do not fully explain why certain predictors remain relevant. The present findings therefore also point to a second dimension that may be critical for their interpretation: the phase of relationship development being examined. The outcome in this dissertation reflects the transition from initial contact to a mutually confirmed romantic relationship over a three-month period, representing a relatively advanced stage compared to studies focusing on initial attraction.

Different phases of relationship formation place different psychological demands on individuals. Early attraction contexts often rely on rapid evaluation and social performance, whereas the transition to a committed relationship requires sustained interaction, tolerance of uncertainty, and the regulation of relational expectations over time. From this perspective, psychological characteristics may not only vary in relevance across contexts, but also across phases of relationship development.

Taken together, the Structured Dating Context Model proposes that relationship formation is shaped by an interaction between (1) the structure of the partner selection context and (2) the phase of relationship development. Contextual scaffolding may reduce the behavioral impact of broad dispositional traits, while phase-specific demands may increase the salience of attachment-related processes.

Within the specific combination studied in this dissertation—structured matchmaking and a later stage of relationship formation—the model predicts attenuation of broad dispositional predictors and increased salience of attachment-related vulnerability, particularly explicit anxious attachment.

7.3 Reflections on the Methodology

Several methodological considerations should be acknowledged when interpreting the current findings.

7.3.1 Operationalization of Success

The outcome variable, whether participants entered into a romantic relationship three months after the initial match, provides a clear and practical measure of success. However, it is a binary indicator (yes/no) that does not fully capture the quality, duration, or developmental trajectory of these relationships. It remains unknown, for instance, whether certain psychological traits predict not just relationship formation, but also relationship satisfaction, resilience, or long-term compatibility. For instance, two participants may both successfully form relationships, yet one may experience this process as natural and fulfilling while the other struggles with significant anxiety and ambivalence throughout. These qualitative differences in the relationship formation process are lost in binary coding, potentially obscuring important individual variations in how psychological traits influence dating experiences.

7.3.2 Sample Characteristics and Generalizability

The study samples consisted of self-selected individuals who actively engaged in professional matchmaking, a group likely characterized by high relational motivation, openness to self-reflection, and willingness to engage in guided support. As such, the findings may not generalize to populations using dating apps, participating in speed-dating events, or engaging in unstructured forms of romantic exploration. Additionally, the sample was skewed toward middle-aged adults, limiting extrapolation to other age groups.

7.3.3 Measurement Considerations

Several limitations concern the measures used. The implicit measures (IATs) showed adequate psychometric properties but demonstrated limited predictive validity in relationship formation outcomes. This may reflect genuine limitations of implicit measurement in this context, methodological constraints of the IAT paradigm (which has faced general criticism regarding reliability and validity; see Greenwald et al., 2009), or both factors combined.

Regarding personality assessment through self-report questionnaires, our sample means were broadly comparable to population norms reported in validation studies, suggesting minimal selection bias. For example, mean scores on extraversion ($M = 3.2$, $SD = 0.8$) and agreeableness ($M = 4.1$, $SD = 0.6$) fell within expected ranges for middle-aged adults, indicating that social desirability effects were likely minimal.

7.3.4 Timing and Context Effects

The studies were conducted within the naturalistic setting of a matchmaking agency, which enhances ecological validity but reduces experimental control. For example, variations in coaching quality, client expectations, or timing between match and first meeting may have influenced the outcome in ways not fully captured by the study design.

Additionally, the structured nature of the process itself may act as a moderating factor, consistent with the Structured Dating Context Model (SDCM) presented earlier. According to the SDCM's first principle, external mediation reduces the influence of traits like self-esteem or extraversion in highly scaffolded environments through mechanisms such as cognitive load reduction and diffusion of personal responsibility. This contextual sensitivity of psychological predictors deserves further investigation.

7.4 Suggestions for Future Research

Building on this recognition of contextual sensitivity, several research directions emerge from these findings. The notion that psychological predictors operate differently across dating contexts—with some factors losing influence while others persist—opens new avenues for understanding relationship formation processes. The Structured Dating Context Model provides a framework for investigating these dynamics but requires empirical validation and refinement. Future research could expand, test, and contextualize these findings along the following lines:

7.4.1 Longitudinal and Dyadic Designs

Future studies should incorporate longitudinal designs that follow couples beyond the initial match to assess relationship development, satisfaction, and stability over time. This would allow for a more dynamic understanding of how psychological factors - such as attachment anxiety - interact with relational processes like conflict resolution, communication, and intimacy.

In addition, dyadic approaches could explore partner effects: How do the traits of one individual influence the experience of the other? Are certain combinations of attachment styles more conducive to success within guided matchmaking than others? By examining both partners' psychological characteristics simultaneously, researchers could gain insights into compatibility dynamics that extend beyond individual predictors alone.

7.4.2 Mechanisms of Guided Matchmaking

While the present research focused on psychological predictors, future work should explore how guided matchmaking may influence relationship formation—that is, through the processes by

which external structure interacts with individual characteristics. In this context, mechanisms refer to hypothetical pathways that could explain why certain psychological vulnerabilities persist or diminish under professional guidance. Rather than assuming mediation, these mechanisms can be conceptualized as contextually induced processes -cognitive, emotional, or interpersonal - that shape how clients perceive, interpret, and respond to relational situations.

From a theoretical standpoint, guided matchmaking can be viewed as a form of contextual regulation (Bandura, 1997; Gross, 2015). Structural elements such as coaching, feedback, and narrative framing may influence perceived self-efficacy, emotional regulation, or cognitive load during the early stages of dating. The way these structural elements are experienced may differ according to dispositional factors such as personality and attachment style. For example, anxiously attached individuals might experience professional framing as temporary reassurance that reduces rejection sensitivity, or conversely as performance pressure that heightens it. Similarly, pacing and reflection could either buffer impulsive reactions or reinforce self-monitoring tendencies, depending on the client's underlying attachment pattern.

A more cautious but potentially fruitful interpretation is that professional framing and coaching *could* influence the typical feedback loop between relational anxiety and relational behavior. The supportive structure of matchmaking might help some clients tolerate uncertainty and engage more confidently in initial encounters, whereas for others the same structure might inadvertently reinforce dependence on external reassurance. Whether such temporary containment facilitates genuine self-regulation - or merely delays the reactivation of attachment anxiety once professional guidance subsides - remains an open empirical question that future research should address.

Empirical research could examine these processes more directly through experimental, longitudinal, and comparative designs. Experimental studies might manipulate specific features of the matchmaking process - such as the tone of compatibility narratives, the amount of coaching, or the pacing of interactions - to test whether such scaffolding moderates the impact of attachment anxiety on relationship formation. Longitudinal or mixed-method approaches could follow clients over multiple matches, integrating repeated psychological assessments with qualitative interviews that capture the lived experience of professional guidance. Comparative studies could further contrast matchmaking services that differ in their degree of structure to identify which elements most effectively support secure relational behavior.

7.4.3 Individualized Matching Strategies

Beyond general optimization, individualized matching strategies offer a conceptual framework for examining person–context interactions in guided relationship formation. Prior research has shown that similarity-based partner matching can enhance initial attraction and rapport (Montoya, Horton, & Kirchner, 2008), yet its long-term effects are more nuanced. Meta-analytic findings indicate that similarity in attachment style may promote early bonding but does not necessarily predict relationship stability or satisfaction (Fitzpatrick & Indvik, 2018). In contrast, complementary matching—where partners differ in certain interpersonal tendencies—has been associated with longer-term balance and mutual regulation (Markey & Markey, 2007; Barelds, 2005).

Theoretical insights from clinical psychology further suggest that structured, phased introductions could serve a regulatory function for clients high in attachment anxiety. Exposure-based approaches (Craske et al., 2014) and pacing interventions drawn from emotionally focused and cognitive-behavioral therapy (Johnson, 2019; Hayes, Strosahl, & Wilson, 2011) may inform the design of graded matchmaking trajectories that gradually increase emotional proximity and tolerance of relational uncertainty.

Future work could build on these frameworks by combining longitudinal data from guided matchmaking with theoretically informed design principles. Such research could clarify how individualized matching strategies might best support secure connection in clients with differing attachment profiles.

7.4.4 Broader Populations and Cultural Contexts

Finally, future studies should extend these investigations to younger populations, diverse gender identities, diverse sexual orientations, and non-Western contexts. Cultural norms, relational expectations, and dating infrastructures vary widely across contexts, and the factors predicting romantic success in one setting—such as initial attraction, self-presentation, or attachment dynamics—may not generalize to other settings, especially when considering differences in age, communication style, or the level of structural guidance involved (Finkel et al., 2012; Sharabi & Caughlin, 2017; Apostolou & Tsangari, 2022; McWilliams & Barrett, 2014; Whitty, 2008; Sorokowski et al., 2025). Understanding how psychological traits function across different cultural and demographic backgrounds remains a crucial step in building inclusive models of relationship formation.

7.4.5 Intervention Studies

The finding that explicit anxious attachment predicts poorer matchmaking outcomes suggests that structural support does not sufficiently buffer attachment-related vulnerability and may, in some cases, even amplify relational anxiety. Future research could explore whether targeted pre-matching or parallel interventions help clients regulate attachment-related anxiety and engage more effectively with structured dating support.

Attachment-focused or cognitive-behavioral approaches aimed at reducing rejection sensitivity and increasing relational self-efficacy may be particularly promising. Such interventions have been shown to reduce attachment-related anxiety and enhance relational functioning in both clinical and community samples (Johnson, 2019; Mikulincer & Shaver, 2016). Experimental trials could compare standard matchmaking services with versions that integrate brief preparatory or concurrent psychological support, testing effects on relationship formation and intermediate outcomes such as anxiety reduction or confidence in dating interactions.

Such research would clarify whether improving attachment-related functioning enhances responsiveness to structured dating interventions and would provide a bridge between clinical and social-psychological models of relationship formation.

7.5 Practical and Scientific Relevance

This dissertation offers both practical insights for matchmaking professionals and theoretical contributions to the scientific understanding of relationship formation.

7.5.1 Practical Implications for Matchmakers and Coaches

The finding that explicit anxious attachment is a key predictor of unsuccessful matchmaking outcomes underscores the importance of addressing attachment-related concerns in the matchmaking process. This finding has direct implications for how matchmaking agencies screen clients, design interventions, and provide ongoing support throughout the matching process.

The emergence of anxious attachment as a negative predictor for matchmaking success points to a fundamental challenge in structured dating contexts. Individuals with anxious attachment experience a characteristic pattern of simultaneously desiring emotional closeness while harbouring persistent fears of rejection or abandonment. This internal conflict manifests in ways that may be particularly counterproductive in the matchmaking environment.

The matchmaking context might even amplify this vulnerability because it combines several elements that activate attachment insecurities. Clients are explicitly aware that they are being assessed as potential romantic partners, which may create performance pressure around intimate self-presentation. The third-party mediation reduces their direct control over the partner selection process, potentially triggering fears of abandonment or rejection that are characteristic of anxious attachment. Additionally, the goal-oriented nature of matchmaking may create pressure to form meaningful connections within a structured timeframe, while the awareness that relationship progress is being professionally monitored may intensify self-consciousness about relational adequacy.

These features create an environment where attachment-related fears of inadequacy and rejection may become especially salient, potentially undermining the very relationship formation process the individual seeks.

For anxiously attached individuals, the key challenge lies in distinguishing genuine incompatibility from anxiety-driven withdrawal: when emotional closeness triggers attachment fears, potentially compatible partners are often rejected before a true connection can develop. Clinical and empirical research indicates that attachment anxiety can manifest as either excessive rejection sensitivity (prematurely ending promising connections) or desperate reassurance-seeking (pursuing unsuitable matches) (Mikulincer & Shaver, 2016). Both patterns may undermine relationship formation, underscoring the importance of addressing attachment-related cognitions before entering the matchmaking process. Increasing awareness of attachment-related anxiety may help clients interpret relational ambiguity less as a threat and more as a normal feature of early connection, thereby reducing avoidance and premature withdrawal that impede relationship formation.

Matchmaking agencies might benefit from incorporating attachment-focused screening during intake assessments. Validated measures like the Experiences in Close Relationships-Revised (ECR-R; Fraley et al., 2000) or the Relationship Questionnaire (Bartholomew & Horowitz, 1991) could identify clients with high attachment anxiety who might benefit from targeted preparation. As discussed

in the section on intervention studies, evidence-based approaches such as brief pre-matching therapy (e.g., attachment-focused CBT or EFT), psychoeducation about attachment patterns, or ongoing coaching during the dating process may help these clients navigate relational uncertainty more effectively.

Although self-esteem did not directly predict matchmaking outcomes (Study 3), Study 4 revealed that higher explicit self-esteem was associated with lower explicit anxious attachment. While this cross-sectional correlation does not demonstrate causality, it suggests that self-esteem and attachment anxiety may be related constructs. Whether interventions targeting self-esteem could indirectly reduce attachment anxiety—or vice versa—remains an empirical question requiring longitudinal intervention research. While these implications are directly relevant for professional matchmaking, they also carry broader significance for relationship counselling and support services. Structured, guided contexts appear to reduce disadvantages for individuals with lower extraversion or self-esteem, suggesting that similar principles of pacing, reflection, and professional mediation may benefit vulnerable singles in other therapeutic or coaching settings.

7.5.2 Methodological Insights and Model Development

Study 5's polynomial regression analysis revealed that traditional difference score approaches—commonly used to study implicit-explicit discrepancies—can lead to unwarranted conclusions about the relative importance of psychological constructs. The polynomial regression analyses showed that apparent "discrepancy effects" between implicit and explicit self-esteem were actually driven primarily by explicit self-esteem alone, rather than by the incongruence between the two measures.

However, it is important to acknowledge that Studies 1, 3, and 4 in this dissertation used traditional analytical approaches rather than polynomial regression. This decision was made for several reasons: first, the primary research questions focused on predictive validity of individual constructs rather than their interactions; second, the sample sizes in some studies were insufficient for the more complex polynomial models; and third, the theoretical framework emphasized comparing implicit versus explicit measures as separate predictors rather than their congruence. Study 5 was specifically designed to address this methodological question and demonstrated the superiority of polynomial approaches for future discrepancy research.

This methodological contribution suggests that researchers studying dual-process models should exercise caution when using difference scores and consider polynomial regression as a more nuanced analytical approach. The finding has implications for how implicit-explicit relationships are conceptualized and measured across psychological domains, extending beyond the current matchmaking context to broader questions about conscious and automatic processes.

7.5.3 Contributions to Psychological Science

Taken together, the findings of this dissertation contribute to relationship science primarily at the conceptual level. By integrating explicit and implicit measurement approaches within a single,

ecologically valid setting, this research clarifies how methodological diversity can enrich theoretical understanding of early relationship formation.

The *Structured Dating Context Model (SDCM)* proposed in this dissertation builds on these insights. Rather than presenting an empirically tested theory, the model synthesizes observed patterns across the studies into a conceptual framework for understanding how individual dispositions interact with structural features of guided dating. It highlights the possibility that certain vulnerabilities—such as anxious attachment—may remain influential even when other dispositional disadvantages are buffered by contextual support.

The SDCM thus offers a theoretical lens through which future research can examine person–context interactions more systematically. In doing so, it contributes to the broader movement within psychological science toward contextually grounded models of relationship formation, while inviting empirical validation across different dating settings and methodological designs.

7.6 Integrative conclusion

This dissertation demonstrates that within the structured environment of professional matchmaking, explicit anxious attachment predicts lower likelihood of relationship formation, whereas personality traits, self-esteem, and implicit measures of attachment and self-esteem show no predictive value. These findings highlight that, in guided dating contexts, consciously accessible relationship representations may exert a stronger influence on early relational outcomes than automatic or dispositional factors.

The *Structured Dating Context Model (SDCM)* integrates these insights into a conceptual framework that situates relationship formation at the intersection of personal vulnerability and environmental scaffolding. It invites future research to test, refine, and extend this framework across diverse relational contexts.

More broadly, these findings suggest a shift in focus for understanding early relationship formation. Rather than emphasizing broad dispositional traits or automatic processes, the results point toward the central role of consciously accessible relational expectations and interpretations. In contexts where individuals engage in deliberate partner selection, it is not who people are in general, but how they consciously anticipate and interpret relational dynamics that appears to matter most.

References

- Apostolou, M., & Tsangari, S. (2022). Why people are single: The Big Five as predictors of involuntary singlehood. *Personality and Individual Differences*, 186, 111375.
<https://doi.org/10.1016/j.paid.2021.111375>
- Back, M. D., Penke, L., Schmukle, S. C., Sachse, K., Borkenau, P., & Asendorpf, J. B. (2011). Why mate choices are not as reciprocal as we assume: The role of personality, flirting, and physical attractiveness in speed-dating. *European Journal of Personality*, 25(2), 120–132.
<https://doi.org/10.1002/per.806>
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: W. H. Freeman.
- Barelds, D. P. H. (2005). Self and partner personality in intimate relationships. *European Journal of Personality*, 19(6), 501–518. <https://doi.org/10.1002/per.549>
- Bartholomew, K., & Horowitz, L. M. (1991). Attachment styles among young adults: A test of a four-category model. *Journal of Personality and Social Psychology*, 61(2), 226–244.
<https://doi.org/10.1037/0022-3514.61.2.226>
- Bowlby, J. (1988). *A secure base: Parent-child attachment and healthy human development*. Basic Books.
- Cameron, J. J., Stinson, D. A., Gaetz, R., & Balchen, S. (2010). Acceptance is in the eye of the beholder: Self-esteem and motivated perceptions of acceptance from the opposite sex. *Journal of Personality and Social Psychology*, 99(3), 513–529.
<https://doi.org/10.1037/a0018558>
- Chen, M., & Bargh, J. A. (1999). Consequences of automatic evaluation: Immediate behavioral predispositions to approach or avoid the stimulus. *Personality and Social Psychology Bulletin*, 25(2), 215–224. <https://doi.org/10.1177/0146167299025002007>
- Craske, M. G., Treanor, M., Conway, C. C., Zbozinek, T., & Vervliet, B. (2014). Maximizing exposure therapy: An inhibitory learning approach. *Behaviour Research and Therapy*, 58, 10–23.
<https://doi.org/10.1016/j.brat.2014.04.006>
- Davila, J., & Cobb, R. J. (2003). Predicting change in self-reported and interviewer-assessed adult attachment: Tests of the individual difference and life stress models of attachment change. *Personality and Social Psychology Bulletin*, 29(7), 859–870.
<https://doi.org/10.1177/0146167203029007005>
- Eastwick, P. W., Finkel, E. J., & Eagly, A. H. (2011). When and why do ideal partner preferences affect the process of initiating and maintaining romantic relationships? *Journal of Personality and Social Psychology*, 101(5), 1012–1032. <https://doi.org/10.1037/a0024062>
- Erol, R. Y., & Orth, U. (2016). Self-esteem and the quality of romantic relationships. *European Psychologist*, 21(4), 274–283. <https://doi.org/10.1027/1016-9040/a000259>
- Evans, J. St. B. T., & Stanovich, K. E. (2013). Dual-process theories of higher cognition: Advancing the debate. *Perspectives on Psychological Science*, 8(3), 223–241.
<https://doi.org/10.1177/1745691612460685>

- Finkel, E. J., Eastwick, P. W., Karney, B. R., Reis, H. T., & Sprecher, S. (2012). Online dating: A critical analysis from the perspective of psychological science. *Psychological Science in the Public Interest*, 13(1), 3–66. <https://doi.org/10.1177/1529100612436522>
- Finkel, E. J., & Eastwick, P. W. (2008). Speed-dating. *Current Directions in Psychological Science*, 17(3), 193–197. <https://doi.org/10.1111/j.1467-8721.2008.00573.x>
- Fitzpatrick, J., & Indvik, J. (2018). Attachment style and romantic relationship outcomes: A review and meta-analysis. *Interpersona: An International Journal on Personal Relationships*, 12(1), 1–21. <https://doi.org/10.5964/ijpr.v12i1.277>
- Fleeson, W., & Nettle, E. E. (2008). The end of the person–situation debate: An emerging synthesis in the answer to the consistency question. *Social and Personality Psychology Compass*, 2(4), 1667–1684. <https://doi.org/10.1111/j.1751-9004.2008.00122.x>
- Fraley, R. C., Waller, N. G., & Brennan, K. A. (2000). An item response theory analysis of self-report measures of adult attachment. *Journal of Personality and Social Psychology*, 78(2), 350–365. <https://doi.org/10.1037/0022-3514.78.2.350>
- Gillath, O., Bunge, S. A., Shaver, P. R., Wendelken, C., & Mikulincer, M. (2005). Attachment-style differences in the ability to suppress negative thoughts: Exploring the neural correlates. *NeuroImage*, 28(4), 835–847. <https://doi.org/10.1016/j.neuroimage.2005.06.048>
- Gillath, O., Karantzas, G. C., & Fraley, R. C. (2016). *Adult attachment: A concise introduction to theory and research*. Academic Press.
- Girme, Y. U., Overall, N. C., & Faingataa, S. (2018). "Date nights" take two: The maintenance function of shared relationship activities. *Personal Relationships*, 21(1), 125–149. <https://doi.org/10.1111/pere.12020>
- Gross, J. J. (2015). Emotion regulation: Current status and future prospects. *Psychological Inquiry*, 26(1), 1–26. <https://doi.org/10.1080/1047840X.2014.940781>
- Hayes, S. C., Strosahl, K. D., & Wilson, K. G. (2011). *Acceptance and commitment therapy: The process and practice of mindful change* (2nd ed.). Guilford Press.
- Joel, S., Eastwick, P. W., & Finkel, E. J. (2017). Is romantic desire predictable? Machine learning applied to initial romantic attraction. *Psychological Science*, 28(12), 1841–1853. <https://doi.org/10.1177/0956797617714580>
- Johnson, S. M. (2019). *Attachment theory in practice: Emotionally focused therapy (EFT) with individuals, couples, and families*. Guilford Press.
- Johnson, S. M., & Greenman, P. S. (2006). The path to a secure bond: Emotionally focused couple therapy. *Journal of Clinical Psychology*, 62(5), 597–609. <https://doi.org/10.1002/jclp.20251>
- Lakey, B., & Orehek, E. (2011). Relational regulation theory: A new approach to explain the link between perceived social support and mental health. *Psychological Review*, 118(3), 482–495. <https://doi.org/10.1037/a0023477>
- Malouff, J. M., Thorsteinsson, E. B., Schutte, N. S., Bhullar, N., & Rooke, S. E. (2010). The five-factor model of personality and relationship satisfaction of intimate partners: A meta-analysis. *Journal of Research in Personality*, 44(1), 124–127. <https://doi.org/10.1016/j.jrp.2009.09.004>

- Markey, P. M., & Markey, C. N. (2007). Romantic ideals, romantic obtainment, and relationship experiences: The complementarity of interpersonal traits among romantic partners. *Journal of Social and Personal Relationships*, 24(4), 517–533.
<https://doi.org/10.1177/0265407507079241>
- McClure, M. J., Lydon, J. E., Baccus, J. R., & Baldwin, M. W. (2010). A Signal Detection Analysis of Chronic Attachment Anxiety at Speed Dating: Being Unpopular Is Only the First Part of the Problem. *Personality and Social Psychology Bulletin*, 36(8), 1024–1036.
<https://doi.org/10.1177/0146167210374238>
- McWilliams, S., & Barrett, A. E. (2014). Online dating in middle and later life: Gendered expectations and experiences. *Journal of Family Issues*, 35(3), 411–436.
<https://doi.org/10.1177/0192513X12468437>
- Mikulincer, M., & Shaver, P. R. (2016). Attachment in adulthood: Structure, dynamics, and change (2nd ed.). Guilford Press.
- Montoya, R. M., Horton, R. S., & Kirchner, J. (2008). Is actual similarity necessary for attraction? A meta-analysis of actual and perceived similarity. *Journal of Social and Personal Relationships*, 25(6), 889–922. <https://doi.org/10.1177/0265407508096700>
- Murray, S. L., Holmes, J. G., & Collins, N. L. (2006). Optimizing assurance: The risk regulation system in relationships. *Psychological Bulletin*, 132(5), 641–666. <https://doi.org/10.1037/0033-2909.132.5.641>
- Oswald, F. L., Mitchell, G., Blanton, H., Jaccard, J., & Tetlock, P. E. (2013). Predicting ethnic and racial discrimination: A meta-analysis of IAT criterion studies. *Journal of Personality and Social Psychology*, 105(2), 171–192. <https://doi.org/10.1037/a0032734>
- Pepping, C. A., MacDonald, G., & Davis, P. J. (2017). Toward a psychology of attachment security. *Personality and Social Psychology Review*, 22(1), 28–64.
<https://doi.org/10.1177/1088868316648270>
- Poulsen, F. O., Holman, T. B., Busby, D. M., & Carroll, J. S. (2012). Physical attraction, attachment styles, and dating development. *Journal of Social and Personal Relationships*, 30(3), 301–319.
<https://doi.org/10.1177/0265407512456673>
- Robins, R. W., Caspi, A., & Moffitt, T. E. (2000). Two personalities, one relationship: Both partners' personality traits shape the quality of their relationship. *Journal of Personality and Social Psychology*, 79(2), 251–259. <https://doi.org/10.1037/0022-3514.79.2.251>
- Schimmack, U. (2021). The implicit association test: A method in search of a construct. *Perspectives on Psychological Science*, 16(2), 396–414. <https://doi.org/10.1177/1745691619863798>
- Schunk, D. H., & DiBenedetto, M. K. (2016). Self-efficacy theory in education. In K. R. Wentzel & D. B. Miele (Eds.), *Handbook of motivation at school* (2nd ed., pp. 34–54). Routledge.
- Sharabi, L. L., & Caughlin, J. P. (2017). What predicts first date success? A longitudinal study of modality switching in online dating. *Personal Relationships*, 24(2), 370–391.
<https://doi.org/10.1111/pere.12188>
- Simpson, J. A., & Rholes, W. S. (2017). Adult attachment, stress, and romantic relationships. *Current Opinion in Psychology*, 13, 19–24. <https://doi.org/10.1016/j.copsyc.2016.04.006>

- Sorokowski, P., Sorokowska, A., Oleszkiewicz, A., et al. (2025). Universality and variability in human romantic love: A large-scale cross-cultural study. *International Journal of Intercultural Relations*, 94, 102211. <https://doi.org/10.1016/j.ijintrel.2025.102211>
- Stinson, D. A., Cameron, J. J., Hoplock, L. B., & Hole, C. (2015). Warming up and cooling down: Self-esteem and behavioral responses to social threat during relationship initiation. *Self and Identity*, 14(2), 189–213. <https://doi.org/10.1080/15298868.2014.969301>
- Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review*, 8(3), 220–247. https://doi.org/10.1207/S15327957PSPR0803_1
- Thoits, P. A. (2011). Mechanisms linking social ties and support to physical and mental health. *Journal of Health and Social Behavior*, 52(2), 145–161. <https://doi.org/10.1177/0022146510395592>
- Trope, Y., & Liberman, N. (2010). Construal-level theory of psychological distance. *Psychological Review*, 117(2), 440–463. <https://doi.org/10.1037/a0018963>
- Tu, E., Muise, A., & Impett, E. A. (2022). Is my attachment style showing? Perceptions of a date's attachment anxiety and avoidance and dating interest during a speed-dating event. *Journal of Research in Personality*, 100, 104269. <https://doi.org/10.1016/j.jrp.2022.104269>
- Vancouver, J. B., & Kendall, L. N. (2006). When self-efficacy negatively relates to motivation and performance in a learning context. *Journal of Applied Psychology*, 91(5), 1146–1153. <https://doi.org/10.1037/0021-9010.91.5.1146>
- Whitty, M. T. (2008). Revealing the 'real' me, searching for the 'actual' you: Presentations of self on an Internet dating site. *Computers in Human Behavior*, 24(4), 1707–1723.

Acknowledgements

The path toward this dissertation has been long and, at times, unexpectedly challenging. Combining family life, professional responsibilities, and academic work required continuous adjustment and perseverance. As a midlife external PhD candidate, this journey differed from a traditional academic trajectory and demanded resilience in ways I had not anticipated.

This dissertation would not have been possible without the support of the people around me. First and foremost, I thank my husband, my parents, and my children. Your patience, unwavering belief, and moral support formed the foundation on which I could build.

Sabien, you deserve special recognition. From the very beginning, you encouraged me to embark on this PhD journey. In moments of doubt, your down-to-earth perspective reminded me that meaningful challenges are rarely easy, and your words helped me to persevere.

I also thank my brothers for their emotional and practical support. Radboud, thank you for your clear and solution-focused support whenever I felt stuck. Sebas, thank you for your technical assistance, both in data processing and in navigating the digital challenges along the way.

To the team at the Open University—Jacques, Nele, Ron, and Johan—thank you for your valuable and critical feedback. Nele, your personal engagement supported me during moments of discouragement. Jacques, your creativity contributed to the development of the IATs. Johan, your sharp questions and attention to detail safeguarded the scientific rigor of this work. Ron, your enthusiasm for statistics made complex analyses more accessible.

A special word of thanks goes to Jan Groentjes at Mens & Relatie. For nearly twenty years, Jan contributed with great precision and a critical mindset to the organization. His role in ensuring the quality and integrity of the data used in this research has been invaluable. Jan passed away unexpectedly on September 30, 2025, shortly before the completion of this dissertation. I remember him with gratitude and respect.

Finally, I would like to thank the matchmakers at Mens & Relatie. You supported your clients with dedication and contributed actively to this research by encouraging participation. Without your commitment, this dissertation would not have been possible. It is my hope that both you and your clients will benefit from its insights. Ultimately, this work was driven by the desire to contribute to the relationship happiness that every person deserves.

Curriculum Vitae

Drs. Liesbeth (Liselotte) Visser

Born: 30 January 1967, Amsterdam, The Netherlands

Research focus

Attachment, self-esteem, and relationship formation in matchmaking contexts

Education

Drs. Social Psychology, Vrije Universiteit Amsterdam (1991)

Academic Position

PhD Candidate, Open Universiteit (2014–present)

Dissertation on psychological predictors of romantic relationship formation in professional matchmaking, focusing on personality, self-esteem, and attachment using both explicit and implicit measures.

Professional Experience

Director and Psychologist, Mens & Relatie (1985–present)

GZ-Psychologist, Psychologisch Adviesbureau Vivid (1999–present)

Lecturer and Trainer, various institutes (including NCOI, UWV, COA) (1989–2021)

Relationship Expert, *Married at First Sight* (RTL) (2021–2022)

Registrations and Certifications

BIG-registered GZ-psychologist

Certified in Emotion-Focused Therapy (EFT; Levels I–III, including advanced training in attachment and identity)

Additional training in EMDR, ACT, CBT, Mindfulness, and mediation

Publications (peer-reviewed)

Visser, L., Lataster, J., Pat-El, R., van Lankveld, J., & Jacobs, N. (2021).

Psychometric properties of two implicit association tests measuring adult attachment. *Psychologica Belgica*, 61(1), 88–103. <https://doi.org/10.5334/pb.1042>

Visser, L., Pat-El, R., Lataster, J., van Lankveld, J., & Jacobs, N. (2024).

Beyond difference scores: Unlocking insights with polynomial regression in studies on the effects of implicit–explicit congruency. *Psychologica Belgica*, 64(1), 5–23. <https://doi.org/10.5334/pb.1246>

Visser, L., Pat-El, R., Lataster, J., van Lankveld, J., & Jacobs, N. (2025).

The relation between Big Five personality traits and relationship formation through matchmaking. *Psychology International*, 7(2), 52. <https://doi.org/10.3390/psycholint7020052>

- Visser, L., Lataster, J., Pat-El, R., van Lankveld, J., & Jacobs, N. (2026). Associations between explicit and implicit self-esteem and attachment in singles and partnered adults. *Psychology International*, 8(1), 12. <https://doi.org/10.3390/psycholint8010012>
- Visser, L., Lataster, J., Pat-El, R., van Lankveld, J., & Jacobs, N. (2026). The role of self-esteem and attachment in relationship formation. *Social Sciences & Humanities*, 13, Article 102724. <https://doi.org/10.1016/j.ssaho.2026.102724>

Books (selected)

- Visser, L. (2012). Is je relatie te redden? Schijnbaar gelukkig.
- Visser, L. (2014). Ja, ik wil: Hoe vind en bind je jouw droompartner?
- Visser, L. (2024). De meeste singles bijten niet.