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Well-being Correlates of Perceived Positivity Resonance: Evidence from Trait and Episode-Level Assessments

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Abstract

Positivity resonance is a type of interpersonal connection characterized by shared positivity, mutual care and concern, and behavioral and biological synchrony. Perceived positivity resonance is hypothesized to be associated with well-being. In three studies (N = 175; N = 120; N = 173), perceived positivity resonance was assessed at the trait level (Study 1) or the episode level, using the Day Reconstruction Method (Studies 2 and 3). Primary analyses reveal that perceived positivity resonance is associated with flourishing mental health, depressive symptoms, loneliness, and illness symptoms. These associations largely remain statistically significant when controlling for daily pleasant emotions or social interaction more generally. Ancillary analyses in Studies 2 and 3 support the construct validity of the episode-level assessment of perceived positivity resonance. The overall pattern of results is consistent with Positivity Resonance Theory (Fredrickson, 2016). Discussion centers on avenues for future research and the need for behavioral interventions.

Keywords

positive affect; positive emotions; social integration; relationships; positive psychology

Both positive emotions and social integration are widely known to be associated with well-being (Lyubomirsky, King, & Diener, 2005; Pinquart & Sörensen, 2000), health (Cohen, 2004; Pressman & Cohen, 2005), and longevity (Chida & Steptoe, 2008; Holt-Lunstad, Smith, & Layton, 2010). Yet, relatively little research has investigated how these two constructs may be intertwined. For instance, are social interactions good for health and

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well-being, in part, because they increase opportunities to experience positive emotions? And are positive emotions more powerful predictors of beneficial outcomes when they are co-experienced during moments of high-quality interpersonal connection?

In her Positivity Resonance Theory, Fredrickson (2016) identifies a specific type of high-quality interpersonal connection—called positivity resonance—that can arise between romantic partners and long-time friends as well as between and among co-workers or complete strangers. Such momentary connections are theorized to be particularly powerful in promoting health and well-being (Fredrickson, 2016). Positivity resonance is a momentary experience that occurs when two or more people have an interpersonal connection characterized by three features: (1) shared positive affect, (2) mutual care and concern, and (3) behavioral and biological synchrony (Fredrickson, 2013, 2016). Though interpersonal connections have long been known to forecast health and well-being (Holt-Lunstad & Smith, 2012), Fredrickson (2016) postulates that the intertwined experiences of shared positive affect, mutual care and concern, and behavioral and biological synchrony function to elevate the quality of episodic interpersonal connections, which over time accumulates to have lasting impact on individuals' enduring health and well-being. Each of these three components makes important contributions to the quality of an interpersonal connection.

Shared positive affect

Shared positive affect refers to any element of pleasant subjective experience that is jointly or co-experienced across two or more people. It is well-established that positive affect promotes health and well-being (Fredrickson, Cohn, Coffey, Pek, & Finkel, 2008; Kok et al., 2013; Sin & Lyubomirsky, 2009). Recent research, however, suggests that positive affect may have even more powerful effects when shared with others. For instance, shared smiles help people to better understand social situations and the emotions of others (Niedenthal, Mermillod, Maringer, & Hess, 2010) and shared laughter, more than solo laughter, is linked to higher relationship quality, closeness, and social support in couples (Kurtz & Algoe, 2015). Research on capitalization indicates that disclosing news of a positive event with others can amplify positive affect, make the event more memorable, and increase life satisfaction. Further, when a shared positive event is met with active and constructive responses by the other (e.g., with enthusiasm and genuine concern), the discloser experiences increases in positive affect and life satisfaction above and beyond the effects of sharing the event itself (Gable & Reis, 2010).

Mutual care and concern

Mutual care and concern refers to the extent to which each person is momentarily invested in the well-being of the other(s) (Fredrickson, 2016). Mutual care and concern is important in high-quality relationships because the feeling of being known or respected confirms one another's worth and sense of competence (Dutton & Heaphy, 2003), making interaction partners less likely to feel judged or monitored and more willing to offer their viewpoints without fear of harming their image (Carmeli, Brueller, & Dutton, 2009; Edmundson, 2004). In a study assessing four different types of close "love" relationships (i.e., romantic,

parental, friendship, altruistic), being invested in the well-being of the other was reported to be the single characteristic most universally endorsed as essential to love relationships, across all four types (Hegi & Bergner, 2010). Perceiving such genuine investment and responsiveness has been found to be a hallmark of closeness and intimacy (Reis, Clark & Holmes, 2004).

Behavioral and biological synchrony

Behavioral and biological synchrony refer to the extent to which peoples' nonverbal behaviors, autonomic physiology, and neural firings share the same tempo. This feature is important to consider within the context of interpersonal connections because synchronized body movements have been found to facilitate embodied rapport (Vacharkulksemsuk & Fredrickson, 2012), compassion and altruistic behaviors (Valdesolo & DeSteno, 2011), emotional support satisfaction (Jones and Wirtz, 2007), and affiliation (Hove & Risen, 2009). Behavioral synchrony has been linked both to physiological synchrony (Feldman, Magori-Cohen, Galili, Singer, & Louzoun, 2011; for a review, see Palumbo et al., 2017) and to neural synchrony (Kinreich, Djalovski, Kraus, Louzoun, & Feldman, 2017). In addition, synchrony in autonomic physiology has been linked to relationship quality (Helm, Sbarra, & Ferrer, 2014) and social bonding (for a review, see Feldman, 2015) and synchrony in neural activity has been linked to interpersonal understanding (Stephens, Silbert, & Hasson, 2010).

An important precondition for positivity resonance is theorized to be real-time sensory connection (Fredrickson, 2016). Real-time sensory connection creates opportunities for positivity resonance to emerge through physical touch, eye contact, vocal acoustics, and synchronized facial expressions and body movements. Consistent with this reasoning, research and theory suggest that high-quality interpersonal connections are characterized by shared behaviors that occur in real-time, like caring touch (Holt-Lundstad, Birmingham & Light, 2008), reciprocated emotional expressions (Lakin, Jefferis, Cheng, & Chartrand, 2003), or shared laughter (Kurtz & Algoe, 2015). Without sensory and temporal connection, attentive eye-contact cannot be made, smiles do not get reflected back, and a caring pat on the shoulder cannot be offered or reciprocated.

In keeping with the Broaden-and-Build Theory of Positive Emotions (Fredrickson, 1998, 2001, 2013), episodic positivity resonance is theorized to have both momentary and long-term effects. That is, episodes of positivity resonance may broaden the mindsets of interaction partners within moments of engagement, thereby enhancing momentary other-focus, perspective taking, empathy, interpersonal understanding, and feelings of togetherness and social closeness. These moments of broadened cognition within episodes of positivity resonance accumulate over time to build each individual's enduring personal resources—such as mindfulness, friendships, and environmental mastery—which can have lasting impact on mental and physical health (Fredrickson et al., 2008). Given the social nature of positivity resonance, moments of positivity resonance may be particularly influential in building enduring social resources such as perceived social support, high-quality social bonds, character strengths of kindness and social intelligence, or biological resources linked to an individual's propensity for and/or positive emotional reactivity within social interactions, such as cardiac vagal tone or tonic oxytocin (Isgett, Kok, Baczkowski, Algoe,

Grewen, & Fredrickson, 2017). We hypothesize that these enduring resources, built through the accumulation of episodes of positivity resonance, ultimately promote better overall health and well-being.

Recent empirical evidence supports the claim that positivity resonance is associated with health. In one study, each evening for nine weeks, participants were asked to report how "close" and "in tune" they felt with the people they had interacted with that day (Kok & Fredrickson, 2010), which we speculate may touch on the elements of mutual care and concern together with behavioral and biological synchrony. Results indicated that increases in feeling "close" and "in tune" with others over the course of the study predicted increases in cardiac vagal tone, a correlate of physical health (Bibevski & Dunlap, 2011; Thayer & Sternberg, 2006).

These initial findings (i.e., Kok & Fredrickson, 2010) support the logic that positivity resonance may be particularly powerful in promoting well-being. Across three studies, the present research expands on these findings by collectively (a) testing whether positivity resonance is associated with multiple measures of well-being, including illness symptoms (Studies 1–3); (b) capturing positivity resonance within a series of targeted daily episodes rather than through global measures (Studies 2 and 3); and (c) testing whether positivity resonance is indeed associated with sociality and real-time sensory connection (Studies 2 and 3). Because we theorize that positivity resonance is unique—going beyond aggregate positive emotions—we also hypothesize that the association between perceived positivity resonance and each of the well-being outcomes (i.e., flourishing mental health, depressive symptoms, loneliness, illness symptoms) will remain statistically significant, even when controlling for overall positive emotions. Because the present studies are the first to test the correlates of perceived positivity resonance, it is not possible to conduct a power analysis based on effect size estimates derived from prior literature. However, the sample sizes in all three studies are sufficiently powered ($1 - \beta > .80$) to allow the detection of medium-sized effects.

Study 1

Method

Participants.—Paper and electronic advertisements were used to recruit participants in Durham and Orange counties of North Carolina for a larger, 18-month research project[1] on health behavior change (Fredrickson et al., 2017). Eligible participants were between 35 and 64 years old, fluent in English, new to meditation, absent any chronic illnesses or disabilities, and able to access the internet from home. The study was conducted between the Summer of 2013 and the Summer of 2016. Participants received compensation after completing various portions of the larger longitudinal study. Those who provided informed consent ($N = 231$) were randomized to one of two experimental conditions: mindfulness meditation (MM; $n = 113$) or loving-kindness meditation (LKM; $n = 118$). Although experimental condition is not the focus of study here, condition was examined as a potential

[1]Data from this larger, NIH-supported study [R01CA170128] have been reported on elsewhere [Fredrickson et al., 2017, Study 2; Rice & Fredrickson, 2016, Study 2] and will continue to support other and related investigations.

moderator in preliminary models and included as a covariate in all primary analyses. Fourteen participants were ultimately excluded from analyses for various reasons (7 each in MM and LKM; for details, see CONSORT Diagram in online supplementary material for Fredrickson et al., 2017). Data available at the 18-month follow-up are analyzed here because they contained all the variables of interest. For the present study, among the 176 participants who completed the 18-month follow-up assessment, one additional participant was excluded for extreme and unusual responses to the trait perceived positivity resonance scale (a response of 0 across all items, > 4 SD below the group mean). Thus, a total of 175 participants (or 152 for analyses that control for 7-day assessments of positive affect) were included in the analysis sample (105 female, M_{age} = 48.66 years, SD = 8.99, Range: 34–65).

Materials and Procedures.—From the 18-month follow-up data, we drew on seven consecutive days of participants' reports on their emotional experiences plus a number of self-report surveys, as described below.

Trait perceived positivity resonance.: Because no single measure of perceived positivity resonance existed, our team developed 12 theory-based items intended to capture the extent to which a person's typical interpersonal connections are characterized by shared positivity, mutual care and concern, and behavioral and biological synchrony. Although a number of existing scales measure the extent to which people have meaningful social relationships, our aim was to capture perceptions of momentarily shared experiences during typical interpersonal encounters. Thus, we assessed not only a person's internal affective experiences, but also their perception of the degree to which this affective experience was shared by the interaction partner(s). This is advantageous compared to existing scales, which often focus only on the respondent's own internal experience of emotion, despite the fact that emotions (positive emotions in particular) are more strongly felt when in the presence of others than when alone (Fredrickson et al., 2008; Srivastava, Guglielmo, & Beer, 2010). All items were inspired by Positivity Resonance Theory (e.g., attune to others; feel 'in sync'). Some items were further inspired by Dutton and Heaphy's (2003) theorizing on high-quality connections (e.g., mutually responsive to one another's needs) or by Finkel and colleagues' (2006) work on high-maintenance interactions (e.g., flow of conversation).

Within the initial pool of 12 items, we selected the eight that most closely matched the seven items that emerged from the multilevel factor analyses—both exploratory and confirmatory—conducted on data from Study 2 and Study 3, respectively (to be reported below).[2] The omission of the remaining four items does not change the pattern of the findings of Study 1. Online supplementary materials (OSM) present the initial 12 items (Table A1), along with a replication of all Study 1 analyses presented in this paper using the 12-item scale (Tables B1–B2). Participants were instructed to think "of all your experiences and encounters with other people – the people you interact with regularly on a daily basis, including family, friends, neighbors, work colleagues, customers, etc. (do not just focus on one person individually but how you feel collectively with other people, in general)" and to estimate how much of the time (from 0–100%) that "…you are able to attune to other

[2]This was possible because although Study 1 was designed before Studies 2 and 3, its data were extracted from a larger longitudinal study that was not completed until after Studies 2 and 3.

peoples' words and experiences?" "…you experience a 'flow of conversation' with other people?" "…you feel energized?" "you and other people share a mutual understanding of one another?" "…you and other people are mutually responsive to one another's needs?" "…you feel a sense of mutual trust with other people?" "you and other people mutually focus on the 'best side' of one another?" and "…you feel 'in sync' with other people?" The Cronbach's alpha coefficient in this sample for the 8-item scale was 0.89.

Habitual positive emotions.: Across seven consecutive evenings (prior to completing all other survey assessments), participants reported their emotional experiences of that day using the modified Differential Emotions Scale (mDES; Fredrickson, 2013). For the present purposes, we focus on the 10 items within the mDES that assess the degree to which respondents experienced different positive emotions (i.e., amusement, awe, gratitude, hope, inspiration, interest, joy, love, pride, and serenity). Each is assessed with a trio of adjectives (e.g., "amused, fun-loving, or silly" or "glad, happy, or joyful"). For each item, participants were asked to indicate the greatest degree to which they experienced the given feelings over the past 24 hours using a 5-point scale ranging from 0 (*not at all*) to 4 (*extremely*). Habitual positive emotions were calculated by computing the mean across the 10 items within each day and then the mean of these daily means over the seven consecutive nightly reports. The Cronbach's alpha coefficient for this measure in this study, computed over individual positive emotions averaged across seven days, was 0.94.

Well-being scales.: Participants completed a series of self-report surveys to index well-being. These targeted flourishing mental health, depressive symptoms, and illness symptoms.

Flourishing mental health.: Participants completed the Mental Health Continuum—Short Form (Keyes, 2009) to assess signs of flourishing mental health. Participants responded to 14 items to indicate how frequently each described their own experiences. Responses were made on a scale from 0 (*never)* to 5 (*every day*). Items included: "In the past week, how often did you feel that you had something to contribute to society?" "In the past week, how often did you feel interested in life?" and "In the past week, how often did you feel confident to think or express your own ideas and opinions?" The Cronbach's alpha coefficient for this scale in this study was 0.93.

Depressive symptoms.: Participants completed the Center for Epidemiological Studies—Depression measure (Radloff, 1977). They responded to 20 items to indicate how frequently they experienced various symptoms of depression in the past week. Responses were made on a 4-point scale ranging from 1 (*hardly*) to 4 (*most of the time*), for instance, "I felt that I could not shake off the blues even with help from my family or friends." The Cronbach's alpha coefficient for this scale in this study was 0.92.

Illness symptoms.: To assess illness symptoms, participants reported the frequency with which they experienced 13 common symptoms of illness or poor health over the past month (Elliot & Sheldon, 1998). Participants used a 9-point scale (0 = *not at all*, 8 = *very frequently*) to rate the frequency of each of the following symptoms: headaches, coughing or sore throat, shortness of breath, stiff or sore muscles, chest or heart pain, faintness or

dizziness, acne or pimples, stomach ache or pain, feeling weak in parts of your body, numbness or tingling in parts of your body, nausea or upset stomach, runny or congested nose, and hot or cold spells. The reports of illness symptoms were positively skewed (skewness = 1.51), so we performed a logarithmic transformation on this variable (resulting skewness = 0.64). All subsequent analyses use this transformed variable. The Cronbach's alpha coefficient for the illness symptoms scale in this study was 0.76.

Results

Preliminary Analyses: Descriptive Statistics and Pearson Correlations.— Means, standard deviations, and sample sizes for measures of trait perceived positivity resonance, habitual positive emotions, and each of the three measures of well-being are presented in the first data column in Table 1. Zero-order Pearson correlations are also presented below the diagonal. As might be expected, all correlations are statistically significant (ps < .05).

Primary Analyses: Is Trait Perceived Positivity Resonance Associated with Well-being?—Based on Positivity Resonance Theory, we hypothesized that perceived positivity resonance would be associated with higher well-being (i.e., greater levels of flourishing mental health, and lower levels of depressive symptoms and illness symptoms). We further hypothesized that the association between trait perceived positivity resonance and each of the three well-being outcome variables would remain statistically significant, even when controlling for habitual positive emotions. To test these predictions, we conducted hierarchical linear regressions (see Table 2), each with one of the three well-being outcomes (i.e., flourishing mental health, depressive symptoms, illness symptoms) as the dependent variable, controlling for experimental condition.[3] In Step 1, we entered trait perceived positivity resonance as the sole predictor of the well-being outcome (see Table 2, Model 1). In Step 2, we added to the model habitual positive emotions (assessed over seven days) in order to observe the unique effect of trait perceived positivity resonance on each well-being outcome when controlling for reported experiences of positive emotions (See Table 2, Model 2).

Consistent with hypotheses, higher mean-levels of trait perceived positivity resonance were significantly correlated with higher levels of flourishing mental health, lower levels of depressive symptoms, and fewer illness symptoms, as shown in Table 2. Results in Table 2 also reveal that trait perceived positivity resonance remained a significant predictor of flourishing mental health and depressive symptoms when covariance with habitual positive emotions is statistically controlled. However, the corresponding prediction of illness symptoms from trait perceived positivity resonance dropped to marginal significance ($\beta = -.16$, $p = .064$) after controlling for habitual positive emotions.

[3]In preliminary models, experimental condition was allowed to interact with trait perceived positivity resonance and habitual positive emotions to test for possible moderation. No main effects for, or interactions with experimental condition were statistically significant. To reduce possible multicollinearity, Table 2 reports the results of models that include experimental condition as a covariate but not the associated interaction terms.

Discussion

Data gathered from a large sample of midlife adults supports the hypothesis that perceived positivity resonance is positively associated with flourishing mental health and negatively associated with depressive and illness symptoms. Not surprisingly, trait perceived positivity resonance shares an association with habitual positive emotions ($r = .36$, $p < .001$). When statistically controlling for shared variance with habitual positive emotions, the associations of trait perceived positivity resonance with flourishing mental health and depressive symptoms remained statistically significant. The association with illness symptoms, however, dropped to marginal significance when habitual positive emotions were included in the model.

Despite this degree of support for our primary hypothesis, this study is limited in four ways. First, evidence for the effect of positivity resonance as a predictor of illness symptoms is mixed. Further testing of this association is warranted. Second, the measure of trait perceived positivity resonance was created anew for this study and has not undergone item refinement and basic psychometric tests for factor structure, internal reliability, and construct validity. Third and most significantly, the level of analysis of Study 1's survey measure of trait perceived positivity resonance does not align well with Positivity Resonance Theory. Specifically, the theory centers on experiences during moments of interpersonal connection, which are episodic and expected to vary across contexts and over time. Fourth and relatedly, evidence suggests that when respondents provide retrospective self-reports of affective experiences "in general" (or any time frame wider than "the last few weeks"), their decontextualized responses are more likely to reflect beliefs about affective experience versus actual affective experiences (Robinson & Clore, 2002). To the extent that beliefs capture personality, such assessments may be appropriate for trait-level constructs. Even so, episodic and contextualized assessment of perceived positivity resonance may offer a more valid test of Positivity Resonance Theory. Studies 2 and 3 address these four shortcomings of Study 1.

Studies 2 and 3

We moved to measuring positivity resonance at the episode level for several reasons. First, episode-level assessments offer a temporal resolution appropriate for capturing the specific behaviors and emotions within specific interpersonal interactions, which are the building blocks of meaningful relationships (Algoe, Kurtz, & Hilaire, 2016). Second, because people's experiences of positivity resonance are likely to vary from one interpersonal connection to the next, positivity resonance may be best represented when assessed across numerous episodes. Third, assessing a construct at the episode level (e.g., think about the last social interaction you had) minimizes reporting biases: Cueing people to think about the particulars of a recent episode helps them to report more accurately on that episode, compared to relying on their own implicit generalizations about themselves across all situations (Robinson & Clore, 2002), as is the case with global self-reports (e.g., think about your social connections in general). A fourth advantage of episode-level assessments is that participants can be cued to a specific episode, making it less likely that they inadvertently

focus only on interactions that are most memorable or prototypic, which itself can introduce bias.

One helpful tool for examining episode-level experiences is the Day Reconstruction Method (DRM; Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004). The DRM provides rich episode-by-episode accounts of behavioral and emotional experiences across an entire day. An episode is defined for respondents as akin to a scene within a stage performance, with changes from one episode to the next demarked by a change of context, characters, or activities. The DRM, although technically a retrospective report based on reconstructive memory of specific episodes, is empirically known to minimize retrospection biases (Kahneman & Krueger, 2006), thus capturing some of the advantages of experience sampling methods without the need to ping participants with survey items throughout their day, which risks disengaging and distracting participants from the very experiences researchers seek to measure.

Studies 2 and 3 offer conceptual replications of Study 1 based on episodic data. We again test the hypothesis that perceived positivity resonance will be significantly associated with indices of well-being. Although depressive symptoms were not assessed in these two studies, we assessed loneliness alongside flourishing mental health and illness symptoms. We also again test whether observed associations between perceived positivity resonance and well-being remain statistically significant after controlling for aggregate positive emotions and, here also, social interaction more generally.

We also took advantage of the episode-level structure of the data in Studies 2 and 3 to test ancillary hypotheses to establish construct validity of our measure of perceived positivity resonance. Specifically, because positivity resonance in part reflects the positive emotions individuals experience when interacting with others, construct validity will be evidenced by a stronger association between perceived positivity resonance and the pleasant emotions participants report during social interactions than between perceived positivity resonance and the pleasant emotions they report during nonsocial episodes. Further, because real-time sensory connection is theorized to be a precondition for positivity resonance to emerge, we expect to find a stronger positive association between perceived positivity resonance and types of social interaction that carry more sensory connection (e.g., face-to-face communication) than between perceived positivity resonance and types of social interaction with less or no sensory connection (e.g., tele/video and computer-mediated communication).

Studies 2 and 3 below allow tests of these hypotheses. Materials and procedures for both studies were nearly identical (see note to Table 3 on variations in scale instructions). We note, however, that study measures were administered in different time sequences across these two studies. In Study 2, all measures were administered on the same day, with the DRM preceding the well-being indices. In Study 3, the DRM was used one week prior to the well-being indices.

Method

Participants.—Study 2 participants were recruited in the Spring of 2014 through Amazon's Mechanical Turk (MTurk), an online portal that allows users to complete tasks

for compensation. Each user received USD 1.00 in exchange for participation. To qualify for the study, participants had to be at least 18 years old, US residents, English-speaking, and full-time employees working at least 40 hours per week.[4] One hundred and twenty-two adults consented and agreed to complete the study. Prior to data analysis, we removed two respondents who provided false or unreliable data. One respondent completed the survey twice, thus we removed the second chronological response. We also removed one respondent because micro-data embedded in the survey revealed a suspicious pattern of mouse-clicks per survey that was not humanly possible (i.e., 500 clicks in 10 seconds). A further investigation of this respondent revealed more suspicious patterns in the data, such as zero variation in their experience of the highest possible pleasant emotions and unpleasant emotions across all emotion reports. Thus, a total of 120 participants were included in the analyses (62 female, M_{age} = 34.08 years, SD = 10.48, Range: 18–63).

Study 3 participants were recruited in the Spring of 2015 from an employee list-serve at the University of North Carolina at Chapel Hill. Because Study 3 was part of a larger research project—which tested the effects of an eight-week experimental intervention[5] on health and well-being—recruitment materials referred to the benefits of daily reflection on increasing well-being and reducing stress, but did not mention specific types of daily reflection. Although the experimental intervention is not the focus of this paper, treatment condition was included as a covariate in all analyses (except as noted in Footnote 8) and as a potential moderator in preliminary analyses. To qualify for the study, participants had to be at least 18 years of age, fluent in written and spoken English, able to access the internet on a daily basis, and not currently enrolled in school as an undergraduate. Participants were paid $100 for completing the study, plus the chance to win one of eight $50 gift cards. One hundred and eighty-one adults consented for the study. Prior to data analysis, two participants were removed who informed researchers about significant life-changes midway through the study that may have substantially influenced their health and mood (e.g., hospitalization for depression and suicidal thinking). Seven participants dropped out prior to completing the DRM, thus, a total of 172 participants were included in the analysis sample (126 female, M_{age} = 39.79 years, SD = 13.97, Range: 21–82). Four participants dropped out prior to completing the final assessment of well-being outcomes, leaving a sample of 168 participants for analyses including the well-being outcome variables.

Materials and Procedure.—Studies 2 and 3 used nearly identical measures and procedures, as described below.

[4]The sample was limited to full time employees because participants were originally recruited from two separate workplace populations – office workers and telecommuters. We had expected these two populations to diverge in their frequency of social episodes and perceived positivity resonance during the workday. However, because no significant main effects of, or interactions with, workplace sample emerged on frequency of social episodes, perceived positivity resonance, or the well-being measures (e.g., flourishing mental health, loneliness, illness symptoms; all ts < 1.25, all ps > .154) or in demographics (i.e., age, gender, income, education, etc.; all ts < 0.68, all ps > .495), we collapsed across these two samples in all reported analyses. The sole observed difference across samples was the duration of social interactions ($t(116) = 7.49$, $p < .001$), which suggested longer interactions for office workers. Table E2 in the OSM reports the results of the preliminary models for the well-being measures.

[5]The intervention was administered via daily emails, which were designed to prime attention to one of three condition-specific topics (i.e., daily positive social experiences, daily positive solitary experiences, or daily tasks). The results of this intervention will be reported elsewhere. Study 3 also included a measure of respiratory sinus arrhythmia assessed alongside well-being measures. Because no meaningful associations emerged between this physiological variable and perceived positivity resonance, it is not reported on here.

Day Reconstruction Method.: Participants completed online surveys within the Day Reconstruction Method (DRM) to reconstruct the details of the previous day in a continuous series of episodes within a specified frame of time. The complete set of DRM instructions can be found in the Online Supplementary Material (Appendix F). In Study 2, we asked participants to list all episodes from the beginning to the end of their workday, including episodes that were not work-related.[6] We only administered the survey in the mid-week to ensure the previous day was a workday. In Study 3, we asked participants to list all episodes from the time they woke up until the time they went to bed, which presumably captures the workday in addition to personal time outside of work. For each episode they recorded, participants provided a short name for the episode, its duration, and some private notes to remind themselves about how they felt during that episode. In Study 2, across all 120 participants, there were 767 total episodes, with each participant reporting an average of 6.4 episodes (range: 1 to 24 total episodes). In Study 3, across all 172 participants, there were 2,229 total episodes, with each participant reporting an average of 13.0 episodes (range: 4 to 30 total episodes). After identifying all episodes, participants next considered each episode in turn and provided information about their social interactions and emotions within each.

Interaction types.: For each episode, participants were asked "During this episode, were you interacting with anyone for more than a few minutes (including by phone, text messaging, e-mail, social media, etc.)?" In Study 2, of the 767 total episodes reported, 451 (59%) included a social interaction, with each participant reporting an average of 3.9 episodes that included an interaction (range: 0 to 13 social episodes). Of the 120 total participants, three participants reported having only non-social episodes and 23 reported having only social episodes. In Study 3, of the 2,229 total episodes reported, 1,443 (65%) included a social interaction, with each participant reporting an average of 8.4 episodes that included an interaction (range: 0 to 25 social episodes). Of the 172 total participants, one participant reported having only non-social episodes and 10 reported having only social episodes. For episodes containing an interaction, participants were then asked to indicate the proportion of time within that episode (from 0 to 100 percent) they spent interacting: *face-to-face*, *phone/video-media*, *mediated communication (e.g., e-mail, texting, etc.)*, or *not interacting*. Although *not interacting* is not a type of social interaction, it captures the possibility that a person might interact with someone for part of the episode but not all of it.

We hypothesized that the link between perceived positivity resonance and well-being would remain significant, even when controlling for daily social interaction more generally. To this end, we assessed daily social interaction in two ways. We created a *frequency of social episodes* variable, by tallying the number of discrete episodes that were categorized as containing a social interaction during the reported day. We also created a *duration of social interaction* variable by multiplying the percentage of time spent interacting during each social episode by the number of minutes in the episode to determine the number of minutes spent interacting in each episode. We then summed, across all social episodes, the reported number of minutes spent interacting (including face-to-face, by phone/video media, or mediated communication). Next, to account for between-participant variation in length of

[6]We limited the DRM to the workday in Study 2 to minimize participant burden for MTurk workers.

the reported day (which necessarily constrains total minutes spent interacting), we divided each participant's total number of minutes spent interacting by their total minutes reported in the day. This duration variable thus assesses the proportion of time respondents reported interacting that day.

Self-reported positive and negative emotions.: For each episode, participants separately rated their positive and negative emotions for each episode ("indicate the greatest amount that you experienced pleasant [unpleasant] emotions during this episode") using a 5-point Likert scale ranging from 1 (*Not at all*) to 5 (*Extremely*). These 1-item responses were used to assess positive and negative emotions, respectively, at the episode level.

We were also interested in pleasant and unpleasant emotions at the person level, given that well-being variables (e.g., flourishing mental health) were only measured at the person-level. We calculated person-level composite scores in several ways. First, we aggregated pleasant [unpleasant] emotions across all episodes to create two person-level mean scores: *pleasant emotions* and *unpleasant emotions*. These two variables capture the average emotional experiences of respondents across all episodes on the reported day.

We were also interested in the degree to which positivity resonance would be associated with the emotions respondents experienced in social vs. non-social episodes. To this end, we aggregated pleasant [unpleasant] emotions scores in two additional ways. We aggregated pleasant [unpleasant] emotions scores across all non-social episodes to create two person-level mean scores: *non-social pleasant emotions* and *non-social unpleasant emotions*. These two variables capture the average pleasant and unpleasant emotional experiences of respondents across all reported episodes that did not contain a social interaction. In a parallel manner, we aggregated pleasant [unpleasant] emotions scores across all social episodes to create two additional person-level mean scores: *social pleasant emotions* and *social unpleasant emotions*. These two variables capture the average pleasant and unpleasant emotional experiences of respondents across all reported episodes that contained a social interaction.

Perceived positivity resonance.: We continued to refine our assessment of perceived positivity resonance across Studies 2 and 3. The measure we used in Study 2 consisted of 13 items. For Study 3, however, we sought a briefer version to reduce participant burden. We thus used both theoretically- and empirically-informed approaches to identify a subset of the 13-items collected in Study 2 that most closely and concisely represented the construct of perceived positivity resonance. Specifically, we conducted a multilevel exploratory factor analysis (Muthén, 1991, 1994) to evaluate factor loadings and the underlying dimensions of the data. We also considered the content validity of the items, attempting to ensure that all facets of positivity resonance (i.e., shared positivity, mutual care and concern, behavioral and biological synchrony) were appropriately captured. Using these approaches, we ultimately chose seven items to capture episode-level perceived positivity resonance. The omission of the remaining six items (collected in Study 2 only) does not meaningfully influence any of the findings presented in Study 2. Online supplementary materials present the initial 13 items (Table A2), along with a replication of all Study 2 analyses presented in this paper using the 13-item scale (Tables C1–C3). Study 3 used the seven-item version of

the scale. The Cronbach's alpha coefficient for the seven-item scale was 0.96 in Study 2 as well as in Study 3.

Within any episode containing an interaction, participants indicated the proportion of time during the episode (from 0 to 100 percent) the experiences described within each of the seven items occurred (see Table 3 for the item wording and descriptive statistics). We adopted this proportion-of-time format to reduce the tendency for respondents to shift scale standards from episode to episode (Biernat & Manis, 1994). Episode-level perceived positivity resonance was computed as the mean across the seven items. To assess person-level perceived positivity resonance, we averaged perceived positivity resonance scores across all social episodes (as the scale was only administered for social episodes).

Well-being scales.: Participants also completed a series of self-reported well-being scales to assess flourishing mental health, loneliness, and illness symptoms.

Flourishing mental health.: As in Study 1, Studies 2 and 3 used the identical 14 items of the Mental Health Continuum – Short Form (Keyes, 2009) to assess flourishing mental health. Inadvertently, however, the response options varied across studies. In Study 2, participants responded to the 14 items on a response scale that ranged from 1 (*rarely or none of the time*) to 4 (*most or all of the time*). In Study 3, the response scale ranged from 1 (*rarely or none of the time*) to 6 (*most or all of the time*). The Cronbach's alpha coefficient for this scale was 0.95 in Study 2 and 0.92 in Study 3.

Loneliness.: To assess loneliness, participants completed Russell's (1996) UCLA Loneliness Scale. Participants responded to 20 items to indicate how frequently each described their experiences. Responses were made on a 5-point scale ranging from 1 (*never*) to 5 (*always*). For instance, "How often do you feel close to people?" (reverse-scored) and "How often do you feel isolated from others?" The Cronbach's alpha coefficient for this scale was 0.96 in Study 2 and 0.93 in Study 3.

Illness symptoms.: As in Study 1, participants reported the frequency with which they experienced the identical 13 common symptoms of illness or poor health over the past month (Elliot & Sheldon, 1998). Here, however, participants used a 7-point scale (1 = *not at all*, 7 = *very frequently*) to rate the frequency of each symptom. As in Study 1, the reports of illness symptoms were positively skewed (Study 2: skewness = 1.75, Study 3: 1.04), so we performed a logarithmic transformation on this variable (resulting skewness = 0.77 in Study 2 and skewness = 0.21 in Study 3). All subsequent analyses use these transformed variables. The Cronbach's alpha coefficient for the illness symptoms scale was 0.91 in Study 2 and 0.77 in Study 3.

Results

Psychometric properties.—We first evaluated the basic psychometric properties of the new measure of episode-level perceived positivity resonance. In both Study 2 and Study 3, the range of the scale was good, with scores on each item covering the full spectrum of the scale, from 0 to 100 (see Table 3 for item means and standard deviations). We conducted a multilevel exploratory factor analysis (MEFA), using Study 2 data, to evaluate

the underlying data structure, followed by a multilevel confirmatory factor analysis (MCFA), using Study 3 data, to test the final model retained in the exploratory phase. Because participants completed the measure multiple times (once per episode when that episode was categorized as social), multilevel analyses were deemed necessary (see Muthén, 1991, 1994). The value of choosing this strategy is twofold: (1) the use of multilevel factor analysis allows us to control for the non-independent (nested or clustered) nature of the data and eliminate the problems a single-level analysis of these data might otherwise create (e.g., misleading standard errors); and (2) multilevel factor analysis may be used to examine factor structures at both lower and upper levels and how they may differ (e.g., dimensions that uniquely reflect more time-varying versus trait-like elements; for empirical examples see Dyer, Hanges, & Hall, 2005; Huang & Cornell, 2015; Reise, Ventura, Nuechterlein, & Kim, 2005). The intraclass correlations (ICCs; shown in Table 3) confirmed the non-independent nature of the data, with all ICCs suggesting that a small to moderate (≥ 0.40 in Study 2; ≥ 0.25 in Study 3) proportion of the variance in each item was attributable to between-person differences.

Both MEFA and MCFA analyses were conducted using Mplus (Version 8; Muthén & Muthén, 2017) and all available data. In the exploratory stage, one to two factors were extracted from the Study 2 data for both the within- and between-persons levels using a maximum likelihood estimator with robust standard errors (MLR). A geomin rotation (oblique) was specified. The largest eigenvalue at the within-person level was 4.86, with the second largest being 0.61. The largest eigenvalue at the between-person level was 6.40, with the second largest being 0.28. Although the model fit indices indicated moderate to poor fit (χ^2 = 194.42, df = 28, p < .001; root mean square error of approximation [RMSEA] = 0.115; confirmatory fit index [CFI] = 0.94; see Hu & Bentler, 1999), scree plot analyses (Cattell, 1966) suggested that only one factor should be retained at each level, and the factor loadings for the 1-within, 1-between factor model were uniformly high (≥ 0.75).[7]

In the confirmatory stage, we tested this 1-within, 1-between factor model using the Study 3 data. The factor loadings for Item 1 at both the within- and between-person levels were fixed to zero, while all other loadings were freely estimated.[8] The MLR estimation procedure was used. The results indicated a reasonable fit of the model to the data. Though the chi-square test of perfect fit indicated a significant lack of fit (χ^2 = 150.60, df = 28, p < .001), alternative measures indicated good fit: RMSEA = 0.056, CFI = 0.96, standardized root mean square residual (SRMR) within = 0.02, SRMR between = 0.02). All factor loadings were significantly different from zero (ps < .001).

Considering both information about fit and the interpretability of the factor loadings, as well as a preference for parsimony (e.g., Preacher, Zhang, Kim, & Mels, 2013), we believe that

[7]The 2-within, 1-between factor model indicated improved fit over the 1-within, 1-between factor solution (χ^2 = 78.29, df = 22, p < .001; RMSEA = 0.075; CFI = 0.98). However, the rotated within-person level factor loadings showed three items loading highly on one factor (Items 1, 2, 4), three items loading highly on another (Items, 5, 6, 7), and the final item (Item 3) showing moderate loadings on both factors, with the factors correlated at 0.78, p < .05. This pattern of episode-specific loadings is not consistent with theory and does not offer a clearly interpretable differentiation between the two factors. Additionally, we experienced problems with model estimation for the 2-within, 2-between factors model, due in part to a large negative residual variance for Item 5 at the between-person level. Therefore, those results were not interpreted.

[8]Note that experimental condition was not included as a covariate in this analysis.

the 1-within, 1-between factor model offers the best solution and that the findings indicate that the 7-item perceived positivity resonance scale is characterized by one strong factor.

We also calculated measures of reliability at both the within- and between-person levels of analysis, following Geldhof, Preacher, and Zyphur (2014) and again using Mplus. Both Study 2 (within: $\alpha = 0.925$; $\omega = 0.924$; between: $\alpha = 0.984$; $\omega = 0.986$) and Study 3 (within: $\alpha = 0.960$; $\omega = 0.961$; between: $\alpha = 0.978$; $\omega = 0.979$) indicated high levels of reliability for the 7-item perceived positivity resonance scale at both levels of analysis.

Ancillary Analyses.

Is Positivity Resonance More Closely Related to Social Emotions than Non-Social Emotions?: In ancillary analyses, to further explore construct validity, we tested several key propositions from Positivity Resonance Theory (Fredrickson, 2013, 2016). First, if episode-level positivity resonance reflects, in part, the positive emotions one shares with others, then we would expect that, on average, the extent to which an individual experiences positivity resonance would be more closely associated with the pleasant emotions they report in their social interactions relative to the pleasant emotions they report when not interacting. To assess this, we computed the correlations between person-level perceived positivity resonance, social pleasant emotions and non-social pleasant emotions (see Table 4). We then conducted Steigler's (1980) z transformation to compare the strength of these correlations using Lee and Preacher's (2013) online calculator. Although perceived positivity resonance was positively associated with pleasant emotions experienced in both social and non-social contexts, consistent with expectations, we found that it was significantly more strongly associated with social pleasant emotions than non-social pleasant emotions (Study 2: $r = 0.62$ as compared with $r = 0.24$, $Z = 4.54$, $p < .001$; Study 3: $r = 0.53$ as compared with $r = 0.29$, $Z = 3.49$, $p < .001$),[9] indicating support for prior theorizing about positivity resonance. We also tested the parallel negative emotion analysis, which revealed that although perceived positivity resonance was negatively associated with unpleasant emotions experienced in both social and nonsocial contexts, the association was significantly stronger for social unpleasant emotions than non-social unpleasant emotions (Study 2: $r = -0.50$ as compared with $r = -0.29$, $Z = 2.31$, $p = .021$; Study 3: $r = -0.39$ as compared with $r = -0.20$, $Z = 2.68$, $p = .007$). Further, when all four affect variables were included in a linear regression model to predict perceived positivity resonance, only pleasant social emotions emerged as a significant positive predictor of perceived positivity resonance (Study 2: $\beta = 0.63$, $p < .001$; Study 3: $\beta = 0.44$, $p < .001$).

Is Positivity Resonance More Closely Associated with Types of Social Interaction that Carry More Sensory Connection?: In further ancillary analyses, we assessed differential associations with perceived positivity resonance by type of interaction during a particular episode. To test this, we estimated a series of multilevel models (see Table 5). First, in Model 1, we tested whether the proportion of time spent interacting during a social episode —regardless of interaction type—was associated with perceived positivity resonance. This

[9]The total sample size for this analysis (Study 1: $N = 94$; Study 2: $N = 161$) was slightly smaller than prior analyses because list-wise deletion is the most appropriate method for this analysis. For this reason, some of the correlations reported in this paragraph vary slightly compared to those in Table 4.

initial test was necessary because many social episodes also included periods of time in which individuals were not interacting. Second, in Models 2–4, we tested the degree to which different *types* of social interactions (i.e., face-to-face, tele/video, computer-mediated) were associated with perceived positivity resonance. Because real-time sensory connection is theorized to be a precondition for positivity resonance to occur, we expected perceived positivity resonance to be more closely associated with types of social interaction that carry more sensory connection (e.g., face-to-face communication [Model 2]) relative to those with less sensory connection (e.g., tele/video [Model 3] and, to an even lesser degree, computer-mediated communication [Model 4]). Each of these models assesses the within-person (i.e., episode level) and between-person (i.e., person level) effects of perceived positivity resonance regressed on the proportion of time spent interacting via any interaction type (see Table 5, Model 1), face-to-face (see Table 5, Model 2), via telephone or video communication (see Table 5, Model 3), and via computer-mediated communication (see Table 5, Model 4). Within- and between-person effects were disaggregated and estimated separately by entering both person-mean-centered scores and person-mean scores as predictor variables (see Raudenbush & Bryk, 2002).

In both Study 2 and Study 3, consistent with expectations, we found significant within- and between-person effects of the proportion of time an individual spent interacting during a social episode (via any interaction type) and perceived positivity resonance. That is, for social episodes in which individuals reported spending more time interacting, relative to these same individuals' other social episodes, they reported higher levels of perceived positivity resonance. And, for individuals who, relative to other individuals, spent more time interacting during social episodes on average, they also reported more perceived positivity resonance on average. In both Study 2 and Study 3, consistent with expectations, we also found significant within- and between-person effects of time spent interacting face-to-face on perceived positivity resonance. That is, for episodes in which individuals reported spending more time interacting face-to-face, relative to these same individuals' other social episodes, they reported higher levels of perceived positivity resonance. And, for individuals who, relative to other individuals, spent more time interacting face-to-face during social episodes on average, they also reported more perceived positivity resonance on average. In contrast, no significant positive within- or between-person effects on perceived positivity resonance emerged for time spent interacting by telephone/video media or through computer-mediated communications. Notably, the within-person effect on perceived positivity resonance of time spent interacting via computer-mediated communications was significant in the *negative* direction, as was the within-person effect of time spent interacting via telephone/video media (albeit only in Study 3).

Primary Analyses.

Is Positivity Resonance Associated with Well-being?: As in Study 1, we hypothesized that perceived positivity resonance would be associated with higher well-being, assessed here as greater levels of flourishing mental health, and lower levels of loneliness and illness symptoms. We further hypothesized that the association between perceived positivity resonance and each of the three well-being outcome variables would remain significant, even when controlling for overall positive emotions, the duration of time spent interacting, or the

frequency of social episodes.[10] To test these predictions, we conducted hierarchical linear regressions (see Table 6), each with one of the three well-being outcomes (i.e., flourishing mental health, loneliness, illness symptoms) as the dependent variable.[11] In Step 1, we entered perceived positivity resonance as the sole predictor of the well-being outcome (see Table 6, Model 1). In Step 2, we added pleasant emotions (see Table 6, Model 2), duration of social interactions (see Table 6, Model 3), or frequency of social episodes (see Table 6, Model 4) to the model in order to observe the unique effect of perceived positivity resonance on the well-being outcome when controlling for each of these variables.

Consistent with hypotheses, higher mean-levels of perceived positivity resonance were significantly correlated with higher levels of flourishing mental health, lower levels of loneliness, and fewer illness symptoms (albeit only marginally in Study 3; see Table 6). We found that perceived positivity resonance remained a significant predictor of flourishing mental health, even when controlling for pleasant emotions, duration of time spent in social interactions, or frequency of social episodes. Similarly, perceived positivity resonance remained a significant predictor of loneliness, even when controlling for pleasant emotions (albeit only in Study 3), duration of social interactions, and frequency of social episodes. We also found that perceived positivity resonance remained a significant predictor of illness symptoms even when controlling for pleasant emotions (Study 2), duration of time spent in social interactions (Study 2), and frequency of social episodes (Study 2 and marginally in Study 3).

Discussion

Studies 2 and 3 used the Day Reconstruction Method (DRM) to create an episode-level assessment of perceived positivity resonance. Multilevel factor analyses, both exploratory (Study 2) and confirmatory (Study 3), suggest the 7-item measure of perceived positivity resonance is characterized by one strong factor, both within- and between-persons. Multilevel reliability estimation similarly suggests that the measure is internally reliable, both within- and between-persons. Ancillary analyses of construct validity further show that perceived positivity resonance is more closely related to (a) emotions experienced within social vs. non-social episodes, and (b) the proportion of time spent in face-to-face interaction vs. interactions with less sensory information (i.e., telephone or video communication, or computer-mediated communication). Taking these latter findings together with Positivity Resonance Theory, we suggest that, in future work, researchers sharpen estimates of perceived positivity resonance by assessing it only during episodes that contain face-to-face interactions.

[10]The frequency of social episodes variable captures the number of episodes that included at least one social interaction. Thus, this variable is less likely to capture the true number of social interactions for people who tended to report fewer, longer episodes. To account for this, we re-ran these analyses with the number of total episodes as a covariate and present the results in Table D of the OSM. The inclusion of number of total episodes as a covariate in the model did not influence the pattern of results presented in Table 6.

[11]In preliminary models, recruitment population (i.e., office workers vs. telecommuters in Study 2) or experimental condition (intervention type in Study 3) were allowed to interact with all other predictor variables to test for possible moderation in Studies 2 and 3. The overall pattern of results remains the same with or without the inclusion of recruitment population or experimental condition as a moderator (see Table E2 in the OSM). That is, the direction of all effects remained the same and fewer than 5% of all significance tests reported in Table E2 differed from those in Table 6. Thus, to reduce possible multicollinearity, Table 6 reports the results of models that include recruitment population or experimental condition as covariates but not the associated interaction terms.

Beyond these preliminary demonstrations of the reliability and validity of our episode-level measure of perceived positivity resonance, primary analyses for Studies 2 and 3 largely replicate those of Study 1. Although depressive symptoms were not measured in Studies 2 and 3, the pattern of results for flourishing mental health was identical across all three studies (cf., Tables 2 and 6). As in Study 1, the evidence for illness symptoms was again mixed. On the one hand, results for Study 2 fully supported our hypothesis that perceived positivity resonance is inversely related to illness symptoms (Table 6, Model 1) and that this association is maintained when statistically controlling for positive emotions (Table 6, Model 2). On the other hand, results for Study 3 showed no association between perceived positivity resonance and illness symptoms (Table 6, Models 1 and 2). Studies 2 and 3 also measured well-being in terms of loneliness, and the duration of social interaction and the frequency of social episodes (person-level measures derived from the DRM). The effects for loneliness patterned those of other well-being measures: Loneliness was inversely related to perceived positivity resonance (Table 6, Model 1), and this effect remained statistically significant when positive emotions were included in the model (Table 6, Model 2; Study 3 only). Models 3 and 4 in Table 6 statistically control for the duration of social interaction (Model 3) and the frequency of social episodes (Model 4) for all well-being measures in Studies 2 and 3. Associations between perceived positivity resonance and both flourishing mental health and loneliness survived the inclusion of both indices of social engagement. The pattern for illness symptoms was again mixed. The inverse association between perceived positivity resonance and illness symptoms survived the inclusion of both indices of social engagement in Study 2, but not in Study 3.

Although using the DRM to assess episode-level perceived positivity resonance better matches the theorized temporal scope of positivity resonance, one limitation of the DRM is that respondents may have had more than one social interaction within any given episode, and the available data do not allow us to discern whether this is the case. In addition, pleasant and unpleasant affective experiences are reported at the episode level rather than at the level of the interaction. To an unknown degree then, those affective measures do not provide a pure measure of affect during social interactions per se. Future research might address these limitations.

General Discussion

The present studies are the first to provide evidence supporting the association between perceived positivity resonance and well-being, measured at both the trait level (Study 1) and the episode level (Studies 2 and 3). More specifically, greater perceived positivity resonance was significantly associated with greater levels of flourishing mental health (Studies 1, 2, and 3), lower levels of depressive symptoms (assessed in Study 1 only) and loneliness (assessed in Studies 2 and 3 only), and fewer illness symptoms (Studies 1 and 2 only; mixed results in Study 3). These associations largely persisted after statistically controlling for positive emotions more generally, or social interaction more generally. Together the results make two contributions to the literature. First, they offer evidence that perceived positivity resonance is a useful new construct, and that our episode-level measure is both reliable and valid. Second, and more importantly, they link perceived positivity resonance to psychological, social, and physical well-being.

All findings reported here are correlational and cannot indicate causality. Even so, for relationship scientists, we note that these findings suggest that even though social integration has been found to promote well-being, it is possible that the well-being benefits of social integration may be particularly powerful when social encounters are marked by positivity resonance. For affective scientists, we also note that the well-being benefits of positive emotions may be particularly powerful when positive emotions are experienced by people who are “in sync” and who share a caring attitude. These findings also suggest that perceived positivity resonance—measured at either trait or episodic levels—may be a useful construct for both social integration researchers and affective scientists. We encourage researchers interested in trait-level assessment of perceived positivity resonance to adopt the items used in Study 3 (rather than those of Study 1) because those newer items (shown in Table 3) have undergone deeper psychometric testing that confirms that they collectively index one strong factor.

We chose to embed the newly-developed measure of perceived positivity resonance within the DRM (Studies 2 and 3) because the DRM is a well-validated tool known to provide more accurate and less biased self-reports of episode-level experiences across an entire day (Kahneman & Krueger, 2006). However, one downside of the DRM is that it may cause respondent fatigue due to the repetition of assessments over numerous daily episodes. In Study 2, we tried to alleviate participant fatigue in the DRM by targeting only part of the day (i.e., the workday). Depending on their needs and aims, researchers studying positive social connections may also wish to consider alternate uses for the episode-level perceived positivity resonance measure introduced here. For example, the Event Reconstruction Method (ERM; Schwarz et al., 2009) might be most suitable for measuring perceived positivity resonance when researchers are interested in targeting particular types of episodes (e.g., think of your most recent classroom experience) instead of an entire day. Alternatively, this measure could be used to assess perceived positivity resonance immediately following a specific social encounter, such as a customer service exchange or laboratory-based interaction between and among strangers.

These initial findings are promising and consistent with theorizing about positivity resonance. Still, more work is needed. Because the correlational nature of this work precludes causal interpretations, it leaves open the possibility that well-being may also support the emergence of positivity resonance, or other, unmeasured variables influence both. Beyond testing causal directions, experimental research is also needed to determine whether positivity resonance can be taught and whether low-cost behavioral interventions that do so can produce improvements in well-being relative to matched control groups. Loneliness and depressive symptoms are widespread in the U.S. (and other industrialized nations) and have been convincingly linked to measures of acute and chronic illness (e.g., Chauvet-Gélinier, Trojak, Vergès-Patois, Cottin, & Bonin, 2013; Luo, Hawkley, Waite, & Cacioppo, 2012). Behavioral interventions that target positivity resonance stand to combat these growing societal and health problems.

Another priority for future research is to obtain self-reports of perceived positivity resonance from multiple interaction partners in order to determine when the experience is truly shared, and the extent to which such shared experiences play a differential role in promoting

well-being. Additionally, because some features of positivity resonance may occur outside of awareness and thus be more difficult for participants to perceive (i.e., behavioral and biological synchrony), researchers working in this area should consider additional, non-self-report assessments—like shared smiles and other forms of positive expressivity, or synchrony across behavioral and biological markers—to provide a more complete picture of positivity resonance. Another future direction would be to consider the impact of positivity resonance within the context of strong versus weak ties (Sandstrom & Dunn, 2014). Perhaps even very brief moments of positivity resonance (e.g., with a passerby) hold the potential to influence well-being. A multidimensional approach to assessing well-being, such as with implicit or physiological measures, will also enrich research linking these constructs to positivity resonance. Finally, we speculate that perceived positivity resonance may matter more than actual positivity resonance (assessed beyond individual self-reports) for measures of well-being such as loneliness. By contrast, actual positivity resonance may matter more than perceived positivity resonance for measures of well-being such as biological markers of physical illness and health.

In conclusion, these studies bring together several lines of research to better understand how positive emotions and social interactions might function in tandem to promote well-being. The present evidence provides initial support for recent theory that suggests shared experiences of positivity may be particularly beneficial for well-being (Fredrickson, 2016). Further, the present research is consistent with prior work that indicates the *quality* of social connections is more important to health, well-being, and longevity than its *quantity* (Holt-Lunstad et al., 2010; Kasser & Ryan, 1999; Pinquart & Sörensen, 2000). In particular, the evidence presented here indicates that perceived positivity resonance may be an important indicator—or building block—of the type of high-quality social relationships that are particularly salutogenic. By moving beyond global constructs associated with social relationships (e.g., social networks, social integration, perceived social support; Berkman & Glass, 2000; Heaney & Israel, 2008), we can begin to see that the degree to which moments characterized by the trio of shared positive affect, mutual care and concern, and behavioral and biological synchrony might—in part—explain the well-established associations between social integration and health, well-being, and longevity.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Descriptive Statistics and Pearson Correlations between Trait Perceived Positivity Resonance and Well-being Measures in Study 1

Variable	Study 1 M (*SD*)	1	2	3	4	5
1. Perceived Positivity Resonance	65.93 (*14.48*) N = 175	--				
2. Habitual Positive Emotions	2.23 (*0.85*) N = 153	.36*** *p* < .001	--			
3. Flourishing Mental Health	3.53 (*.91*) N = 174	.44*** *p* < .001	.63*** *p* < .001	--		
4. Depressive Symptoms	1.56 (*0.46*) N = 175	−.35*** *p* < .001	−57*** *p* < .001	−.66** *p* < .001	--	
5. Illness Symptoms	.76 (*.77*) N = 175	−.19** *p* = .014	−.17* *p* = .035	−.19** *p* = .014	.37*** *p* < .001	--

Note.

* *p* < .05,

** *p* < .01,

*** *p* < .001.

In Study 1, of the 175 total participants, 1 participant did not complete the measure of flourishing mental health, and 22 participants did not report daily positive emotions during the 7-day assessment.

Table 2

Standardized and Unstandardized Coefficients for Regression of Well-being Measures on Trait Perceived Positivity Resonance and Positive Emotions in Study 1

	Flourishing Mental Health					Depressive Symptoms					Illness Symptoms				
	B	***SE*** $_B$	**LB**	**UB**	***β***	***B***	***SE*** $_B$	**LB**	**UB**	***β***	***B***	***SE*** $_B$	**LB**	**UB**	***β***
Model 1															
Positivity Resonance	.027	.005	.017	.036	.42***	−.010	.002	−.015	−.006	−.33***	−.002	.001	−.004	.000	−.19*
Model 2															
Positivity Resonance	.015	.004	.007	.023	.23**	−.005	.002	−.010	.000	−.16*	−.002	.001	−.004	.000	−.16†
Positive Emotions	.603	.071	.463	.743	.55***	−.281	.040	−.360	−.202	−.51***	−.018	.016	−.051	.014	−.10

Note. Positivity Resonance = Trait Perceived Positivity Resonance. This table reports the results of models that include Experimental Condition as a covariate but not the associated interaction terms to avoid possible multicollinearity. Preliminary models allowed condition to interact with predictors, but no main effect for or interaction with condition were statistically significant (see Table E1 in the OSM). In Study 1, of the 175 total participants, 1 participant did not complete the measure of flourishing, and 22 participants did not report daily positive emotions during the 7-day assessment. Therefore, the final sample for this set of analyses was N = 152. LB/UB = lower/upper bound 95% confidence interval for B.

$^{***}p < .001$,

$^{**}p < .01$,

$^{*}p < .05$,

$^{\dagger}p < .10$

Table 3

Descriptive Statistics and Factor Loadings for the Perceived Positivity Resonance Items

Study 2: Multilevel Exploratory Factor Analysis[a]						
					Rotated Factor Loadings	
Perceived Positivity Resonance Items	*N*	Mean	SD	ICC	Within	Between
1. …did you experience a mutual sense of warmth and concern toward the other(s)?	449	62.90	31.72	0.43	0.75* (0.03)	0.99* (0.02)
2. …were you able to attune to and connect with the other(s)' experiences?	447	66.47	30.45	0.45	0.77* (0.03)	0.96* (0.02)
3. …did thoughts and feelings flow with ease between you and the other(s)?	445	68.62	29.09	0.47	0.83* (0.02)	0.95* (0.02)
4. …did you feel energized and uplifted by the company of the other(s)?	447	60.08	33.57	0.40	0.75* (0.03)	0.88* (0.04)
5. …were you and the other(s) mutually responsive to one another's needs?	446	68.21	29.18	0.45	0.79* (0.02)	0.97* (0.02)
6. …did you feel a sense of mutual trust with the other(s)?	445	67.80	30.23	0.44	0.87* (0.02)	0.96* (0.02)
7. …did you feel in "in sync" with the other(s)?	446	68.16	30.53	0.42	0.84* (0.02)	0.97* (0.02)
Study 3: Multilevel Confirmatory Factor Analysis[b]						
					Factor Loadings	
Perceived Positivity Resonance Items	*N*	Mean	SD	ICC	Within	Between
1. …did you experience a mutual sense of warmth and concern toward one another?	1,394	72.53	27.86	0.25	21.54* (0.93)	13.07* (1.20)
2. …were you able to attune to and connect with the other(s)?	1,385	73.22	26.83	0.28	20.76* (0.91)	14.06* (1.00)
3. …did thoughts and feelings flow with ease between you and the other(s)?	1,385	71.55	28.32	0.31	21.19* (0.84)	14.08* (1.51)
4. …did you feel a mutual sense of being energized and uplifted in each other's company?	1,369	68.03	29.85	0.26	23.29* (0.89)	14.39* (1.34)
5. …were you and the other(s) mutually responsive to one another's needs?	1.391	71.97	28.41	0.31	20.88* (0.88)	15.14* (1.39)
6. …did you feel a sense of mutual trust and respect with one another?	1,395	77.69	26.78	0.29	19.61* (1.01)	13.50* (1.42)
7. …did you feel "in sync" with the other(s)?	1,377	71.91	28.53	0.32	21.27* (0.84)	15.38* (1.28)

Note.

[a] In Study 2, for each item, the question stem was, "For what proportion of time during this episode (from 0 to 100 percent)…"; $N_{participants}$ = 117, $N_{observations}$ = 449, using all available data.

[b] In Study 3, for each item, the question stem was, "Considering only the time during this episode when you were interacting with others (face-to-face, or otherwise), for what proportion of the time…"; $N_{participants}$ = 171, $N_{observations}$ = 1,416. Factor variance at both the within- and between-person levels was fixed at one. ICC = intraclass correlation. Factor loading standard errors are in parentheses.

* $p < .001$.

For researchers interested in assessing perceived positivity resonance—at either the trait or episode level—the authors recommend using the question stem and items as worded in Study 3.

Table 4

Descriptive Statistics and Associations between Perceived Positivity Resonance, Pleasant and Unpleasant Emotions, and Well-being in Study 2 (below diagonal) and Study 3 (above diagonal)

Emotion Variable (Person-Level)	Study 2 M (*SD*)	1	2	3	4	5	6	7	8	Study 3 M (*SD*)
1. Perceived Positivity Resonance	65.55 (*23.21*) *N* = 117	--	.55*** *p* < .001	.30*** *p* < .001	−.40*** *p* < .001	−.21** *p* =. 008	.37*** *p* = .010	−.38*** *p* < .001	−.14† *p* = .078	70.85 (*17.18*) *N* = 171
2. Social Pls. Emotions	3.47 (*0.81*) *N* = 117	.62*** *p* < .001	--	.52*** *p* < .001	−.33*** *p* < .001	−.09 *p* = .258	.40*** *p* < .001	−.28*** *p* < .001	−.11 *p* = .162	3.49 (*0.62*) *N* = 171
3. Non-Social Pls. Emotions	3.21 (*1.13*) *N* = 97	.24* *p* = .018	.56*** *p* < .001	--	−.13 *p* = .105	−.37*** *p* < .001	.15† *p* = .067	.00 *p* = .984	−.11 *p* = .173	3.05 (*0.75*) *N* = 162
4. Social Unpls. Emotions	1.91 (*0.82*) *N* = 117	−.48*** *p* < .001	−.62*** *p* < .001	−.35** *p* < .001	--	.57*** *p* < .001	−.19* *p* = .014	.22** *p* = .005	.23** *p* = .004	1.86 (*0.61*) *N* = 171
5. Non-Social Unpls. Emotions	1.95 (*1.00*) *N* = 97	−.29** *p* = .005	−.34** *p* = .001	−.56*** *p* < .001	.52*** *p* < .001	--	−.05 *p* = .515	−.08 *p* = .335	.25** *p* = .002	1.83 (*0.71*) *N* = 162
6. Flourishing Mental Health	2.98 (*0.66*) *N* = 104	.44*** *p* < .001	.41*** *p* < .001	.43*** *p* < .001	−.43*** *p* < .001	−.36** *p* = .001	--	−.64*** *p* < .001	−.12 *p* = .123	4.59 (*0.76*) *N* = 168
7. Loneliness	2.43 (*0.79*) *N* = 104	−.29** *p* = .003	−.24** *p* = .014	−.34** *p* = .002	.32*** *p* = .001	.30** *p* = .005	−.70*** *p* < .001	--	.20* *p* = .012	2.04 (*0.50*) *N* = 168
8. Illness Symptoms	0.55 (*0.43*) *N* = 104	−.22* *p* = .025	−.11 *p* = .288	.04 *p* = .696	.21* *p* = .035	.20† *p* = .063	−.33** *p* = .001	.33** *p* = .001	--	0.68 (*0.37*) *N* = 168

Note. The test statistic for Study 2 is a Pearson correlation, whereas the test statistic for Study 3 is a standardized beta (controlling for condition). In Study 2, of the 120 total participants, three did not report any social episodes and thus, did not have scores for perceived positivity resonance and social pleasant or unpleasant emotions. Twenty-three participants did not report having any non-social episodes and thus did not have scores for non-social pleasant or unpleasant emotions. In Study 3, of the 172 total participants, one did not report any social episodes and thus, did not have a score for positivity resonance and social pleasant or unpleasant emotions. Ten participants did not report having any non-social episodes and thus did not have scores for non-social pleasant or unpleasant emotions.

* $p < .05$,

** $p < .01$,

*** $p < .001$.

Table 5

Associations between Perceived Positivity Resonance and Time Spent Interacting Face-to-Face, by Tele/Video Media, and by Computer-Mediated Communication (Within- and Between-person Effects) in Study 2 (highlighted) and Study 3

	Estimated within-person effect				Estimated between-person effect (i.e., person means)			
	***B* (SE)**	**95% CI**	**Test statistic (*t*)**	**Variance explained**	***B* (SE)**	**95% CI**	**Test statistic (*t*)**	**Variance explained**
Model 1: Interacting (any type)								
Study 2	0.25 (0.04)	[0.16, 0.33]	5.53,$p < .001$	8.03%	0.32 (0.10)	[0.11, 0.53]	3.07, $p = .003$	7.10%
Study 3	0.20 (0.02)	[0.15, 0.24]	8.65, $p < .001$	5.54%	0.20 (0.08)	[0.04, 0.35]	2.50, $p = .013$	1.18%
Model 2: Face-to-face								
Study 2	0.16 (0.03)	[0.11, 0.22]	5.57,$p <.001$	8.08%	0.14 (0.06)	[0.02, 0.26]	2.27, $p = .025$	2.78%
Study 3	0.21 (0.02)	[0.18, 0.24]	13.68,$p < 001$	13.19%	0.23 (0.06)	[0.11, 0.35]	3.71,$p < .001$	3.02%
Model 3: Tele/video media								
Study 2	0.00 (0.03)	[−0.07, 0.07]	0.01, $p = .995$	0.00%	0.03 (0.09)	[−0.13, 0.20]	0.40, $p = .688$	0.00%
Study 3	−0.10 (0.03)	[−0.17, −0.04]	−3.09, $p = .002$	0.68%	−0.20 (0.13)	[−0.45, 0.06]	−1.52, $p = .131$	0.44%
Model 4: Computer-mediated								
Study 2	−0.08 (0.04)	[−0.16, −0.01]	−2.23, $p = .027$	0.93%	−0.10 (0.09)	[−0.27, 0.07]	−1.15, $p = .253$	0.01%
Study 3	−0.24 (0.03)	[−0.29, −0.19]	−9.26, $p < .001$	6.41%	−0.15 (0.10)	[−0.34, 0.05]	−1.46, $p = .145$	0.00%

Note. Preliminary models allowed sample population (Study 2) or experimental condition (Study 3) to interact with predictors, but no main effect were statistically significant and fewer than 5% of interactions with condition (1 of 24 tests) were statistically significant (see Table E3 in the OSM). In Study 2, of the 120 total participants, three did not have any social episodes. Thus, the samples (person-level and episode-level) for this set of analyses are: $N_{participants} = 117$, $N_{social\text{-}episodes} = 449$. In Study 3, of the 172 total participants, one did not have any social episodes. Of the 1,443 episodes that contained a social interaction, 39 episodes contained missing data on one or more variables. Thus, the samples (person-level and episode-level) for this set of analyses are: $N_{participants} = 171$, $N_{social\text{-}episodes} = 1{,}404$.

Table 6

Standardized and Unstandardized Coefficients for Regression of Wellbeing Measures on Positivity Resonance, Positive Emotions, Duration of Social Interaction, and Frequency of Social Interaction in Studies 2 and 3

		Flourishing					Loneliness					Illness Symptoms				
		B	***SE*** $_B$	**LB**	**UB**	***β***	***B***	***SE*** $_B$	**LB**	**UB**	***β***	***B***	***SE*** $_B$	**LB**	**UB**	***β***
Model 1																
Study 2:	Positivity Resonance	.012	.002	.007	.017	$.44^{***}$	−.009	.003	−.016	−.003	$-.29^{**}$	−.004	.002	−.007	−.001	$-.22^{*}$
Study 3:	Positivity Resonance	.016	.003	.010	.022	$.37^{***}$	−.011	.002	−.015	−.007	$-.38^{***}$	−.003	.002	−.006	.000	$-.14^{\dagger}$
Model 2																
Study 2:	Positivity Resonance	.007	.003	.001	.012	$.25^{*}$	−.005	.004	−.012	.002	−.16	−.004	.002	−.008	−.0001	$-.24^{*}$
	Pleasant Emotions	.278	.079	.121	.436	$.36^{***}$	−.227	.102	−.430	−.025	$-.25^{*}$	.016	.059	−.102	.133	.03
Study 3:	Positivity Resonance	.010	.004	.003	.017	$.23^{**}$	−.010	.002	−.015	−.005	$-.35^{***}$	−.002	.002	−.006	.002	−.11
	Pleasant Emotions	.332	.106	.123	.541	$.26^{**}$	−.042	.071	−.182	.097	−.05	−.036	.057	−.148	.075	−.06
Model 3																
Study 2:	Positivity Resonance	.012	.003	.007	.017	$.43^{***}$	−.010	.003	−.016	−.003	$-.30^{**}$	−.004	.002	−.007	−.0003	$-.22^{*}$
	Dur. Social Interaction	.168	.195	−.220	.555	.08	.148	.243	−.334	.630	.06	−.118	.137	−.390	.155	−.08
Study 3:	Positivity Resonance	.015	.003	.009	.021	$.34^{***}$	−.010	.002	−.014	−.006	$-.35^{***}$	−.003	.002	−.006	.001	−.13
	Dur. Social Interaction	.442	.256	−.063	.948	$.13^{\dagger}$	−.384	.165	−.710	−.057	$-.17^{*}$	−.111	.135	−.378	.156	−.07
Model 4																
Study 2:	Positivity Resonance	.012	.002	.007	.017	$.44^{***}$	−.009	.003	−.016	−.003	$-.30^{**}$	−.004	.002	−.007	−.001	$-.22^{*}$
	Freq. Social Interaction	.035	.024	−.013	.082	.13	−.039	.030	−.098	.020	−.13	−.008	.017	−.041	.026	−.05
Study 3:	Positivity Resonance	.016	.003	.009	.022	$.35^{***}$	−.010	.002	−.014	−.006	$-.36^{***}$	−.003	.002	−.007	.000	$-.15^{\dagger}$
	Freq. Social Interaction	.019	.014	−.008	.046	.10	−.023	.009	−.040	−.005	$-.19^{*}$	.008	.007	−.006	.022	.09

Note. In Study 2, of the 120 total participants, 16 did not complete the wellbeing measures due to time constraints, and three did not have any social episodes and thus, did not have a positivity resonance score. Therefore, the final sample for this set of analyses was $N = 101$. In Study 3, we controlled for condition across all models. Of the 172 total participants, 4 did not complete the wellbeing measures. Therefore, the final sample for this set of analyses was $N = 168$. LB/UB = lower/upper bound 95% confidence interval for *B*.

$^{***}p < .001$,

$^{**}p < .01$,

$^{*}p < .05$,

$^{\dagger}p < .10$