Impact of Spousal Congruence on Emotional Perception on Solitude in Older Couples: A Response Surface Analysis

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Abstract

Background and Objectives: Solitude is a common yet nuanced experience in later life, but how older couples jointly experience and perceive solitude remains underexplored. This study examines the influence of congruent and incongruent emotional states between spouses on their subjective experience of solitude, with particular attention to potential gender differences. Understanding this relational dynamic may provide insights to support emotional well-being among aging couples.

Research Design and Methods: A total of 73 older couples aged 60 to 100 years in Hong Kong SAR, China, participated in this study. Participants completed online questionnaires and Ecological Momentary Assessments (EMA) twice daily for 14 days. Polynomial longitudinal regression models and Response Surface Analysis (RSA) were employed to explore the relationship between congruence and discrepancy in positive affect (PA) and negative affect (NA) between spouses and their perceived solitude.

Results: Significant associations were found between spousal congruence in NA and perceived solitude for both genders, with women showing a more pronounced impact when perceiving greater NA than their partners (women: $a_1 = 0.389$, $p < .001$; $a_2 = 0.360$, $p < .001$; $a_3 = 0.559$, $p < .001$; men: $a_1 = 0.494$, $p < .001$; $a_2 = 0.333$, $p < .001$; $a_3 = 0.452$, $p < .001$). For PA, women experienced increased solitude when perceiving greater PA than their partners ($a_1 = -0.285$, $p < .001$; $a_4 = 0.429$, $p < .001$), whereas men's solitude was affected by both congruence and incongruence in PA ($a_1 = -0.224$, $p < .001$; $a_3 = -0.228$, $p < .001$).

Discussions and Implications: Spousal emotional congruence significantly influences perceptions of solitude, differing by gender. Interventions should target emotional communication skills, couple-based therapy, and support groups to enhance relational dynamics, reduce loneliness, and

promote emotional well-being in older adults navigating solitude together.

Keywords: Ecological Momentary Assessment; Gender Differences; Mental Health

Translational Significance

This study employs a novel approach by using Ecological Momentary Assessments and Response Surface Analysis to examine how emotional congruence and incongruence between spouses influence perceptions of solitude among older couples. This real-time, dynamic method offers a more nuanced understanding of emotional interactions in daily life. Findings reveal that shared negative emotions intensify solitude, especially for women, while discrepancies in positive emotions also contribute to emotional distance. These insights suggest that interventions should enhance emotional communication through couple-based therapy and support groups, ultimately reducing solitude, strengthening relational bonds, and improving emotional well-being in aging populations.

Introduction

As individuals age, their emotional experiences often shift, with solitude becoming an increasingly salient and multifaceted aspect of life. Solitude has been linked to both adaptive and maladaptive outcomes, depending on the individual's capacity to manage its psychological implications (Long & Averill, 2003; Weinstein et al., 2023). For older couples, solitude is not only shaped by personal reflection but also deeply intertwined with the dynamics of their relationship, as they rely heavily on each other for emotional and practical support amidst functional decline. While solitude has been extensively studied as an individual phenomenon, its shared and relational dimensions—particularly how couples navigate solitude together in the context of aging—remain poorly understood. Understanding these dynamics is critical for advancing theoretical insights and designing practical interventions to enhance well-being in later-life relationships.

Concordance theory posits that alignment in emotional experiences fosters psychological harmony, while misalignment leads to cognitive dissonance, discomfort, and heightened feelings of solitude (Osgood & Tannenbaum, 1955; Qian & Kan, 2024). Spousal negative and positive affective states have been consistently linked to concordant solitude (Asendorpf, 2010; Flora & Segrin, 2000; Luhmann & Hawkley, 2016). Emotional congruence—defined as the alignment of emotional experiences between partners—has been identified as a critical factor in mitigating loneliness and fostering relationship satisfaction (Meier et al., 2023; Mund & Johnson, 2021). Conversely, emotional incongruence, characterized by mismatched affective responses, can intensify solitude and emotional distress. Moreover, within-couple synchrony in personality traits has been shown to predict perceived spousal support and enhance relational satisfaction over time (Lewis & Yoneda, 2021). Drawing on concordance theory, older couples often function as an emotional unit, with partners mutually influencing each other's mood states, especially in long-

term marriages where emotional and physiological synchrony tends to increase with age (Hoppmann & Gerstorf, 2009; Pauly et al., 2021). This emotional synchrony is often beneficial when positive emotions are shared, but may intensify the negative effects of emotional misalignment.

Gender differences play a critical role in how emotional congruence and incongruence influence solitude among older couples. Research has shown that men and women process emotional alignment differently within marital relationships, resulting in varied experiences of loneliness and well-being (Ermer & Proulx, 2019; Mund & Johnson, 2021). Women, being more emotionally attuned, benefit significantly from congruence in affective states. Conversely, mismatches, particularly involving negative affect, exacerbate their solitude due to their heightened sensitivity to relational dynamics and emphasis on emotional reciprocity (Caspi et al., 1992; Gable et al., 2006; Gross & John, 2003). In contrast, men, who often internalize emotional discord due to socialization patterns that encourage emotional suppression, are less responsive to congruence but more vulnerable to loneliness when misalignment occurs, especially in spousal support contexts (Baek et al., 2021; Nolen-Hoeksema, 2012; Tamres et al., 2002). These patterns inform our study's premise that emotional congruence or incongruence between spouses shapes experiences of solitude in gender-specific ways. For example, recent dyadic research shows that emotional incongruence tends to "rub off" more from husbands to wives, leaving women feeling more emotionally isolated (Weber & Hülür, 2023). Longitudinal studies further reveal that marital quality and emotional congruence play dynamic, gender-specific roles in shaping loneliness over time (Moorman, 2015; Velotti et al., 2016). Taken together, these findings underscore gender as a core variable in understanding how emotional congruence shapes solitude in later life, highlighting its essential role in dyadic research.

Despite the well-documented significance of emotional congruence, much of the existing research has focused on individual differences within couples, often neglecting the relational dynamics arising from partner similarity. The findings in this area are mixed, with some studies reporting negligible effects and others indicating moderate associations between partner similarity and relationship quality (Dyrenforth et al., 2010; Gonzaga et al., 2007; Watson et al., 2004). These inconsistencies may stem from variations in methodologies, the specific characteristics examined (e.g., personality traits, emotional states), and the theoretical frameworks utilized. Traditional approaches such as profile correlations and discrepancy scores have been criticized for relying on linear assumptions, which may oversimplify the complex interplay between partner similarity and relational outcomes. Emerging evidence suggests that the relationship between partner similarity and relationship satisfaction may be nonlinear, with moderate levels of similarity yielding more favorable outcomes compared to extreme congruence or incongruence (Schönbrodt et al., 2018).This highlights the need for more nuanced analytical methods to fully understand how partner similarity influences relationship dynamics and well-being.

In super-aging societies like Hong Kong, where many older couples navigate life's challenges together, understanding the dynamics of their relationships is particularly crucial. Spouses often serve as primary sources of care and support, facilitating aging-in-place (Chui, 2020). However, the tendency to overlook these relational dynamics has limited our understanding of how later-life marriage shapes well-being. Recognizing this gap, the Hong Kong government has begun shifting its focus. Rather than viewing caregiving in later life solely through the lens of individual roles—i.e., caregiver and care-receiver—it is promoting a more holistic perspective that considers collaborative care arrangements within older couples (Chan et al., 2023; Cheung et al., 2022).

To address these gaps, this study leverages ecological momentary assessment (EMA), a

method that captures real-time emotional responses at frequent intervals. By applying Response Surface Analysis (RSA), we aim to explore the nuanced effects of spousal emotional congruence and incongruence on solitude, with a particular focus on gender differences. This paper seeks to answer two core questions: (1) How does the alignment or misalignment of spouses' emotional states influence their experience of solitude? (2) How do gender differences shape these relationships? By addressing these questions, this study provides valuable insights into the emotional underpinnings of solitude and offers guidance for designing targeted interventions for older couples.

Methods

Participants and Procedures

The participants were older couples aged 60–100 years residing in Hong Kong SAR, China. Recruitment was conducted through regional elder service centers and neighborhood organizations. Eligible couples completed a baseline web-based questionnaire, followed by a 14-day EMA protocol and a 12-month follow-up survey.

To accommodate participants' technological familiarity, the EMA protocol was administered through a hybrid approach using WhatsApp and follow-up phone calls. At baseline, trained research assistants worked with each couple to establish individualized assessment times based on their daily routines. Participants recorded responses on printed EMA forms and submitted them by sending a photo via WhatsApp twice daily over 14 consecutive days. If a response was not received within one hour of the scheduled time, a research assistant placed a reminder call. Each entry took approximately 2-3 minutes and covered momentary affect, solitude, and stressor experiences.

Participants who completed fewer than 24 out of 28 EMA entries (i.e., <86% compliance)

were excluded from analysis, resulting in the removal of 10 couples (20 individuals) from the final analytic sample. This threshold was established to ensure the reliability of estimates in longitudinal mixed-effects and response surface models (Allison, 2003; Little, 1992). Of the retained participants (73 couples, 146 individuals), only 7 individuals had missing EMA entries requiring interpolation. In all such cases, no more than two prompts were missing per participant, and missing values were imputed using a conservative single-point linear interpolation approach to maintain temporal continuity without introducing bias.

Data collection occurred from November 2020 to August 2021. The study protocol was authorized by the Institutional Review Board of the University of Hong Kong. Written informed consent for publication of their clinical details was obtained from the participants.

Measures

Response variable

In this study, solitude was the response variable (Fang et al., 2022; Jiang et al., 2019). The solitude scale questionnaire includes the following item: "Do you feel solitude at the present moment?" Responses are rated on a scale of 1 to 5 as follows: "Not at all, A little, Moderate, Very, Completely". Higher scores indicate a stronger sense of solitude experienced by the participants at the current time.

Explanatory variables

Negative and positive affective experiences were measured using the Multidimensional Mood Questionnaire (Birditt et al., 2019; Pauly et al., 2018). The EMA questionnaire collected the current emotional states of the participants, including "sad, irritated, anxious, sleepy." Similarly, the average scores of the variables "happy, quiet, excited, calm" from the EMA data represent PA. Endpoint scores ranged from 1 to 5. The average scores of these variables are computed to

represent NA/PA, where higher scores indicate higher levels of emotional experiences in participants at the current moment (Chui et al., 2014).

Control variables

Control variables included participants' gender, year of birth, number of children, educational level, occupation, source of income, average monthly income, house ownership, activity of daily living, and instrumental activity of daily living (Liu et al., 2021). Family structure was assessed by the number of children (0, 1, 2, 3, ≥4). Socioeconomic indicators included educational level (no formal education, primary school, high school, college or higher), occupational status (unemployed, part-time), average monthly income (≤1,999 HKD, 2,000-4,999 HKD, 5,000-9,999 HKD, ≥10,000 HKD), and house ownership (public housing, privately owned property, rented, assisted ownership, and others). Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL) were assessed using the Barthel Index and the Lawton IADL Scale, respectively, with higher scores indicating greater functional difficulties (Leung et al., 2007; Sainsbury et al., 2005; Tong & Man, 2002).

Statistical Analysis

All analyses were conducted using R version 4.4.1 (2024-06-14 ucrt), RSA 0.10.6 version (Response Surface Analysis), and lavaan 0.6-18 version (Latent Variable Analysis). The main function of RSA compares several nested polynomial regression models and provides plotting functions for 3D wireframe surfaces. For missing data within the retained participants, linear interpolation was applied to fill in any missing values from the EMA responses. This approach helped minimize data loss while maintaining data continuity.

Modeling Approach and Performance

RSA is used to explore the congruence hypotheses, involving polynomial regression. The

advantage of RSA lies in its ability to visualize the results of polynomial regression in 3D, allowing us to understand how the dependent variable changes under various combinations of independent variables. RSA can also examine interactions without being limited by linear assumptions.

In this study, solitude in older individuals is considered as the response variable. Polynomial regression models are established with the individual's NA and their partner's NA as explanatory variables to investigate how the response variable changes when both explanatory variables simultaneously increase or decrease (congruent changes) and when they change in opposite directions (incongruent changes). Similarly, models are built using the individual's PA and their partner's PA as explanatory variables.

In the polynomial regression, the dependent variable is solitude, and the independent variables include the individual's NA/PA and its squared term, the partner's NA/PA and its squared term, as well as the cross-product term of the NA/PA of both spouses. By utilizing the surface value parameters a_1 to a_5 provided by RSA, the congruence or incongruence of negative/positive affective experiences between spouses and their impact on individual solitude can be assessed along the congruence and incongruence lines on the response surface.

RSA Parameters

Within the response surface plot, two lines are of particular interest: the Line of Congruence (LOC) and the Line of Incongruence (LOIC). The Line of Congruence comprises points where x and y are equal, forming a line on the xy plane at a 45° angle, representing the change in z value under congruent variations. The Line of Incongruence consists of points where x and y are opposite to each other, forming a line perpendicular to the Line of Congruence on the xy plane. The response surface corresponding to the Line of Congruence has $x=y$, where coefficient a_2 determines whether the response surface is a line or a curve, and a_1 determines the slope of the response surface. The

response surface associated with the Line of Incongruence has $x = -y$, where coefficient a_4 determines whether the response surface is a line or a curve, and a_3 determines the slope of the response surface. In this study, *x* represents the NA or PA of the older individual, and *y* represents the NA or PA of their partner.

Results

Descriptive Characteristics

The initial study data consisted of 166 older adults (83 couples), of which 146 participants (73 couples) met the study eligibility criteria and were selected for further analysis. The mean age was 77.6 years (SD = 6.9), and 50% were females. Overall, 91.1% had one or more children, 40.3% lived in public housing, and the mean score for ADL and IADL difficulties was 1.6 (SD = 3.6; range = 0-40) and 1.4 (SD = 2.8; range = 0-16), respectively. Tables 1 and 2 display the characteristics of older couples in our sample.

Effects of Emotional Congruence and Incongruence on Solitude

We evaluated our findings using the five surface test values (a_1, a_2, a_3, a_4, and a_5) provided by RSA. When NA was used as an explanatory variable, significant values of a_1, a_2, and a_3 were found in both women ($a_1 = 0.389$, $p < .001$; $a_2 = 0.360$, $p < .001$; $a_3 = 0.559$, $p < .001$) and men ($a_1 = 0.494$, $p < .001$; $a_2 = 0.333$, $p < .001$; $a_3 = 0.452$, $p < .001$) samples. This indicates that both congruence and incongruence in perceived NA between spouses lead to an increase in individual solitude. The significant a_2 value indicates that the line of congruence is quadratic. Additionally, the a_3 value for women was higher than that for men, suggesting that when women perceive NA to a greater extent than men, the impact of NA on their solitude is more pronounced (see Table 3 Panel 1, and Figure 2).

When PA was used as an explanatory variable, significant a_1 and a_4 values and a non-significant a_5 value were found for women (a_1 = -0.285, p <.001; a_4 = 0.429, p <.001; a_5 = -0.078, p = 0.129), indicating that particularly when women perceive PA more strongly than men, their solitude increases, demonstrating a strict dissimilarity effect. For men (a_1 = -0.224, p <.001; a_3 = -0.228, p <.001), significant a_1 and a_3 values were found, indicating that both congruence and incongruence in perceived PA between spouses lead to an increase in men's solitude (Table 3 Panel 2).

To aid interpretation, we visualized the RSA surfaces in Figure 2. For NA (Panels A and B), both men and women reported higher levels of solitude when either they or their partners experienced high NA. The curved surface indicates that even when both partners shared similar negative emotional states, solitude remained elevated. This suggests that emotional congruence alone does not provide protection against solitude when the shared emotional state is negative. Notably, this effect was more pronounced for women, as evidenced by the steeper slope in Panel A, indicating that women experience greater solitude under conditions of shared negative emotion.

In contrast, for PA (Panels C and D), both men and women reported the lowest levels of solitude when both partners shared high levels of PA. This illustrates the "buffering" effect of shared positive emotion, where emotional alignment in positivity can reduce feelings of solitude. However, when partners experienced a mismatch in PA—particularly when one partner felt positive and the other did not—solitude increased, especially for women (Panel C). This suggests that emotional misalignment in positive emotions can lead to feelings of emotional disconnection, even when both partners are physically present together.

Discussion

This study advances our understanding of the emotional dynamics within older couples, particularly by examining how the congruence and incongruence in spouses' perceptions of negative and positive affective experiences influence their perceptions of solitude. By employing RSA, we provide a nuanced exploration of these dynamics. Building on concordance theory, which emphasizes the importance of emotional alignment in mitigating psychological discomfort, this study highlights how spousal affective congruence and incongruence shape perceptions of solitude. While corroborating established associations—such as reduced solitude when both partners report high levels of positive affect—we further identified novel, gender-differentiated and nonlinear patterns that are not readily captured by traditional linear approaches. Specifically, incongruence in positive affect was associated with heightened solitude in women, but not in men, revealing an asymmetric susceptibility to emotional mismatch. These findings contribute to a more comprehensive understanding of how emotional alignment and misalignment impact solitude in older adults, offering new insights into the relational underpinnings of emotional well-being in later life.

Our study provides a novel contribution by exploring the nuanced gender differences in how emotional alignment impacts solitude (Asendorpf, 2010; Flora & Segrin, 2000; Luhmann & Hawkley, 2016). For men, solitude increased more sharply at lower levels of shared NA, whereas for women, solitude rose more acutely at higher levels of shared NA. Moreover, when women perceived themselves as experiencing more NA than their partners, their solitude escalated more rapidly, reflecting a heightened sensitivity to emotional mismatches. These findings reveal critical gender disparities in emotional regulation and support the concordance theory which posits that emotional alignment reduces cognitive dissonance and psychological discomfort (Mund & Johnson, 2021; Qian & Kan, 2024).

Our findings indicate that men exhibit lower immediate sensitivity to their spouse's emotional experiences compared to women. This observation aligns with previous research suggesting that men often internalize negative emotions, which can intensify feelings of loneliness when emotional congruence with their spouse is lacking (Carr & Utz, 2020; Mund & Johnson, 2021). Socialized to suppress emotional expression (Tamres et al., 2002), men may manage mild or moderate emotional discrepancies with relative detachment. However, under conditions of significant emotional misalignment, this suppression can lead to greater emotional distress, resulting in heightened loneliness (Meier et al., 2023; Nolen-Hoeksema, 2012). Additionally, studies have shown that men are generally less adept at navigating emotional discord within relationships, further exacerbating their vulnerability to loneliness when emotional alignment breaks down (Baek et al., 2021; Ermer & Proulx, 2019). These gender-specific responses highlight the need for tailored interventions that address the unique emotional coping mechanisms of men and women within older couples.

Our study found that women experience a sharper increase in solitude at higher levels of shared NA, particularly as the perception of NA intensifies. This heightened sensitivity to emotional mismatches may be attributed to the greater emotional expressiveness typically associated with women, who are often more attuned to emotional cues and place greater value on emotional intimacy and reciprocal emotional support (Asendorpf, 2010; Flora & Segrin, 2000; Mund & Johnson, 2021). Therefore, when women perceive significant emotional incongruence in the form of NA, it may lead to a sharper increase in solitude compared to men. This pattern reflects women's reliance on emotional connection as a key source of relational satisfaction, making them more vulnerable to the effects of emotional discord.

The relationship between PA and solitude is complex and exhibits significant gender

differences. When couples share positive emotions, their sense of solitude decreases, which aligns with concordance theory, as emotional alignment fosters relational harmony and reduces psychological discomfort (Mund & Johnson, 2021). However, when there is a discrepancy in the perception of positive emotions, especially at lower levels of PA, women's perceived solitude increases, highlighting their heightened sensitivity to emotional mismatches within relationships. This pattern underscores the critical role of emotional alignment in mitigating perceived relational isolation and suggests that women, more than men, rely on emotionally shared—not necessarily co-located—positive experiences as a key source of emotional connection and relational satisfaction. Men, on the other hand, experience a decrease in perceived solitude with an increase in lower-level positive emotions, suggesting that men may benefit from even minimal positive emotional alignment. When discrepancies in the perception of positive emotions occur at higher levels, both genders report an increase in solitude, though women remain more sensitive to these disparities (Asendorpf, 2010; Flora & Segrin, 2000; Luhmann & Hawkley, 2016).

This gender pattern indicates that men prioritize their own positive emotions during daily joys, while women experience increased solitude when their positive emotions are not reciprocated by their partners. The lack of shared joy or emotional communication highlights the critical role of emotional reciprocity in mitigating solitude, especially for women who value shared positive experiences for relational satisfaction (Asendorpf, 2010; Meier et al., 2023). Additionally, the regulation of emotional expressions, particularly emotional suppression, significantly impacts solitude within relationships. Emotional suppression adversely affects both partners, with spouses often exhibiting similar suppression behaviors. Notably, suppression by husbands is more detrimental to marital satisfaction than by wives, and wives are more sensitive to their partner's suppression and overall emotional similarity (Velotti et al., 2016). When positive emotions are not

reciprocated or partners do not engage with one another's affective state, women may feel emotionally isolated, exacerbating their solitude (Nolen-Hoeksema, 2012). Furthermore, high-intensity positive affect that is not mutually shared may lead to increased emotional incongruence, contributing to a pronounced rise in perceived solitude for both partners, with women showing heightened sensitivity to this mismatch.

Building on our findings, interventions aimed at reducing solitude in older couples should prioritize emotional alignment while accounting for gender-specific emotional processing patterns. For women, who are more sensitive to emotional mismatches, strategies like mindfulness-based stress reduction and reflective communication training can help reduce negative affect and improve relational harmony (Fang et al., 2022). Shared activities, such as gratitude exercises or collaborative hobbies, can enhance positive emotional alignment and strengthen relational bonds (Birditt et al., 2020). For men, who may be less responsive to emotional cues but vulnerable to emotional disconnection, tools like EMA can offer real-time feedback on emotional states, encouraging greater awareness and responsiveness to their partner's emotions (Lei et al., 2023; Zhang & Gou, 2022). Emotionally focused therapy can address relational challenges by promoting deeper emotional connection and improving both partners' ability to navigate emotional incongruence (Greaney et al., 2019). Clinicians and caregivers can integrate these approaches through dyadic counseling or structured psychoeducation sessions, especially during transitions such as retirement or caregiving onset. For policymakers, supporting community-based programs or telehealth interventions that foster emotional awareness and dyadic coping in older couples may serve as a preventive strategy to reduce late-life loneliness and its downstream health consequences. Importantly, solitude may arise not only from emotional mismatch but also from shared emotional strain. Interventions should therefore address both emotional disconnection and co-occurring

distress to fully support couples at risk.

Our study also has limitations. First, the sample is confined to older couples from Hong Kong, which may limit the generalizability of the findings to other cultural or demographic contexts. Future research should validate these findings across diverse cultural contexts to explore how cultural factors shape emotional dynamics in older couples. Second, to minimize participant burden, we measured NA/ PA using only eight items. While these items have proven reliable in capturing short-term emotional shifts, our findings might have been influenced by the limited selection of specific items. Future studies should adopt more comprehensive momentary affect assessment to capture a broader range of emotional experiences. Third, while EMA prompts were administered at fixed time intervals, the protocol did not record whether partners were physically co-present or at home at the time of each response. Although all participants were cohabiting, we cannot confirm momentary co-location during EMA completion. This is a potential limitation, as contextual factors like physical proximity and setting may influence momentary affect and solitude. Incorporating passive location sensing or co-presence markers in future research would strengthen inferences about the situational embeddedness of dyadic emotional processes.

Building on these considerations, future research should explore the long-term effects of emotional congruence on solitude and other mental health outcomes. In addition to examining relationship dynamics—such as conflict resolution, emotional support, and communication patterns—they deserve further attention, as they may moderate how emotional alignment impacts well-being among older couples (Chan et al., 2023; Cheung et al., 2022). Future studies should also examine whether the gendered effects of emotional congruence observed in individualistic societies generalize to collectivistic contexts, where relational harmony and interdependence norms may shape how solitude is experienced (Decuyper et al., 2012).

Conclusions

This study highlights the significant role of emotional congruence and incongruence in influencing solitude among older couples. By advancing the theoretical framework of concordance theory, our findings demonstrate its applicability in understanding the complex emotional dynamics within spousal relationships and their impact on solitude. The experience of shared negative emotions and their disparities may intensify feelings of solitude, particularly for women. Positive emotions, when shared, reduce solitude, but discrepancies may still lead to emotional distance. These findings suggest the need for interventions that foster emotional congruence and effectively manage emotional mismatches. By addressing these dynamics, interventions could not only mitigate solitude but also enhance relational satisfaction and emotional well-being, ultimately improving the quality of life for aging populations.

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Conflict of Interest

The authors declare no competing interests.

Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Author Contributions

N. J., K. C., and Y. X. contributed to conceptualization, literature review, data analysis, and wrote the original manuscript. V. W. Q. L., the corresponding author, contributed to the conception and suggestions of this study and supervised the whole research process. V. W. Q. L. conducted the baseline and EMA survey and contributed to the research strategy and data management. All authors read and approved the final manuscript.

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Table1. Demographic Characteristics

Characteristic	Mean (SD) or *N* (%)
Age in years	77.6(6.9)
Sex at birth	
Male	73(50)
Female	73(50)
Number of Children	
0	13(8.9)
1	29(19.9)
2	58(39.7)
3	26(17.8)
≥4	20(13.7)
Educational level	
No formal education received	28(19.2)
Primary school	62(42.5)
High school	42(28.8)
College or higher	14(9.6)
Occupational states	
Unemployed	143(97.9)
Part-time	3(2.1)
Average monthly income (HKD)	
≤1,999	11(7.5)
2,000-4,999	77(52.7)
5,000-9,999	39(26.7)
≥10,000	13(8.9)
Prefer not to disclose	6(4.1)
House ownership	
Public housing	59(40.4)
Privately owned property	51(34.9)
Rented accommodation	5(3.4)
Assisted home ownership	28(19.2)
Others	3(2.1)
ADL difficulties	1.6(3.6)
IADL difficulties	1.4(2.8)

Notes: *N*=146, in total 73 married couples. ADL = Activities of Daily Living; IADL = Instrumental Activities of Daily Living.

Table 2. Outcome and exposure variables at the prompt level

Variable	Women			Men		
	N	Mean	SD	*N*	Mean	SD
Solitude	2,044	1.344423	0.7376082	2,044	1.255382	0.6422438
NA	2,044	1.438112	0.5875070	2,044	1.339041	0.5192310
PA	2,044	2.677348	0.6997871	2,044	2.762476	0.7318306

Notes: *N*=146, in total 73 married couples. SD = standard deviation; NA = Negative affective experiences; PA = Positive affective experiences.

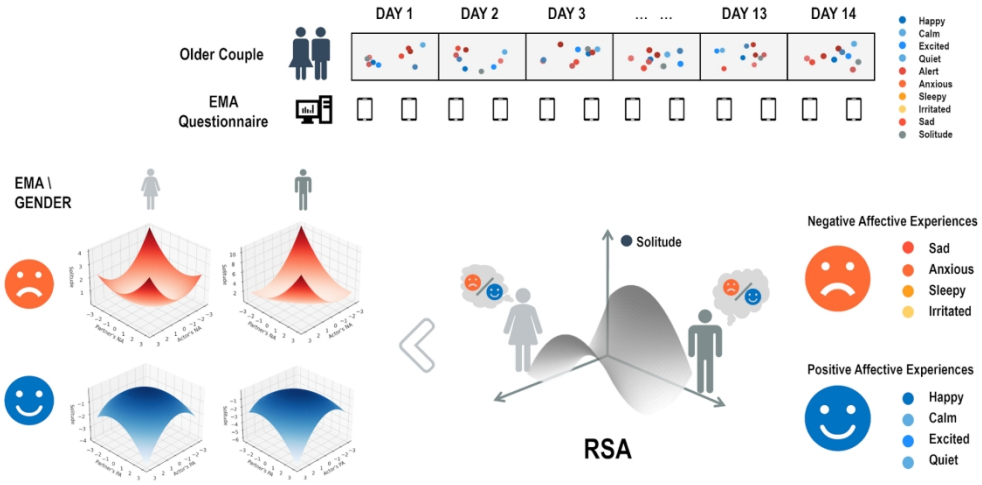
Table 3. Prediction of women's and men's solitude in actor's and partner's negative and positive affective experience

Parameter	Parameter estimates						
	Estimate	**SE**	**t**	***p***	**Surface values**		***p***
Panel 1. Negative affective experience							
Women							
Intercept	1.248	0.018	1.693	<.001			
NA							
A	0.474	0.046	0.377	<.001	a_1	0.389	<.001
P	-0.085	0.058	-0.060	.142	a_2	0.360	<.001
A^2	0.126	0.036	0.163	<.001	a_3	0.559	<.001
A×P	0.084	0.060	0.070	.158	a_4	0.191	.132
P^2	0.150	0.063	0.153	.017	a_5	-0.024	.739
Men							
Intercept	1.170	0.018	1.821	<.001			
NA							
A	0.473	0.052	0.382	<.001	a_1	0.494	<.001
P	0.021	0.039	0.020	.581	a_2	0.333	<.001
A^2	0.141	0.072	0.166	.050	a_3	0.452	<.001
A×P	0.094	0.075	0.090	.209	a_4	0.145	.357
P^2	0.098	0.042	0.146	.021	a_5	0.043	.590
Panel 2. Positive affective experience							
Women							
Intercept	1.273	0.020	1.726	<.001			
PA							
A	-0.065	0.033	-0.061	.049	a_1	-0.285	<.001
P	-0.221	0.035	-0.219	<.001	a_2	0.047	.122
A^2	0.080	0.031	0.075	.009	a_3	0.156	.011
A×P	-0.191	0.051	-0.150	<.001	a_4	0.429	<.001
P^2	0.158	0.043	0.144	<.001	a_5	-0.078	.129
Men							
Intercept	1.197	0.019	1.863	<.001			
PA							
A	-0.226	0.032	-0.257	<.001	a_1	-0.224	<.001
P	0.002	0.028	0.002	.942	a_2	0.074	.018
A^2	0.148	0.043	0.155	<.001	a_3	-0.228	<.001
A×P	-0.074	0.052	-0.066	.154	a_4	0.221	.032
P^2	0.000	0.030	0.000	.996	a_5	0.148	.003

Notes: *N*=146, in total 73 married couples. SE = standard error; A = actor; P = partner; NA = Negative affective experiences; PA = Positive affective experiences.

Figure 1. Study design. *N* = 73 married couples followed by 14 days of EMA(2/day).
Note. EMA = Ecological Momentary Assessment; RSA = Response Surface Analysis.
Alt Text: This infographic illustrates a 14-day EMA study of older couples, showing gender differences in affective responses using RSA, with solitude and emotional valence as key dimensions.

Figure 2. Associations between similarity in NA/PA and women's/men's solitude. All predictor variables were grand mean centered.
Note. NA = Negative affective experiences; PA = Positive affective experiences.
Alt Text: The four 3D-response surface plots show how actor–partner similarity in negative and positive affect relates to solitude in older couples, highlighting stronger effects of negative affective experiences for women.



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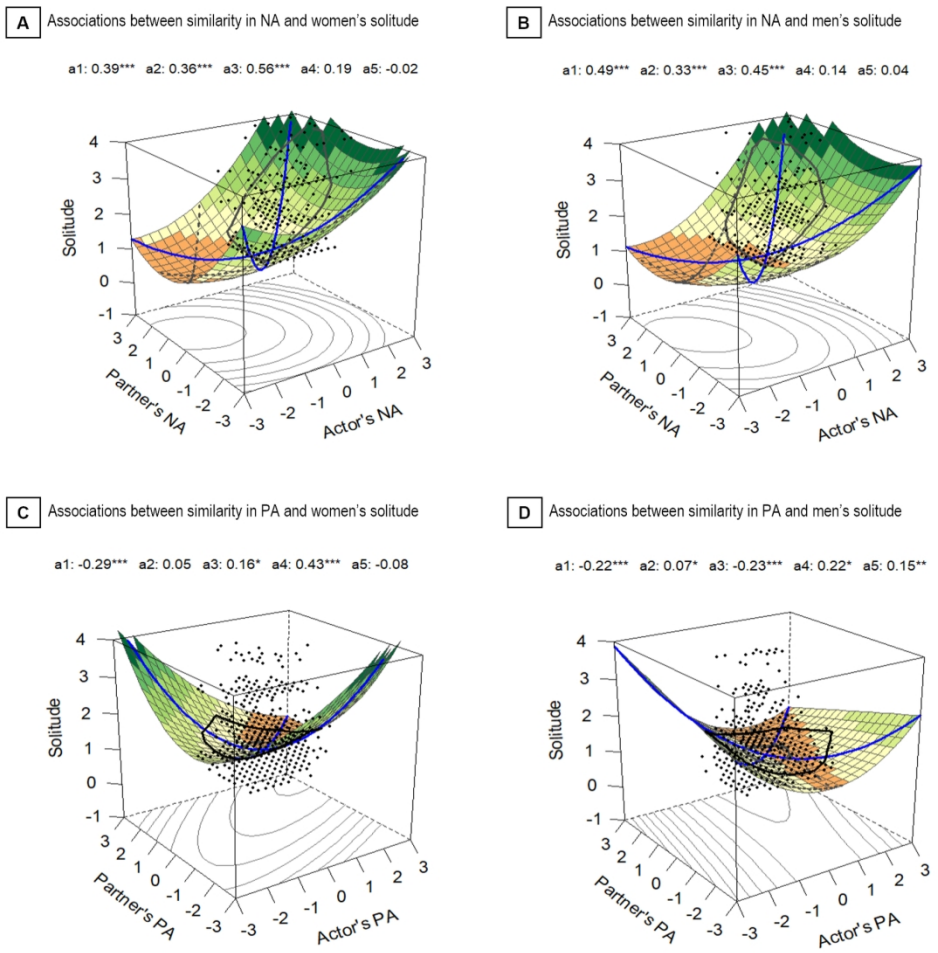
165x80mm (300 x 300 DPI)



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