

Compassion's Relational Nature: Ecological Momentary Assessment of the Three Flows of Compassion and Connection

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Abstract

Objectives

Compassion is recognized as a dynamic and relational process, yet most research has examined its three flows in isolation and as static, between-person constructs. Crucially, this has overlooked their relational nature which could be linked to perceived connection, a construct rooted in the same affiliative system. To address these gaps, this study employed an Ecological Momentary Assessment (EMA) approach to capture within-person fluctuations among the three flows (self-compassion, compassion to others, and compassion from others) and perceived connection, examining their dynamics at both contemporaneous and prospective levels.

Methods

A total of 152 adults (Mage = 28.47 years, SD = 11.54; 82.9% female) completed five EMA prompts per day over ten days, each assessing compassion flows and perceived connection using network analyses.

Results

The temporal network showed that self-compassion was positively associated to all remaining compassion flows as well as perceived connection prospectively. The contemporaneous network revealed positive partial correlations between all compassion flows and perceived connection. The between-person network showed that the compassion flows formed a fully connected structure.

Conclusions

Taken together, findings support the relational nature of compassion flows and highlight robust associations among variables both contemporaneously and across time, possibly reflecting a common affiliative motivational system. Self-compassion was the only node prospectively linked to all others, suggesting its relevance as a target for compassion-based interventions. Finally, individual variability in these patterns calls for idiographic approaches and points to promising avenues for future research.

Introduction

Although compassion has been conceptualized in various ways across theoretical frameworks and traditions (Strauss et al., 2016), it can be broadly understood as a sensitivity to suffering in oneself and others, coupled with a motivation to alleviate or prevent it (Gilbert, 2014). Such orientation toward suffering has long been recognized as inherently relational and social, both in contemplative traditions and, more recently, in secular research (Dunne & Manheim, 2023; Kirby et al., 2026; Quaglia et al., 2025). In this sense, compassion has been conceptualized as flowing in distinct yet interrelated directions: from

oneself to others (compassion to others), toward oneself (self-compassion), and from others to oneself (receiving compassion from others).

Meta-analytic evidence has consistently shown that self-compassion is associated with greater psychological wellbeing (Zessin et al., 2015), and reduced negative psychological outcomes (MacBeth & Gumley, 2012). Additionally, interventions explicitly cultivating self-compassion yield meaningful reductions in depression, anxiety, stress, and self-criticism (Ferrari et al., 2019). More broadly, compassion-based programs, such as Compassion-Focused Therapy (CFT; Gilbert, 2014), which aims to cultivate all three flows of compassion and reduce associated fears (Kirby, 2025), have also demonstrated significant benefits for wellbeing and reduced psychopathology (Brown & Ashcroft, 2025; Leaviss & Uttley, 2015). The majority of this evidence, however, reflects a partial view. Indeed, contemplative science has predominantly focused on self-compassion, while compassion to others and from others have been largely examined as separate constructs (Quaglia et al., 2021). This dualistic framing has overlooked the inherently interconnected nature of compassionate experience (Quaglia et al., 2025), in which no flow is fully separable from the others. The experience of receiving compassion from others, in particular, has remained comparatively understudied (Kirby et al., 2026).

Beyond this empirical gap, there is growing theoretical recognition that the three flows share common psychophysiological mechanisms, and that studying them in isolation may obscure how they interact and mutually influence one another. According to Gilbert's evolutionary framework, compassionate engagement across the three flows activates affiliative motivational systems oriented toward social bonding and care (Gilbert, 2014, 2020; Kirby, 2025). Specifically, compassionate motives stimulate the soothing system via parasympathetic activation, generating feelings of safeness, contentment, and calm that facilitate caring behavior and strengthen social connectedness (Förster & Kanske, 2022; Kirby, 2025).

Similarly to compassion, social connection has been consistently linked to psychological and physical wellbeing. Among its various conceptualizations (Baek et al., 2025), perceived connection, understood as the subjective sense of belonging to a larger whole, extending beyond close relationships to encompass others more broadly (Hagerty et al., 1993; Townsend & McWhirter, 2005), is particularly relevant to compassionate experience, as it captures the relational quality that compassion inherently implies. Higher levels of perceived connection are associated with greater happiness, resilience, and reduced depression and anxiety (Seppälä et al., 2013), and the absence of social connection has been linked to significantly increased mortality risk (Holt-Lunstad et al., 2015). Meta-analytic findings indicate that higher levels of self-compassion are associated with greater perceived social support and reduced loneliness (Wang & Lou, 2022), and intervention studies suggest that compassion training may increase social connectedness and prosocial behaviors (Hutcherson et al., 2008; Luberto et al., 2018). Furthermore, neurobiological research suggests that compassion activates affiliative brain systems related to social connectedness via oxytocinergic and vagal pathways, which are implicated in bonding, trust, and prosocial behavior (Di Bello et al., 2020; Förster & Kanske, 2022). Yet this relationship may also operate in the reverse direction: experiences of perceived connection, by activating the soothing system

and its associated sense of safeness, could in turn facilitate compassionate responding (Gilbert, 2020; Kirby et al., 2026). To the best of our knowledge, no empirical study has directly examined whether momentary perceived connection can predict subsequent compassionate responding.

Addressing this gap requires moving beyond the trait-level approaches that have dominated compassion research by employing within-person designs, such as Ecological Momentary Assessment (EMA). Preliminary efforts in this direction have confirmed the dynamic nature of self-compassion and meaningful within-person variability in daily life (Fraser et al., 2025). More recently, a small number of studies have investigated two compassion flows simultaneously, namely, self-compassion and compassion to others, highlighting the importance of their within-person interplay. Specifically, self-compassion was associated with greater wellbeing only when it co-occurred with compassion for others (Sahdra et al., 2023), and both flows jointly predicted momentary romantic attraction (Ciarrochi et al., 2024). However, to date, only one study has examined all three compassion flows concurrently in everyday life (Varley et al., 2024b). The study employed binary items to assess the presence of compassionate opportunities and actions along the three flows, and separate models for each flow, finding that attachment anxiety and avoidance predicted individual differences in the likelihood of reporting compassionate opportunities. However, the three flows were not examined as an interrelated dynamic system, and temporal associations between them were not examined, leaving the within-person interplay among the flows and their relationship with perceived connection unexplored.

Alongside the importance of within-person dynamics, individual differences are also known to shape access to compassionate responding, with transdiagnostic barriers such as fear of compassion and self-criticism shown to inhibit compassionate engagement across clinical and non-clinical populations (Gilbert et al., 2011; Kirby, 2025). Emerging research suggests that self-identification (i.e., the tendency toward rigid, self-referential processing) could be a transdiagnostic factor underlying a broad range of psychopathological processes (Giommi et al., 2023). Such rigid self-identification may be particularly relevant to compassionate engagement, which inherently requires shifting attention and motivational resources beyond habitual self-focused concerns toward suffering, bonding, and care (Abatista & Cova, 2023; Stellar et al., 2017). This construct has been recently operationalized by Soler et al. (2021, 2026), capturing the degree to which individuals experience hypo-identification with the self on three subscales (acceptance, decentering and non-attachment). To the best of our knowledge, the potential role of self-identification in shaping the within-person dynamics between compassion and perceived connection has not yet been investigated.

To address these gaps, we employed an EMA design together with network models to examine the dynamic interplay among the three flows of compassion and perceived connection in daily life, and whether self-identification predicted between-person variability in these dynamics. First, we hypothesized that the interpersonal flows of compassion (namely, compassion to others and compassion from others) would positively predict subsequent perceived connection, given that these flows directly engage the affiliative motivational system and its soothing-based orientation toward bonding and care (Gilbert, 2014, 2020). Second, we hypothesized that perceived connection would

positively predict subsequent levels of all three compassion flows, given that experiences of connection activate the soothing system and its associated caring motivational orientation, facilitating compassionate responding across all three flows (Gilbert, 2020; Kirby et al., 2026). Finally, we explored whether self-identification predicted individual differences in these dynamics, anticipating that the compassion-connection relationship would be more pronounced in individuals low in self-identification, given that rigid self-referential processing may compete with the outward, affiliative orientation that compassionate responding requires.

Method

Open Science Practice

This study is part of a broader longitudinal project preregistered on the Open Science Framework prior to data collection Open Science Framework, which received ethical approval from the Ethics Committee of XXX [BLINDED FOR REVIEW] (Ethical registration number: XXX [BLINDED FOR REVIEW]). The main hypotheses, design, and measures remained unchanged from the preregistration. However, the original statistical plan (separate univariate multilevel models with a single dependent variable per model) was replaced with multivariate multilevel network analysis (mIVAR), in which all variables are modelled simultaneously as both predictors and outcomes. This approach better captures the fluctuating and interconnected nature of compassion (Fraser et al., 2025; Quaglia et al., 2021, 2025) and avoids the need for multiple testing corrections. Additionally, the preregistered operationalization of momentary self-transcendence as a two-dimensional construct (connection and diminished self-salience) could not be supported due to statistical reasons. Since connection plays an important part in self-transcendence states (Abatista & Cova, 2023; Parola et al., 2026; Yaden et al., 2017), only the momentary perceived connection item was retained and analyzed in this study. Finally, the exclusion criterion related to significant exposure to the November 2024 floods (see **Participants**) was not part of the original preregistration, as this unforeseen event occurred after the study had been preregistered. The criterion was introduced prior to data collection to minimize the potential confounding impact of acute trauma exposure.

Participants

Participants were eligible if they were adults (between 18 and 65 years old), resided in Spain, and had high Spanish proficiency (native or $\geq$ C1 level). Exclusion criteria were: (a) history or current diagnosis of a severe mental disorder (e.g., psychotic, bipolar disorder), and (b) significant exposure to the severe floods that affected the XXX [BLINDED FOR REVIEW] region in November 2024, shortly before data collection began, given the potentially acute traumatic impact of this event on affected individuals.

Of 170 initially enrolled participants, 18 were excluded for completing fewer than 75% of EMA prompts, resulting in a final sample of 152 participants. The overall compliance rate exceeded 90%, well above the average compliance typically reported in EMA studies (Wrzus & Neubauer, 2023). Although the original sample size calculation was conducted for multilevel mixed-effects models based on comparable EMA

studies (e.g., Colombo et al., 2021; Sahdra et al., 2023), the analytical approach was subsequently refined to mIVAR. For mIVAR, adequate estimation of individual-level parameters requires a minimum of 20 valid observations per participant (Blanchard et al., 2023). All retained participants exceeded this threshold, given that the 75% completion criterion corresponded to a minimum of approximately 37 valid responses per participant out of 50 scheduled prompts. Participants had a mean age of 28.47 years ($SD = 11.54$), the majority identifying as female (82.9%) and of White or European ethnic origin (91.5%). Most had completed undergraduate education or above (67.1%) and were either students (55.9%) or employed (31.6%). Full demographic details are reported in **Supplementary Material S1**.

Procedure

Recruitment was conducted through online advertisement such as posts on academic and psychology-focused platforms (e.g., university website) and social media (e.g., Instagram, LinkedIn) and advertisements at the university campus. In both cases, individuals accessed study information through a QR code or link directing them to a Qualtrics survey, where they could read details about the study and complete an initial eligibility screening. The study was conducted entirely online. Prior to enrollment, eligible participants provided informed consent.

Before the EMA phase, participants watched a brief explanatory video on the theory behind the three flows of compassion and concrete examples from daily life, designed to avoid confusion about compassion with related concepts such as pity or kindness (Cole-King & Gilbert, 2014; Gilbert, 2014; Gilbert et al., 2019; Kirby et al., 2022). This introduction also served to support construct validity and ensure a shared understanding of the EMA items, as recommended in experience sampling research (Fritz et al., 2024). Afterward, the participants completed a comprehension quiz to verify adequate understanding of the three flows of compassion, with a minimum score of 75% required to proceed. All participants met this threshold. Then, they completed a battery of baseline questionnaires and were subsequently instructed on how to install and use the GDPR-compliant EMA app *m-Path* (Mestdagh et al., 2023; <https://m-path.io>).

The EMA phase lasted 10 days, a duration consistent with similar previous EMA studies (e.g., Colombo et al., 2021; Sahdra et al., 2023). Participants received five semi-randomized prompts per day between 9:00 a.m. and 10:00 p.m., delivered randomly within fixed two-hour time windows. Participants were required to respond within one hour of receiving the notification. Responses submitted after this window were recorded as missing. Compliance was encouraged through monetary compensation of €15. Throughout the study, participants had access to the contact information of the researcher responsible for data collection, whom they could reach regarding any technical issues, psychological concerns, or other doubts arising during participation.

Measures

Baseline measures

Self-identification. The Delusion of Me (DoM; Soler et al., 2021) reflects the degree to which individuals experience hypo-identification with the self. The construct has demonstrated adequate reliability in general population and clinical samples (Soler et al., 2021, 2026). DoM integrates three closely related components, each assessed by a validated self-report measure: (1) acceptance measured by the *non-judging* subscale of the *Five Facet Mindfulness Questionnaire* (FFMQ; Baer et al., 2006; Spanish validated version: Cebolla et al., 2012); (2) decentering measured by the *Experiences Questionnaire* (EQ; Fresco et al., 2007; Spanish validated version: Soler et al., 2014); and (3) non-attachment measured by the *Non-Attachment Scale* (NAS-7; Sahdra et al., 2010; Spanish validated version: Feliu-Soler et al., 2016). A composite DoM score was computed by standardizing and averaging the three subscales, such that higher DoM scores reflect greater acceptance, decentering, and non-attachment (lower self-identification). The DoM score demonstrated excellent internal consistency in the present sample ($\alpha = .90$, $\omega = .92$), consistent with the validation study ($\omega = .95$; Soler et al., 2021). See **Supplementary Material S2** for full scoring details and subscale-level psychometric properties.

Ecological momentary assessments

Compassion. The three flows of compassion were assessed using single items. Two items assessing self-compassion and compassion to others were adapted from Sahdra et al. (2023): "Since the last notification, to what extent have you treated yourself with tolerance and care?" and "Since the last notification, to what extent have you treated others with tolerance and care?", respectively. A third item was developed for the present study to capture the third flow of compassion, receiving compassion from others, following the same wording style and format as the Sahdra et al. (2023) items: "Since the last notification, to what extent have you been open to accepting others treating you with tolerance and care?". All items were rated on a visual analogue scale from 0 (*Not at all*) to 100 (*Very much*),

Perceived Connection. Perceived connection was assessed with a single item based on Brown and Leary's theoretical framework (2016), adapted from the connection item of the *Nondual Awareness Dimensional Assessment-State* (NADA-S; Hanley et al., 2018). The original item was rephrased to replace language specific to contemplative experience with more accessible wording suitable for a general population in daily life contexts: "Since the last notification, to what extent have you felt part of a whole and connected to others?". The item was rated on a 7-point Likert scale (1 = *not at all* to 7 = *completely*).

Statistical Analysis

Multilevel vector autoregressive (mIVAR) models were estimated using the *mIVAR* package (Epskamp et al., 2018) in R (v4.4.2; R Core Team, 2024), and statistical significance was set at $p < .05$. mIVAR simultaneously estimates three network structures: a *temporal network* of directed lagged effects between variables (lag-1), a *contemporaneous network* of within-assessment partial correlations after accounting for lagged effects, and a *between-individuals network* based on participants' trait-level means.

After checking the mIVAR assumptions (e.g., stationarity, multivariate normality and equidistance in the assessment intervals), population-level effects and individual-level random slopes were estimated using the *lmer* estimator. The model included four nodes, specifically: self-compassion, compassion to others, compassion from others and perceived connection. Full details of assumption checks and model specification are reported in **Supplementary Material S3**.

To examine whether self-identification predicted individual differences in temporal dynamics, subject-specific random slopes from the temporal network were extracted for six theoretically relevant lagged associations. These random slopes were then regressed on self-identification to test whether this baseline characteristic was associated with deviations from the average temporal effects. Specifically, we examined lagged effects (1) from perceived connection to self-compassion, (2) from perceived connection to compassion to others, (3) from perceived connection to compassion from others, (4) from self-compassion to perceived connection, (5) from compassion to others to perceived connection, and (6) from compassion from others to perceived connection. All regression analyses were evaluated using an alpha level of .05.

Results

The overall compliance rate was excellent, with 93.92% of EMA assessments completed (SD = 0.05; range: 76–100%), yielding 7,138 out of 7,600 possible observations. Table 1 summarizes descriptive statistics for all baseline and EMA variables.

Table 1
Descriptives of baseline and EMA Variables

Baseline variable	M (SD)	Range	
Self-identification	87.03 (14.17)	24–127	—
EMA Variables	Between-Person M (SD)	Within-Person Mean SD	ICC
Self-compassion	76.97 (13.25)	13.68	0.43
Compassion to others	79.33(13.10)	13.94	0.41
Compassion from others	78.25 (16.10)	12.86	0.55
Perceived connection	3.90 (1.09)	1.14	0.45
<i>Note.</i> M = Mean; SD = Standard Deviation; ICC = Intraclass Correlation Coefficient. Self-identification (DoM) scores are reported as raw summed scores for descriptive interpretability; all analyses were conducted on the standardized composite (mean of the three z-scored subscales), as described in the Measures section.			

Assumption checks indicated some degree of non-stationarity and non-normality across participants. Although mIVAR assumes stationarity and normality, violations of these assumptions are common in

EMA data and have been acknowledged as an inherent limitation of the modeling framework rather than a fundamental barrier to its application (Epskamp et al., 2018).

mlVAR networks

Non-detrended and detrended models were estimated, where detrending refers to the correction of systematic increases or decreases in scores over the course of the study. Both models produced highly similar results, differing only in two temporal paths and one between-person path. Main results are therefore reported using non-detrended data, as its interpretation is more intuitive. The detrended output and a description of these differences are provided in **Supplementary Material S5**. Temporal, contemporaneous, and between-person networks, as well as the standard deviation networks for the temporal and contemporaneous effects are presented in **Fig. 1**.

Figure 1

Non-detrended mlVAR Network Results for the Three Flows of Compassion and Perceived Connection

Note

Blue lines represent positive associations, and line thickness reflects association strength. The edge weights displayed alongside each line represent regression coefficients (β) in the temporal network and partial correlations (r) in the contemporaneous and between-person networks. In the temporal network (panel a), directed arrows indicate lagged effects from time $t - 1$ to time t , and curved self-loops represent autoregressive effects from time $t - 1$ to time t . The contemporaneous network (panel b) and between-person network (panel c) display undirected partial correlations. Panels d and e show the random-effects SD networks for the temporal and contemporaneous networks, respectively. Grey line thickness reflects the magnitude of the standard deviation of each edge across individuals, indicating the degree of heterogeneity in that association across participants.

Node labels: 1 = self-compassion; 2 = compassion to others; 3 = compassion from others; 4 = perceived connection.

Temporal Network

The temporal network (Fig. 1a) showed a relatively sparse pattern of lagged associations among the four variables. The strongest temporal effect was an autoregressive path of perceived connection ($\beta = 0.26$), followed by self-compassion ($\beta = 0.23$) indicating moderate within-person stability from one assessment to the next. Smaller positive autoregressive effects were also observed for compassion from others ($\beta = 0.14$) and compassion to others ($\beta = 0.13$).

Across variables, only a few cross-lagged effects emerged. The clearest cross-lagged association was a reciprocal loop from self-compassion to compassion from others ($\beta = 0.08$) and from compassion from

others to self-compassion ($\beta = 0.10$). There was another significant cross-lagged effect from self-compassion to compassion to others ($\beta = 0.09$). Finally, smaller effects were found from self-compassion to perceived connection ($\beta = 0.04$), and vice versa from perceived connection to self-compassion ($\beta = 0.05$) and from perceived connection to compassion to others ($\beta = 0.04$). In the detrended data, an additional association from perceived connection to compassion from others ($\beta = 0.03$) and a negative association between connection and compassion to others ($\beta = -0.06$) emerged.

Contemporaneous Network

The contemporaneous network (Fig. 1b) was a fully connected network (i.e., every node was connected to all other nodes) showing strong positive partial correlations among the compassion variables. The strongest association was between compassion to others and compassion from others ($r = 0.38$), followed by associations between self-compassion and compassion from others ($r = 0.30$). Other weaker associations were found between perceived connection and self-compassion ($r = 0.16$), perceived connection and compassion to others ($r = 0.19$), perceived connection and compassion from others ($r = 0.15$), and between compassion to others and self-compassion ($r = 0.17$).

Between-Person Network

The between-person network (Fig. 1c) displayed strong and coherent trait-level associations among the compassion constructs. Specifically, all three compassion variables (self-compassion, compassion to others, and compassion from others) formed a *clique*: a fully connected subset of nodes in which every variable was directly and quite strongly associated with each other. The strongest association was between self-compassion and compassion from others ($r = 0.56$). The next strongest association in the *clique* was between compassion from others and compassion to others ($r = 0.41$), followed by the association between self-compassion and compassion to others ($r = 0.36$). No association was observed between perceived connection and any of the three flows of compassion. Note that the self-compassion and compassion from others association was absent in the detrended model (see **Supplementary Material S5**).

Random-Effects Networks (Individual Variability)

The random-effects SD networks (Fig. 1d-e) indicated heterogeneity across participants in both temporal and contemporaneous associations, with most edge SDs ranging between .03 and .19, indicating that the strength and direction of several associations varied between individuals.

In the temporal network, the largest variability was observed for autoregressive paths ($SDs = .18-.19$). Cross-lagged paths also showed variability, including paths that were non-significant at the population level: the lagged effect of compassion from others on compassion to others ($SD = .15$), the lagged effect of compassion to others on perceived connection ($SD = .06$), the lagged effect of compassion to others on self-compassion ($SD = .07$), and the lagged effect of compassion from others on perceived connection ($SD = .07$) and vice versa ($SD = .03$). In the contemporaneous network, the greatest heterogeneity was observed among the three compassion variable associations ($SDs = .14-.18$).

Self-identification and Temporal Dynamics: Individual Differences in Connection-Compassion Associations

Baseline DoM scores were not significantly associated with any of the six examined person-level temporal slopes (full results are reported in Table 2).

Table 2
Self-identification (DoM) as a Predictor of Individual Differences in Temporal Network Slopes

Pathway (predictor → outcome)	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	95% CI	<i>R</i> ²
Perceived connection → self-compassion	.000	.005	.09	.929	[– .009, .010]	.000
Perceived connection → c. to others	.000	.005	.03	.978	[– .009, .010]	.000
Perceived connection → c. from others	–.003	.002	–1.24	.216	[– .007, .002]	.010
Self-compassion → Perceived connection	.002	.001	1.41	.162	[– .001, .004]	.013
C. to others → Perceived connection	–.002	.003	–.82	.413	[– .008, .003]	.004
C. from others → Perceived connection	.004	.005	.80	.426	[– .006, .013]	.004
<i>Note.</i> <i>B</i> = unstandardized regression coefficient; <i>SE</i> = standard error of the regression coefficient; <i>t</i> = <i>t</i> -statistic; <i>p</i> = <i>p</i> -value; CI = confidence interval; <i>R</i> ² = coefficient of determination; C. to others = compassion to others; C. from others = compassion from others.						

Discussion

The present study examined the dynamics between the three flows of compassion and perceived connection in daily life using an EMA design and multilevel network approach. Overall, the results revealed a more complex picture than anticipated.

Our first hypothesis, that interpersonal compassion flows (compassion to others and from others) would predict perceived connection over time, was not supported. Notably, however, self-compassion did show a small but significant temporal effect on perceived connection, suggesting that while interpersonal compassion does not predict perceived connection prospectively, intrapersonal compassion may do so. One possible interpretation of this result is that compassion to others and from others are relational, so they arise within interpersonal contexts and may therefore reflect or co-occur with perceived connection rather than being its antecedents. Self-compassion, instead, operates independently of relational context and may serve as a facilitative intrapersonal process. Specifically, by activating the soothing and affiliation system (Gilbert, 2010), self-compassion may foster the physiological and psychological

conditions for openness toward the shared human condition, thereby facilitating a prospective sense of belonging and perceived connection (Neff & Seppälä, 2016). Although prior work has consistently linked self-compassion to social connectedness and relational well-being (Lathren et al., 2021; Neff et al., 2007), this evidence has been largely cross-sectional or experimental, without establishing temporal patterns. The present findings tentatively extend this literature by suggesting that self-compassion may also operate prospectively, preceding and potentially facilitating the emergence of perceived connection.

Our second hypothesis, that perceived connection would predict all three compassion flows over time, was partially supported. Specifically, perceived connection predicted subsequent compassion to others and subsequent self-compassion. To our knowledge, this provides the first evidence that momentary perceived connection facilitates subsequent compassionate responding both toward oneself and toward others, consistent with the notion that connection nurtures a shared affiliative-soothing system underlying both forms of compassion (Gilbert, 2014; Kirby, 2025). This finding, combined with the reverse pathway found in our first hypothesis (self-compassion predicting subsequent connection), suggests a reciprocal temporal relationship between self-compassion and perceived connection, in which each may reinforce the other over time. The temporal association between perceived connection and compassion received from others did not reach significance in the primary model. A possible explanation is that openness to receiving compassion from others depends more on specific interpersonal events occurring within the observation window than on one's broad momentary sense of perceived connection, and whether such interactions occur depends on external circumstances rather than internal state. Across all significant paths, the temporal effects were small in magnitude, consistent with the pattern of modest within-person associations typically observed in EMA research (Fraser et al., 2025).

Interestingly, alongside the temporal network, the contemporaneous network revealed small partial correlations between perceived connection and all three compassion flows, indicating that moments of heightened perceived connection tend to co-occur with greater compassion. This is consistent with the theoretical proposition that compassion and connection are both expressions of the soothing and affiliative motivational system (Gilbert, 2014; Kirby, 2025), and with EMA evidence showing that self- and other-compassion can co-occur positively within persons in daily life (Sahdra et al., 2023). Experimental studies have shown that inducing compassion through brief exercises increases connectedness and positive affiliative affect (Hutcherson et al., 2008; Kirschner et al., 2019), further supporting an empirical link between compassion and perceived connection. To the best of our knowledge, no EMA research to date has examined directly the within-person, moment-to-moment relationship between compassion and perceived connection. Ciarrochi and colleagues (2024) offer the closest parallel, showing that within-person fluctuations in compassion toward self and others co-occurred with fluctuations in romantic attraction at the same assessment moment, a pattern consistent with our findings albeit in a more specific interpersonal context. Interestingly, they found individual variability in the strength of this link, suggesting that the relationship between compassion and interpersonal experience may be person-specific rather than uniform. While lagged effects were small and observed only along certain pathways, contemporaneous associations were present across all three compassion flows and their relationship

with perceived connection. This suggests that compassion-connection dynamics may operate primarily at a timescale shorter than the two-hour interval between assessments.

Our third hypothesis, that self-identification would predict individual differences in compassion-connection temporal dynamics, was not supported. Self-identification did not significantly predict any of the six examined person-level temporal slopes, suggesting that the strength and direction of compassion-connection lagged associations were not shaped by individuals' tendency toward rigid self-referential processing. To our knowledge, self-identification has not been previously examined as a predictor of within-person compassion-connection dynamics in EMA research, making direct comparison with existing literature difficult. This null finding is, however, consistent with emerging evidence suggesting that dispositional traits do not always account for individual differences in within-person dynamics (e.g., Biehler & Naragon-Gainey, 2022; Mey et al., 2020). For instance, dispositional self-compassion did not moderate within-person mindfulness-wellbeing associations in daily life (Biehler & Naragon-Gainey, 2022), indicating that other complex, context-dependent factors may better explain such variability. Notably, the mIVAR random-effects SD network indicated individual variability in temporal associations, suggesting that other individual-level characteristics, whether dispositional, contextual, or relational, may better account for these person-specific patterns.

Beyond the specific hypotheses of this study, some interesting insights emerged from the network analyses. In the temporal network, self-compassion emerged as the node with the greatest prospective influence, being the only variable to predict all three other nodes and showing a reciprocal relationship with compassion received from others. Specifically, this loop may reflect a mutually reinforcing dynamic: self-compassion, by activating the soothing system and generating a sense of internal safety, may reduce fears of received compassion and lower defensive self-referential barriers, thereby increasing openness to receiving care from others (Gilbert, 2014; Kirby et al., 2019; Varley et al., 2024a). In turn, the experience of receiving compassion from others may further consolidate self-compassionate states, as being treated with warmth and care by others may reinforce one's capacity to extend similar warmth toward oneself, consistent with developmental accounts suggesting that early experiences of receiving compassion from caregivers lay the foundation for self-compassion across the lifespan (Kirby, 2025).

Finally, at the between-person level, the three compassion flows formed a *clique* in the non-detrended model, suggesting that compassion functions as a unified relational orientation at the trait level, extending previous findings of only partial intercorrelations among the flows (Kirby et al., 2019). It should be noted, however, that this structure was not fully replicated in the detrended model, in which the direct association between self-compassion and compassion from others was absent, suggesting that the *clique* may be partly driven by shared linear trends rather than stable trait-level covariation, and should be interpreted with caution. Nonetheless, the consistent association of compassion to others with both remaining flows across both models provides partial empirical support for theoretical accounts arguing that the three flows are inherently interdependent (Kirby et al., 2026; Quaglia et al., 2025).

Strengths and limitations

This study presents several strengths. First, to our knowledge, this is the first EMA study to examine the within-person dynamics of all three compassion flows simultaneously using multilevel network analysis, consistent with theoretical accounts of compassion as an inherently relational and interdependent construct (Kirby et al., 2026; Quaglia et al., 2025). Second, participants received psychoeducation on the three compassion flows to support construct validity and shared understanding of the items (Fritz et al., 2024). Third, the study achieved a high compliance rate of 93.92%, above the average reported in EMA self-compassion research (Fraser et al., 2025), supporting data quality and reducing concerns about missingness bias. Finally, the study was preregistered prior to analysis, and all materials were shared openly in line with open science practices, enhancing transparency and replicability.

However, some limitations should be acknowledged. First, the small temporal cross-lagged effects should be interpreted cautiously rather than as indicative of absent relationships. Two methodological factors may have contributed to their magnitude. The two-hour interval between assessments may not have been sufficiently fine-grained to capture rapid compassion-connection dynamics (Epskamp et al., 2018; Jordan et al., 2020), as suggested by the stronger contemporaneous associations observed in the present study. Additionally, in mIVAR models variance in each node is simultaneously distributed across all lagged predictors, which tends to attenuate individual parameter estimates (Epskamp et al., 2018). Second, the sample consisted predominantly of young, Spanish-speaking, educated women, which, while reflecting a common demographic in EMA compassion research (Fraser et al., 2025), limits generalizability to more diverse populations. Third, all EMA constructs were assessed using single items, which limits construct validity relative to multi-item scales. However, single-item measurement is common practice in EMA research given the need to minimize participant burden across repeated assessments (Fritz et al., 2024), and previous studies assessing compassion variables demonstrated that single-item compassion measures can meaningfully capture the constructs of interest while maintaining acceptable reliability in daily life contexts (Sahdra et al., 2023). Fourth, the compassion items assessed a specific affiliative-caring facet of the construct (e.g., treating oneself or others with tolerance and care, and openness to receiving tolerance and care from others) rather than the full compassion construct, which also encompasses noticing and being moved by suffering and the motivation to alleviate it (Gilbert, 2014). This operationalization differs from prior EMA approaches that assessed compassionate opportunities and actions (Varley et al., 2024b) and may not fully capture the breadth of compassion as theorized. Finally, despite the use of lagged associations, the observational nature of the design does not allow causal inference, and directional interpretations remain tentative.

Future directions and clinical implications

The present findings open several avenues for future research. First, as the contemporaneous associations suggest that compassion-connection dynamics may unfold at timescales shorter than the two-hour assessment interval, future studies employing more intensive sampling strategies, such as shorter inter-prompt intervals or burst sampling designs (e.g., Wooldridge et al., 2025), would allow the temporal resolution of these dynamics to be examined more precisely. Second, the heterogeneity in random effects indicates that meaningful individual differences in compassion-connection dynamics

exist beyond what self-identification could explain. Consistent with EMA evidence showing that compassion dynamics are not uniform across individuals (Ciarrochi et al., 2024; Sahdra et al., 2023), future research should explore alternative moderators, including contextual factors, attachment style, and fears of compassion. A further methodological advance would be to assess potential moderators in real time via EMA to capture their within-person variability rather than relying solely on baseline trait measures. Third, given self-compassion's role as the primary prospective node in the temporal network, future intervention studies could test whether compassion-based practices (e.g., compassionate imagery, loving-kindness meditation) produce downstream increases in perceived connection and interpersonal compassion, thereby examining the temporal sequence suggested by the present findings under controlled experimental conditions.

From a clinical standpoint, the present findings highlight the potential value of idiographic approaches for compassion-based interventions. Group-level network analyses are useful for identifying general tendencies across individuals, but the random effects heterogeneity underscores that many individuals deviate from these population-level averages, a concern that aligns with broader methodological arguments about the limits of applying nomothetic findings to individual cases (Fisher et al., 2018; Hayes et al., 2019). Applying network analysis at the individual level would allow clinicians to map the specific compassion-connection dynamics of a given client, potentially identifying whether self-compassion is functioning as a temporal resource or whether received compassion is disconnected from the broader system, patterns that may indicate blocks or resistances to compassionate experience (Gilbert, 2014) and that could serve as intervention targets. This aligns with process-based approaches in clinical psychology that emphasize understanding the individual's functional patterns rather than applying group-derived norms (Hayes et al., 2019; Hofmann & Hayes, 2019), already suggested by Ferrari and her colleagues (2022) regarding Neff's self-compassion specific subscales. Finally, the reciprocal dynamic between self-compassion and received compassion identified in the temporal network has direct relevance for compassion-based interventions. Specifically, it suggests that experiences of receiving compassion, whether in the therapeutic relationship, dyadic exercises, or group-based compassion programs, may consolidate and reinforce self-compassion, and vice versa. This points to the relational context of compassion cultivation as a clinically meaningful lever. Clinicians working to foster self-compassion should also attend to whether clients are able to openly receive compassion from others, as the two flows appear to mutually reinforce each other in daily life (Kirby, 2025; Kirby et al., 2026).

Declarations

Competing Interests

MW is a trained mindfulness and self-compassion teacher. The remaining authors have no relevant financial or non-financial interests to disclose.

Author Contribution

GP: Conceptualization, Data curation, Investigation, Methodology, Project administration, Visualization, Writing- original draft and Writing - review & editing. AJM: Data curation, Formal analysis, Methodology, Validation, Visualization and Writing – review & editing. DC: Conceptualization, Formal analysis, Methodology, Project administration, Supervision and Writing – review & editing. EE: Conceptualization, Methodology, and Writing – review & editing. RB: Supervision and Writing – review & editing. MW: Conceptualization, Funding acquisition, Methodology, Project administration, Supervision and Writing – review & editing.

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Data Availability

The study was preregistered at <https://osf.io/s54ex/>. The dataset and R code generated and analyzed during the current study are available in the OSF repository in an open-access file, folder: “Compassion’s Relational Nature”, <https://osf.io/uwb45/files/osfstorage>.

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Figures

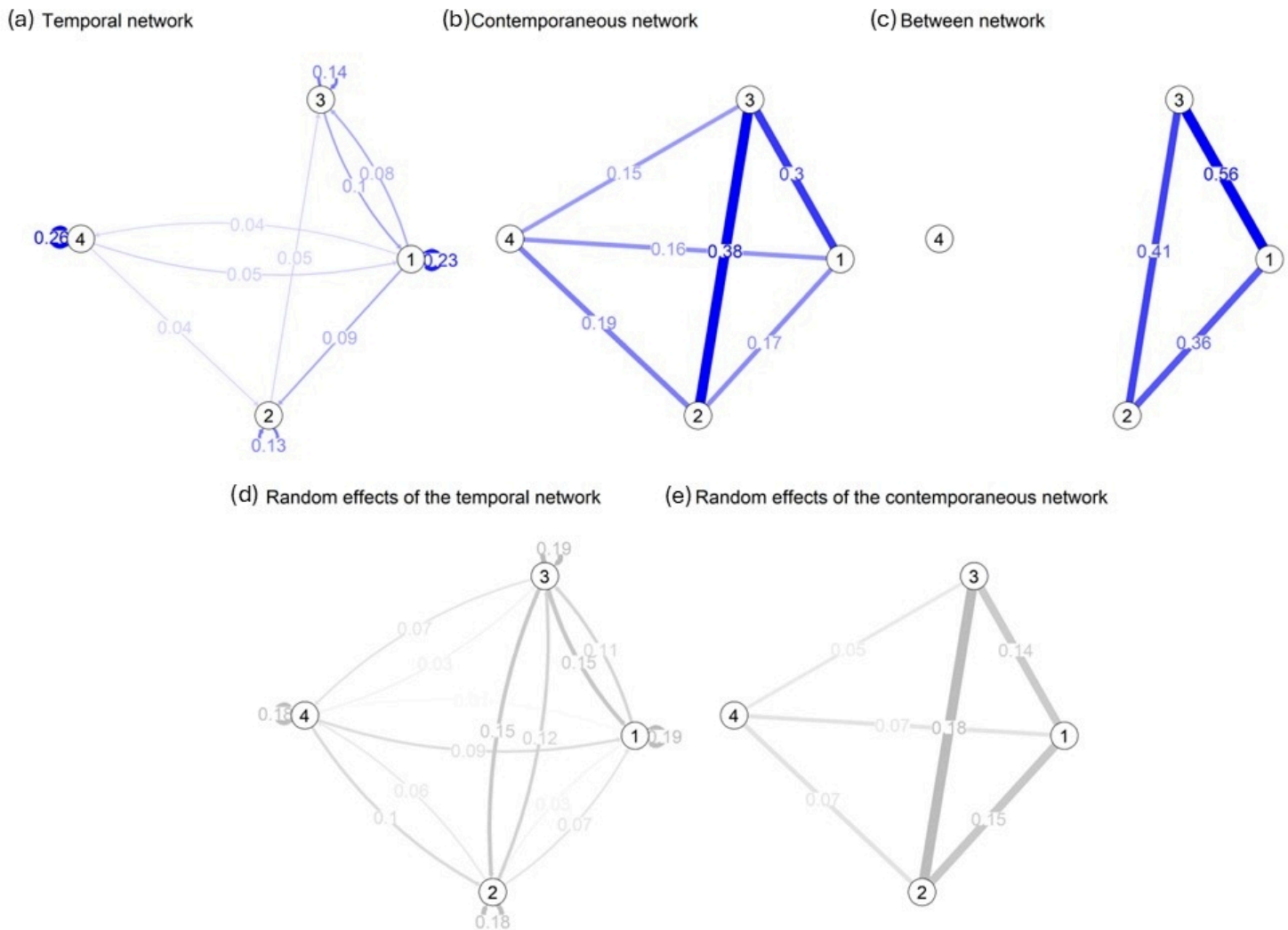


Figure 1

Non-detrended mIVAR Network Results for the Three Flows of Compassion and Perceived Connection

Note. Blue lines represent positive associations, and line thickness reflects association strength. The edge weights displayed alongside each line represent regression coefficients (β) in the temporal network and partial correlations (r) in the contemporaneous and between-person networks. In the temporal network (panel a), directed arrows indicate lagged effects from time $t - 1$ to time t , and curved self-loops represent autoregressive effects from time $t - 1$ to time t . The contemporaneous network (panel b) and between-person network (panel c) display undirected partial correlations. Panels d and e show the random-effects SD networks for the temporal and contemporaneous networks, respectively. Grey line thickness reflects the magnitude of the standard deviation of each edge across individuals, indicating the degree of heterogeneity in that association across participants.

Node labels: 1 = self-compassion; 2 = compassion to others; 3 = compassion from others; 4 = perceived connection.

Supplementary Files

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