SAFE AND IN SYNC: EVIDENCE FOR THE ANTECEDENTS AND SOCIAL OUTCOMES OF PERCEIVED POSITIVITY RESONANCE ACROSS CONTEXTS

Khoa D. Le Nguyen

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Approved by:

Barbara L. Fredrickson

Catherine Zimmer

Keely A. Muscatel

Patrick Akos

Sara B. Algoe

ABSTRACT

Khoa D. Le Nguyen: Safe and In Sync: Evidence for the Antecedents and Social Outcomes of Perceived Positivity Resonance Across Contexts
(Under the direction of Barbara Fredrickson)

Positivity resonance is an interpersonal affective state that emerges during social interactions within a safe, real-time sensory-rich context, and is characterized by three co-occurring, intertwined components: shared positive affect, nonverbal caring synchrony, and biological synchrony. Using a combination of cross-sectional studies (Study 1, 2, and 4) and a longitudinal field experiment (Study 3), the research program (total N = 3509, 84.3% White, 91.3% women) examines the contextual influences, antecedents, and outcomes of perceived positivity resonance. There were three sets of findings. First, findings from preliminary contextual exploration helped characterize perceived positivity resonance in greater detail, suggesting that in dyads, perceived positivity resonance is weakly shared between partners (Study 1); in groups, participants' group-level ratings of their perceived positivity resonance with members was strongly related to averages of participants' perceived positivity resonance with individual members (Study 2); across social targets, perceived positivity resonance with weak and strong ties were highly correlated (Study 3); and perceived positivity resonance could potentially exist in asynchronous media (Study 4). Second, across studies, correlational findings supported the two theorized antecedents of perceived positivity resonance, namely, perceived safety (Studies 1-4) and real-time sensory connection (Studies 2 and 4), measured directly or by proxy. Fourth, the findings also revealed consistent cross-sectional and longitudinal correlations between perceived positivity resonance and various measures of social resources for both

individuals (Studies 1, 3, and 4) and groups (Study 2), as measured by both self-reports (Studies 2-4) and other-reports (Study 1). Moreover, experimental evidence from Study 3 suggests that attempts to increase moments of social connection, especially with weak ties, may indirectly enhance social resources by elevating perceived positivity resonance over time. Furthermore, such social resources may predict downstream benefits such as individuals' health behavior (Study 4) and perceived group performance (Study 2). The overall findings suggest that positivity resonance may build consequential personal and collective social resources and thereby promote the well-being of individuals and communities.

To my advisor, mentors, family, and friends,
who fuel me toward the finish line and beyond.

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LIST OF ABBREVIATIONS

CFI	Comparative Fit Index
df	Degrees of Freedom
DSEM	Dynamic Structural Equation Modeling
IRI	Interpersonal Reactivity Index
PosRes	Positivity Resonance
RMSEA	Root Mean Square Error of Approximation
SEM	Structural Equation Modeling
SRMR	Standardized Root Mean Square Residual
VAR(1)	Vector Autoregressive Model (lagged by one entry)

CHAPTER 1: INTRODUCTION

There is nothing in the world so irresistibly contagious as laughter and good humor.

— Charles Dickens, A Christmas Carol

What creates a moment of positive human connection? Is it the pleasant and uplifting feelings reverberating among people, flowing through shared laughter and warm gazes? Is it the mutual valuing of one another's happiness and well-being? Is it a sense of effortless coordination, a feeling of being "in sync," "on the same wavelength," and able to "finish each other's sentences"? Drawing from affective science, developmental psychology, and relationship science, the Positivity Resonance Theory (Fredrickson, 2016) of co-experienced positive affect asserts that human positive connection is a synthesis of the above features and that this fleeting state may occur across all forms of social relationships, including romantic pair-bonding, parent-child attachment, platonic friendship, and even non-close relationships. This holistic experience, "positivity resonance," is a momentary experience during interpersonal interaction that consists of three components: shared positive affect (a pleasant subjective feeling co-experienced by two or more people), caring nonverbal synchrony (nonverbal synchronous behavior that signals mutual care and concern), and biological synchrony (spatiotemporal matching of biological rhythms among people; Fredrickson, 2016). Evidence suggests that these elements co-occur. For example, various biological systems have been shown to synchronize across individuals during moments marked by shared positive affect

(self-reported or behaviorally coded; Chen et al., 2020) or caring nonverbal behavior synchrony (eye gaze or playful exchanges; Feldman et al., 2011; Kinreich et al., 2017). The Positivity Resonance Theory (Fredrickson, 2016) offers a framework for how the experience of positivity resonance may emerge and over time build social and group-level resources such as social bonds, interpersonal togetherness, and prosocial tendencies (Fredrickson, 2016; Brown & Fredrickson, 2020). As an interpersonal affective experience, positivity resonance is hypothesized to emerge when two antecedents are satisfied: partners engage in real-time sensory connection (Major et al., 2018), and partners perceive safety in their current circumstances. Positivity resonance is hypothesized to momentarily broaden individuals' other-focused thoughts and action tendencies, and in doing so, over time build social and group-level resources (Fredrickson, 2016; Brown & Fredrickson, 2020) such as individuals' prosocial character traits (West et al., 2021; Zhou et al., under review) and high-quality relationships (Brown et al., 2021; Chen et al., 2020; Otero et al., 2019).

Although the Positivity Resonance Theory was built from two mature branches of psychology (namely, developmental science and relationship science), research that directly targets positivity resonance remains in its infancy. The current dissertation research focuses on several unexplored issues. First, unexamined conceptual and contextual questions remain about the perception of positivity resonance, e.g., those regarding the degree to which it is shared among dyads and its characteristics across interactions with different social partners in different contexts (e.g., in everyday life or on text-based social media). Second, perceived safety as a precondition for positivity resonance has not yet been tested. Third, the evidence for links between positivity resonance and social and group-level resources is still limited, particularly

outside of the non-romantic relationship contexts. The current research aims to investigate and fill in the literature gaps on these three issues.

In the sections that follow, I first present a review of the research literature on positivity resonance and its components. Second, I identify several literature gaps in three topics: (1) the conceptual and contextual issues within individuals' perceptions of positivity resonance, (2) the theorized preconditions for positivity resonance, and (3) the theorized social outcomes of positivity resonance. And last, I provide a summary of the three primary aims that guide the four studies reported in this dissertation.

Review of the Literature on Positivity Resonance

According to the Positivity Resonance Theory (Fredrickson, 2016; Brown & Fredrickson, 2020), positivity resonance is a subtype of co-experienced positive affect states, which, like other collective emotional states, are "macro-level phenomena that emerge from emotional dynamics among individuals who are responding to the same situation" (Goldenberg et al., 2020). Just as individuals' emotions are brief, multi-component responses (i.e., experiential, behavioral, physiological; Levenson et al., 2017), positivity resonance is theorized to consist of three interwoven responses: (a) shared positive affect (experiential), (b) cross-person caring nonverbal synchrony (behavioral), and (c) cross-person biological synchrony (physiological; Fredrickson, 2016; Brown & Fredrickson, 2020).

Shared Positive Affect

The first defining feature of positivity resonance is shared positive affect (Fredrickson, 2013; Brown & Fredrickson, 2020), which refers to any pleasant subjective feelings momentarily co-experienced by two or more people. These positive feelings

include all flavors of pleasantness: e.g., mutual joy, interest, warm-heartedness, amusement, hope, serenity, gratitude, pride, inspiration, and awe. Unlike intrapersonal affect, shared positive affect is characterized by slightly greater longevity and magnitude. Extant research suggests individuals' positive affect is amplified and expressed more frequently when they co-experience positive events with others (Boothby et al., 2014; Addyman et al., 2018), and the expression of positive affect is sustained when reciprocated by others (Bai et al., 2016).

Previous research has focused on shared positive affect among romantic couples, however, shared positive affect is also possible in non-romantic social exchanges. In research on romantic couples, shared positive affect has been assessed by coding shared laughter in couples' interactions (Kurtz & Algoe, 2015) or by having spouses retrospectively rate their continuous individual affective experience during couples' conversations with researchers later identifying moments of affect co-experience (Brown et al., 2021). Not limited to romantic relationships, however, the experience of shared positive affect is possible across a range of relationships, observed in interactions among friends and family (Bai et al., 2016), work colleagues (Rhee & Yoon, 2012), and brief social exchanges between strangers such as customers and service workers (Pugh, 2001; Tan et al., 2004).

Shared positive affect may co-occur among individuals through various mechanisms. A person may catch another's joy by unconsciously mimicking their affective state (e.g., emotional contagion; Niedenthal et al., 2010; Singer & Lamm, 2009). Positive affect may be transmitted through the disclosure of emotional stories (Rime, 2009), by which listeners actively imagine themselves in the storyteller's shoes to understand their emotional states. Positivity resonance may be dynamically co-created by interacting partners. When we see a friend's smile, we may interpret the smile to mean they are happy to see us, which evokes our joy, and we smile in

return, thus joining in and co-creating an experience of shared positive affect. Experiencing a common event is another way through which shared pleasant feelings may emerge. A victory for the home team during a basketball game against its archrival can set off fans' collective euphoria in the stadium. In such situations, loved ones or strangers alike may simultaneously exchange affiliative and positive nonverbal responses, such as grins, hugs, and high fives, that further amplify shared positive affect (Boothby et al., 2014; Addyman et al., 2018).

Cross-Person Caring Nonverbal Synchrony

The second feature of positivity resonance is caring nonverbal synchrony (Fredrickson, 2013; Brown & Fredrickson, 2020), which refers to mutual, synchronous behaviors signaling that individuals are reciprocally invested in others' well-being during a particular social interaction. Caring nonverbal behaviors may include a mutual gaze (Kinreich et al., 2017), affectionate touch (Jolink et al., 2021), and a variety of responsive behaviors such as head-nodding, waving, clapping, and orienting one's body position toward others (Kane et al., 2012). These caring behaviors may serve to promote perceived responsiveness (Jolink et al., 2021; Kane et al., 2012), the extent to which a person feels that they are being understood, valued, and cared for by others (Reis, 2014).

In caring nonverbal behaviors, synchronicity and reciprocity provide a platform for developing interpersonal relationships and prosociality. For example, synchronization in body movement was shown to explain the effect of mutual disclosure on embodied rapport and high-quality connections between strangers (Vacharkulksemsuk & Fredrickson, 2012). A meta-analysis of 42 experimental studies by Mogan et al. (2017; total $N = 4327$) concluded that behavioral synchrony leads to greater levels of perceived

social bonding (e.g., closeness, trust), social cognition (e.g., attention to social stimuli), and prosocial behaviors (effect sizes: .11 to .28).

Together, caring nonverbal behavior and perceived responsiveness result in a dynamic, reinforcing cycle of mutually responsive behaviors during which, when a person perceives responsiveness, they may be more motivated to be responsive toward their partners' well-being and needs (Reis, 2014; Wieselquist et al., 1999). Although this positive feedback loop of mutually responsive behaviors has more often been studied on larger time scales (e.g., weeks, months, years; Reis, 2014; Wieselquist et al., 1999), it may also occur in micro-moments of interactions (e.g., seconds, minutes). These behaviors promote individual and joint enduring social resources such as partners' personal development, trust, relationship commitment, and bonds (Reis, 2014).

Cross-Person Biological Synchrony

The third component of positivity resonance is cross-person biological synchrony (Fredrickson, 2013; Brown & Fredrickson, 2020), which refers to the extent to which people's autonomic physiology and neural responses match one another's responses temporally (and spatially in the brain). Consistent with the conceptualization of positivity resonance, cross-person biological synchrony of various systems has been linked to other components of positivity resonance, including caring nonverbal synchrony (e.g., Feldman et al., 2011; Kinreich et al., 2017) and shared positive affect (Chen et al., 2020). Research suggests biological synchrony plays an important role in human social-emotional development, bonding, communication, and social coordination (e.g., Feldman, 2015; Mogan et al., 2017). Evidence suggests that biological synchrony can occur between parent-infant dyads (Feldman, 2015; Davis et al., 2018), romantic

couples (Chen et al., 2020; Timmons et al., 2015), dyads of strangers (Palumbo et al., 2017), and among individuals in a group (Kazi et al., 2019).

Biological synchrony with parental figures appears vital to infants' socio-emotional development (Feldman, 2015). During face-to-face interactions between responsive parents and their infants, behavioral synchrony emerges together with synchrony in autonomic physiology via shared eye contact, facial expressions, vocal tonality, and touches (e.g., heart rhythm; Feldman et al., 2011). This biological synchrony appears to regulate the infant's oxytocin system, as high parent-child behavioral synchrony forecasts a high correlation between a parent's and an infant's OT response (Feldman et al., 2010). The resulting synchronous oxytocin system is proposed to support future adult sociality, pair bonding, and parenting behavior and also exerts a lasting effect on a range of functions, including stress management, emotion regulation, and mental health (Feldman, 2015). In contrast, a lack of behavioral coordination with parents leads to short-term expressions of distress in infants (e.g., Ekas et al., 2013) and long-term impairment in children's cognitive and socio-emotional skills. For example, in the case of depressed postpartum mothers, reductions in the mother's positive affect, social sensitivity, and responsiveness combine to inhibit synchrony with their children (Granat et al., 2017).

Throughout the human lifespan, synchrony continues to be integral to social coordination and bonding. In a sample of long-time married couples, observer-coded shared positive affect between couples was associated with couples' physiological linkage (Chen et al., 2020). Specifically, positive affect was related to higher in-phase linkage (spouses' physiological responses rise and fall together) and lower anti-phase

linkage (spouses' physiological responses change in opposite directions), relative to shared negative affect, shared neutral affect, and unshared positive affect (Chen et al., 2020). Greater in-phase physiological linkage during shared positive affect, in turn, predicted higher-quality interactions and relationships measured concurrently and even five to six years later. These findings were unexpected, given the vast affective science literature typically emphasizing that "bad is stronger than good" (Baumeister et al., 2001). At a neural level, neural firings sync between romantic partners during shared nonverbal social behaviors (e.g., eye contact and positive affect expression; Kinreich et al., 2017). Such cross-person coupling of brain activity underlies interpersonal understanding and facilitates joint decision-making and action (Hasson et al., 2012).

Positivity Resonance Is a Holistic Construct

Although the previous sections separately review the three components of positivity resonance—shared positive affect, caring nonverbal synchrony, and biological synchrony—it is important to recognize this experience as a holistic synthesis of these three co-occurring elements. In line with this conceptualization, Otero et al. (2019) measured positivity resonance in couples' interactions with a novel behavioral coding system in which researchers holistically code observable components of positivity resonance, instead of targeting individual components of such as physiological synchrony (Chen et al., 2020) or shared positive affect (Brown et al., 2021). The findings reveal that the holistic assessments outperform a long-standing behavioral coding used to identify co-occurring positive affective expression in predicting couples' marital satisfaction (Otero et al., 2019). This result supports the conceptualization of positivity resonance as a shared, multi-component affective experience and suggests that this multifaceted experience

may be more potent than any one of its individual components in terms of building relationships and collective resources.

Exploring Contextual Aspects of Perceived Positivity Resonance

The perception of positivity resonance is likely to be shaped by features of the context in which social interactions unfold. In the following subsections, I explore a range of contextual aspects, including (1) cross-person agreement on perceptions of shared experiences, (2) the influence of the social context (group vs. dyad), (3) the social targets (weak social ties versus strong social ties), and (4) and the influence of interactive medium (virtual and asynchronous online versus in-person).

Positivity Resonance Across Perceivers

To assess the shared experience of positivity resonance, studies have commonly used self-reports of perceived positivity resonance from one individual in any given interaction (Major et al., 2018; Prinzing et al., 2020; West et al., in press; Zhou et al., under review) alongside dyad-based approaches such as measuring co-occurrence of self-reported positive affect (Brown et al., 2021; Chen et al., 2020) and physiological linkage (Chen et al., 2020) in dyads. The use of self-reports raises interesting methodological and theoretical questions about how well a person perceives the shared experience of positivity resonance and the degree to which interaction partners agree or disagree in their perception of such experiences.

Although individuals are believed to accurately perceive their own present and recent emotion experiences (Mauss & Robinson, 2009), perceiving positivity resonance may be more challenging because it involves assessing self and others' affective states to infer shared experiences. Specifically, one person's conscious perception of positivity

resonance may not accurately reflect their partner's experiences due to a variety of reasons. First, individuals, even those high in empathic accuracy, may have difficulties reading the affective states of emotionally inexpressive social targets (Zaki et al., 2008). Further, individuals' interpretations of others' affective experiences are colored by their own affective states. For example, when sexually aroused, men tend to overperceive sexual intent from women (Benbouriche et al., 2018). The ability and motivation to accurately read others' emotions also vary across individuals and contexts. For example, women tend to have higher empathic accuracy than men when empathy-related gender-role expectations or obligations are made salient (Ickes et al., 2000). These sources of discrepancy mean perceived positivity resonance may not reflect the co-experience of positive affect among individuals, and individuals in dyads or groups may have different perceptions of this shared experience. To date, cross-person agreement on reports of perceived positivity resonance has been unexplored and thus is addressed in Study 1 (the Sorority Study).

Positivity Resonance in Groups versus Dyads

In addition, an individual's experience of positivity resonance may be different in groups as opposed to in dyads. To date, positivity resonance has only been studied in dyadic interactions (Otero et al., 2019; Brown et al., 2021; Chen et al., 2020) or unspecified types of interactions (i.e., it was unknown whether the interactions were in dyads or groups; e.g., Major et al. 2018, West et al. 2021). Moreover, group interactions are not the sum of dyadic interactions. An individual's experience of positivity resonance in a group may be shaped by the type of activity the group is engaged in. Some types of group activities may be more amenable to experiences of positivity resonance than other activities (e.g., dancing may promote physical synchrony). To begin exploring perceived positivity resonance in groups, this dissertation focuses on group

conversational exchanges. Group conversations differ from dyadic conversations in factors, including the number of people who are present, allocation of speaking time and eye contact, responsive feedback, and turn-taking. Each of these factors in turn may influence the experience of positivity resonance.

First, the mere presence of more people in an interaction may change perceived safety, a theorized antecedent of positivity resonance (Fredrickson, 2016). For situations with greater numbers of observers and social evaluation pressure, a higher proportion of individuals reported fear and anxiety about communication with others (McCroskey & Richmond, 1988). Second, relative to a dyadic interaction, fewer people may claim a larger proportion of speaking time in a group, which results in the uneven allocation of speaking time. Uneven allocation of speaking time may reflect the dominance or perceived status of members (Mast, 2002) or gender composition of the group (Bear & Woolley, 2011). Similarly, as any individual can only maintain eye contact with one person at a time, some members of the group may receive more eye contact than others. Uneven speaking time or received eye contact and other nonverbal communications may make any given group member feel excluded or unsafe, thereby reducing their propensity for perceived positivity resonance with the group.

Third, Cooney (2020) postulates that responsive feedback (e.g., head nods) when others are speaking might decrease as group size increases due to the diffusion of responsibility, although this hypothesis warrants greater empirical evidence. As a group context potentially impacts the responsive nonverbal communication that creates the basis for caring nonverbal synchrony across people, it may in parallel change a person's perceived positivity resonance in a group conversation. Finally, turn-taking becomes

more complex and potentially clumsy as people jostle for speaking chances. Failing to coordinate turn-taking may create conflicts and negative emotions, thus reducing individuals' potential for positive affect synchrony. Overall, the impact of these complex dynamics within-group interactions on positivity resonance and perceptions of it are potentially consequential yet poorly understood.

Given all the ways that group interactions differ from dyadic interactions, an important open question becomes how to conceptualize and measure an individual's perceived positivity resonance in group interactions. Although we can view this perception as simply an aggregate of perceived positivity resonance with individual group members, there may be emergent, group-level processes that can be better captured by assessing an overall, group-level perception of positivity resonance within any given group interaction. Additionally, the group-level perception of interpersonal affective experiences may be influenced by bias in memories, wherein people tend to remember positive or negative emotional experiences that are intense or located at the end of an event (Kahneman et al., 1993). In the context of groups, an individual's very positive or very negative interactions with a particular group member may disproportionately influence or even completely determine this individual's perception of positivity resonance with all members. To date, the nature of how one perceives positivity resonance in a group is an unexplored empirical issue and thus is addressed in Study 2 (the Classroom Study).

Positivity Resonance with Strong Ties versus Weak Ties

Positivity resonance can occur in interactions with two types of social ties — strong ties and weak ties — which may serve different social functions. Strong ties such as romantic partners, family members, and friends are intimate, longer-lasting social relationships. These ties serve communal purposes—such as satisfying our deepest needs to belong (Baumeister & Leary,

1995) and providing important sources of emotional support (Gurung et al., 1997) —and are strongly linked to health and well-being (Gurung et al., 1997; House et al., 1988). Weak ties are less intimate and transient relationships with strangers and acquaintances that can act as bridges between separate social networks and facilitate the diffusion of social information (Granovetter, 1973). Weak ties were traditionally thought by researchers to serve more non-communal, instrumental roles such as helping individuals seek and secure career opportunities (Granovetter, 1973). However, recent research has shown that the frequency of interaction with weak ties (i.e., strangers and acquaintances) also contributes to individuals' positive affect and sense of community, independently from the frequency of interaction with strong ties (Sandstrom & Dunn, 2014). These results suggest that beyond bridging social networks and facilitating informational exchange, weak ties may contribute to individuals' sense of connectedness and belonging.

As strong ties and weak ties differ in characteristics and social functions, it is an open empirical question as to whether or to what degree individuals' perceived positivity resonance with these ties are distinct or related. The Positivity Resonance Theory hypothesizes that the experience of positivity resonance is similar in these social ties and arises from the same preconditions, and that differences reside in the intensity and frequency of these experiences (Fredrickson, 2016). Moreover, there may be stable individual differences in the motivation or ability to co-create moments of positivity resonance with other people regardless of tie strength due to traits such as extraversion or agreeableness. Therefore, positivity resonance with weak and strong ties may be related at the person level. Positivity resonance with weak and strong ties may also reciprocally

influence one another, as a social experience with one type of tie may "set the mood" for a subsequent social episode with the other type of tie. For example, having a good social interaction at home may boost one's mood and translate into a pleasant interaction with the cashier at the grocery store, or vice versa. To date, the questions of whether and to what degree positivity resonance differs across weak and strong ties remain unanswered. This question is addressed in Study 3 (the Daily Wellness Study).

Online Environments versus In-Person Interactions

Group and dyadic social interactions are different in virtual/online versus in-person environments. Virtual and online environments, even for real-time interaction, decrease synchronous sensory-rich connection, a theorized precondition for the co-experiencing of positive affect (Fredrickson, 2016). Virtual and online interaction also alters social interaction in other ways. Unlike in in-person interaction, video conference applications often show one's own video image as a default, which may disrupt perceived safety with feelings of self-consciousness (Carver & Scheier, 1978) or distress (Windheim et al., 2011). Further, participants in online interactions (e.g., teleconferences) also report more multitasking and a lower ability to pay attention (Lyons et al., 2010). These disruptions in social attention and engagement may prevent individuals from forming synchronous, responsive connections to others. In contrast, people who are anxious about in-person social interaction often prefer online interaction over in-person (Caplan, 2006). These individuals tend to take more interpersonal risks such as revealing personally identifiable information and pursuing online-initiated relationships compared to individuals who are not anxious about in-person social interaction (McCarty et al., 2011). This evidence suggests that online social platforms may enhance perceived safety for individuals who

are typically uncomfortable with offline interactions, thereby promoting their experiences of positivity resonance online.

In addition, the amount of real-time sensory connection, a theorized necessary precondition for positivity resonance (discussed in more detail in the antecedent session; Fredrickson, 2016), decreases in virtual and online interactions and appears to be absent for asynchronous media (e.g., texting, posting, messaging, emailing). The diminution in or absence of real-time sensory connection should, respectively, hamper or preclude cross-person affective, behavioral, and biological synchrony, thereby decreasing or completely preventing positivity resonance. Indeed, Major and colleagues (2018) found lower perceived positivity resonance across communication contexts in the following order: in-person, video/phone call, and e-mail/messaging communication. However, inconsistent with theory, for asynchronous media (e.g., texting, posting, emailing) that appear devoid of real-time sensory connection, participants still reported a certain level of positivity resonance (Fritz et al., under review; Major et al., 2018). The theory (Fredrickson, 2016) focuses on the affective dynamics conveyed within real-time sensory connection, best exemplified by in-person social presence, the predominant social environment in which humans evolved. As such, the theory does not predict the emergence of positivity resonance in asynchronous contexts. However, as the evidence suggests (Fritz et al., under review; Major et al., 2018), people still report experiences of positivity resonance when reflecting on asynchronous interactions. Because asynchronous social interaction is a relatively recent evolutionary advance, it is unclear whether these experiences of positive connection are real, illusory, projected, or simply desired. Perhaps, although these asynchronous media remove real-time sensory

connections, they may still simulate or approximate the experience of feeling "in sync" through other social cues. For example, instant messaging has been reported to create a perception of "near-synchrony" for interactive partners (Rettie, 2009). Other cues such as similarity in the use of language and online nonverbal expressions (e.g., emojis, reactions) may also support feelings of being "in-sync", which characterizes perceived positivity resonance. To date, it is unclear whether this perception reflects positivity resonance or different collective affective states, and what evokes this perception.

Virtual and online environments may also alter the experience of positivity resonance in groups. In video conference software (e.g., Zoom), people can choose "gallery mode" and take in a view of everyone (up to 25 people) or in "speaker mode" and focus largely on the current speakers while minimizing or hiding others' faces. These variations may make one feel more like interacting with a group versus with an individual, thereby potentially changing a person's perceived positivity resonance both with all group members as a unit and with each member as an individual. As virtual and online interactions are becoming increasingly a part of life and potentially alter social connection, it is important to empirically test how virtual and online environments shape perceived positivity resonance and its relationships to the theorized antecedents and outcomes. This topic is addressed in Study 2 (the Classroom Study) and Study 4 (the WW Connected Community Study).

In short, we can gain conceptual clarity of perceived positivity resonance by considering its contextual aspects: the interactants who perceive the experience, the social context (group vs. dyad), the social targets (weak ties versus strong ties), and the interactive medium (virtual/online versus in-person). Having contextualized positivity resonance, I next review the antecedents that give rise to this interpersonal experience.

Antecedents of Positivity Resonance

Positivity Resonance Theory posits two important pre-conditions for the emergence of positivity resonance: perceived safety and real-time sensory connection. Here I unpack these preconditions to elucidate their nature and how each supports positivity resonance, as well as identify empirical gaps in testing these preconditions.

Perceived Safety and other Safety-Related Precursors

Perceived safety is a momentary experience hypothesized to allow individuals to forge positive, well-attuned connections with others (Fredrickson, 2013). The nature of perceived safety (or lack of threat) can be not only physical (Culbertson et al., 2001) but also social and psychological (Edmondson & Lei, 2014). When a person perceives a threat, that triggers negative affect and diminishes positive affect (Zautra et al., 2005), thereby inhibiting the experience of positivity resonance.

The perception of threat may be influenced by internal, trait factors. For example, individuals with high trait social anxiety are more likely to interpret ambiguous facial expressions as threatening (Yoon & Zinbarg, 2007), attend to and fixate on social threats (Buckner et al., 2010), and react to those with exaggerated negative emotional reactivity and decreased cognitive emotion regulation (Goldin et al., 2009). Threat sensitivity, in turn, decreases positive affect during social interaction. For example, people with a fear of social interaction, have been found to reflect negatively on even "successful" social interactions which involved a responsive partner (played by a confederate) and encouraging evaluation from the experimenter (Wallace, & Alden, 1997). A meta-analysis of 19 studies (Kashdan, 2007) concluded that social anxiety is inversely related to experienced positive affect (r =-.36). Through reducing perceived safety and positive

affect in social situations, internal factors such as social anxiety may reduce individuals' experiences and perceptions of positivity resonance with others.

Although the Positivity Resonance Theory (Fredrickson, 2016), as first articulated, only discussed internal, person-specific causes of perceived safety (e.g., social anxiety, depression, and loneliness), it is theoretically interesting and practically useful to consider potentially malleable external factors that shape perceived safety, ranging from physical environments (Loewen, et al. 1993) to other people's behavior (Mullen et al., 2018). Regarding physical environment, adequate lighting, open space, and unambiguous refuge make people feel safer in their neighborhoods (Loewen, et al. 1993), whereas local neighborhood physical disorder (litter, graffiti, lack of greenery) is negatively related to perceived safety (Milles, 2008). In the social environment at work, psychological safety, or the perception that "people are comfortable being themselves" (Edmondson, 1999, p. 354), is linked to a variety of factors such as greater commitment-based human resource practices and ethical leadership behavior (Edmondson & Lei, 2014). Online environments also have cyber threats and cyberbullying (Willard, 2007), ranging from physical threats (e.g., death threats, threats of physical assault) to socio-psychological threats (e.g., verbal harassment, unwanted images, personal information leaks) that may impact perceived safety. Longitudinal evidence revealed that cyberbullying partially mediates 9.4% of the negative effects of social media use on mental health and wellbeing among a large sample of youth (n = 12,866; Viner, 2019), even after cyber-related mediators such as lack of sleep and physical activity were taken into account. This evidence suggests that online threats have important psychological consequences on individuals' sense of safety.

As perceived safety is crucial for creating positivity resonance, external social factors that may influence perceived safety positively (e.g., others' empathic behaviors) or negatively (e.g.,

others' incivility) may also act as precursors of positivity resonance. A person's display of empathy, showing others that they share, understand, and care about their experiences (Batson, 2009) has the potential to make others feel safe. For example, colleagues' empathy appears to build psychological safety in work teams (Duhigg, 2016). In contrast, employees' perceptions of incivility and abusive behaviors from leadership have inversely predicted employee's self-reported perceptions of a safety climate and psychological health in the workplace (Mullen et al., 2018). Experiencing everyday race-based or sex-based discrimination or aggression, which can be considered additional forms of incivility, may also threaten one's sense of safety (Davidson et al., 2016; Macmillan et al., 2000). Even though uncivil behaviors and behavioral displays of empathy should hypothetically lower and raise perceived safety, respectively, scant empirical evidence supports these links. Testing such external safety-associated factors, in contrast with internal factors, could yield actionable solutions to promote individuals' positivity resonance by changing their environment. The current research thus tests whether these external safety-related conditions, i.e., empathy (Study 1, the Sorority Study) and incivility (Study 3, the Daily Wellness Study), as well as perceived safety itself (Study 2, the Classroom Study and Study 4, the WW Connected Community Study), predict perceived positivity resonance.

Real-Time Sensory Connection

The second theorized pre-condition for positivity resonance is real-time sensory connection (e.g., seeing, feeling, hearing each other as a social episode unfolds). Real-time sensory connection via face-to-face interaction may allow people to send, receive, and thus coordinate important nonverbal behaviors such as eye gaze, vocalization, facial

expression, physical touch, and body gestures to form a synchronous connection across the human lifespan.

One of the most powerful sensory connections, eye contact (Farroni et al., 2002), allows for gaze-triggered facial mimicry and interpretation of smiles (Niedenthal et al., 2010). Human newborns can detect whether eye gaze is direct or averted and have been found to prefer faces that engage in mutual eye contact to faces that look away. Additionally, in adults, according to the Simulation of Smiles model (SIMS model; Niedenthal et al., 2010), eye contact plays an important role in judging the social meaning of a smile, which could convey genuine personal happiness, affiliative intent, or domineering stances, among other subtleties. Eye contact triggers facial mimicry and neural simulation of the smile, which are theorized to allow a person to interpret the smilers' intentions. Blocking either eye contact or facial mimicry has been shown to impair people's ability to distinguish genuine smiles that convey happiness or friendly, affiliative intention from those that do not (Niedenthal et al., 2010; Rychlowska, et al., 2014). Thus, gaze-triggered mimicry is a mechanism through which positive affect is understood and spread during social interactions. In line with the SIMS model (Niedenthal et al., 2010) and Positivity Resonance Theory (Fredrickson, 2016), the neural firings of couples come into sync during moments of nonverbal communication such as eye contact and positive affect sharing (Kinreich et al., 2017).

In addition to eye contact, physical touch facilitates physiological synchrony and shared affect between individuals. In a study of mothers and babies (Waters et al., 2017), mothers underwent certain emotion-evoking tasks and upon reuniting with their babies, were randomly assigned to hold their babies in their lap or not touch their babies. Babies who sat on their mothers' laps showed higher sympathetic nervous system covariation with their mothers over

time compared to the no-touch condition. In adult romantic couples, physical touch has been found to increase respiration synchrony between partners in general, and physiological and neural synchrony when one partner endures pain (Goldstein et al., 2017, 2018).

Initial direct evidence that positivity resonance requires real-time sensory connection was established by Major and colleagues (2018), who used the Day Reconstruction Method (DRM) to study participants' social interactions. Participants reported all their social episodes over an entire day through the DRM, rated their perceived positivity resonance in each social episode, and also indicated the proportion of time spent in face-to-face interactions vs. interactions with less sensory information (telephone/video call or texting/messaging). Within individuals, episodic reports of perceived positivity resonance were positively related to face-to-face interaction, unrelated or inversely related to video and phone calls, and negatively related to texting and messaging (Major et al., 2018). Between individuals, frequent face-to-face interactions were also positively correlated with greater perceived positivity resonance (Major et al., 2018). In short, real-time sensory connection such as eye contact and physical touch allows individuals to connect more readily, establish biological synchrony, and spread positive affect, thereby co-creating positivity resonance.

Inconsistent with the Positivity Resonance theory (Fredrickson, 2016), however, for interactive media that are devoid of real-time sensory connection, participants still reported positivity resonance (Fritz et al., under review; Major et al., 2018). Perhaps, with the absence of real-time connection, asynchronous media may still facilitate feelings of being "in-sync" and "on the same wavelength" through social cues such as similar usage

of language and emojis. Among these social cues, a fast tempo of texting can create a perception of synchrony and continuous engagement between interactive partners (Rettie, 2009). According to Rettie (2009), texting is typically described as "quick, instant, or immediate." Message-based interactions have been reported to create perceptions of "near-synchrony" (Rettie, 2009) that may give rise to perceived positivity resonance in virtual social interaction, even though the sensory connection and crucial components of positivity resonance such as biological synchrony are likely missing. In Study 4 (the WW Connected Community Study), I investigate the possibility that the perceived speed of mutual responding acts as an antecedent for perceived positivity resonance in interactions devoid of real-time sensory information.

Outcomes of Positivity Resonance

As an offshoot of the Broaden-and-Build Theory of positive emotions (Fredrickson, 1998, 2001, 2013; Le Nguyen & Fredrickson, 2017), the Positivity Resonance Theory (Fredrickson, 2016; Brown & Fredrickson, 2020) offers a framework for how everyday experiences of positivity resonance may accumulate to build enduring resources. Specifically, positivity resonance is hypothesized to (1) momentarily broaden individuals' other-focused thoughts and action tendencies, and in doing so with regular occurrences, (2) build social and well-being resources over time (Fredrickson, 2016; Brown & Fredrickson, 2020). Here, I review the indirect and direct evidence for these two hypotheses at the individual and dyad/group levels, with a focus on social outcomes. While doing so, I also identify literature gaps to be addressed by the current research.

Broaden Hypothesis

For individuals, the experience of positivity resonance may momentarily enhance a person's inclusive sense of self and prosocial tendency (Fredrickson, 2016). The expansive sense

of self is well-illustrated in those who "fall in love" (Aron et al., 1992), a situation in which individuals are theorized to experience positivity resonance at great intensity and frequency (Fredrickson, 2016). In daily life, however, experimentally adding a small dose of positive connection with strangers momentarily increases the expansive feeling of belonging (Sandstrom & Dunn, 2014). Experiences of positivity resonance may also momentarily promote other-focused cognition and behavioral tendencies such as positive spontaneous social thoughts, perspective-taking and empathy, interpersonal understanding, and feelings of belonging and togetherness (Fredrickson, 2013, 2016). Experimental evidence shows that creating behavioral synchrony, a component of positivity resonance, has been shown to increase compassion and altruistic behaviors toward synchronous partners (Valdesolo & Desteno, 2011) and affiliation with strangers (Hove & Risen, 2009).

In groups, positivity resonance may broaden collective attention and cognition. Experimental evidence shows that inducing positive mood (versus neutral mood) in members of temporary workgroups helps groups brainstorm more creative ideas (Grawitch et al., 2003a, 2003b), a manifestation of expanded cognition (Isen et al., 1987). Experiencing shared positive affect and behavioral synchrony may also make groups more prosocial and cooperative. In two studies conducted by Barsade (2002), a trained confederate acted out positive or negative moods when working with temporary groups. Barsade (2020) showed that the confederates' moods were contagious to participants and that those in positive mood groups cooperated more and had less conflict than those in negative mood groups. Across three experiments conducted by The evidence regarding

group positive affect suggests that momentary experiences of positivity resonance among members in a group may also promote immediate expansive,

Build Hypothesis

As moments of positivity resonance broaden prosocial cognitions and behavioral tendencies in individuals and collectively within groups, day-to-day experiences of positivity resonance are theorized to compound over time to build enduring personal and group resources (Fredrickson, 2013; Brown & Fredrickson, 2020).

In individuals, positivity resonance has also been linked to higher levels of flourishing mental health and resilience, and lower levels of anxiety, depressive symptoms, and loneliness (Major et al., 2018; Prinzing et al., 2020). Beyond promoting the well-being of individuals, positivity resonance may promote prosocial qualities (e.g., altruism, spirituality, humility) that benefit a community's well-being (West et al., 2021; Zhou et al., under review). Longitudinal experimental evidence shows that cultivating day-to-day positivity resonance with a focus on strangers and acquaintances increases individuals' prosocial qualities (Zhou et al., under review). In the same study, daily measured perceived positivity resonance was related to higher daily measured prosocial qualities and lower daily measured self-centered qualities both within persons and between persons. These increases in prosocial tendencies can affect trajectories of public health, as prosocial tendencies have been shown to predict greater self-reported hygienic behaviors (e.g., handwashing and mask-wearing) during the COVID-19 pandemic (West et al., 2021).

For groups, positivity resonance is hypothesized to build collective social resources such as mutual bonds, collective identity, or affective culture (Fredrickson, 2016; Brown & Fredrickson, 2020). Consistent with this hypothesis, positivity resonance in married couples,

assessed holistically through behavioral coding, predicted higher combined marital satisfaction (Otero et al., 2019). Global assessments of relationship quality in romantic couples were also associated with facets of positivity resonance such as co-experienced positive affect (self-rated: Brown et al., 2021; expression: Kurtz & Algoe, 2015) and physiological synchrony during co-experienced positive affect (Chen et al., 2020). In unfamiliar dyads who watched a television show together, positive affective synchrony, as indexed by behavioral expression, predicted stronger feelings of connectedness (Cheong et al., 2020). Additionally, the effects of positivity resonance on group and dyad-level resources have been shown to be distinct from the effects of positive affect experienced alone (Brown et al., 2021; Otero et al., 2019) or negative affect synchrony (Chen et al., 2020), thereby building the case for the unique contribution of co-experienced positive affect to promoting important social outcomes.

Indirect evidence suggests that positivity resonance may build a range of important collective resources in group contexts, such as group cohesiveness, members' engagement, and coordination. Group positive affect is associated with group cohesiveness (Terry et al., 2000), the degree to which members are attracted to the group, its members, and its collective tasks. Group cohesiveness in turn was predictive of group performance according to a meta-analysis of 186 estimates of cohesiveness–performance relations (*r*s range from .14 to .34, Beal et al., 2003). Furthermore, according to a meta-analysis of 39 independent studies (2799 groups; Knight & Eisenkraft, 2015), group positive affect is linked to social integration ($r = .34$) and superior group performance ($r = .25$) in work teams. Moreover, physiological and behavioral synchronization during a group drumming task has also been shown to predict individuals' experience of group

cohesiveness, and physiological synchrony also predicted performance in a subsequent group task that involved improvised drumming together (Gordon et al., 2020). These findings on group affect and synchronization suggest that positivity resonance, which has both features, may foster group-level resources such as group cohesiveness and social integration, which ultimately promotes group success.

Cultivating interpersonal and group social resources also implies the accumulation of personal social resources. As individuals build a variety of meaningful connections with close and non-close others, they may accrue actual social resources such as a romantic partner, more received support, less social isolation, and larger social network sizes. They may also accrue perceived social resources, such as social well-being, a sense of belonging to the community, and less loneliness. These perceptions partly reflect the actual social resource a person may have, such as a close confidante or a loving community. For example, feeling lonely is associated with actual social isolation (Holt-Lunstad et al., 2015). Moreover, these perceived resources also often impact well-being equally or more strongly than actual social resources (Holt-Lunstad et al., 2015; Russell et al., 2012; Uchino, 2009; Wethington & Kessler, 1986). Thus, despite being correlated, perceived and actual resources are two distinct hypothesized outcomes of positivity resonance, with the former potentially having equal or greater impacts on psychological and physical health relative to the latter.

When studying the hypothesized social resource outcomes of positivity resonance, it is crucial to theoretically and empirically distinguish the effect of interpersonal positivity resonance from intrapersonal positive affect. First, positive affect has been theorized (Fredrickson, 1998) and empirically shown to influence a similar group of prosocial outcomes and social resources (Carlson et al., 1988; Isen, 1987; Lyubomirsky et al., 2005) that are proposed to be built by

positivity resonance. Moreover, positive affect is, by definition, a component of positivity resonance, albeit when it is experienced together with another person. Statistically establishing the independent contribution of positivity resonance to social outcomes would serve to establish the discriminant validity of interpersonal positivity resonance as distinct from intrapersonal positive affect.

In sum, positivity resonance may promote both personal social resources and group-level social resources that are consequential for the well-being and success of individuals, groups, and communities. Although evidence for the social resource-building hypothesis is accumulating (Major et al., 2018; Chen et al., 2020; Brown et al., 2021; Otero et al., 2019; Prinzing et al., 2020; West et al., 2021; Zhou et al, under review), two literature gaps are apparent. First, evidence for the effects of positivity resonance on social resources (besides prosocial qualities) has been limited to heterosexual romantic contexts. According to theory, however, positivity resonance can be experienced with both close others or strangers and acquaintances (Fredrickson, 2016). Thus, the current investigation (all studies) addresses this gap by examining the effects of perceived positivity resonance on social resources across a variety of social contexts and relationship types.

Second, among social contexts, there is no direct evidence for the antecedents or outcomes of positivity resonance in groups. Moreover, one must be cautious to rely on group positive affect as an indicator of positivity resonance because group positive affect is typically computed by aggregating members' intrapersonal affect that reflects their experience over lengthy periods (Collins et al., 2013). For this reason, it is unknown whether reported positive affect truly co-occurred between individuals in groups (Brown

& Fredrickson, 2020). Therefore, there is a need to study the interpersonal experience of positivity resonance and its perception during group interactions. This topic of positivity resonance in groups was investigated in Study 2 (the Classroom Study).

Aims of the Current Research

The current research addresses three overarching aims with four studies. As a caveat, the terms "antecedents" and "outcomes" used to describe two of the aims and throughout the dissertation indicate theorized, not empirical, causes and effects of positivity resonance. These studies, except for Study 3, did not involve the randomization of conditions to test causality. Through these studies, I mainly investigate whether the associative network is consistent with the theorized links.

The first aim, the "contextual exploration" aim, is to examine the contextual aspects of perceived positivity resonance: the perceiver, the social context (small groups), the social targets (weak ties and strong ties), and the interactive medium (asynchronous virtual/online environment). In Study 1 (the Sorority Study), I examined agreement across different partners' perceived positivity resonance in dyads. In Study 2 (the Classroom Study), I compared two approaches to assess individuals' perceived positivity resonance with group members in a small group context: one involved measuring overall, group-level perception, and the other involved averaging perceptions regarding individual group members. In Study 3 (the Daily Wellness Study), I examined the association between individuals' perceived positivity resonance across social targets (weak ties and strong ties. In Study 4 (the WW Connected Community Study), I explored whether individuals could perceive positivity resonance in an asynchronous online environment. Perceived positivity resonance was measured at two different time frames: at the

episode level (i.e., a single interaction; Studies 1 & 3) and across all social interactions over two weeks (Studies 2 & 4).

The second aim, the "antecedents" aim, is to examine theorized antecedents of perceived positivity resonance, namely, perceived safety and real-time sensory connection. I examined whether perceived positivity resonance would be predicted by two opposing external conditions, others' empathy and incivility, on the assumption that they impact perceived safety (Studies 1 and 3, respectively). I also tested whether perceived positivity resonance would be predicted by perceived safety directly (Studies 2 and 4). I also tested in online/virtual contexts whether perceived positivity resonance was predicted by real-time sensory connection, as indicated by the quantity of synchronous virtual interaction (Study 2), and its distant digital proxy, perceived speed of mutual responding for message-based communication (Study 4).

The third aim, the "outcomes" aim, is to test the outcomes of perceived positivity resonance regarding personal and group social resources. These resources include mutual social ties and social ties nominated by others (Study 1), perceived group cohesiveness (Study 2), perceived personal social resources such as social well-being, belongingness, and loneliness (Study 3), and feelings of connection to specific communities (Study 4). Studies 2 and 4 also tested instrumental benefits of social resources cultivated by positivity resonance such as group performance and individuals' positive weight-related health behavior.

CHAPTER 2: STUDY 1 - THE SORORITY STUDY

Focused Introduction

In Study 1, I examined the self-reported experience of positivity resonance among female college students in two sororities. Corresponding to the three overarching aims of this dissertation (contextual exploration, antecedents, outcomes), Study 1 addressed three topics: (1) cross-person agreement on perceived positivity resonance in dyads, (2) a safety-associated external factor, the other's empathy, as a potential antecedent of positivity resonance, and (3) relational network size and mutual ties as individual-and dyad-level social outcomes of positivity resonance.

Contextual Exploration: Agreement Between Individual Reports of Perceived Positivity Resonance in Dyads

Positivity resonance is conceptualized as a shared affective experience (Brown & Fredrickson, 2021), yet no study has tested whether perceptions of positivity resonance are truly shared among partners. An individual may misperceive others' affect and misinfer shared experience due to a variety of factors: the social targets' low emotional expressivity (Zaki et al., 2008), projection of one's own affective state onto others (e.g., Benbouriche et al., 2018), individual differences in motivation and ability to accurately perceive others' emotions across situations (Ickes et al., 2000). Thus, I examine the extent to which self-reported perceptions of positivity resonance reflect shared experiences by testing the correlation between self-reports from both individuals within multiple dyads.

Hypothesized Antecedents: Empathy and Perceived Safety

According to the Positivity Resonance Theory (Fredrickson, 2016), perceived safety is a precondition of positivity resonance. Others' empathy during an interaction, an external factor assumed to promote perceived safety, may also precede positivity resonance. Showing someone empathy communicates other-focused non-judgment and care, and may help them feel understood, validated, and encouraged to disclose their authentic self (Myers, 2000). Displayed empathy has been linked to interpersonal trust (Aggarwal et al., 2005) and psychological safety in work teams (Duhigg, 2016). To the extent that one individuals' empathy can make others feel safe, it can create conditions conducive for positivity resonance to arise during social interaction. In this study, I tested whether self-perceived positivity resonance toward an interactant would be predicted by that interactant's dispositional empathy. In line with the literature on empathy (Batson, 2009), I indexed dispositional empathy with a trio of components, one cognitive (perspective-taking; Davis, 1983), one emotional (empathic-concern; Davis, 1983), and one motivational (compassionate goals; Crocker & Canevello, 2008). In addition to assessing empathy for negative emotions, I also assessed empathy for positive emotions, which is an often-overlooked aspect of empathic responding (Morelli et al., 2015).

Hypothesized Outcomes: Person-level and Group-Level Social Resources

Shared experiences of positivity resonance are theorized to help build social resources such as social bonds (Fredrickson, 2013; Brown & Fredrickson, 2021). At the person level, experiencing higher levels of positivity resonance with others may help individuals form social bonds and grow their relational network. Together, social bonds and relational network size represent the structural components of social resources, as

opposed to the evaluative or functional components such as loneliness and perceived social support (Holt-Lunstad et al., 2010).

Here, I disentangle an individual's subjective perception of social resources from the resources their network provides by obtaining other-reported assessments of social bonds. Based on past research, I conceptualize an individual's relational network size as a multifaceted construct indicated by the numbers of people who (1) choose to co-experience positive emotions with this individual by sharing good news (Gable et al., 2006), (2) chose to entrust them by sharing bad news (Wheeless, & Grotz, 1977), (3) provide them with social support (Gurung et al., 1997), and (4) form a close bond with them (Buhrmester & Furman, 1987).

At the dyad level, social resources may manifest as mutual social bonds. Therefore, I investigated the association between averaged perceptions of positivity resonance within dyads and mutual close bonds (i.e., reciprocal nomination of one another as closest friends) within those same dyads.

Study Overview

To address these ideas, in the Fall of 2018, I surveyed participants in two sororities on trait empathy, positive affect, perceived episodic positivity resonance with individual sorority sisters, and nominations of sisters on questions about social relationships. I obtained both person-level data and dyadic data. However, because the number of dyads was low and reduced confidence in dyadic analyses, I only proposed exploratory research questions for these analyses.

Addressing the "contextual exploration" aim, Research Question 1 (RQ1) asked whether and to what degree self and partner perceived episodic positivity resonance would be related within individual dyads.

Addressing the “antecedents” aim, Hypothesis 1 (H1) stated that the social network's mean perceived episodic positivity resonance with a specific interactant would be predicted by the interactant’s self-reported trait empathy.

Hypothesis 2 (H2) and exploratory Research Question 2 (RQ2) addressed the “outcomes” aim. H2 stated that at the person level, a sorority member’s episodic self-reports of positivity resonance with other sisters would predict this member’s social resources, operationalized as the member’s relational network size. Here, a participant’s relational network size reflects the number of meaningful bonds (sharing good news, sharing bad news, helping, and being a close friend) all other sorority members in the network reported having with that participant. RQ2: Would mean perceived positivity resonance within a dyad predict the likelihood of a mutual close bond within that dyad (i.e., reciprocal nomination of one another as closest friends)?

Method

Participants

The target sample size was 150 based on power calculations using Monte Carlo simulations for the planned models (see Analytical Approach). Using these models, I determined that power at this sample size was excellent for all parameters (91%), assuming moderate effect sizes and 20% missing data.

The procedure for this study was approved by the Institutional Review Board at the University of North Carolina at Chapel Hill. Female students who were members of either of two sorority organizations were sent an email inviting them to participate in the research study. Those who consented (N = 158, n_1 = 85, n_2 = 73) completed a one-time survey. For their participation, a $500 donation was committed to each sorority's charity

of choice. Participants were 18-22 years old (M_{Age} = 19.7) and predominantly White (96.84%).

Measures

Perceived Episodic Positivity Resonance. Perceived episodic positivity resonance was assessed using a seven-item scale (Major et al., 2018). These items measured the extent (from 0-100% of the time) to which indicators of one or more elements of perceived positivity resonance were present during a specific recalled interaction with a specific sorority member. Sample items included "…did you feel energized and uplifted by the company of this person?" (indicating shared positive affect) and "did you feel "in sync" with this person?" (indicating perceptions consistent with caring nonverbal synchrony and biological synchrony). Participants listed up to 11 people in the sorority with whom they spent the most time. They were then asked to remember the longest interaction they had with each of these individuals in the past 7 days and completed the Perceived Positivity Resonance Scale for one recalled interaction for each identified sorority member. The scale showed good reliability (between-person ω = .98; within-person ω = .94; Geldhof et al., 2014). Due to discrepancies in the numerical range between perceived episodic positivity resonance scores (0-100) and other variables (1-5 or 1-7), I divided perceived episodic positivity resonance scores by 10 prior to analysis.

The assessments of perceived episodic positivity resonance were used in five different ways to support testing an array of hypotheses. The derived variables can be categorized under "dyad-specific positivity resonance" and "network-based positivity resonance."

Dyad-Specific Positivity Resonance. *Self dyad-specific perceived positivity resonance* and *Partner dyad-specific perceived positivity resonance* refers to a participant and their partner's perceived episodic positivity resonance with one another within a dyad. This measure was used in the testing of RQ1 on self-partner concordance.

Mean dyad-specific perceived positivity resonance was computed by taking the mean of dyad members' perceived episodic positivity resonance with one another. This measure was used to test RQ2 on the dyad-based outcome.

Network-Based Positivity Resonance. *Network's mean perceived positivity resonance with a specific interactant* was computed by averaging all interacting partners' reports of perceived episodic positivity resonance with a given interactant. This measure was used to test H1 on the empathy antecedent. To obtain stable, consensus-based assessments of overall partner-reported perceived positivity resonance, I excluded those who had only one partner's report of positivity resonance.

An individual's mean perceived positivity resonance with their identified network represents a participant's tendency to perceive positivity resonance with nominated others and was computed by averaging this participant's perceived episodic positivity resonance with all their nominated interacting partners. This measure was used to test H2 on network-based outcomes.

Empathy. In this study, dispositional empathy was operationalized as a latent factor of four variables: perspective-taking, empathic concern, positive empathy, and compassionate goals.

Empathic Concern. Participants rated four statements measuring empathic concern from the shortened Interpersonal Reactivity Index (IRI; Ingoglia, Lo Coco, & Albiero, 2016) on a scale from 1 (*Does not describe me at all*) to 5 (*Describes me very well*). Sample statements included "I often have tender, concerned feelings for people less fortunate than me", "When I see someone being taken advantage of, I feel kind of protective toward them", "I would describe myself as a pretty soft-hearted person", and

"When I watch a good movie, I can very easily put myself in the place of a leading character." The subscale demonstrated good internal consistency (α = .75).

Perspective-Taking. Participants rated four statements measuring perspective taking (the shortened IRI; Ingoglia, et al., 2016) on a scale from 1 (*Does not describe me at all*) to 5 (*Describes me very well*). Sample statements included "I sometimes try to understand my friends better by imagining how things look from their perspective," "I try to look at everybody's side of a disagreement before I make a decision," "When I'm upset at someone, I usually try to 'put myself in his shoes for a while," and " Before criticizing somebody, I try to imagine how I would feel if I were in their place." The measure demonstrated good internal consistency (α = .78).

Positive Empathy. Empathy for others' positive emotions (Morelli et al., 2015) was measured with the seven-item Positive Empathy scale (1 = *Does not describe me at all*, 5 = *Describes me very well*). Sample items included "When I see someone else smile, I can't help but smile too." And "If I don't understand why someone is excited, I try to put myself in their shoes and understand what they're thinking and feeling." The scale showed good reliability (α = .86).

Compassionate Goals. To assess participants' intention to be compassionate toward their friends, I used the seven-item Compassionate Goals subscale from the Compassionate and Self-image Goals Scale (Crocker & Canevello, 2008). I asked them how much (1 = *Not at all*, 5 = *Extremely*) they wanted or tried to do each of seven compassionate behaviors in the area of friendship during the past 7 days. Sample behaviors included "Avoid doing things that aren't helpful to me or others" and "Have compassion for others' mistakes and weaknesses". The scale had good internal consistency (α = .75).

Relational Network Size. Participants were provided with their sorority's roster. They could select up to eight names from a roster and type up to an additional three names that they

were unable to find in the roster (maximum 11 nominations[1]), in response to the following questions: (1)"Whom do you share good news with?" (2)"Who do you turn to when something bad happens?" (3)"Who have you helped (whether in a big or small way)?" (4)"Who are your closest friends?" A participant's relational network size was operationalized as the latent factor indicated by the number of nominations they received from other sorority sisters for these four categories (sharing good news, sharing bad news, helping, and being one of the closest friends).

Sociability. Participants' propensity to spend time with others was measured by asking them to nominate up to 11 names for "Who do you spend the most time with?" The number of nominations a participant made was used to indicate their degree of sociability.

Positive Affect. Affect was measured using the Actual Affect subscales from the Affect Valuation Index (Tsai et al., 2006). Participants read a list of 9 positive emotions (e.g., happy, elated, and content) and reported how frequently, from never (1) to all the time (5), they actually felt a specific emotion on a typical week. Positive affect was reliably measured ($\alpha = .89$).

Other covariates. Residential locations (1 = *live in the sorority house*, 0 = *live outside the sorority house*), membership tenure (larger values indicate longer membership, each unit = one semester), and graduation year (larger values indicate later

[1] For the second sorority, initially I was given an outdated roster that did not include the names of some members of the sorority, and 23 of these members participated in the current study. Although all participants had the option to type in any missing names, I sent all members of this second sorority a subsequent survey 12 days later to obtain more complete data. This second survey only included nomination and positivity resonance questions using an updated, complete roster. I combined nominations from the second survey into the data, and as a result, one participant made a total of 12 nominations for the "whom you help" category, exceeding the maximum 11 nominations. For the ancillary analyses of H1 and H3, I created and controlled for two dummy variables representing participants (1) whose names were not included in the original, outdated roster and (2) who received nominations in the second survey that used the updated roster. These controls did not change the main findings.

graduation year, each unit = one year) could have influenced participants' social network nominations and thus were included in the analyses.

Analytic Approach

For RQ1 & RQ2 on dyad-specific analyses, some participants may have been a part of more than one dyad, for which a network analysis approach: Quadratic Assignment Procedure (Simpson, 2002) to test H1 and Exponential Random Graph Model (Robins et al., 2007) to test H3b was recommended to control for nonindependence in the data. However, this approach necessitated separate analyses for each sorority, which made the sample sizes too small (42 dyads in Sorority 1 and 25 in Sorority 2) and thus reduced my confidence in these inferential results. Therefore, I treated RQ1 and RQ2 as exploratory research questions and did not use a network analysis approach to correct for nonindependence, but instead utilized regular linear statistics (e.g., correlation) as descriptive statistics.

For RQ1, I computed Pearson correlation coefficients between self-and partner-reported episodic positivity resonance.

For H1 and H2, I analyzed the data from two sororities using latent variables in a multi-group structural equation modeling (SEM) framework and the program Mplus, using full information maximum likelihood estimator with robust standard errors (Muthén & Muthén, 2019). To ensure the latent constructs were equivalent across the two sororities, I investigated measurement invariance of the latent factors (Table S1.2), including configural invariance (factor loadings and intercepts were freely estimated), metric invariance (factor loadings were constrained to be equal across the two groups, but the intercepts were freely estimated), and scalar invariance (both factor loadings and intercepts were constrained to be equal across the two groups). Similarly, in subsequent multi-group path analyses, I allowed the regression coefficients

to be freely estimated across the two groups or constrained them to be equal. The model fit statistics of the constrained models were compared to the initial unconstrained models using chi-square difference tests (Kline, 2015). Constraints that did not significantly decrease model fit were retained. Model fits were comprehensively evaluated using the recommended combination of fit indicators including the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). Conventional cut-offs for fit indices were used as a reference for judging models: CFI values greater than .95, RMSEA values less than .08, and SRMR values less than .08 indicate good model fit (Schreiber et al., 2006).

For H1, an interactant's trait empathy was first modeled as a latent factor of four continuous indicators: positive empathy, empathic concern, perspective-taking, and compassionate goals in an initial measurement model. I then included the interactant's latent trait empathy as a predictor of the mean level of episodic positivity resonance that other sorority sisters perceived with this interactant. In ancillary analyses, I controlled for interactants' self-reported trait positive affect and sociability, factors that could potentially make the interactants' networks perceive more positivity resonance toward them.

To test H2, I indexed latent relational network size with four indicators: a participant's number of other-reported nominations received from all other sorority members regarding four categories including closeness, good news disclosure, bad news disclosure, and helping. Measurement invariance was also investigated as described above. Next, I regressed the latent relational network size on participants' mean self-reported perceived episodic positivity resonance with all other sorority members in their identified network. Several control variables,

including group membership, living location, and class year, were tested, and insignificant control variables were removed to reduce the complexity of the models. I further controlled for competing predictors of relational network size including positive affect and sociability, defined by the number of people with whom participants reported spending a lot of time.

For RQ2, I regressed mutual dyadic bond, operationalized as self-and-partner mutual nominations of closeness within the dyad (1 = both listing one another as one of their "closest friends", 0 = no one or only one person reporting a close bond), on mean episodic positivity resonance within the dyad using logistic regression.

Results

Preliminary Analyses

Table S1.1 shows the descriptive statistics of and correlations among variables in Study 1. Preliminary results were partially consistent with the primary hypotheses. An interactant's positive empathy and compassionate goals were correlated with the network's mean perceived episodic positivity resonance with this interactant (Table S1.1). Furthermore, an individual's mean perceived episodic positivity resonance with their identified network was also correlated with the number of nominations they received in terms of sharing good and bad news (Table S1.1).

RQ1: Cross-Person Correlation between Perceived Episodic Positivity Resonance Within Dyads. In total, participants provided 602 reports of perceived positivity resonance with other sorority members in the past two weeks. Out of 602 reports, there were 67 dyads with mutual reports of episodic positivity resonance (134 reports). Within these dyads, self and partner perceived episodic positivity resonance had a correlation of $r = .24$ ($p = .051$). This

finding provides evidence perceived episodic positivity resonance within dyads was either not correlated or weakly correlated.

Primary Analyses

As students were recruited from two sororities, multi-group SEM models were fit for the data. Both measurement models of empathy and relational network showed scalar invariance, and multi-group SEM models fitted equally well when regression paths were constrained to being equal relative to when they were allowed to vary across the two groups of participants (Table S1.2). As the constrained models were more parsimonious, they were selected, and their results are presented below.

H1: Effect of Interactant's Empathy and the Network's Perceived Episodic Positivity Resonance with the Interactant. Among participants who had at least two episodic reports of perceived positivity resonance from other sorority sisters, 31.25% had exactly two other reports, 37.50 % had three other reports, and 31.25% had four or more reports.

Figure S1.1 shows the results of models testing H1. The initial measurement model for empathy was fitted on four observed variables that represent different but related aspects of empathy: perspective-taking, empathic concern, compassionate goals, and positive empathy. As perspective-taking and empathic concern are two subscales of the IRI scale and therefore expected to have shared method variance, I allowed these two indicators to co-vary. The scalar-invariance model of empathy showed excellent fit ($\chi 2(8) = 4.78$, CFI = 1.00, RMSEA = .00, SRMR=0.04; Table S1.2, H1, Model 2). All indicators loaded significantly on the latent factor (Figure S1.1).

An interactant's latent empathy significantly predicted the mean network perceived episodic positivity resonance with the interactant (b = .83, 95% CI = [0.19, 1.47], $\beta_{Group\ 1}$ = .32, $\beta_{Group\ 2}$ = .38, p = .011; Figure S1.1). After controlling other factors that may have evoked others' perceived episodic positivity resonance with the interactant—an interactant's trait positive affect (p = .87) and sociability (p = .33), as indexed by the number of sisters the interactant reported spending a lot of time with—latent empathy still significantly predicted perceived episodic positivity resonance from network (b =1.04, CI 95% = [0.35, 1.73], p = .003).

H2: Effect of Individual's Perceived Episodic Positivity Resonance with Their Network on Relational Network Size. Figure S1.2 shows the results of the model testing H2. The constrained measurement model of latent relational network size demonstrated excellent fit (Table S1.2, H2 Model 2). All indicators loaded significantly on the latent factor (Figure S1.2).

Perceived episodic positivity resonance significantly predicted latent relational network size (b = .26, 95% CI = [.05, .46], $\beta_{Group\ 1}$ = .25, $\beta_{Group\ 2}$ = .17, p = .015). In an ancillary model, several competing predictors of relational network size were controlled for, including positive affect (p = .185), sociability (b = .14, 95% CI = [.05, .24], p = .009), membership tenure (p = .755), graduation year (p = .162), and living location (sorority house: b = .90, 95% CI = [0.20, 1.59], p = .011). Nevertheless, the link between perceived episodic positivity resonance and relational network size remained significant (b = .23, 95% CI = [.04, .43], p = .021).

RQ2: Association between Mean Dyad-Specific Perceived Positivity Resonance and Mutual Close Bonds in Dyads. Participants in dyads with mutually reported perceived episodic positivity resonance all also nominated each other as one another's "closest friends." Because no

variance emerged in these nominations of mutual close bonds, the analysis for this research question was not possible.

Discussion

I studied perceived quality of social interactions and social relationships in two student organizations to address three topics: self-and-partner agreement on ratings of perceived episodic positivity resonance in dyads ("contextual exploration" aim, RQ1), the other's trait empathy as an antecedent of self's perceived episodic positivity resonance ("antecedents" aim, H1), and the effects of perceived episodic positivity resonance on social resources ("outcomes" aim, H2 & RQ2).

Corresponding to the "contextual exploration" aim, there was a small preliminary correlation between self-and-partner perceived episodic positivity resonance (r = .24) within dyads. Consistent with the Positivity Resonance Theory (Fredrickson, 2016), this correlation suggests a small degree of shared perception between people in dyads about the degree of positive connection they co-experienced. One caveat is that the correlation may also be partly due to common method variance. That is, inflated associations can result from similar methods of assessing two variables, such as the use of the same self-report scale for positivity resonance for both dyad partners in this study.

On the other hand, this modest correlation also suggests that partners in a dyad remember the experience of positivity resonance with one another differently to a substantial degree. This potential discrepancy could be due to a variety of factors such as biases in memory of affective experiences (e.g., Robinson & Clore, 2002) or actual misperception of the other's affective states (e.g., due to the social target's lack of emotional expressivity; Zaki et al., 2008). Perhaps, most importantly, although

participants in dyads were asked to report on the longest interaction with the other in the past week, I do not have the information on whether they each considered the same or a different specific interaction. If respondents reflected on different interactions, that would likely lower cross-person agreement on perceived episodic positivity resonance score in these dyads. Finally, as the survey question did not ask participants specifically about interactions that only involved two people, there may have been more than two people participating in reported interactions. Interactions are more complex in groups than in dyads (e.g., Cooney, 2020) and thus may create more variability in partners' perceptions of episodic positivity resonance with one another.

Corresponding to the "antecedents" aim, the results showed that an interactant's dispositional empathy predicted others' episodic reports of perceived positivity resonance during their interactions with this interactant. Each standard unit increase in the interactant's trait empathy corresponded to a .32-.38 unit increase in other's perceived episodic positivity resonance. The current results thus suggest that one person's trait empathy may create conditions conducive for the episodic emergence of positivity resonance, presumably through making other individuals feel safe. However, I temper this interpretation for two reasons. First, perceived safety was not measured, and the link between others' empathy and one's perceived safety was not tested. Second, I only measured self-reported cognitive, emotional, and motivational aspects of empathy rather than behavioral displays of empathy. Nevertheless, past evidence suggests that non-behavioral aspects of empathy can translate into prosocial actions (Crocker & Canevello, 2008; Morelli et al., 2014). These findings also expand the theorized safety-linked precursors of positivity resonance beyond internal factors (Fredrickson, 2016) to include an external, situational factor (i.e., others' empathy). With this connection between empathy and positivity

resonance established, I proceeded, in Study 2, to directly examine perceived safety as an antecedent of perceived positivity resonance.

Corresponding to the "outcomes" aim, the association between perceived episodic positivity resonance and social resources was supported at the person level (H3a). Individuals' mean perceived episodic positivity resonance with others in the sorority predicted their latent relational network size, as indexed through nominations by all other sorority sisters. Consistent with the types of social resources proposed by the Positivity Resonance Theory (Fredrickson, 2016), relational network size was multifaceted: It reflected being chosen as someone (a) with whom to co-experience positive emotions (through the disclosure of good news), (b) entrusted (through the disclosure of bad news), (c) with whom close bonds have formed (through nomination as a close friend), and (d) worthy of social support provision (through giving help). The association of perceived episodic positivity resonance with relational network size was independent of individuals' sociability and positive affect, thus providing evidence for the discriminant validity of this relatively novel construct. Practically, the correlational findings on the "antecedents" and "outcomes" aims together suggest that promoting empathy within a community can engender positive moments of connection and build stronger relationships among its members.

One strength of this research is the use of other-reported data (e.g., relational network size) to supplement self-reported data of social resources. Other-reported data may be a more objective assessment of an individual's social resources (i.e., the resources which others provide) in comparison to self-reported data (which reflect the subjective perception of one's social resources). Furthermore, this enables the modeling of social

relations in which (1) an individual's trait characteristics influence others' perceptions of episodic interactions with that individual, and (2) an individuals' perceived quality of episodic interactions with others predict others' stable relationships with that individual.

There were several limitations of this study besides the issue of partners in dyads potentially reporting positivity resonance for different social episodes. First, the number of complete dyads in this study was small and thus only supported exploratory results regarding dyadic hypotheses. Second, the hypothesis that dyad-specific mean perceived episodic positivity resonance predicts mutual close bonds could not be examined due to the lack of variance in mutual close bonds. This is because participants were asked to report episodic positivity resonance for those with whom they spent the most amount of time, who also happened to be their closest friends. Therefore, as long as both partners in a dyad reported positivity resonance for one another, they mutually nominated each other as their closest friends. One way to circumvent low variance in the future would be to have participants report on all their interaction partners during a specific time frame. However, such inclusive reporting can only be done if the number of partners is not large. Alternatively, if the number of partners is large, researchers can randomly identify the social targets (from the pool of possible social partners) for positivity resonance reports. Third, self-reports of perceived episodic positivity resonance are likely to include reporting biases due to a variety of factors, including but not limited to memory distortion, experimenter demand, and social desirability (Robinson & Clore, 2002; Schwarz et al., 2009). Fourth, the modest preliminary cross-person correlation for episodic self-reports of positivity resonance in dyads raises the possibility that the self-reported measure may not accurately reflect subjectively experienced (and perceived) positivity resonance and/or objectively assessed positivity resonance (i.e., indicated by affective, behavioral, and physiological synchrony). Fifth, the study

design was cross-sectional, and thus no causal conclusions can be drawn or implied about the hypothesized links. Finally, participants were mostly White female university students from 18 to 22 years old, thereby limiting the generalizability of the findings. Partially addressing this limitation, in Study 2 (the Classroom Study) I aimed to recruit from a more representative pool of college students.

CHAPTER 3: STUDY 2 - THE CLASSROOM STUDY

Focused Introduction

In Study 2, I investigated the self-reported experience of positivity resonance among college students in classroom workgroups. As this study took place during the COVID-19 pandemic, which necessitated a shift from in-person classes to online classes, the social interactions examined in this study were virtual. Corresponding to this dissertation's three overarching aims (contextual exploration, antecedents, and outcomes), Study 2 addressed three topics: (1) approaches to assessing individuals' perceived positivity resonance with group members in a small group context (group sizes ranging from 3 to 11) (2) perceived safety & quantity of real-time interaction as antecedents of perceived positivity resonance, and (3) effects of individuals' perceived positivity resonance on individuals' perceptions of group cohesiveness and performance.

Contextual Exploration: Individuals' Perceived Positivity Resonance with Group Members

Group interactions differ from dyadic interactions in terms of others' presence, allocation of social attention and speaking time, conversation coordination, and amount of responsive feedback**.** Memories of interaction with group members may also be highly influenced by extreme positive or negative interactions with a particular member. Therefore, unlike assessments of perceived positivity resonance across two interactants in a dyad, assessment of individuals' perceived positivity resonance with people in a group context may reflect the outcomes of group dynamics and certain memory biases. Thus, an important open question is how to conceptualize and measure a participant's perceived positivity resonance with their group

members. Here I develop and compare two different approaches. One approach is to average participants' reports of their perceived positivity resonance with each group members. By measuring perceived positivity resonance with specific individuals, this approach may target dyadic processes and, as a drawback, potentially miss some information related to group processes. Another approach is to obtain participants' overall, group-level ratings of their perceived positivity resonance with other group members as a holistic unit. By measuring group-level perceptions, this approach may capture more information related to group-level processes, which can be beneficial for studying social interaction in a small group context. Whether a person's mean perceived positivity resonance with individuals is equivalent to a their perceived positivity resonance with the entire group is an empirical question explored in this study.

Another consideration is that group-level perceptions of positivity resonance with members may be affected by intensity bias in memories. People tend to remember strong positive or negative emotional experiences more than average experiences (Kahneman et al., 1993). In the context of groups, a person may have very positive or very negative interactions with a particular group member relative to other group members. The interactions with this group member may in turn disproportionately influence this person's group-level perception of positivity resonance with all group members. Here I explored whether group-level perceived positivity resonance is better informed (i.e., predicted) by the average perception or by the most positive and/or negative perceptions of positivity resonances with particular individual members of the group.

Hypothesized Antecedents: Perceived Safety & Quantity of Real-Time Sensory Connection

Study 1 (the Sorority Study) provided evidence that an individual's empathy, assumed to make others feel safe, facilitates others' perceived positivity resonance. Expanding on this result,

the current study directly tests perceived safety and real-time sensory connection, the theorized antecedents of positivity resonance (Fredrickson, 2016), in virtual group interactions. Perceived safety and real-time sensory connection are theoretically tightly linked to defining components of positivity resonance (safety linked to shared positive affect, and real-time sensory connection linked to shared positive affect, nonverbal caring synchrony, and biological synchrony). Therefore, I also expected both antecedents to predict perceived positivity resonance in virtual interactions.

In the current study, the social context became (due to COVID-19) virtual interactions among university students in workgroups. In this context, socio-psychological threats (e.g., ostracism, microaggressions) are relevant to students' sense of safety. Thus, perceived safety in this context likely pertains to psychological safety, the degree to which individuals feel comfortable being themselves and take interpersonal risks (Edmondson, 1999). Although psychological safety has been mainly studied in work teams and organizations (Edmondson & Lei, 2014), the construct is relevant to other social contexts, especially small student workgroups, and thus was examined in this study. Further, as students' interactions turned virtual, it became possible to test real-time sensory connection as an antecedent of positivity resonance. Thus, I used the quantity (in time) of virtual synchronous interaction as an indicator of real-time sensory connection.

Hypothesized Outcomes: Perceived Group-Level Resources and Performance

Expanding on the findings of Study 1 (the Sorority Study), Study 2 examined the effects of perceived positivity resonance on group-level resources related to social bonds. The social resource I examined in Study 2 was group cohesiveness, which refers to the degree to which members are attracted to the group, its members, and its collective tasks (Chang & Bordia,

2001). Group cohesiveness can be conceptualized as having two facets, task commitment and interpersonal attraction (Chang & Bordia, 2001). Task commitment refers to members' motivation and dedication to achieve collective goals and tasks, and interpersonal attraction reflects members' motivation to form and maintain social relationships with others in the group (Chang & Bordia, 2001). Positivity resonance is hypothesized to promote group success by building social resources such as group cohesion. Consistent with this hypothesis, a meta-analysis of 186 estimates of cohesiveness–performance relations concluded that both task commitment and interpersonal attraction predicted various measures of group performance (*r*s range from .14 to .34, Beal et al., 2003). Therefore, I assessed group performance and tested whether perceived positivity resonance had an indirect effect on group performance mediated by the interpersonal and task aspects of group cohesiveness.

Study Overview

To address the empirical points of interest, Study 2 examined perceived positivity resonance, measured globally across two weeks of interactions, in the context of small groups. The study was conducted with student workgroups in several undergraduate classes at UNC that had group work or group discussion as a curricula component. Students completed 2 surveys, one in January/February and the other in April 2020, to assess their group interactions and perceptions of group characteristics.

Corresponding to the "contextual exploration" aim, I tested a set of exploratory research questions on the measurements of individuals' perceived global positivity resonance with group members. RQ1a: To what extent is a person's group-level rating of perceived global positivity resonance with members associated with that person's mean

perceived global positivity resonance with the individual members of that group? RQ1b: Is a person's group-level perceived global positivity resonance better predicted by the mean perceived global positivity resonance with individual members versus by the highest and/or lowest perceived global positivity resonance with particular individual members in the group?

Corresponding to the "antecedents" aim, I hypothesized that a person's perceived global positivity resonance with group members (group-level ratings or individual-based mean scores) is predicted by perceived safety (H1a) and the total amount of synchronous group digital interaction (H1b).

The second set of hypotheses (H2a-c) corresponds to the "outcomes" aim. Hypothesis 2a (H2a) stated that perceived global positivity resonance with group members (group-level ratings or individual-based mean scores) would predict perceived group-level social resources, as conceptualized as group cohesiveness. Furthermore, I hypothesized that group-level social resources would predict perceived group performance (H2b), and perceived global positivity resonance would indirectly predict group performance through group-level social resources (H2c).

Additionally, I compared the two approaches to measuring perceived global positivity resonance with group members (group-level ratings versus individual-based mean scores) in their prediction of outcomes through RQ2: Which of the two measurement approaches, group-level ratings versus individual-based mean scores, better predict group-related outcomes?

Method

Participants

The procedure for this study was approved by the Institutional Review Board at the University of North Carolina at Chapel Hill. The target sample size was 390 (approximately 130

groups) based on power calculations using Monte Carlo simulations for the planned multilevel SEM models (see Analytical Approach). I determined that power at this sample size was adequate for all parameters (86% - 96%), assuming moderate effect sizes.

Participants were recruited from nine undergraduate classes at UNC, all of which had a component of group activities in the curricula. For their participation, students were entered into a raffle for ten $50 gift cards. Two surveys were sent to participants, one in January/February 2020 (Time 1) and one in April 2020 (Time 2). At Time 1, there were 344 complete responses. Around the time of the study, the COVID-19 pandemic spread across the world. To control the viral spread and protect public health, many local authorities imposed "lockdowns" or "stay at home" orders, and classes UNC moved online in March 2019 as a consequence. Classes moving online may have drastically impacted students' interaction with classmates (e.g., Somasundaram, 2020). Instead of in-person interaction, students interacted with others through video conferences (Zoom) and message-based media. Except when in individual breakout rooms, students' conversations with one another likely became more restricted during a Zoom class session where only one person could speak at a time. As a result, the nature and context of social interactions assessed at Time 2 are not equivalent to those at Time 1, and therefore it is not meaningful to quantify changes from Time 1 to Time 2. Further, variables related to social interactions measured at Time 1 likely captured the first impression of social others and thus are likely volatile and unreliable. I thus only analyzed Time 2 data concerning the interaction-related variables, thereby salvaging a thwarted longitudinal study by changing it into a cross-sectional study. As a result of the

class format change in response to the pandemic, two classes ($n_{\text{Time 1}}$ = 145) canceled group activities altogether and were therefore excluded from the study.

At Time 2, 181 students from seven classes responded to the survey. After the exclusion of participants who reported not interacting with their group members at all for the two weeks leading to the Time 2 survey, 106 participants remained for the final analyses (64 groups; age from 18 to 22; 84.3 % identified as women). Participants identified as White (75.3%), Black (9.0%), Asian (10.1%), and other (5.6%). Table S2.1 shows descriptions of class characteristics for the final sample. For the PSYC 270 and PSYC 210 courses, students were initially working in smaller groups, but with variability in attendance, small groups were disrupted, and there were changes in group membership. After discussion with the course instructor, I opted to use the larger recitation section (sizes ranged from 20 to 22 students) because each section was the consistent unit in which students worked on the course projects.

Procedure

Students who consented completed two 10–15-minute online surveys about their experiences with the group activities in their class. The initial survey was sent out around late January/early February 2020, one week after the student groups were formed and had their first interaction. The second survey was sent out in April 2020. All results reported here are based mostly on data collected in April (Time 2), except for some control variables which were collected in January/February (Time 1; flagged in the Measures subsection).

Measures

Antecedents of Positivity Resonance.

Perceived Safety. I tailored a measure of perceived safety in students' workgroups by selecting and modifying items from the six-item Team Psychological Safety Scale (Edmondson,

1999) to fit the classroom context. The resulting five items asked about students' experience in their group, including "I'm not afraid to express my opinions in my group," "I am afraid to express my opinions in my group" (reverse-coded), "There is a threatening environment in my group" (reverse-coded), "I feel safe to take a risk in my group," and "I feel it is difficult to ask others for help in my group,"(reverse-coded) with response choices ranging from 1 (strongly disagree) to 7 (strongly agree). The scale had good reliability ($\alpha = .71$).

Synchronous Connection. Participants reported how long they spent interacting with their group mates during the past two weeks, and the percentage of their interaction duration that was synchronous (i.e., through video conferences or calls). The quantity of synchronous and asynchronous interaction was calculated by multiplying the reported duration of interaction with the percentage of interaction that was synchronous.

Perceived Global Positivity Resonance. Perceived positivity resonance was assessed globally over two weeks for group members overall (*group-level ratings*) and individual members (*individual-level ratings*). At each assessment, participants provided group-level ratings of perceived global positivity resonance with group members for the past 14 days using the same seven-item scale described in Study 1 ($\alpha = .96$). Again, due to differences in the numerical range between perceived global positivity resonance scores (0-100) and other variables (5-, 6-, and 9-point scales), I divided perceived global positivity resonance scores by 10 before analysis.

I also collected individual-level ratings of perceived global positivity resonance. Participants reported their perceived positivity resonance with individual group members for the past 14 days using two items from the seven-item scale: "…did you experience a

mutual sense of warmth and concern toward this person?" and "did you feel 'in sync' with this person?" This two-item scale demonstrated a high correlation with the full seven-item scale for an individual social target (r = .97, Zhou et al., under review). For group-level perceived global positivity resonance, the two items were highly correlated with the full scale (r = .96, the current study).

I also computed *individual-based mean scores* by numerically averaging participants' positivity resonance reports for individual group members. For this computation, I excluded participants who only reported positivity resonance for one group member (21% of respondents), resulting in 84 (of 106) participants with mean scores.

Perceived Group Social Resources.

Task Commitment. Group members' perceived motivation and perceived effort contributed to reaching collective goals were assessed using two scales. The first scale was the Task Cohesion Subscale from the Revised Scale of Cohesion (Chang & Bordia, 2001). Participants rated four items on a 9-point scale, ranging from 1 (strongly disagree) to 9 (strongly agree). Sample items included "My group is united in trying to reach its goal for performance," "All group members take responsibility for any mistake," "Everyone tries to help if members have problems," and "My group members communicate freely about each other's responsibility." Cronbach's α for this scale was .76.

The second scale measured social loafing (Mulvey & Klein, 1998). This scale asked participants to indicate their agreement with four statements about their group using a 5-point Likert scale from strongly disagree (1) to strongly agree (5). The four items were: "Members of my group are trying as hard as they can" (reverse-coded), "Members of my group are "free-loaders," "Members of my group are contributing less than I anticipated," and "Given their

abilities, my group members are doing the best they can" (reverse-coded). Cronbach's α for this scale was .86.

To create one measure of task commitment, Social Loafing was reverse-scored, and the two measures, Social Loafing and Task Cohesion Subscale (r = .48), were standardized and averaged.

Interpersonal Attraction. Perceived group members' motivation to form and maintain social relationships within the group was measured by the Social Cohesion Subscale from the Revised Scale of Cohesion (Chang & Bordia, 2001). Participants rated four items on a 9-point scale, ranging from 1 (strongly disagree) to 9 (strongly agree). Sample items included "Group members rather go out on their own than as a group" (reverse-coded), "Group members rarely socialize together" (reverse-coded), "Group members like to spend time together outside of work hours," and "Group members stick together outside of the group work." Cronbach's α for this scale was .78.

Perceived Performance.

Perceived Group Performance. Perceived performance was measured through group members' self-assessment of group performance based on a measure adapted from Chang and Bordia (2001). Participants were asked to rate on a 5-point scale in response to three questions: "How productive do you think your group was?" (1 = *not productive at all*, 5 = *very productive*), "How well do you think your group worked together as a group?" (1 = *very poor*, 5 = *very good*), "Did your group accomplish its tasks successfully?" (1 = *very unsuccessful*, 5 = *very successful*). Cronbach's α for this scale was .80.

***Grades*.** Students had the option to share their group-activity-related grades with the researcher at the conclusion of the semester. However, the nature of the grades varied from class to class. Students could have received the same grade for the final projects or different grades for their individual work that used the outputs from group discussions and activities. Additionally, the COVID-19 lockdown resulted in changes to learning, teaching, and grading. Campus leaders urged instructors to evaluate students' work compassionately and extended the Pass/Fail grade option to all courses. All these factors may have resulted in atypical grades, as evidenced by a null correlation between individuals' previous GPAs and group grades (r = .19, p = .13). Therefore, grades were not used as an outcome for group performance.

Control Variables. As students were recruited from classes with varied characteristics (e.g., class size, instructor, presence of TA, department, etc.), class was controlled in all analyses. I speculated that perceived positivity resonance with group members could be influenced by the size of the student group, an individual's number of prior acquaintances and friends in the group, interest in the class, and interest in group work. I also speculated that group outcomes such as cohesion and performance could be influenced by the aforementioned factors, as well as students' previous GPA. To distinguish the contribution of positivity resonance from that of positive affect to outcomes, positive affect was also included as a control in analyses of outcomes. Several of these controls are described in more detail below:

Positive Affect. Participants completed the hedonic well-being subscale of the Mental Health Continuum–Short Form (Keyes, 2009). Participants used a scale from 0 (never) to 5 (every day) to respond to three items: "In the past week, how often did you feel [interested in life/ happy/ satisfied]?" Cronbach's α for this scale was .87.

Past GPA. Participants were given the option to self-report their GPA for their last semester (Fall 2019).

Motivation to Work with a Group. At Time 1, participants indicated the extent to which they liked working in a group by responding to two items. "I like working with classmates on a group project," and "I'd rather have individual assignment than group assignment" (reverse-coded) on a scale from 1 (Strongly disagree) to 7 (Strongly agree). These two items were moderately correlated (r = .58) and averaged to create a mean motivation score.

Motivation to Take the Class. At Time 1, participants indicated the extent to which they were intrinsically interested in the class by responding to two items. "Personally, I do not find this class interesting" (reverse-coded) and "I'm excited about taking this class" on a scale from 1 (Strongly disagree) to 7 (Strongly agree). The two items were highly correlated (r = .77) and averaged to create a mean motivation score.

Analytical Approach

The data were hierarchically organized, and persons (Level 1) were nested within groups (Level 2), which were nested within class (Level 3). As such, I opted to use multilevel SEM to analyze these data. The SEM models were fitted in Mplus (Muthén & Muthén, 2019), with parameter estimates obtained using a maximum likelihood estimator with robust standard errors. Within and between sources of variance were partitioned, and Level 1 variables were subjected to implicit, model-based group mean centering. The number of classes in the final sample was low (seven classes), so I controlled for classes as a default in all analyses instead of modeling a random effect for class at Level 3. As the robust maximum likelihood estimator in Mplus does not output standardized

coefficients for multilevel SEM models, I z-transformed independent and dependent variables to obtain pseudo-standardized coefficients.

A large proportion of the groups (50%) only had one participant respond, leading to potentially low Level 2 (between-groups) variance in the data. Thus, for each multilevel model, I first fit an intercept-only model to estimate the variances of the dependent variables at Level 1 and Level 2 and to determine if a multilevel model was necessary. Next, if the variances of dependent variables at Level 2 were not significantly different from zero, I then proceeded with a traditional one-level regression model with individuals as the only unit of analysis. This was done to simplify analyses and avoid convergence issues. Among the dependent variables in all models, only a person's group-level ratings of perceived global positivity resonance (measured with 7 items) with members showed significant variance at Level 2 and thus were modeled with two-level SEM. The remaining variables (individual-based mean scores of perceived global positivity resonance, interpersonal attraction, task commitment, and group performance) were analyzed using one-level models.

For the analyses of RQ1a and RQ1b only, because the mean scores for perceived global positivity resonance with individual members were computed across two-item reports, and to keep the measure consistent, I used the same two items for individuals' group-level ratings of perceived global positivity resonance with group members. To test RQ1a, I regressed group-level ratings of perceived global positivity resonance (two-item version) on individual-based mean scores of perceived global positivity resonance (Model 1). For RQ1b, group-level perceived global positivity resonance (two-item version) was regressed on the highest, lowest, or both highest and lowest scores of perceived global positivity resonance with individual members (respectively Model 2-a, b, c), then on the highest, lowest, and mean perceived global positivity

resonance scores (Model 3). F-tests were conducted to compare the models (Model 2a and Model 2b against Model 2c; Model 1 and Model 2c against Model 3; see Table S2.3).

Following RQs 1a and 1b, for the next two sets of hypotheses (H1a-b and H2a-b), I present the main results based on a person's group-level perceived global positivity resonance (full seven-item version) instead of individual-based mean perceived global positivity resonance for two reasons. First, the former measures used a complete scale of positivity resonance whereas the latter only used two items. Second, the sample size was reduced for mean scores (84 remained out of 106) because I excluded 20% of participants who only reported positivity resonance for one group member. Nevertheless, these analyses were also repeated with the individual-based mean scores of positivity resonance, and the results are briefly described.

To test H1a and H1b, a person's group-level perceived global positivity resonance with members was regressed on perceived safety and duration of synchronous interaction at Level 1 and Level 2, while controlling for the effect of class at level 2.

To test H2a and H2b, I regressed group cohesiveness measures (task and interpersonal attraction) on a person's group-level perceived global positivity resonance with group members and perceived group performance on both group cohesiveness measures and perceived positivity resonance, while controlling for the effect of class. I also estimated the indirect effect of perceived global positivity resonance on group performance as mediated by task commitment and interpersonal attraction.

To answer RQ2, I reran the models testing H2a-b while including both the group-level ratings (two-item version) and the individual-based mean scores of perceived global positivity resonance as predictors to contrast the predictive strength of each measure.

In ancillary analyses, I controlled for competing predictors of global positivity resonance (class, group size, interest in group work, duration of meeting time, and the number of prior friends/acquaintances in the group) in testing the hypotheses on antecedents. When testing the hypotheses on outcomes, I also controlled for potential competing predictors of perceived social resources (class, group size, interest in group work, duration of meeting time, positive emotions, and the number of prior friends/acquaintances in the group) and competing predictors of group performance (class, group size, past GPA, interest in class, interest in group work, duration of meeting time, positive emotions, and the number of prior friends/acquaintances in the group). Due to the small sample, I tested the control variables individually to avoid overfitting and convergence issues.

Results

Preliminary Analyses

Table S2.1 shows descriptive information by class. For the T2 analyzed sample, 32 of the 64 groups had only one survey responder. Therefore, I anticipated that there may be low variances at the between-group level (Level 2).

Table S2.2 shows the descriptive statistics of and zero-order correlations among main study variables and covariates. Among the hypothesized antecedents of perceived global positivity resonance for groups, only perceived safety was correlated with perceived global positivity resonance. Consistent with the primary hypothesis, group-level ratings and individual-

based mean scores of positivity resonance were correlated with task commitment, interpersonal attraction, and group performance.

Among those who reported positivity resonance for two or more individual members in their group, the differences between the lowest and highest positivity resonance with group members varied greatly, ranging from 0 to 100%, with an average difference of 2.95 (SD = 2.85). A person's individual-based mean perceived positivity resonance was also highly, but not perfectly, associated with a person's group-level perceived positivity resonance with the members, suggesting they may be related but not synonymous with one another (Table S2.3).

RQ1: Associations between Group-Level Measure and Individual-Level Measures of Perceived Global Positivity Resonance. I tested whether a participant's group-level perceived global positivity resonance with members would be best predicted by that participant's mean, highest, and/or lowest score for perceived global positivity resonance with individual members. Because I looked at the highest and lowest global positivity resonance scores, I only included those who reported positivity resonance with two or more individuals in their group ($n_{\text{participant}}$ = 84, n_{group} = 57). I used the two-item scale to compute group-level perceived global positivity resonance for testing RQ1 and RQ2 to keep the measure consistent across the assessment approaches.

An intercept-only two-level model was fitted for a person's group-level perceived global positivity resonance. Level 2 variance was not significantly different from zero ($variance_{\text{Level 2}} = 2.01$, $p = .15$). Therefore, I fitted one-level regressions with a step-by-step model comparison (Table S2.3).

For RQ1a, I regressed group-level perceived global positivity resonance (two-item version) on individual-based mean perceived global positivity resonance (Model 1). For RQ1b, group-level perceived global positivity resonance was regressed on the highest, lowest, or both highest and lowest scores of perceived global positivity resonance with individual members (respectively Model 2-a, b, c). Finally, the highest, lowest, and mean perceived global positivity resonance scores were all entered together as predictors (Model 3). I then compared the models (Model 2a and Model 2b against Model 2c; Model 1 and Model 2c against Model 3; see Table S2.3) using F-tests.

According to Table S2.3, the lowest or highest scores for perceived global positivity resonance with group members predicted group-level perceived positivity resonance better when combined (Model 1c) than when analyzed separately (Model 1a & 1b). The results further showed that Model 3 achieved better fit than Model 1c, suggesting that adding mean scores improves Model 1c's prediction of group-level perceived global positivity resonance with groups (Table S2.3). In contrast, adding the highest and lowest scores to the computed mean scores of perceived global positivity resonance did not improve predictions of group-level perceived global positivity resonance (Table S2.3). Participants thus seem to use the mean perception of interaction with all individual members to inform the overall perceived positivity resonance with the entire group, rather than relying solely on perceived positivity resonance with particular individuals in the group. Each unit increase in individual-based mean scores predicted a .78 unit increase in group-level ratings of positivity resonance, and zero-order correlation showed the individual-based mean measure was highly correlated with the group-level ratings ($r = .72$).

I hypothesized post hoc that perhaps the association between individual-based mean scores and group-level ratings of perceived global positivity resonance may be moderated by

several factors: class, group size, the gap between the highest and lowest levels of positivity resonance experienced with group members. All moderation effects were nonsignificant except for class. Specifically, the association between the individual-based mean scores and group-level ratings of perceived positivity resonance was not significant for the course NSCI.175.002 (b = -.43, p = .23). Nevertheless, caution should be applied when interpreting these results as the sample size (n = 84) did not provide enough power for the moderation analysis using classes (16 parameters).

Primary Analyses

Hypothesis 1a-b: Effects of Perceived Safety and Synchronous Interaction Quantity on Perceived Global Positivity Resonance. An intercept-only two-level model was fit for the endogenous (dependent) variable, i.e., a person's group-level rating of perceived global positivity resonance with members. Level 2 variance was significantly different from zero ($variance_{\text{Level 1}}$ = 5.00, p < .001; $variance_{\text{Level 2}}$ = 2.02, p = .021). Therefore, I proceed to fit a two-level random intercept model, in which group-level perceived global positivity resonance was regressed on perceived safety and quantity of synchronous interaction both at Level 1 (within-groups) and Level 2 (between-groups) while controlling for effects of class at Level 2 (n =106 individuals). Perceived safety predicted greater group-level perceived global positivity resonance at the person level (b = 1.27, 95% CI = [.49, 2.05], β = .42, p = .001) but not at the group level (p = .181), thus partially supporting H1a. On the other hand, the effect of the quantity of synchronous interaction on group-level perceived global positivity resonance was significant at the group level (b = 1.15, 95% CI = [.26, 2.03], β = .48, p = .011), but not at the person level (p = .758), providing partial evidence for H2b. As there was no

residual Level-2 variance of group-level perceived global positivity resonance ($variance_{between}$ = 0.46, p = .521), I did not proceed to fit a random slope model. I repeated the analyses with individual-based mean scores (one-level model, n = 84) of perceived global positivity resonance with individual group members, which yielded significant effects for quantity of synchronous interaction and perceived safety.

In subsequent ancillary models, I controlled for competing predictors of group-level perceived global positivity resonance, including class interest, interest in group work, amount of time interacting asynchronously, the number of prior friends and acquaintances in the group at Level 1, and group size at Level 2. Due to the small sample, I entered the control variables one by one to avoid convergence issues and minimize the parameter-observation ratio. After controls were added, group-level perceived global positivity resonance was still predicted by perceived safety at the person level and quantity of synchronous interaction at the group level.

Hypothesis 2a-b: Effects of Perceived Global Positivity Resonance on Group Cohesiveness and Performance. To test the second set of hypotheses, I fit a mediation model with group performance as the outcome, group-level perceived global positivity resonance as the predictor, and interpersonal attraction and task commitment as the mediators. To determine whether a multilevel structure was needed for the SEM model, an intercept-only two-level model was fit for the endogenous (dependent) variables, i.e., interpersonal attraction, task commitment, and group performance. Level 2 variances for all three variables were not significantly different from zero ($ps \geq .12$). Therefore, to reduce models' complexities I fitted one-level SEM models for the individuals.

Figure S2.1 shows the results for the analyses of outcomes. Group-level perceived positivity resonance with group members predicted both aspects of group cohesion, including

greater task commitment (b = .16, 95% CI = [.11, .22], β = .50, p < .001) and interpersonal attraction (b = .30, 95% CI = [.18, .42], β = .42, p < .001), supporting H1a. Higher perceived group performance was predicted by both task commitment (b = .26, 95% CI = [.11, .41], β = .28, p = .001) and interpersonal attraction b = .11, 95% CI = [.05, .18], β = .26, p = .001). Group-level perceived global positivity resonance also had significant indirect effect on group performance as mediated by task commitment (indirect: b = .04, 95% CI = [.01, .07], β = .14, p = .003) and interpersonal attraction (indirect: b = .03, 95% CI = [.01, .06], β = .11, p = .006), thus confirming H2b. After controlling for social and task commitment, group-level perceived global positivity resonance still had a significant direct effect on group performance (b = .08, 95% CI = [.03, .14], β = .28, p = .002; total effect: b = .16, 95% CI = [.11, .21], β = .53, p < .001). The same model was repeated with the individual-based mean scores of perceived global positivity resonance as the predictor (one-level model, n = 84), and the pattern of results remained unchanged.

Additionally, I also controlled for competing predictors of goal and interpersonal attraction (positive emotions, group size, interest in class, interest in group work, time in meeting) and competing predictors of group performance (positive emotions, group size, individual's past GPA, interest in class, interest in group work, time in meeting). Due to the small sample, I entered the control variables one by one to avoid convergence issues and minimize the parameter-observation ratio. After these factors were controlled for, the pattern of findings remained substantively the same.

RQ2: Comparisons between Group-Level Ratings and Individual-Based Mean Scores of Perceived Global Positivity Resonance in Predicting Group Outcomes. I compared

two approaches to assessing perceived global positivity resonance with group members (group-level ratings versus individual-based mean scores) in their ability to predict social resources and group performance. To do so, I included both predictors in the same SEM model. When the individual-based mean scores were controlled, group-level perceived global positivity resonance significantly predicted task commitment (b = .18, 95% CI = [.09, .27], β = .57, p < .001) but not interpersonal attraction (p = .706). Group-level ratings also indirectly predicted group performance through task commitment (b = .05, 95% CI = [.01,.09], β = .19, p =.011), but not interpersonal attraction (p = .711). In contrast, when the group-level ratings were controlled, mean perceived global positivity resonance with group members predicted interpersonal attraction (b = .35, 95% CI = [16, .54], β = .48, p < .001), but not task commitment (p = .466). Further, the individual-based mean scores did not have a significant indirect effect on group performance through interpersonal attraction (p = .071) or task commitment (p = .477). Individuals' group-level ratings for perceived global positivity resonance with group members had a significant total effect on group performance (b = .10, 95% CI = [.02, .18], β = .35, p = .013), whereas the individual-based mean scores did not have a total significant effect (p = .270). In sum, although two approaches to assessing perceived global positivity resonance with group members individually both predicted relevant outcomes, when entered into the model together, the group-level ratings predicted task commitment and group performance better, whereas the individual-based mean scores predicted interpersonal attraction better.

Discussion

I investigated global assessments (over two weeks) of perceived positivity resonance during online interactions in undergraduate students' workgroups. This research addressed three topics: (1) the approaches to assessing perceived global positivity resonance with group members

in a small group context ("contextual exploration" aim, RQ1a-b), (2) real-time sensory connection and perceived safety as antecedents of perceived global positivity resonance (“antecedents” aim, H1a-b), and (3) the effects of perceived global positivity resonance on group resources and group performance (“outcomes” aim, H2a-c and RQ2).

Regarding the “contextual exploration” aim, I found that group-level ratings of perceived global positivity resonance with all members were highly correlated with mean scores of perceived global positivity resonance with individual members (r = .72). Furthermore, I found that the group-level ratings were better predicted by the individual-based mean scores relative to the highest or lowest scores of perceived global positivity resonance with particular members. This suggests that the group-level measure may capture the averaged impression of interaction quality with all individual members rather than just with any single influential individual.

Corresponding to the “antecedents” aim, I found, at the person level, that as participants felt psychologically safer in the group, they perceived higher levels of global positivity resonance with group members. Despite being in the same group environment, participants may have different perceptions of safety due to internal factors (e.g., trait anxiety) or external factors (e.g., being ostracized from the group), which may explain the person-level statistical effect. At the group level, the quantity of synchronous interaction through video and phone calls, which presumably reflects the degree of real-time sensory connection, was associated with perceived global positivity resonance. Members in the same group may experience similar durations of synchronous interaction. This may explain why the quantity of synchronous interaction did not have a statistical effect at the person-level, but instead at a group-level. Together, the findings on the

"antecedents" aim provide the first evidence supporting the proposition that perceived safety and quantity of synchronous connection precede perceived positivity resonance in online interaction.

Corresponding to the "outcomes" aim, an individual's perceived global positivity resonance with group members predicted their perception of group-level cohesion, including two aspects: task commitment (the extent to which all group members are motivated and put effort into achieving collective goals) and interpersonal attraction (the strength of social bonds between members). The two aspects of group cohesiveness, in turn, predicted perceived group performance, which was consistent with the literature on team cohesion and teamwork (Beal et al., 2003). Through group cohesiveness, perceived global positivity resonance indirectly predicted perceived group performance. These findings thus are the first evidence supporting the theory that positivity resonance builds group collective resources (Brown & Fredrickson, 2020), which may produce instrumental consequences such as group performance. Together, the findings on the "antecedents" and "outcomes" aim have practical implications for designing an environment to promote cohesiveness and performance in small work teams.

There were slight differences in how well the two approaches to assessing perceived global positivity resonance with group members (group-level ratings vs. individual-based mean scores) predicted group outcomes. The group-level ratings had an edge predicting task commitment and group performance, whereas the individual-based mean scores better predicted interpersonal attraction. This suggests that the group-level ratings may potentially capture group processes better than the individual-based mean scores, especially those corresponding to collective task and performance. The individual-based mean scores may also suffer from incomplete information, as participants often provided self-reports of positivity resonance for only some members of their groups. Due to this incomplete information, the individual-based

mean scores may inadequately capture group processes that involve all members. On the other hand, participants might have reported positivity resonance individually for members whom they particularly liked or frequently socialized with, which may explain the higher associations between the individual-based mean scores and interpersonal attraction. For future research on group positivity resonance, the group-level assessment is recommended for its shorter length and slightly better prediction of task-related outcomes compared to the individual-based mean scores, whereas separate assessments of one's perceived positivity resonance with individual group members are still appropriate for studying interactions between individual members.

Study 2 has several strengths. First, I collected and compared two measures of perceived global positivity resonance with group members, group-level ratings versus individual-based mean scores across interactions with individual group members. This allowed for more rigorous measurement of perceived global positivity resonance in a small group context as well as a better understanding of how a person perceived their interactions with a group of people based on individual impressions with each member. Compared to Study 1, directly measuring perceived safety also allowed for a stronger test of perceived safety as an antecedent of positivity resonance.

Due to the impact of the COVID-19 pandemic, the study suffered from several limitations. First, the pandemic forced changes to the study plan, including dropping 42% of the initial sample and changing the longitudinal design into a cross-sectional design. The cross-sectional findings provided weaker evidence for the hypothesized causal effects of positivity resonance on social resources and group performance relative to the original (planned yet foregone) longitudinal design. Second, the unusual context for

social interaction (e.g., social isolation from friends, exclusively online interaction) during the pandemic also limited the generalizability of the findings. Third, objective measures of group performance such as grades were unusable due to unusual changes in academic situations, including the widespread adoption of pass/fail grading, and therefore the results were based entirely on self-reported measures. Finally, the sample was drastically reduced as many classes dropped group work after the onset of the pandemic, thus reducing statistical power. Furthermore, as 50% of groups ended up with only one student response, there was little variance at the group level, and most effects emerged at the individual level. An individual's perceptions of positivity resonance with group members and group social resources may not accurately reflect actual or consensus-based perceptions of positivity resonance and group social resources. A student may perceive high levels of global positivity resonance and group resources in their group, but other members whose data are missing may disagree. For all of these reasons, I thus substantially temper the claim that perceived positivity resonance in a group predicts group-level resources. Like Study 1, self-reports may not reflect the experience of positivity resonance due to numerous biases (e.g., memory errors, demand effects, social desirability; Robinson & Clore, 2002; Schwarz et al., 2009). Relatedly, the global assessments across multiple interactions over two weeks may reflect beliefs about typical experiences of positivity resonance (Robinson & Clore, 2002) rather than positivity resonance actually subjectively experienced during various episodes of interactions. Lastly, like Study 1, Study 2 drew a sample of college students, thus limiting the generalizability of the results. Overcoming the weaknesses of the cross-sectional design and the college sample, Study 3 used data from a longitudinal randomized intervention and sampled from a more diverse community population.

CHAPTER 4: STUDY 3 - THE DAILY WELLNESS STUDY

Focused Introduction

In Study 3, I investigated the daily self-reported experience of positivity resonance with weak ties and strong ties in a community sample. Corresponding to this dissertation's three overarching aims (contextual aspects, antecedents, outcomes), Study 3 addressed three topics: (1) the relationship between perceived positivity resonance with strong ties and with weak ties (2) incivility as a safety-related external precursor of perceived positivity resonance, and (3) effects of individuals' perceived positivity resonance on perceived social resources such as social well-being, belongingness, and loneliness.

Contextual Exploration: Perceived Positivity Resonance Across Strong Ties and Weak Ties

Empirical evidence (Zhou et al., under review) suggests that individuals can experience positivity resonance with both strong ties (families, romantic partners, or friends) and weak ties (strangers and acquaintances). Strong versus weak ties differ in levels of intimacy and tend to serve distinct functions (Granovetter, 1973). Nevertheless, positivity resonance experienced with strong and weak ties is hypothesized to be of the same kind, albeit with potential differences in length and intensity. Because a person may have a stable motivation or ability to co-create moments of positivity resonance with other people, I hypothesized a correlation between positivity resonance with weak ties and strong ties at the between-person level. In addition, within individuals, a social interaction at one point may set the mood or influence a subsequent social interaction.

For example, having a good social interaction at home may boost one's mood and translate into a pleasant interaction with the cashier at the grocery store, or vice versa. Therefore, perceived positivity resonance with weak ties and strong ties on the same day may influence one another and co-vary within individuals.

Hypothesized Antecedents: Incivility and Perceived Safety

Compared to empathy (Study 1), others' incivility is also an external condition but, by contrast, may decrease perceived safety. Thus, according to theory (Fredrickson, 2016), to the extent that incivility reduces perceived safety, incivility would also diminish positivity resonance. Lower self-reported perceptions of a safety climate and psychological health at work have been linked to social threats such as self-reports of others' uncivil and abusive behavior (Mullen et al., 2018) and street harassment (Davidson et al., 2016; Macmillan et al., 2000). Those who reported facing gender-based or race-based discrimination and incivility at work also reported low job satisfaction and emotional well-being (Deitch et al., 2003) and ultimately were more likely to leave their jobs (Cortina et al., 2013). Experiences of incivility online in the form of cyberbullying and online aggression have also been linked to greater anxiety and lower feelings of happiness (Viner et al. 2019). These findings suggest that incivility potentially lowers perceived safety. On the assumption that exposure to uncivil behaviors (i.e., condescension, rudeness, and sarcastic comments) decreases perceived safety, I predicted that experienced incivility would be a safety-related precursor of lower perceived positivity resonance.

Hypothesized Outcomes: Perceived Social Resources

As positivity resonance has been shown to build social resources such as meaningful connections with others (Study 1, the Sorority Study), by extension it should also shift perceived social resources such as increasing social well-being and a sense of belonging to the community

and reducing loneliness. The perception of social resources (e.g., loneliness or perceived social support) is equally or more influential on well-being outcomes than actual social resources (e.g., actual social isolation or received social support) from one's social network (Holt-Lunstad et al., 2015; Russell et al., 2012; Uchino, 2009; Wethington & Kessler, 1986). Through this study, I examine the perception of personal social resources, with a focus on social well-being, belongingness, and loneliness—jointly referred to as social flourishing. Social well-being, as conceptualized by Keyes (1998), consists of five dimensions that reflect the degree to which individuals are functioning well in their social lives, including social integration (i.e., having a good relationship with the community), social acceptance (i.e., feeling comfortable with others), social contribution (i.e., perceiving self's social values), social actualization (i.e., believing in progress and growth of the society), and social coherence (i.e., perceiving that one's social life makes sense). Belonging may be defined as feelings of being included and accepted (versus excluded and rejected) by one's social groups. In contrast, individuals may feel loneliness, which refers to the distressing feeling accompanying the perception that one's social needs are not being met by the quantity or quality of social relations (Hawkley & Cacioppo, 2010).

Research on "the need to belong" hypothesis suggests that people achieve belongingness and social connectedness by having frequent pleasant, mutually caring interactions (characteristics of positivity resonance) with stronger ties, or people with whom they can build enduring relationships (Baumeister & Leary, 1995). However, the frequency of interaction with weak ties has also been shown to contribute to individuals' positive affect and sense of community, independently from the frequency of interaction with strong ties (Sandstrom & Dunn, 2014). Therefore overall, I expected that perceived positivity resonance during interactions with a variety of weak and strong social ties

would predict greater social flourishing (e.g., greater social well-being and belongingness and lower loneliness).

Study Overview

To test these ideas, I analyzed data from a double-blind randomized controlled trial that aimed to increase social connectedness. This was a collaborative study that served multiple purposes, and the primary purpose was to test the link between positivity resonance and prosocial tendencies (Zhou et al., under review). During the 5-week intervention period, each night, all participants were invited to report their perceived episodic positivity resonance with strong and weak ties, positive emotions, and incivility that they experienced during the past day. Participants were also asked to complete pre-and post-intervention surveys (i.e., T1 and T2 surveys) on several measures, including social well-being, belongingness, and loneliness. Participants in three out of four groups were randomized to receive instructions to make small shifts in behavior over five weeks. Two treatment groups were asked to create more frequent moments of high-quality social connection, either in general (*Social Connectedness-General*) or with a focus on strangers and acquaintances (*Social Connectedness-Weak Ties*). I contrasted these two treatment groups with two control groups: an active control group in which study participants were asked to mindfully attend to the present moment more frequently (*Mindfulness Active Control*) and a non-intervention group (*Monitoring Passive Control*), in which there were no instructions to change behavior yet daily reports were made. The effects of randomized condition were examined on daily perceived episodic positivity resonance and prosociality in Zhou et al. (under review), which found the three groups, Mindfulness Active Control, Social Connectedness-General, and Social Connectedness-Weak Ties similarly raised daily perceived episodic positivity resonance.

To address the "contextual exploration" aim, I first explored the link between perceived episodic positivity resonance with weak ties and strong ties. Exploratory Research Question 1 (RQ1) asked whether and to what degree perceived episodic positivity resonance with weak ties and strong ties are related at the between-person level (i.e., if there is covariation between averaged positivity resonance with weak ties and strong ties across individuals) and within-person level (i.e., if there is covariation between positivity resonance with weak ties and strong ties on the same day).

To address the "antecedents" aim, I examined whether experiences of incivility during social interactions, which potentially threaten one's sense of safety, would predict decreased perceived episodic positivity resonance irrespective of tie strength. Accordingly, Hypothesis 1a-b stated that (H1a) individuals who, on average, reported more incivility (compared to other individuals), would perceive less episodic positivity resonance (between-person effects), and (H1b) on days in which individuals reported more incivility (compared to other days), they would perceive less episodic positivity resonance (within-person effects).

To address the "outcomes" aim, I first indexed social flourishing with three indicators: social well-being, belongingness, and loneliness. I then tested the effects of the randomized condition and elevations in perceived episodic positivity resonance on shifts in social flourishing throughout the intervention. Accordingly, Hypothesis 2a stated that compared to the Passive Monitoring Control group, those randomized to the two Social Connectedness groups would show T1-T2 increases in social flourishing. Hypothesis 2b stated that individuals' elevations in daily perceived episodic positivity resonance (mean levels and trajectories) would predict individuals' T1-T2 changes in

social flourishing. Hypothesis 2c stated that individuals' elevations in daily perceived episodic positivity resonance (mean levels and trajectories respectively) mediate the effects of the two Social Connectedness groups on T1-T2 changes in social flourishing.

In addition, I tested an ancillary research question (RQ2): does an active control group focusing on mindfulness differ from two Social Connectedness groups in its effects on social flourishing? Like in the two previous studies, to separate positivity resonance from positive affect in the nomological network, I controlled for positive affect when examining the effects of perceived episodic positivity resonance on changes in social resources.

Method

Participants

The procedures for this study were approved by the Institutional Review Board at the University of North Carolina at Chapel Hill. We recruited working professionals or graduate and professional students in the Chapel Hill - Raleigh - Durham and surrounding areas in North Carolina who were between the ages of 20 and 65, and able to access a computer or mobile device.

We aimed to obtain a sample size of 360 based on a priori power calculations using Monte Carlo simulations for the planned multilevel models (see Analytical Approach). For these models, power at this sample size was excellent for all parameters (ranging from 90% to 96%), assuming moderate effect sizes and 20% attrition. We recruited 416 participants for the study. As analyses for the study primarily relied on nightly reported data of positivity resonance, I only retained 405 participants who completed at least one nightly report (M_{age} = 33.84, SD_{age} = 11.22, ranging from 20 to 64; 81% identified as women). Participants identified as White (68%), Hispanic (7%), Black (12%), Asian (8%), and other, and were compensated up to $100. For

specific statistical models, sample sizes were lower than 405 because following best practices, I excluded participants with few nightly reports than the number of parameters estimated at the within-person level in each model (Bollen, 1989, p. 243).

Procedure

The current intervention study used a double-blind, randomized placebo-controlled design. All participants were asked to complete a pre-intervention (T1) online survey, 35 consecutive brief nightly online self-reports, a post-intervention online survey (T2), and a post-intervention in-person laboratory session to collect behavioral and implicit dependent measures. The current investigation did not utilize these measures. Data were collected between March and November of 2019.

Behavioral Interventions. Participants were randomly assigned to one of four groups, which included two experimental groups (Social Connectedness-General, Social Connectedness-Weak Ties) and two control groups (Mindfulness Active Control, Monitoring Passive Control). Participants assigned to either Social Connectedness condition were instructed via email to view a short TEDx video (11 min, 38 sec) that conveyed the value of day-to-day positive connection with others. The next morning, they received daily email reminders to try to experience more positive moments of connection with people such as "a shared smile with another person, a laugh with a friend or acquaintance, or a simple act of kindness." For the Social Connectedness-Weak Ties group, the instructions emphasized the connection with people "outside your close circle of friends and family." Participants randomized to the Mindfulness Active Control group were instructed to view a different short TED video (9 min, 24 sec) that conveyed the value of mindful awareness. Beginning the next morning, they were reminded via daily

emails to “try to experience more moments of mindfulness, taking time to pay attention to the present moment throughout your day. You could practice mindfulness during routine activities, while you wait in line or are stuck in traffic, or during short breaks at work.”

Measures

Among assessments collected in the intervention study, only measures used to test the current dissertation hypotheses are described here (for measures of prosocial and self-centered tendencies, see Zhou et al, under review).

Social Flourishing (T1 & T2 Measures).

Belongingness. To indicate their sense of belonging in their college community, participants rated how much they agreed (1 = *Strongly disagree*, 7 = *Strongly agree*) with 12 statements from the General Belongingness Scale (Malone et al., 2012). Sample statements included “When I am with other people, I feel included” and “I feel like an outsider” (reverse-scored). The scale showed good reliability (α_{T1} = .87, α_{T2} = .85).

Loneliness. Feelings of being cut off or separated from others were measured using a short form of the UCLA Loneliness Scale (Hays & DiMatteo, 1987). Participants indicated how frequently eight statements described them on a 4-point scale (1 = *Never*, 4 = *Often*). Sample statements included “I lack companionship,” “There is no one I can turn to.” The scale showed good reliability (both αs = .94).

Social Well-Being. Social well-being was measured using the “social” items from Eudaimonic Well-Being Subscale of the Mental Health Continuum - Short Form (MHC-SF; Keyes, 2009). Participants were asked to indicate on a 6-point Likert scale (1 = never, 6 = every day) how often in the past month they have experienced various aspects of positive social functioning (e.g., “...that you belonged to a community (like a social group, or your

neighborhood)" and "that you had something important to contribute to society." The scale showed good reliability at both time points (α_{T1} = .77, α_{T2} = .80).

Nightly Measures.

Perceived Episodic Positivity Resonance. Perceived episodic positivity resonance was assessed using the shortened two-item scale introduced in Study 2 (the Classroom Study). Participants recalled daily both their longest interaction with strangers and acquaintances *and* their longest interaction with close friends and loved ones during the day and responded to the scale for each of these two interactions. The scales show reliability both between ($\omega_{strong\text{-}ties}$ = 1.00, $\omega_{weak\text{-}ties}$ = .99) and within ($\omega_{strong\text{-}ties}$ = .97, $\omega_{weak\text{-}ties}$ = .96) people (Geldhof et al., 2014). In addition to using daily perceived episodic positivity resonance with weak ties and strong ties, I also computed a mean score across both social targets (strangers/acquaintances and close others) for a total daily perceived positivity resonance score ($\omega_{between\text{-}person}$ = 1.00; $\omega_{within\text{-}person}$ = .88).

Positive Affect. On a 5-point scale (1 = *Not at all*, 5 = *Extremely*), participants responded to the statement "Today I felt pleasant emotions. (Note: may include amusement, awe, gratitude, hope, inspiration, interest, joy, love, pride, or serenity)."

Incivility. On a 5-point scale (1 = *Not at all*, 5 = *Extremely*), participants responded to the statement "Today someone put me down or was condescending to me."

Analytical Approach

I used SEM throughout the analysis process. To analyze daily reports of perceived episodic positivity resonance, I used the Dynamic Structural Equation Modeling (DSEM) framework because, unlike the multilevel SEM framework, it can estimate autoregressive effects common in intensive longitudinal data. For model estimation under the DSEM

framework, I used Bayesian Markov Chain Monte Carlo in Mplus (MCMC, Muthen & Muthen, 1998-2017; Asparouhov et al., 2018) to avoid the potential convergence and intractable issues with traditional methods like maximum likelihood (McNeish & Hamaker, 2018; Asparouhov et al., 2018). In contrast with a frequentist method like Maximum Likelihood, Bayesian MCMC produces an entire distribution of possible values for each parameter of interest by using information from the observed data (i.e., posterior distributions) instead of a single point estimate. For reporting, each posterior distribution is summarized by its median, similar to a point estimate of a given parameter. With Bayesian estimation, I relied on whether the 95% credible interval included zero to decide whether an estimate was null in the population (McNeish & Hamaker, 2018). Therefore, *p* values listed in the results given by Mplus are analogous to one-tailed *p* values but should not be understood in terms of significance like a traditional frequentist *p* value. Rather, from a Bayesian estimator, a *p* value of .05 for a positive estimate of a parameter indicates that 5% of the posterior distribution is below zero (Muthén, 2010 p.7). Similar to Full Information Maximum Likelihood (FIML), the Kalman filter employed in these dynamic models addressed missing data by making predictions of the next observation based on the lagged data (McNeish & Hamaker, 2018).

To model the daily reports of perceived episodic positivity resonance with weak and strong ties, I fit a Lag-1 multilevel vector autoregressive model (multilevel VAR(1)) in Mplus Version 8 (Muthen & Muthen, 1998-2017), in which at Level 1 (within persons), autoregressive effects of daily perceived episodic positivity resonance with strong ties and weak ties were evaluated. Due to large discrepancies in the numerical ranges between perceived episodic positivity resonance scores (0-100) and other variables (1-7), I divided perceived episodic positivity resonance scores by 10 before analyses. To remove Nickell's bias and Ludtke's bias

for the autoregressive effects (Nickell, 1981; Ludtke et al., 2008; Asparouhov et al., 2018), I used the latent centering approach to partition the between-person and within-person effects for nightly reported measures. Because previous research has revealed that people report more positive affect on the weekends (Stone et al., 2012; Ryan, Bernstein, and Brown, 2010), all models controlled for the effects of weekend at Level 1. To determine the link between perceived episodic positivity resonance with weak and strong ties (**RQ1**), the former was regressed on the latter both at Level 1 and 2, and correlations between episodic positivity resonance reported for the two targets were also obtained at Level 1 and 2.

Subsequent models used daily mean scores of perceived episodic positivity resonance across both categories of social partners. To test **H1**, incivility was added to the previous model as a predictor of perceived positivity resonance at both Level 1 and 2. At Level 2, I controlled for randomized condition, coded as dummy variables (reference group = Monitoring Passive Control group).

To test **H2a-c**, I first modeled social flourishing for each time point (Time 1 and Time 2) as one latent factor indexed by three continuous indicators: social well-being, belongingness, and loneliness (Figure S3.2). To ensure the latent factors were equivalent across the two time points, I tested longitudinal measurement invariance (see Table S3.2) using the same procedures described in Study 1.

I then incorporated the latent social flourishing into the multilevel VAR(1) DSEM model testing **H2a-c**. At Level 1, the autoregressive effect and trajectory over time of perceived episodic positivity resonance were estimated. At Level 2, I estimated the effects of randomized condition, coded as dummy variables (reference group =

Monitoring Passive Control group), on individuals' mean levels and trajectories of daily perceived episodic positivity resonance. To test **H2a**, I regressed T1-T2 residual changes in social flourishing (T2 levels controlled for T1 levels) on randomized condition. To test **H2b**, I regressed T1-T2 residual changes in social flourishing on individuals' mean levels and trajectories of daily perceived episodic positivity resonance. To test whether individuals' mean levels and trajectories of daily perceived episodic positivity resonance mediated the effect of randomized condition on T1-T2 changes in social flourishing (**H3c**), I computed a between-person indirect effect of randomized condition on T1-T2 social flourishing residual changes through individuals' mean levels and trajectories of daily perceived episodic positivity resonance at Level 2.

To answer ancillary RQ2, which asked whether the active control group focusing on mindfulness would differ from the two Social Connectedness groups in its effects on social flourishing, I set the reference group as the Mindfulness Active Control group when testing the effects of randomized condition. Finally, to confirm whether the effects of perceived episodic positivity resonance on social resources would be independent of the effects of positive emotions, I added the individuals' levels of positive affect at Level 2 to the previous model testing H2a-c as a competing predictor of social resources.

Results

Given that Zhou et al. (2020) used the same sample as used here, I have flagged the small subset of results regarding the effect of randomized condition that was reported previously (in Zhou et al., under review).

Preliminary Analyses

The data cleaning of nightly reports, documented in Zhou et al. (2020), resulted in a final sample of 405 participants and 10,152 person-days[2]. Across the usable nightly reports, participants completed on average 25 surveys (SD = 8.75, range: 1-35). Descriptive statistics of and zero-order correlations among between-person variables are presented in Table S3.1.

Analyses testing subsequent hypotheses revealed similar patterns of results when daily reports of perceived episodic positivity resonance for weak ties were analyzed separately from reports for strong ties. For parsimony, all analyses reported below reflect the mean score across both categories of social partners.

RQ1: Associations between Perceived Episodic Positivity Resonance with Strong Ties and Weak Ties. To examine the association between episodic reports of perceived positivity resonance with weak and strong ties (RQ1), I fit a Lag-1 multilevel vector autoregressive model (multilevel VAR(1)) of perceived episodic positivity resonance with strong ties and weak ties. At Level 1 and Level 2, perceived episodic positivity resonance of weak ties was regressed on strong ties. Because five parameters (perceived positivity resonance with strong ties, two effects of weekend, two autoregressive effects) were estimated at the within-person level, the final analyses only used data from participants with at least 5 nightly reports (N = 387, n = 12453 person-days).

There were significant and positive autoregressive effects of perceived episodic positivity resonance with weak ties (b = .18, CI 95% = [.15, .21], β = .18, $p_{\text{one-tail}} < .001$)

[2] This is the number of usable and observed nightly reports for these 405 participants. The Kalman filter employed in all DSEM models compensated for missing data, thereby resulting in more person-days reported for these models.

and strong ties (b = .16, CI 95% = [.12, .19], β = .16, $p_{\text{one-tail}} < .001$). These effects suggest that reports of perceived episodic positivity resonance were related from one day to the next for either social target categories and reflect temporal stability in individual differences in perceived episodic positivity resonance.

I found a significant association between perceived episodic positivity resonance with weak ties and strong ties (b = .54, CI 95% = [.47, .62], β = .67, $p_{\text{one-tail}} < .001$). Each standardized unit increase in participants' average levels of perceived episodic positivity resonance with weak ties corresponded to a .67 unit increase in perceived episodic positivity resonance with strong ties. There was also a significant within-person association between perceived episodic positivity resonance with weak ties and strong ties (b = .16, CI 95% = [.13, .18], β = .19, $p_{\text{one-tail}} < .001$). On days in which participants perceived higher episodic positivity resonance with weak ties by one standardized unit, they also did so with strong ties by .19 units.

Primary Analyses

Hypothesis 1a-b: Effects of Incivility on Perceived Episodic Positivity Resonance. The first set of hypotheses stated that nightly reports of experienced incivility would predict lower nightly reported perceived episodic positivity resonance between persons (H1a) and within persons (H1b). I tested these hypotheses by fitting a Lag-1 multilevel vector autoregressive (multilevel VAR(1)), in which perceived episodic positivity resonance was regressed on perceived incivility at Level 1, while time (day in study) and weekend were controlled for. At Level 2, I regressed perceived episodic positivity resonance on perceived incivility while controlling for randomized condition. Because 3 parameters (incivility, weekend, and autoregressive effect) were estimated at the within-person level, the final analyses only used data from participants with at least three nightly reports (N = 390, n = 12472 person-days).

Both hypotheses were confirmed. People who reported experiencing greater incivility in general perceived lower episodic positivity resonance overall (between-person effect; b =-.91, CI 95% = [-1.34, -0.50], β = -.24, $p_{\text{one-tail}} < .001$), and on days in which people reported experiencing greater incivility, they also perceived lower episodic positivity resonance (within-person effect; b =-.40, CI 95% = [-.46, -.34], β = -.18, $p_{\text{one-tail}} < .001$), a thus supporting H1a & H1b.

Intervention Effects on Perceived Episodic Positivity Resonance. The intervention effects on perceived episodic positivity resonance, tested in Zhou et al. (under review), were integral to testing the mediation hypotheses within the third and fourth set of hypotheses. The findings are re-reported here. To model participants' perceived episodic positivity resonance scores over the 35 days, a Lag-1 multi-level vector autoregressive (multilevel VAR(1)) model was fitted. At Level 1, perceived episodic positivity resonance was regressed on time while weekend was controlled; this yielded participants' trajectories of perceived episodic positivity resonance at Level 2. At Level 2, the mean levels and trajectories of perceived episodic positivity resonance were regressed on randomized condition (dummy-coded as three variables; reference group = Monitoring Passive Control) at Level 2. Because three parameters (time, weekend, and autoregressive effects) were estimated at the within-person level, the final analysis only used data from participants with at least three nightly reports (N = 390, n = 12,472 person-days).

Similar to the model testing RQ1, there was a significant and positive autoregressive effect (b = .16, CI 95% = [.13, .19], β = .16, $p_{\text{one-tail}} < .001$) of perceived episodic positivity resonance. Figure S3.1 (Zhou et al., under review, pg. 50) illustrates

the effect of randomized condition on the trajectories of perceived episodic positivity resonance, referred to as "Group x Time interaction" in the original paper. There were no significant main effects of randomized condition, time, or weekend on mean levels of perceived episodic positivity resonance. However, a significant effect of randomized condition on the trajectories of perceived episodic positivity resonance did emerge, specifically for the Social Connectedness-Weak Ties group (b = .15, CI 95% = [.04, .25], β = .18, $p_{\text{one-tail}}$ = .003) and the Mindfulness Active Control group (b = .11, CI 95% = [.01, .22], β = .14, $p_{\text{one-tail}}$ = .015), but not for the Social Connectedness-General group ($p_{\text{one-tail}}$ = .071), all relative to the Passive Control group. The trajectories of perceived positivity resonance over time were significantly different from zero for participants randomly assigned to the Social Connectedness-Weak Ties group (b = .16, $p_{\text{one-tail}}$ < .001, CI 95% = [.01, .23]), the Social Connectedness-General group (b = .09, $p_{\text{one-tail}}$ = .010, CI 95% = [.02, .16]), and (unexpectedly) the Mindfulness Active Control group (b = .12, $p_{\text{one-tail}}$ < .001, CI 95% = [.05, .20]). Moreover, these three simple slopes did not differ significantly from one another. In contrast, the trajectories of perceived episodic positivity resonance over time were not significantly different from zero for those randomized to the Monitoring Passive Control group (b = .01, $p_{\text{one-tail}}$ = .398, CI 95% = [-.06, .08]). This pattern of results suggests that the two variants of the Social Connectedness intervention elevated perceived episodic positivity resonance over time, whereas the no-intervention Monitoring Passive Control group did not. The model explained 6.8% of the variance in trajectories of perceived episodic positivity resonance, suggesting a small effect size of randomized condition (Snijders & Bosker, 2011; Cohen, 1992).

Hypothesis 2a-c: Intervention Effects on T1-T2 Changes in Social Flourishing, as Mediated by Perceived Episodic Positivity Resonance. Latent social flourishing was indexed with loneliness, belongingness, and social well-being in the measurement model. The model

showed metric invariance (Table S3.2). All loadings of indicators were significant (Figure S3.2). The final metric-invariance model showed excellent fit ($\chi2(8) = 1.76$, CFI =1.00, RMSEA = 0.00, SRMR = 0.02; Table S3.2). Thus, I incorporated latent social flourishing into the model testing H2a-c.

I tested H2a-c by fitting a Lag-1 multilevel vector autoregressive (multilevel VAR(1)) for individuals' episodic positivity resonance scores over the 35 days. Time and weekend were included as Level 1 predictors of perceived episodic positivity resonance. Changes in social flourishing were operationalized as T1-T2 residual changes in latent social flourishing (T2 levels regressed on T1 levels), which varied significantly across individuals (*residual variance* = .14, $p < .001$). Randomized condition, dummy-coded as three variables (reference group = Monitoring Passive Control) was included as Level 2 predictors of individuals' levels and trajectories of perceived episodic positivity resonance, and of T1-T2 residual changes in social flourishing. T1-T2 residual changes in social flourishing were also regressed on individuals' levels and trajectories of perceived positivity resonance. Because three parameters (time, weekend, and autoregressive effects) were estimated at the within-person level, the final analyses only used data from participants with at least three nightly reports ($N = 390$, $n = 12472$ person-days).

H2a stated that relative to the Monitoring Passive Control group, the two social connectedness groups would show increases in social flourishing, indicated by positive significant effects on residual T1-T2 change scores. H2a was not supported. Specifically, the effects of the two Social Connectedness groups on T1-T2 changes in social flourishing did not differ from the Monitoring Passive Control group (all $p_{\text{one-tail}}$s $\geq .080$).

Figure S3.3 shows the associations between perceived episodic positivity resonance and changes in social flourishing. H2b stated that the mean level and/or trend of daily perceived episodic positivity resonance, respectively, would predict individuals' T1-T2 changes in social flourishing. Both hypotheses were supported: individuals' changes in social flourishing were predicted by the mean level of perceived episodic positivity resonance (b = .14, CI 95% = [.09, .19], β = .20, $p_{\text{one-tail}} < .001$) and by growth in perceived episodic positivity resonance (b = 4.92, CI 95% = [1.40, 8.41], β = .13, $p_{\text{one-tail}} = .002$).

H2c stated that the mean level and/or trend of daily perceived episodic positivity resonance, respectively, would mediate the effect of the two Social Connectedness groups on individuals' T1-T2 changes in social flourishing. H3c was partially supported, and only for one of the two Social Connected groups. Specifically, the Social Connectedness-Weak ties condition had a significant indirect effect on T1-T2 changes in social flourishing, as mediated by the trajectories (b = .08, CI 95% = [.01, .17], $p_{\text{one-tail}} = .005$), but not the mean levels ($p_{\text{one-tail}} = .281$), of daily perceived episodic positivity resonance (Figure S3.3 illustrates this effect). In contrast, the Social Connectedness-General group did not have an indirect effect on changes in social flourishing ($p_{\text{one-tail}} = .056$). Unexpectedly, the Mindfulness condition also had a positive indirect effect on T1-T2 changes in social flourishing, as mediated by trajectories of perceived episodic positivity resonance (b = .06, CI 95% = [.00, .14], $p_{\text{one-tail}} = .014$).

Ancillary Analyses. Regarding RQ2, the two variants of the Social Connectedness intervention did not differ from the Mindfulness Active Control group either in their effects on daily perceived episodic positivity resonance ($p_{\text{one-tail}}$s $\geq .246$), as previously shown in Zhou et al. (under review), or in their indirect effects on changes in latent social flourishing through perceived episodic positivity resonance ($p_{\text{one-tail}}$s $\geq .247$).

Finally, to explore whether associations between perceived episodic positivity resonance and social outcomes were independent of positive affect, I added individuals' positive affect experienced throughout the intervention (between-person level) as additional predictors of changes in social flourishing. Controlling for positive affect did not substantively change the results regarding H3a-c on "outcomes." Critically, changes in social flourishing were still predicted by the mean levels (b = .10, CI 95% = [.05,.16], β = .16, $p_{\text{one-tail}} < .001$) and trajectories ($b$ = 4.18, CI 95% = [0.76,7.83], β = .12, $p_{\text{one-tail}}$ = .008) of daily perceived episodic positivity resonance. Additionally, the Social Connectedness Weak-Ties group still indirectly predicted positive changes in social flourishing through growth in daily perceived episodic positivity resonance (b = .06, CI 95% = [.01,.16], $p_{\text{one-tail}}$ = .009), relative to the Monitoring Passive Control group.

Discussion

For Study 3, I analyzed data from a behavioral intervention that targeted social connectedness and featured nightly self-reports of perceived episodic positivity resonance. I addressed three topics: the association between perceived episodic positivity resonance with weak ties and strong ties ("contextual exploration" aim, RQ1), (2) the role of daily experienced incivility, an assumed precursor of the perceived safety, as an antecedent of daily perceived episodic positivity resonance ("antecedents" aim, H1a and H1b); and (3) the effects of daily experiences of positivity resonance on individual-level social flourishing—namely, social well-being, belongingness, and (the lack of) loneliness ("outcomes" aim, H2a-c; RQ2).

Addressing the "contextual exploration" aim, the results revealed that perceived episodic positivity resonance with strong ties and weak ties were associated in two ways:

First, individuals who on average perceived greater episodic positivity resonance with weak ties also did so with strong ties; and second, for each individual, perceived episodic positivity resonance with strong and weak ties also co-varied from day to day. The within-person link is consistent with the possibility that in daily interactions, positivity resonance with strong and weak ties may reciprocally influence one another. Furthermore, the significant autoregressive effects and between-person associations together suggest that there may be temporally stable individual differences that underlie the tendency to experience positivity resonance with both strong and weak ties. As the episode-based perceptions of positivity resonance with weak ties and strong ties were related, both perceptions yielded similar findings for analyses of antecedents and outcomes.

Addressing the "antecedents" aim, the findings show that perceived incivility predicted perceived episodic positivity resonance both at the within-person and between-person levels. On days when participants perceived higher incivility, they reported lower episodic positivity resonance, and participants who on average perceived higher incivility also reported lower episodic positivity resonance across interactions. As incivility is presumed to diminish perceived safety, the findings also are consistent with the perceived safety as a proposed antecedent of positivity resonance (Fredrickson, 2016).

The third set of hypotheses, which addressed the "social outcomes" aim, were partially supported. Previous research using this data (Zhou et al., under review) showed that when participants adopt the intention to increase social connectedness specifically with weak ties, they show improvements in perceived episodic positivity resonance of all their interactions, that is, with both weak and strong ties. Building on this finding, I found that individuals who reported improvements in perceived episodic positivity resonance throughout the intervention

experienced larger T1-T2 increases in social flourishing. I also found that, compared to the Monitoring Passive Control condition, both variants of the Social Connectedness intervention did not have a significant total effect on changes in social flourishing, but one of the variants (Weak Ties) did have a positive indirect effect on individual's changes in social flourishing, as mediated by growth in perceived episodic positivity resonance. This finding is consistent with those in Zhou et al. (under review), which show that only the Weak Ties variant of the intervention led to higher mean levels of prosocial tendencies relative to the Monitoring Passive Control group.

Regarding RQ2, the two variants of the Social Connectedness intervention did not differ from the Mindfulness Active Control group, which was largely consistent with findings from Zhou et al. (under review). In line with these findings, past research has found that increases in trait mindfulness were associated, indirectly, with increases in perceived social connection, as mediated by improvements in decentering, i.e., mentally detaching from the contents of consciousness (Adair et al., 2018).

Finally, for the third set of hypotheses, the results remained substantively similar after positive emotions were controlled for. Overall, these findings provide some experimental and correlational longitudinal evidence that daily experiences of episodic positivity resonance may cultivate social flourishing (social well-being, belongingness, and loneliness) over time, and appear to do so independently of individuals' general positive affect. Regarding practical implications, although in need of replication, the indirect effects of the Social Connectedness - Weak Ties intervention suggest that framing the social connectedness intervention with a focus on weak ties may yield greater social benefits than framing it in general terms.

The strengths of Study 3 include its random assignment that enabled tests of causal effects, the use of intensive repeated measures of perceived episodic positivity resonance and incivility, and the relatively large sample size. A limitation of Study 3 is that it relied on self-reports of perceived positivity resonance, which can be subjected to biases (e.g., memory distortions, desirability; Robinson & Clore, 2002; Schwarz et al., 2009). However, the use of time-limited (i.e., targeting "today") and episodic assessments (i.e., the Event Reconstruction Method for perceived positivity resonance; peak affect for emotion reports) potentially helped alleviate such biases (Robinson & Clore, 2002; Schwarz et al., 2009). Moreover, due to an execution error, there was no baseline measure of daily or habitual perceived positivity resonance. Obtaining pre-intervention levels of perceived positivity resonance would strengthen the design and conclusions of future studies that seek to test the causal effects of positivity resonance. In addition, as changes in mindfulness have been indirectly linked to increases in perceived social connection (Adair et al., 2018), future research on social connectedness behavioral interventions should use a different active control group.

Furthermore, although Study 3 targeted social flourishing as a form of perceived social resources, it did not examine the nonsocial benefits (e.g., health, health behavior, work performance) these resources may yield. Study 4 thus expands on the present work by investigating health behavior as one potential benefit of the social resources that may be cultivated through positivity resonance.

CHAPTER 5: STUDY 4 - THE WW CONNECTED STUDY

Focused Introduction

In Study 4, I investigated social interactions in an online wellness community. Addressing the three overarching aims, I explored positivity resonance in an asynchronous, online social media platform ("contextual exploration" aim), tested perceived safety and a proxy of real-time connection as preconditions of positivity resonance ("antecedents" aim), and tested the social resources built by positivity resonance and a potential ensuing beneficial behavior ("outcomes" aim).

Contextual Exploration: Social Interactions in an Asynchronous Online Social Environment

Investigation of contexts that support perceptions of positivity resonance has been limited to mostly face-to-face interactions or interactions with familiar others. When perceived positivity resonance was investigated in online interactions in Study 2, it was between and among classmates who had previously interacted in person. However, social interaction on online platforms (e.g., Instagram, Twitter, TikTok), often with strangers, has become increasingly common and popular (Auxier & Anderson, 2021). The different characteristics and features of each platform may distinctively shape the social interactions that unfold. The online environment investigated in Study 4 is WW (formerly Weight Watchers) Connect, a WW members-only digital community for weight loss and wellness. The members using the platform may choose to remain completely anonymous or not as they can choose their own displayed usernames and curate their profiles. Communication on the platform is asynchronous and public among WW members.

Members may join groups, follow other members and coaches, post texts, images, and videos, and respond to others' postings by liking or commenting. There is no private messaging. Below, I discuss how these characteristics may influence the theorized precursors of positivity resonance—namely, the type of perceived safety one may feel (e.g., physical and social threats) and the approximation of real-time sensory connection—as well as the theorized social outcomes of positivity resonance.

Hypothesized Antecedents: Perceived Safety and Perceived Speed of Mutual Responding

Perceived Safety. In an online social environment, particularly an online community that aims to support individuals' wellness journeys, socio-psychological threats (e.g., stigma, social exclusion, leaking of private information) are likely to be relevant. In contrast, physical threats (e.g., death threats), although possible, are unlikely. Thus, the perception of safety in this wellness online community likely concerns psychological safety (Edmondson, 1999), which reflects whether individuals feel comfortable to be themselves in the community and to take interpersonal risks. Despite mainly being studied in work organizational contexts (Edmondson & Lei, 2014), psychological safety applies to the current context and thus was examined in this study.

Real-Time Connection and Perceived Speed of Mutual Responding in Online Interaction. Another feature of the virtual, text-based social platform studied here is the lack of real-time sensory connection, which is, according to theory, a necessary precondition for positivity resonance (Fredrickson, 2016). Nevertheless, individuals have reported perceived positivity resonance during asynchronous interactions (Fritz et al., under review; Major et al., 2018). These findings suggest that, although positivity resonance, in theory, cannot exist during

asynchronous interactions (Fredrickson, 2016), it is possible to have a subjective experience (or perception) of it in this context.

This inconsistency may be explained by the possibility that during asynchronous interactions, other cues for social coordination that approximate synchrony may act as a distant proxy of real-time connection to evoke the perception of positivity resonance. In message-based channels, a sense of coordination and being "in sync" could potentially be evoked by speedy exchanges (Rettie, 2009). Moreover, Rettie (2009) argues that for promoting perceived synchrony, the objective response time may not be as important as the perceptions of continuous engagement and speedy responses. For example, participants reported perceiving texting, but not email, as a synchronous medium, even though the text response lags were at times comparable to that of email (Rettie, 2009). This is likely due to the socially shaped expectation that people always keep their phone nearby and can continuously engage in communication (Rettie, 2009). Therefore, the perception of quick mutual responses is a candidate precursor that may be a digital, distant proxy for real-time connection and thereby support the perception of positivity resonance in a message-based online social environment.

Comparing Theorized Antecedents against Other Potential Precursors. In previous research, the hypothesized antecedents of positivity resonance—namely, perceived safety and synchronous interaction—have not been benchmarked against other potential dispositional and situational precursors of this positive connection. There may be stable individual differences in the experience and/or perceptions of positivity resonance across situations. For example, a person may have a typical social interaction

style, like being gregarious or extraverted, that generalizes across situations and influences their perceived positivity resonance across a range of interaction partners.

Perceived positivity resonance can also be shaped by situational factors such as people's expectations for how they should behave in a particular situation. Those situation-specific expectations are shaped by social norms (Legros & Cislaghi, 2020). Social norms can be individuals' beliefs or collective normative rules about what behaviors are common (descriptive norms) or approved (injunctive norms) in a social group (for a review of reviews, see Legros & Cislaghi, 2020). Social norms have been shown to also motivate people to behave prosocially, as reflected by donating to charity (Shang & Croson, 2009; Nook et al., 2016), acting fairly in game-theory tasks (Bardsley & Sausgruber, 2005), conserving the environment (Goldstein et al., 2018), and voting (Bond et al., 2012; Nickerson, 2008). Therefore, perceived descriptive and injunctive prosocial norms for social participation may influence people's interaction with others and lead to greater perceived positivity resonance.

In this study, I examined the hypothesized antecedents of perceived positivity resonance—perceived safety and perceived mutual response speed—in the context of an online community. Furthermore, I benchmarked these hypothesized antecedents against a disposition factor, a person's general perceived positivity resonance, and two situational factors, injunctive and descriptive norms for social participation in this online community.

Hypothesized Outcomes: Social Resources in Online Environments

Evidence for the "build" effect of positivity resonance on social resources is still nascent and thus has not yet been tested specifically within a virtual environment. Online communities in which members have shared interests and goals have developed rapidly and played an increasingly important role in human social life (Plant, 2004). It is thus relevant and important to

ask the question: can accumulated moments of positivity resonance with online strangers build community-specific social resources, such as feelings of connection to the community? Feelings of connection to the community may manifest in a sense of belonging to the community, positive evaluation of one's membership in the community, and identification with the community. Study 4 examines enduring outcomes of perceived positivity resonance in the context of the Connect platform.

Furthermore, in a digital wellness community, the social resources built through accumulating positivity resonance moments may promote health behaviors associated with the community. According to the *upward spiral theory of lifestyle change* (Van Cappellen et al., 2018), social "vantage resources," such as perceived social integration or social support can boost the positive affect felt during health behaviors (e.g., feeling good about tracking food and eating nutritious food) and thus strengthen people's nonconscious motives for repeatedly engaging in those behaviors. Supporting this theory, perceived social integration has predicted future physical activity—mediated by sociality during an intervening instance of physical activity, positive affect felt during that activity, and positive spontaneous thoughts about physical activity (Rice et al., 2019). Alternatively, having greater social resources (e.g., a sense of connection) specific to a community may promote individuals' health behavior relevant to that community through other mechanisms, including social influence (following normative health behavior in the community) or social control (being monitored, encouraged, persuaded, reminded, or pressured by others in the community to enact a health behavior; Thoits, 2011). In an online health community, as members feel a stronger positive connection to the community, they may be more likely to engage in health behaviors that are relevant to

that community. Therefore, in the context of the weight loss community in Study 4, I examine the effect of perceived social resources on dietary monitoring, a behavior that has been decisively linked to healthy weight loss according to a systematic review by Burke and colleagues (2011, 15 studies, $N = 3103$).

Study Overview

To address the three overarching aims, I collected data from the Connect platform. Participants completed a one-time survey that assessed perceived global positivity resonance (over two weeks of interactions) on the Connect platform, its hypothesized antecedents, and its perceived social resource outcomes. They also indicated whether they consented to their app data being collected and analyzed for this research study; among these data, their dietary monitoring (food tracking) data were used in the analysis.

To address the "contextual exploration" aim, I asked whether individuals perceived global positivity resonance on an asynchronous online platform (RQ1). To address the "antecedents" aim, the first set of hypotheses (H1a, H1b) stated that perceived global positivity resonance on the Connect platform would be predicted by perceived safety (H1a) and perceived speed of mutual responding, a proxy of perceived synchrony (H1b). The second set of hypotheses (H2a-c) addressed the "outcomes" aim. H2a stated that perceived global positivity resonance on the Connect platform would predict feelings of connection to the community. Furthermore, I hypothesized that connection to the community predicts future food tracking behavior (H2b) and that perceived global positivity resonance on the Connect platform would indirectly predict food tracking behavior through connection to the community (H2c).

Method

The Online Wellness Community

The commercially available weight loss and wellness program WW (formerly Weight Watchers) includes a mobile application component with many features such as food tracking, sleep tracking, and a meal planner. The Connect platform in the WW app is a members-only online community where members can publicly post texts, photos, and videos (there is no private messaging feature); search for posts according to their interests with hashtags (e.g., #transformationtuesday, #bettertogether); like and comment on others' posts; and find and follow other members and coaches. They can also join Connect Groups with specific interests such as the Peloton Lovers group (36k members), Self-Compassion group (33k members), and Hiking group (17k members).

Participants

The procedure for this study was approved by the Institutional Review Board at the University of North Carolina at Chapel Hill. The target sample size was 500 based on a priori power calculations using Monte Carlo simulations for the planned SEM models (see Analytical Approach). Using these models, I determined the power at this sample size was excellent for all parameters (>99%), assuming moderate effect sizes and 20% missing data. As approximately 60-80% of participants recruited via emails in the past reported not using the Connect platform, I aimed to recruit 2,500 participants to obtain enough Connect users. The acquired sample included 2,840 participants who completed the survey (92.6% female; age ranging from 19 to 88 years old, averaging 55.61 years old; membership length ranging from 2 to 217 days, averaging 92.15 days). They identified as White (86.4%), Hispanic (3.5%), Black (4.1%), multi-ethnic (1.4%), and

other racial/ethnic/undisclosed groups (4.6%). Among the respondents, 686 participants reported interacting with others on the Connect platform in the past 14 days and were referred to as *current Connect users*, and the remaining participants were referred to as *current nonusers* (*n* = 2,154). Out of those 686 current Connect users, 669 participants (23.6% of the full sample) who reported perceived positivity resonance scores for their interactions over Connect were included in all analyses. The remaining participants who did not report perceived positivity resonance (17 current Connect users and 2,154 current Connect nonusers) still provided data on control and "outcomes" variables, and thus their data were incorporated to test H2b.

Measures

Perceived Positivity Resonance.

Perceived Global Positivity Resonance on the Connect Platform. Because individual interactions on the Connect platform are message-based and likely brief, instead of being asked to focus on a particular interaction, participants were instructed to think about all their interactions with members of the online community in the past 14 days. I assumed that a global assessment approach would produce a more stable measure. Participants then reported their perceived global positivity resonance using the brief two-item version of the scale described in Study 3. The items were "...did you experience a mutual sense of warmth and concern toward the others?" and "did you feel 'in sync' with the others?" The two items demonstrated extremely high correlation with the full scale in previous research (r = .97, Zhou et al., under review) and high correlation with one another (r = .75). I divided perceived global positivity resonance scores by 10 before analysis to reduce differences in the numerical range between perceived global positivity resonance scores (0-100) and other variables (6- and 7-point scales).

General Perceived Positivity Resonance. In addition, participants responded to the same two items while being asked to "consider all your interactions with other people in your life in the past 14 days." The items were highly correlated with one another (r = .73).

Antecedents of Perceived Positivity Resonance.

Perceived Safety[3]. The same measure of perceived safety in Study 2 was reused, with one item "I am afraid to express my opinions" removed to make the scale shorter. The resulting scale had four items, with statements such as "I'm not afraid to express my opinions" and "There is a threatening environment." (α = .63).

Perceived Speed of Mutual Responding. Participants indicated the degree to which they disagreed or agreed with two items regarding their interactions with others on Connect: "I have been quick at responding" and "Others have been quick at responding" (1 = *strongly disagree*, 7 = *strongly agree*). The two items were moderately correlated with one another (r = .56).

Perceived Descriptive Norms for Social Participation[3]. Participants indicated how frequently "a typical WW member shares about themselves or interacts with others on Connect" and "a typical WW member gives social support to others on Connect" on a 6-point scale (1 = *less than once a month / never*; 6 = *daily*). The two items were highly correlated with one another (r = .71).

[3] A portion of current nonusers (those who reportedly had no interactions on the Connect platform in the past two weeks, n = 674) indicated they used the Connect platform generally and provided self-reports of perceived safety on Connect. Participants were also asked to give their "best guess" of the descriptive and injunctive norms for social participation if they did not use Connect (2053 and 2080 current nonusers responded, respectively). These "antecedent" variables were noncomparable across users and nonusers, and the analyses, which centered on positivity resonance, did not concern nonusers' data for these variables. Therefore, I excluded nonusers' data for these variables from the current study.

Perceived Injunctive Norms for Social Participation[3]. Participants indicated the degree to which they agreed or disagreed with four items. Items include: "... a typical WW member would think I should share about myself or interact with others on Connect," "... a typical WW member would think I should give social support to others on Connect," "... a typical WW member would expect me to share about myself or interact with others on Connect," "... a typical WW member would expect me to give social support to others on Connect" (1 = strongly disagree, 7 = strongly agree). The scale had excellent reliability (α = .90).

Individual Social Resources.

Belongingness to the Community. I adapted the four-item membership subscale of the Math Sense of Belonging Scale (Good et al., 2012) to measure feelings of belonging to the community. A sample item is "I feel that I belong to the WW community" (1 = strongly disagree, 7 = strongly agree). The scale had excellent reliability (α = .96).

Positive Evaluation of the Community. I adapted the four-item Private Collective Self-Esteem of the Collective Self-esteem Scale (Luhtanen & Crocker, 1992) to measure the extent to which participants evaluate their memberships in the WW community positively. A sample item is "In general, I'm glad to be a member of the WW community" (1 = *strongly disagree*; 7 = *strongly agree*). The measure had good reliability (α = .78).

Identification with the Community. The extent to which the WW community was important to the participants' identities was measured using an adapted version of the four-item Importance to Identity Subscale of the Collective Self-esteem Scale (Luhtanen & Crocker, 1992). A sample item is "The WW community is an important reflection of who I am" (1 = *strongly disagree*; 7 = *strongly agree*). The measure was reliable (α = .78).

Food Tracking Behavior. Consistent food tracking is an important weight management behavior associated with weight loss success (Ingels et al., 2017). The WW app allows WW members to input and monitor the type and amount of food they eat and records members' food tracking behaviors. From the app's data, I obtained the number of days participants tracked their food using the app (regardless of the number of meals or food entries per day) within the 7 days following the survey.

Positive Affect. Participants completed the hedonic well-being subscale of the Mental Health Continuum–Short Form (Keyes, 2009) as described in Study 2 (the Classroom Study). Cronbach's α for this scale was .88.

Analytical Approach

Preliminary analyses were conducted to obtain descriptive statistics and zero-order correlations among study variables. To test H1a and H1b on antecedents, I regressed perceived global positivity resonance on the Connect platform on perceived safety and perceived speed of mutual responding, while controlling for general perceived positivity resonance. I then added to the model descriptive and injunctive norms as competing predictors of perceived global positivity resonance on the Connect platform.

A series of structural equation models (SEM; Kline, 2015) were conducted to test H2a-c on outcomes. The SEM models were fitted in Mplus (Muthén & Muthén, 2009), with parameter estimates obtained using a maximum likelihood estimator with robust standard errors. The SEM models had the following structure:

I first indexed connection to the community as a latent variable using multi-group confirmatory factor analysis (CFA; Kline, 2015) for two groups of participants, current Connect users (n = 686) and current Connect nonusers (n = 2154; defined respectively as

people who did or did not interact with others on Connect within the past 14 days). I hypothesized that connection to the community would emerge from the following three indicators: belongingness to the community, positive evaluation of the community, and identification with the community. All indicators were set to load on one latent factor (i.e., connection to the community). I tested the measurement invariance (configural, metric, and scalar invariance) of the latent factor across the two groups using the same process as Studies 1 and 3. Model fits were comprehensively evaluated using the recommended combination of fit indicators previously used in Studies 1, 2, and 3, including CFI, RMSEA, and SRMR.

I then integrated the latent construct of connection to the community into subsequent SEM models testing H2a-c (See Figure S4.2 for an illustration of the conceptual associations). Tests of H2a and H2c involved perceived global positivity resonance on the Connect platform and thus only used the subset of current Connect users who provided positivity resonance self-reports (n = 669), whereas the test of H2b had available data from the entire sample (n = 2840). To test H2a, I regressed connection to the community on perceived global positivity resonance on the Connect platform. To test H2b, I regressed food tracking on connection to the community in a multi-group SEM (current Connect users and nonusers). I selected the best fitting model from the two models with the free and constrained regression paths using the same procedure described for the multi-group CFA. To test H2c, I regressed food tracking on both perceived global positivity resonance on the Connect platform and connection to the community, as well as computed an indirect effect (through Connection to the community) of perceived global positivity resonance on the Connect platform on food tracking.

In subsequent sensitivity analyses, I also controlled for a competing predictor of connection to the community (positive affect) in testing H2a, and competing predictors of

tracking behavior (i.e., positive affect, race, gender, age, membership length, current weight) in testing H2b and H2c.

Results

Preliminary Analyses

Table S4.1 shows the descriptive statistics for two groups of participants, current Connect users and current nonusers. Relative to the nonusers, the Connect user group was older, weighed more and slightly shorter tenure, tracked food more often, and consisted of a higher proportion of women and people of color. Psychologically, they reported higher general positivity resonance, slightly higher positive affect, more positive feelings about the WW community, including more belongingness, positive evaluation, and identification. As the Connect users have higher means for the hypothesized social and behavioral "outcomes," there were potential ceiling effects for these variables for this group. As I planned to index a latent variable with social "outcomes" variables, the latent variable may have suffered from a similar ceiling effect.

Table S4.2 shows the means, standard deviations, and zero-order correlations among main study variables and covariates. Regarding RQ1, perceived global positivity resonance on the Connect platform was significantly different from zero (M = 7.39, $t(668) = 71.7$, $p < .001$), only slightly lower than general positivity resonance experienced (M = 7.87, $t(536) = 6.43$, $p < .001$). Worth noting, perceived global positivity resonance on the Connect platform appeared higher than averaged perceived positivity resonance for weak ties (M = 6.65; Study 3) but, unsurprisingly, lower than averaged perceived positivity resonance for strong ties (M = 8.15; Study 3).

Perceived global positivity resonance on the Connect platform was correlated with general perceived positivity resonance to a small degree (r = .35, p < .001; Table S4.2). This suggests that although there may be individual differences in the tendency to perceive positivity resonance, these perceptions also appear to be specific to social contexts.

Among potential antecedents of positivity resonance, perceived safety, perceived speed of mutual responding, and descriptive norms for participants were positively correlated with perceived global positivity resonance on the Connect platform (Table S4.2). Consistent with the hypotheses on outcomes, perceived global positivity resonance on the Connect platform was correlated with belongingness to the community, positive evaluation of the community, and identification with the community, and these three variables were positively correlated with food tracking (Table S4.2).

Primary Analyses

Hypothesis 1a-b: Effects of Perceived Safety and Perceived Speed of Mutual Responding on Perceived Positivity Resonance. Table S4.3 shows the models predicting perceived global positivity resonance on the Connect platform. I regressed perceived global positivity resonance on the Connect platform on perceived speed of mutual responding and perceived safety while controlling for general perceived positivity resonance. After controlling for general perceived positivity resonance, community-specific situational factors such as perceived safety (b = .50, 95%CI = [0.31, 0.69], β = 0.22, p < .01) and perceived speed of mutual responding (b = .35, 95%CI= [0.20, 0.50], β = 0.19, p < .01) significant predicted perceived global positivity resonance on the Connect platform, thus supporting H1a and H1b (Table S4.3). Moreover, to test the robustness of these two hypothesized predictors I added to the regression descriptive and injunctive social norms of participation. Perceived safety (b = .44, 95%CI =

[0.25, 0.63], β = 0.19, $p < .01$) and perceived speed of mutual responding ($b = .34$, 95%CI = [0.18, 0.50], β = 0.19, $p < .01$) remained significant predictors even when indicators of socially normative behavior are included (Table S4.3). Between the two norms, only descriptive norms for social participation predicted perceived global positivity resonance on the Connect platform ($b = .22$, 95%CI = [0.12, 0.32], β = 0.17, $p < .01$), whereas injunctive norms did not ($p > .05$). These findings support hypotheses H1a and H1b: perceived safety and perceived speed of mutual responding predict perceived global positivity resonance on the Connect platform independently of Connect-specific social norms and general perceived positivity resonance.

Hypothesis 2b-c: Associations among Perceived Positivity Resonance, Social Resources, and Future Food Tracking. In preparation for the testing of H2a-c, I conducted a CFA model across two groups, current Connect users and current nonusers, indexing connection to the community with three indicators, belongingness to the community, positive evaluation of the community, and identification with the community (Table S4.4). The measurement models showed metric invariance (Table S4.4). The metric-invariance model fit was excellent ($\chi2$ (2) = 3.62, $p = .164$, RMSEA = .02, CFI = 1.00, SRMR = .02; Table S4.4). Figure S4.1 illustrates the factor loadings for connection to the community in the context of the multi-group SEM testing H2b.

Figure S4.2 shows the results for H2a and H2c. Hypotheses H2a and H2c stated that perceived global positivity resonance on the Connect platform would predict connection to the community and, indirectly, future food tracking. These hypotheses were only testable for current Connect users who provided self-reports of positivity resonance ($n = 669$) and were examined in the same model (Figure S4.2). As predicted in H2a, perceived global positivity resonance on the

Connect platform predicted greater connection to the community (b = .13, 95% CI = [.11, .16], β = .53, p < .001).

Figure S4.1 shows the results for H2b. H2b stated that connection to the community would predict future food tracking (testable with the entire sample; n = 2,840). H2b was tested in a multigroup model for current Connect users and nonusers. Allowing the associations between connection to the community and food tracking to vary freely across current Connect users and nonusers resulted in a better fitting model ($\chi 2$ (1) = 8.99, p < .001). I thus selected the unconstrained model, which showed excellent model fit ($\chi 2$ (6) = 12.88, p < .001, RMSEA = .03, CFI = 1.00, SRMR = .02). Connection to the community predicted greater number of days tracking food for the current Connect users (b = .28, 95% CI = [.08, .48], β = .13, p = .005) and, to a larger magnitude, for the current nonusers (b = .66, 95% CI = [.51, .80], β = .23, p < .001), thereby supporting H2b. Connection to the community explained 2% and 6% of food tracking behavior respectively for the current users and nonusers.

H2c (testable only with current Connect users; n = 669) was not supported, as perceived global positivity resonance on the Connect platform did not have an indirect effect on numbers of days tracking food through connection to the community (indirect effect: b = .03, 95% CI = [-.01, .07], β = .05, p = .115; Table S4.3). When both were included in one model, neither perceived global positivity resonance on the Connect platform and connection to the community predicted food tracking (respective p = .928 and p = .111).

Ancillary Analyses

Next, I controlled for positive affect as a competing predictor of connection to the community in testing H2a and H2c and competing predictors of food tracking behavior (positive affect, age, gender, race, membership length, and current weight) in testing H2b and H2c. When

these controls were included, the pattern of findings remained similar, with one exception: in the multi-group model testing H2b, the association between connection to the community and food tracking only trended toward significance for the current Connect users (b = .15, 95% CI = [-.01, .31], β = .10, p = .065).

Across models, it was apparent that for the current Connect platform users, the association between connection to the community and future food tracking received mixed support, whereas, for the rest of the sample, connection to the community robustly predicted food tracking. I speculate post hoc that this discrepancy may be due to a ceiling effect on connection to the community for the current Connect platform users. The data supported this speculation. In terms of connection to the community, the current Connect platform users show significantly lower variance relative to the nonusers ($\Delta\chi^2(1) = 4.68$, $p < .05$). Each indicator of connection to the community was also higher in the Connect user group relative to the nonuser group (Table S4.1). There was also a higher mean (Mann Whitney U test; $p < .001$) and lower variance (Levene's Test: $F(1, 2838) = 71.29$, $p < .001$) of food tracking frequency for the users relative to the nonusers. Together, these findings suggest that the low variabilities and already high levels of connection to the community and food tracking frequency for the current Connect users may explain the weaker observed association between these two constructs in this subsample.

Discussion

In Study 4, I investigated online interactions in an online commercial weight-loss community to address three aims: explored perceived global positivity resonance in an asynchronous online social context ("contextual exploration" aim), tested the two theorized antecedents of positivity resonance, perceived safety and perceived speed of mutual responding

as a proxy of real-time connection (“antecedents” aim), and tested the association of perceived global positivity resonance on the Connect platform with perceived connection to the community and a related downstream tangible benefit, i.e., food tracking behavior (“outcomes” aim).

Corresponding to the "contextual exploration" aim, I found that people reported a global perception of positivity resonance during asynchronous online interactions. This result conceptually replicates previous findings on perceived episodic positivity resonance in technology-mediated communication (Fritz et al., under review; Major et al., 2018). According to a strict interpretation of the Positivity Resonance Theory (Fredrickson, 2016), interactions that lack real-time sensory connection and cross-person biological synchrony should not be capable of eliciting positivity resonance. Therefore, a theoretical implication of this finding is that in an asynchronous online context, the subjective perception (or experience) of positivity resonance, or at least self-reports of it, may not reflect true, objectively assessed positivity resonance, but only a pseudo, incomplete or ersatz version of this experience.

I also found that the levels of perceived global positivity resonance on the Connect platform were significantly, but only slightly, lower than general perceived positivity resonance. This suggests that online interactions in certain communities can be perceived as mutually pleasant, caring, and “in sync” and have the potential to contribute to a person’s social well-being as established by previous literature (Best et al., 2014). Alternatively, people may conceivably expect that online interactions are low-quality and shallow and therefore judge perceived positivity resonance online more leniently (Biernat & Manis, 1994). In sum, findings on contextual exploration illustrate a potential positive side of online interaction and also call for more research to understand how individuals experience and evaluate positivity resonance across modes of interactions.

Corresponding to the “antecedents” aim, the results show that perceived safety and perceived speed of mutual responding, a condition presumed to generate perceived synchrony and coordination, predicted perceived global positivity resonance on an online wellness community. Both hypothesized antecedents remained significant after norms for social participation and general perceived positivity resonance were taken into account. The findings reinforce the importance of perceived safety across all interactional contexts.

Further, the findings support a novel hypothesized precursor, perceived mutual speedy response, that potentially acts as a distant proxy of the theorized antecedent “real-time sensory connection” in supporting perceived global positivity resonance during asynchronous interactions. Parallel to real-time sensory connection, which sets the stage for biological, affective, and nonverbal caring synchrony to emerge, during asynchronous interactions, I speculate that mutual speedy responding potentially fosters a perception of synchrony in positive affect by reducing the lag time between one's own experience of positive affect and one's knowledge of their interaction partner's positive affect. Likewise, perceptions of mutual speedy responding may generate the perception of mutual care by signaling a form of relational responsiveness. Taken together, these perceptions of synchrony of positive affect and mutual care, which potentially result from perceived mutual speedy responding, may create perceived positivity resonance in the absence of real-time sensory contact, which is posited by theory to be a necessary (yet not sufficient) condition for seeding positivity resonance.

Regarding the “outcomes” aim, perceived global positivity resonance during asynchronous online interactions predicted enduring connection to the online community,

including a sense of belongingness, positive evaluation of membership, and identification with the community. This effect was independent of trait positive affect, which suggests that beyond the effect of pleasant feelings, positivity resonance may contribute to building a person's social resources. These social resources, in turn, predicted food tracking behavior, a key health behavior connected to weight loss success. There was, however, mixed support for the association between connection to the community and food tracking for those who interacted with others on the Connect platform in the past two weeks (in contrast with people who did not). The data suggested that a ceiling effect (high level, low variability) on both the predictor and the outcome accounted for this mixed association. Potentially for the same reason, there was no indirect effect of perceived global positivity resonance through connection to the community on food tracking. Overall, the results suggest that when participants engaged in asynchronous social interactions, perceived global positivity resonance for those interactions was linked to social resources, and these resources, in general, predicted greater weight-loss-related health behavior. Altogether, the findings on antecedents and outcomes provide practical ideas for the design of online communities (e.g., fostering psychological safety and creating "live" opportunities for synchronized interactions) to promote interaction quality, belongingness, and desirable, health-building behaviors among members.

The strengths of this study are the large sample size and objective measurements of important real-world behavior. Like in previous studies, self-reports of perceived positivity resonance also may not reflect the subjective experience of positivity resonance. Similar to the Classroom Study (Study 2), Study 4 used global assessments that captured multiple interactions over two weeks, which do not correspond to the conceptualization of positivity resonance as a momentary experience. Another limitation of the current approach is that perceived positivity

resonance was measured concurrently with perceived safety, perceived speed of mutual responding, and indicators of connection to the community, thus preventing any causal inferences. To overcome this limitation, researchers can potentially conduct future lab or field experiments that manipulate the proposed antecedents, such as speed of mutual responding, and measure participants' perceived positivity resonance during a social episode. The results of such research would further illuminate the nature and causes of the subjective experience of positivity resonance in asynchronous online contexts.

CHAPTER 6: GENERAL DISCUSSION

Across four studies, I addressed three overarching aims: (1) I explored the contexts surrounding the perception of positivity resonance experiences in group, dyadic, and online interactions, (2) I tested the "antecedents" of perceived positivity resonance, and (3) I examined the social resource "outcomes" of perceived positivity resonance. The labels "antecedents" and "outcomes" do not indicate theorized causal links, and only one of the four studies (Study 3) allowed for a test of causality. Below I discuss and synthesize the findings corresponding to three aims and their implications.

Contextual Exploration and Measurement Implications

Four focal exploratory sets of findings were associated with the context surrounding positivity resonance perception in dyads, groups, weak ties, and an online community.

Perceived Positivity Resonance in Dyads

The first set of findings concerns dyad-specific agreement on ratings of perceived positivity resonance. There appeared to be a weak association between self- and partner-perceived episodic positivity resonance within dyads in Study 1 (the Sorority Study). As positivity resonance is conceptualized as a collective affective experience (Brown & Fredrickson, 2020), this modest self-partner agreement offers preliminary, albeit weak, evidence for the validity of perceived positivity resonance as a self-report measure of shared experience. This small correlation also suggests a possible cross-person discrepancy in perceived positivity resonance, which may be a result of participants in dyad reporting on different social interactions. The cross-person discrepancy in reports of positivity resonance may also be caused

by biases in memory for affective experience (Robinson & Clore, 2002) or inaccurate perception of a partner's affective state (Benbouriche et al., 2018). Importantly, inaccurate perception of affect can be influenced by a variety of factors, such as the social target's low emotional expressivity (Zaki et al., 2008), the projection of one's own internal affective state onto another (Benbouriche et al., 2018), individual differences in motivation and ability to read others' emotions accurately (Ickes et al., 2000), and social class (lower-SES individuals perceive affect more accurately than high-SES individuals; Kraus et al., 2010).

Perceived Positivity Resonance in Groups

The second set of findings concerns two approaches (group-level ratings versus individual-based mean scores) to assessing perceived positivity resonance with group members in a small group context. The results of Study 2 (the Classroom Study) revealed that the group-level ratings of perceived global positivity resonance ratings with all members were highly correlated with the mean scores of perceived global positivity resonance with individual members of that same group. The individual-based mean scores also predicted the group-level ratings better than the highest and/or lowest positivity resonance scores with individual group members. Theoretically, these findings suggest that individuals may form their perceptions of positivity resonance with all group members by averaging perceived positivity resonance with individual members, instead of relying solely on information about interactions with just one member. It is still possible, however, that the perception of positivity resonance with each individual may be weighted differently in any "mental averaging" process. For example, due to a bias for intensity and recency in affective memory (Kahneman et al., 1993), extremely positive or

recent interactions with a group member may be heavily weighted in a person's retrospective reports of group-level perceived positivity resonance with all members.

Additionally, both the individual-based mean scores and group-level ratings for perceived positivity resonance yielded similar results in subsequent analyses of hypothesized "antecedents" and "outcomes." When both assessment scores were included in the model predicting outcomes, slight differences emerged. The group-level ratings predicted the task commitment aspect of group cohesiveness and group performance better, whereas the computed individual-based scores predicted the interpersonal attraction aspect of group cohesiveness better.

Three possible explanations might explain the difference in individual-based scores and group-level ratings' prediction of outcomes. First, the group-level ratings may capture group processes related to collective tasks and perform better than the computed individual-based scores because participants may have made group-level judgments of positivity resonance with all members by thinking about work-related interactions. Second, the individual-based score may have been based on incomplete information because a majority of participants reported perceived positivity resonance with only some members of their groups (only 5.6% provided reports on all group members). As a result, the individual-based scores may be skewed towards experiences with a few members instead of the entire group. Third, participants might have similarly reported perceived positivity resonance individually only for members with whom they frequently socialized and based their assessments of interpersonal attraction for the group on their interactions with those individuals.

Study 2 is the first to examine perceived positivity resonance in a small group context. Its findings on assessment approaches have methodological implications for assessment choice in future research on groups. If a researcher's goal is to measure overall perceived positivity

resonance with all the group members, the group-level measure is recommended for its shorter length, high correlation with the individual-based mean scores, and slightly higher predictive validity for task-related outcomes. In addition, this approach sidesteps the problem of missing data when participants do not report interactions with all the group members. However, if the researcher is interested in interactions between individual group members with one another, the approach of obtaining a separate positivity resonance score for each within-group dyad is more appropriate.

Positivity Resonance with Strong Ties and Weak Ties

The third set of findings concerns the correlation between perceived positivity resonance with weak and strong ties. I found between- and within-person correlations between perceived episodic positivity resonance with weak and strong ties in Study 3 (the Daily Wellness Study). Individuals who tended to perceive greater positivity resonance with weak ties also did so with strong ties, indicating potential stable individual differences in the tendency to make positive social connections with others, regardless of social closeness. Further, on days when people perceived more positivity resonance with strong ties, they also did so with weak ties. This suggests that the affective quality of social interactions with weak and strong ties may influence one another within the same day. If this possibility is true, a person may be able to improve their quality of interaction with certain social partners (e.g., their spouses) by cultivating positive connections with other partners (e.g., the cashier at a coffee shop). Alternatively, an event within the same day may affect an individual's perceived positivity resonance with both categories of social ties (e.g., getting a promotion makes a person happy and thus more sociable and friendly with other people).

Furthermore, in the subsequent analyses of "antecedents" and "outcomes" of positivity resonance, I found the same patterns of results regardless of whether perceived positivity resonance was assessed for weak or strong ties. Together, these findings provide the first evidence supporting the theoretical assertion that perceived positivity resonance with weak ties and strong ties may differ in intensity but not necessarily in kind (Fredrickson, 2016). By extension, perceived positivity resonance with both types of ties can emerge from the same antecedents (e.g., perceived safety and synchronous sensory connection) and contribute to some of the same social outcomes (e.g., a sense of belonging; Sandstrom & Dunn, 2014).

Perceived Positivity Resonance in Asynchronous Online Social Interactions

The fourth set of findings concerns perceived positivity resonance during online, asynchronous interactions. In Study 4, the WW Connected Community Study, I found that individuals report experiencing positivity resonance assessed globally over two weeks of asynchronous interactions. This result replicates previous findings on perceived episodic positivity resonance in technology-mediated communication (Fritz et al., under review; Major et al., 2018). Moreover, the levels of perceived positivity resonance reported in the online community were also notably high, just slightly lower than general perceived positivity resonance. However, individuals may conceivably have lower expectations for the affective quality of online interaction, and therefore give online interactions inflated perceived positivity resonance scores, as has been shown in past research on shifting standards (Biernat & Manis, 1994). Nevertheless, the high levels of perceived positivity resonance in an online context are consistent with the literature on social media and well-being. A systematic review of 43 empirical papers (Best et al., 2014) concluded that although social media can expose users more to harm, social isolation, and cyber-bullying, they can produce social benefits for users such as

greater perceived social support, increased social capital, and increased opportunity for self-disclosure. In line with these conclusions, findings from the WW Connected Community Study (Study 4) suggest that online interaction can have positive affective qualities (i.e., perceived to be mutually pleasant, caring, and "in sync") and thus potentially contribute to fulfilling one's need for social connection.

In apparent contradiction with the reported perceived positivity resonance, however, asynchronous interactions lack "real-time sensory connection," which is theorized as a necessary (albeit not sufficient) precondition for the emergence of the affective, behavioral, and biological synchrony components of positivity resonance (Fredrickson, 2016). Therefore, despite being endorsed on the self-report items used here, positivity resonance does not, in theory, exist in asynchronous interactions. There are several possible explanations for this contradiction. First, that the subjective perception of positivity resonance may not reflect positivity resonance as biological and behavioral synchrony may lie outside of an individual's conscious awareness. Second, subjectively perceived positivity resonance may map onto objectively assessed positivity resonance (i.e., indicated by affective, behavioral, and physiological synchrony), but only in the presence of real-time sensory connection. In the absence of real-time sensory connection, cues that signal a sense of seamless coordination, mutual positive affect, and mutual responsiveness may conceivably generate a perception of positivity resonance. Third, the self-reported measure may not accurately reflect perceived positivity resonance due to multiple biases (memory errors, demand effects, social desirability; Robinson & Clore, 2002; Schwarz et al., 2009). Relatedly, participants may interpret the item that measures synchrony (i.e., did you feel "in sync" with others?) loosely as "being on the same

wavelength" or "feeling like a unit" rather than as an indication of temporal synchrony, and thereby still respond affirmatively to this item on the self-report scale. However, if individuals do subjectively experience positivity resonance in asynchronous media, this raises the interesting possibility that they may do so with multiple partners in multiple separate, extended asynchronous "conversations" that overlap in time. This simultaneous subjective experience of multiple positive connections seems unlikely for separate real-time interactions, and thus the possibility of it in an asynchronous context should be investigated further in future research. In sum, the self-reported perception of positivity resonance during asynchronous interactions may reflect a pseudo, incomplete, or ersatz version of positivity resonance. Despite these caveats, the self-reported perception of positivity resonance may still serve as a meaningful indicator of the affective quality of asynchronous interactions.

Antecedents of Perceived Positivity Resonance

Perceived Safety and Safety-Related Precursors

Consistent with the Positivity Resonance Theory (Fredrickson, 2016), I found correlational evidence for perceived safety as a hypothesized antecedent for positivity resonance. External safety-related conditions—empathy from others (Study 1, the Sorority Study) and experiences of incivility (Study 3, the Daily Wellness Study)—predicted perceived episodic positivity resonance, and perceived safety itself predicted perceived global positivity resonance over two weeks of interactions (Studies 2 and 4, respectively, the Classroom Study and the WW Connected Community Study). The association between safety-related predictors and perceived positivity resonance was robust across different contexts, in interactions in daily life (Studies 1 and 3) and via digital channels (Studies 2 and 4). Moreover, perceived safety still significantly predicted perceived positivity resonance in an online community (Study 4) after I controlled for

perceived speed of mutual responding, norms for social participation within the community, and perceived general positivity resonance.

The findings on perceived safety across all studies have several theoretical implications. They provide the first empirical, albeit correlational, evidence for perceived safety and external safety-related factors as potential antecedents of positivity resonance. Also, the findings on external safety-related conditions (i.e., others' empathy or incivility) expand the theoretical conversation on the sources of perceived safety that contribute to positivity resonance. In the original theory paper (Fredrickson, 2016), internal factors such as trait negative affectivity were believed to shape perceived safety and thereby influence the experience of positivity resonance. The current findings expand the theory by suggesting that, alongside the traits of target individuals, external safety-related conditions (others' empathy and day-to-day fluctuations in experienced incivility) may also impact a target individuals' perceived safety, and consequently, their perceived positivity resonance.

Real-time Sensory Connection and Its Distant Digital Proxy

Findings from the Classroom Study (Study 2) and the WW Connected Community Study (Study 4) provided correlational evidence that real-time sensory connection and its distant proxy—mutual speedy response—may precede perceived positivity resonance. In Study 2, the amount of synchronous meeting time via video or phone call predicted perceived global positivity resonance among students interacting virtually in groups over two weeks. The results from Study 2 replicate previous findings (Major et al., 2018) in a new social context (group interactions) and provide additional

evidence supporting a theorized antecedent of positivity resonance, namely, real-time sensory connection.

In Study 4, I found that perceived speed of mutual responses predicted perceived positivity resonance assessed globally over two weeks in an asynchronous online platform, even after factors such as general perceived positivity resonance, community-specific perceived safety, and community-specific prosocial norms were taken into account. As established in this investigation and previous research (Major et al., 2018; Fritz et al., under review), perceptions of positivity resonance appear to exist in asynchronous interactions, albeit with the potential absence of actual positivity resonance, as objectively indicated by affective, behavioral, and physiological synchrony. The findings here suggest that perceived mutual speedy response supports the perception of positivity resonance during asynchronous interactions. Without real-time connection, mutual speedy responses serve as a signal for the experience of feeling "in sync" by decreasing the lag time between one's own experience of positive affect and one's knowledge of partner's positive affect. The perception of mutual speedy responding may also generate the perception of mutual care by signaling the interactants' intention and effort to be responsive.

The link between mutual speedy responding and perceived positivity resonance, however, may be moderated by multiple factors. First, an individual's expectations of response speed may differ for different social partners (e.g., people may adjust expectations for typically slow responders). Second, they may associate response speed with feeling "in sync" differently across communication channels (e.g., speedy responses on texting and instant messaging may feel "synchronous," but speedy email responses may not; Rettie, 2009). Third, a question remains whether response lag time needs to be below a certain threshold (seconds, minutes, or hours) to

create feelings of being "in sync," and whether this threshold is different for various interactive platforms (e.g., text, Twitter, Snapchat). Finally, it is unknown whether quick response times evoke the same feelings for unpleasant exchanges or backfire by amplifying negative affect and "out of sync" feelings. An understanding of these boundary conditions can illuminate how mutual speedy responding may support perceived positivity resonance in asynchronous online environments.

Outcomes of Perceived Positivity Resonance

Perceived Positivity Resonance Predicted Social Resources

Across the four studies, I found consistent cross-sectional and longitudinal correlations between perceived positivity resonance and various measures of social resources for both individuals and groups. Cross-sectionally, I found that perceived episodic positivity resonance predicted relational network size as indicated by social ties nominated by others (Study 1, the Sorority Study). Moreover, perceived global positivity resonance over two weeks predicted perceived group cohesiveness, as indicated by explicit self-report (Study 2, the Classroom Study), and perceived connection to a specific community, again as indicated by explicit self-report (Study 4, the WW Connected Community Study). Longitudinally, I found in Study 3 (the Daily Wellness Study) that individuals who reported greater daily perceived episodic positivity resonance (regardless of tie strength) throughout an intervention experienced shifts in perceived social resources such as T1-T2 increases in social flourishing, as indicated by self-reports of social well-being, belonging, and loneliness. Moreover, when people focused their behavioral change efforts on increasing connectedness with strangers and acquaintances (i.e., the Social Connectedness-Weak Ties intervention), they indirectly augmented

perceived social resources (i.e., greater belonging and social well-being, and lower loneliness) through elevations in daily perceived positivity resonance with both strong and weak ties.

These findings are consistent with theories of collective affect (Barsade & Gibson, 2012; Brown & Fredrickson, 2021; Goldenberg et al., 2020), which state that collective affective states, e.g., positivity resonance, generate emergent collective properties that, according to Brown and Fredrickson (2021), benefit both the individual and the group. In line with this proposal, the current investigation provided evidence for the associations of perceived positivity resonance with both personal and group social resources.

Personal Social Resources. Studies 1, 3, and 4 provide evidence for an individual's social resources. In Study 1 (the Sorority Study), an individual's mean perceived episodic positivity resonance with others was linked to their relational network size, as indicated by social bonds nominated by others. These social bonds are characterized by various consequential aspects of relationships highlighted in past research, including disclosure of positive events (capitalization; Gable et al., 2006), helping (social support; Gurung et al., 1997), disclosure of negative events, and perceived closeness (trust and intimacy; Buhrmester & Furman, 1987; Wheeless, & Grotz, 1977). In Study 3 (the Daily Wellness Study) and 4 (the WW Connected Community Study), perceived episodic and global positivity resonance, respectively, was linked to self-reported measures of individuals' perceived enduring social resources, whether the resources were context-general (e.g., general belongingness, Study 3) or context-specific (e.g., belongingness to a community, Study 4). In combination, Studies 1, 3, and 4 together suggest that positivity resonance may cultivate a person's more objectively assessed social resources such as other-reported high-quality social bonds, and thereby influence their perceptions of social resources (such as self-rated sense of belonging, loneliness, and perceived social

support). In addition, recurring moments of positivity resonance may repeatedly activate other-focus mindsets and feelings of oneness, and in doing so, can also directly shift the enduring perception of social resources (Fredrickson, 2016). Such effects are consequential as perceived social resources have predicted important outcomes, such as physical health, equally or better than actual social resources (Holt-Lunstad et al., 2015; Uchino, 2009).

Group Social Resources. Although evidence for collective resources can be inferred from evidence for individual social resources (e.g., one's marital status implies a marriage of two people), Study 2, the Classroom Study, provides direct evidence for collective social resources, better aligning with theories of collective affect (e.g., Brown & Fredrickson, 2021). Study 2 shows that in a small group context, an individual's perceived positivity resonance with group members, measured globally over two weeks of interactions, was associated with their perception of group cohesiveness, including task commitment and interpersonal attraction. This suggests incidents of perceived positivity resonance among group members may promote members' commitment and effort toward the group's collective goal (task commitment) and members' personal bonds with one another through social activities (interpersonal attraction). Furthermore, perceived positivity resonance with group members predicted perceived group performance, mediated by both of the aforementioned aspects of group cohesiveness, thus providing evidence for the downstream collective benefits. These findings are consistent with the literature on group positive affect (Knight & Eisenkraft, 2015; Peñalver et al., 2019), which has established that group positive affect is linked to group resources such as social integration, coordination, and supportive team climate, and

superior team performance. As pointed out by Brown and Fredickson (2021), however, group positive affect has often been computed by aggregating intra-individual positive affect over lengthy periods of time and thus is not the same as the simultaneous co-experience of positive affect among members. Thus, to my knowledge, this study of perceived positivity resonance in a small group context demonstrates for the first time the association of co-occurring positive affect with perceived group resources and performance.

Although the current investigation did not test the mechanism through which positivity resonance potentially builds social resources, several pathways are possible. Incidents of positivity resonance may cultivate social bonds and collective resources by momentarily broadening relational frames of mind and promoting mutual other-focus and felt unity (Fredrickson, 2016). Positivity resonance may also build such social bonds and resources through incremental reinforcement. When we experience positivity resonance with someone (e.g., "connecting" and "having fun"), the experience is rewarding and motivates us to seek out and engage with those individuals. The recurrence of such collective experience over time is theorized to promote social bonds, interpersonal togetherness, and cooperative, effective groups (Brown & Fredrickson, 2021).

Causal Interpretation

Out of the four studies, only Study 3 (the Daily Wellness Study) had a randomized controlled design that enabled tests of causality. The findings from Study 3 revealed a causal indirect effect of the Social Connectedness-Weak Ties intervention condition on increases in perceived social resources. Specifically, relative to the Passive Control condition, the Social Connectedness-Weak Ties condition indirectly predicted changes in perceived social resources, conceptualized as social flourishing (social well-being, belongingness, loneliness), as mediated

by elevated perceived positivity resonance (for both strong and weak ties). In other words, as individuals attempt to foster positive moments of connections in daily life, especially with weak ties, they are more likely to experience increases in social flourishing. This finding suggests that framing the social connection intervention with a focus on weak ties may be more effective than a focus on general social connectedness for promoting positivity resonance and perceived social resources. Several explanations may account for this pattern of results. It is possible that specifying a social target may help participants build an action plan to enact the intervention, a well-established method for effectively turning intentions into behavior (e.g., an implementation intention: "If I encounter my neighbor on my way to work, I will bid her good day"; Webb & Sheeran, 2008). Alternatively, participants may have strived to create positive moments of connection with strong ties by default, and a specific focus on weak ties, relative to a general focus, pushed them to make additional efforts to connect with less familiar others and thus gain greater benefits from the intervention. Finally, participating in a variety relationship types and social networks is a defining aspect of social integration and social well-being (Brissette, Cohen, & Seeman, 2000; Keyes, 1998) and has been linked to lower loneliness (van Tilburg et al., 1998; Stevens & Westerhof, 2006). Therefore, instructions to focus on weak ties could have prompted participants to foster positive connections with a more diverse network of people, and therefore experience bigger increases in social flourishing.

Despite the causal evidence for the effect of perceived positivity resonance on changes in perceived social resources, measured as social flourishing (Study 3), the causal link between positivity resonance and social resources could also be bidirectional.

Existing resources such as social bonds may create more opportunities for participation in social events and in-person interactions, thereby creating the conditions for real-time sensory connection, a precondition for positivity resonance. Feeling more belongingness, less loneliness, and more connection to a community may also help a person perceive more safety in their social environment (e.g., Gerlach & Gockel, 2018), thereby further laying the fertile ground for positive moments of connection to occur. Therefore, incidents of positivity resonance and social resources could mutually influence one another through the reciprocal dynamics of an upward spiral (Fredrickson & Joiner, 2018).

Implications for General Health and Well-Being

Correlational evidence from the WW Connected Community Study (Study 4) supports the proposal that resources cultivated by perceived positivity resonance promote nonsocial benefits such as health behavior. In Study 4, perceived global positivity resonance in an online social platform was associated with a greater sense of connection to the community, which in turn predicted more frequent future food tracking, a key health behavior previously linked to weight loss success (Burke et al., 2011). From an affective scientific perspective, the *upward spiral theory of lifestyle change* (Van Cappellen et al., 2018; Rice et al., 2019) proposes that positive affect experienced during health behaviors (e.g., feeling good when tracking food) heightens incentive salience for cues associated with those behaviors (e.g., mealtime, wellness app, spontaneous pleasant thoughts about food tracking), which in turn, nudges subsequent decisions to repeat those behaviors (e.g., food tracking). Social "vantage resources," such as feeling connected to a wellness community, can amplify the positive affect felt during those health behaviors (e.g., tracking food feels more pleasant when one can share their progress with the community), which in turn may reinforce people's nonconscious motives for engaging in

those health behaviors (e.g., track food more often). From a social psychological perspective, greater integration into a wellness community may increase individuals' relevant health behaviors through other cognitive mechanisms (e.g., heightened perception of cooperation, self-efficacy for behavior, behavioral intention; Burke et al., 2008) and social mechanisms (e.g., normative social influence, social control of health behavior; Thoits, 2011). Consistent with this existing evidence, Study 4's findings suggest that as members feel a stronger positive connection to the online health community, they may be more likely to engage in relevant health behaviors.

These findings are consistent with the Positivity Resonance Theory (Fredrickson, 2016), which proposes that moments of perceived positivity resonance promote better overall health and well-being through building enduring resources such as social resources (e.g., perceived social support, social bonds) and biological resources that serve to increase positive emotional reactivity to positive events (e.g., cardiac vagal tone; tonic oxytocin; Isgett et al., 2017). The association between social resources and health behavior found in the WW Connected Community Study (Study 4) elucidates an additional potential mechanism underlying the link between perceived positivity resonance and well-being previously established (Major et al., 2018). That is, the community-specific social resources cultivated through positivity resonance can help individuals enact community-specific health behavior that ultimately contributes to greater well-being.

Strengths of the Current Research

There are several strengths of the current research. First, two out of the four studies have relatively large sample sizes ($n_{\text{Study 3}}$ = 405 and 10,152 person-days, $n_{\text{Study 4}}$ = 2840). Second,

although three of the four studies were cross-sectional, Study 3 uses an intensive longitudinal randomized control trial that involved densely repeated self-reports of perceived positivity resonance, which enabled tests of causality. Study 3's intervention thus established that efforts to increase moments of positive social connection with a focus on weak ties would indirectly increase perceived social resources (greater social well-being and belonging, and lower loneliness) by elevating daily positivity resonance.

Third, I incorporated multiple different measures of perceived positivity resonance across studies, which enabled me to investigate the construct validity and predictive validity of these self-reported measures in the Sorority Study (Study 1) and the Classroom Study (Study 2). In Study 1, using reports on social interaction quality from both dyad partners, I preliminarily tested the degree to which perceived positivity resonance is shared in dyads, a defining feature of the positivity resonance construct. Although this test is exploratory due to the small number of dyads, it contributes to examining the validity of self-reports of positivity resonance. In Study 2, I compared two approaches (group-level ratings versus individual-based mean scores) to measure an individual's perceived positivity resonance with group members and found convergence in the findings, thus supporting the validity and utility of both approaches.

Fourth, the studies included multiple measures of social outcomes varying in several dimensions: self-rated versus other-rated, evaluative (e.g., belonging, task commitment, interpersonal attraction) versus structural (e.g., relational network size), context-general (e.g., belongingness in general) versus context-specific to a group or community (e.g., belongingness to a community), and individual-level (e.g., loneliness, social well-being) versus group-level (e.g., perceived group cohesiveness, perceived group performance). Therefore, they provide robust evidence for the link between positivity resonance and wide-ranging types of social

resources across multiple contexts. In addition, Study 4 collected real-world behavioral data from an online weight loss community, thus elucidating one potential mechanism for a previously found link between positivity resonance and well-being (Major et al., 2018) in an ecologically valid way.

Finally, across all four studies, the effects of perceived positivity resonance on social resources were tested and shown to be robust while controlling for positive affect. These findings established the discriminant validity of positivity resonance as a collective-level construct, distinguishing it from individual-level positive affect. As positive affect is a well-established theoretical and empirical driver of greater social resources (Lyubomirsky, King, & Diener, 2005; Fredrickson, 2001) and is, when shared, by definition, a component of positivity resonance, the evidence passes a stringent test for establishing the independence and distinct contribution of these two constructs. Although affective science (and psychology in general) has traditionally focused on intra-individual experience, affective theories (e.g., Goldenberg et al., 2016; Fredrickson, 2016) have started to focus on collective affective states or interpersonal affective processes at the level of dyads and groups, which cannot be captured at the individual level. Evidence for the distinction between positive affect and positivity resonance thus supports this pivot and the need to develop and refine theories on collective affective phenomena.

Limitations and Future Directions

Issues Related to the Measurement of Positivity Resonance

Although common threads emerged among findings across studies, it is crucial to highlight the differences across studies in the timeframes for positivity resonance assessments. Perceived positivity resonance was assessed episodically for particular, specific social interactions in Study 1 (the Sorority Study) and Study 2 (the Daily

Wellness Study), and globally for all of a respondent's social interactions within two weeks in Study 2 (the Classroom Study) and Study 4 (the WW Connected Community Study). Global assessments may introduce more bias into the reports of positivity resonance. For example, like perceptions of affect more generally (Robinson & Clore, 2002), global perceptions of positivity resonance over extended periods of time may reflect people's beliefs about their socioemotional experiences, rather than their actual experiences in the moment. Based on Robinson & Clore (2002), I chose the two-week time frame for assessing global positivity resonance in Studies 2 and 4, which should mitigate this concern to a degree (i.e., relative to asking about perceived positivity resonance during longer periods of time or in general). Further, Studies 1 and 3 used episodic assessments (i.e., reports of perceived positivity resonance for a specific social interaction) with a confined time frame (i.e., "today" in Study 3), which may also attenuate such bias and more closely reflect the momentary experience of positivity resonance. Due to the differences in assessment timeframe, one should take caution when interpreting the findings. Nevertheless, although the inconsistent time frame of assessments and usage of global assessment were not ideal, there were several convergences of findings regarding safety-linked antecedents and social outcomes across the global and episodic measures of positivity resonance. These convergences inspire some confidence in the results based on global assessments.

Relatedly, a limitation of all studies is the reliance on self-reports of perceived positivity resonance. First, self-reports may suffer from reporting biases (e.g., those related to memory distortion, researcher demand, and social desirability; Robinson & Clore, 2002; Schwarz et al., 2009). Second, preliminary evidence (Study 1) indicates a low correlation between reports of positivity resonance by partners in dyads, suggesting the potential for substantial subjectivity in self-reports (although respondents may not have been referring to the same social episode).

Third, self-reports of perceived positivity resonance during asynchronous online interactions may reflect an experience entirely different from objectively-assessed positivity resonance during asynchronous social interactions through messages and emails. That is, individuals reported perceiving positivity resonance even in the absence of real-time sensory connection, which is theorized to be a necessary precondition. Fourth, individuals may use separate standards for judging the perceived positivity resonance for their online interactions compared to in-person interactions, making the comparison of quality between these two modes of interactions inaccurate. Overall, it remains an open, empirical question as to how well perceived positivity resonance, especially when reported for asynchronous online interactions, aligns with positivity resonance as indicated by behavioral, physiological, and observer-rated measures. Thus, caution should be taken and more research is needed before interpreting perceptions of positivity resonance in asynchronous online contexts as reflecting positivity resonance.

One method to limit recall bias and maximize the ecological validity of self-reports is to use event-contingent "ecological momentary assessment" (Shiffman et al., 2008). For example, participants can be asked to fill out an assessment whenever they indicate engaging in a social interaction lasting more than 10 minutes in their everyday life (Reis & Wheeler, 1991). To validate the self-reported measure, researchers can also study social interaction in the lab and assess the moment-to-moment ratings of positivity resonance (e.g., akin to the method used in Brown et al., 2021) to obtain evidence that aligns better with the momentary nature of the positivity resonance experience. In such a study, observer-rated data (Otero et al., 2019) and data on physiological hallmarks of positivity resonance (Chen et al., 2020) can be correlated with and compared against

reports of perceived positivity resonance from both of the interactants in dyads. In combination, these sources of data could serve to more definitively test the validity of the self-report measure used in this dissertation, while also providing a more complete picture of the positivity resonance experience during synchronous interactions.

Future research focusing on asynchronous environments should also further investigate the interpersonal affective experience of individuals that may be akin to positivity resonance. First, research is needed to determine the characteristics of the self-reported measure of positivity resonance (e.g., measurement invariance, convergence validity) and how participants interpret and use the measure across synchronous and asynchronous modes of interaction. Second, to address the issue of shifting standards (Biernat & Manis, 1994) for evaluating experienced positivity resonance across synchronous and asynchronous contexts, research should compare absolute, objective versus subjective response scales for self-reports of positivity resonance. Third, future research should empirically test whether the hypothesized hallmarks of positivity resonance (e.g., shared positive affect, caring behavioral synchrony, and physiological synchrony), or at the very least their digital proxies, are present during message-based communication. For example, caring nonverbal "synchrony" between two individuals can be operationalized as the degree of concordance in the use of language and emoticons (e.g., 'liking,' 'loving,' or "smiley face" emojis). Another example would be measuring indicators of physiological similarity (e.g., heart rate variability) between two individuals during an episode of asynchronous interaction. Finally, researchers can correlate perceived positivity resonance reports with these hallmarks in individual asynchronous interaction episodes. In combination, evidence generated by such research would elucidate the interpersonal experience of individuals in an asynchronous context and determine whether it is akin to positivity resonance as

theoretically defined. The results of such research can inform whether the Positivity Resonance Theory needs to be modified or refined to better accommodate asynchronous social interactions, despite their absence in environments in which human emotions and social behaviors evolved.

Improvement in Intervention and Study Design

Although Study 3 (the Daily Wellness Study) offers a potentially effective intervention that modestly boosts levels of positivity resonance, future interventions can be optimized for greater effectiveness. I conducted 10 informal post-intervention semi-structured interviews which revealed suboptimal features of the intervention in Study 3. For example, study participants tended to "tune out" the daily email reminders because they were too frequent and repetitive. One issue is that these reminders might have left the impression that the intervention was delivered by a machine and not by humans, inadvertently going against the intervention's intention to encourage social connectedness. Future interventions can incorporate design features, such as human imagery and testimonials to create perceived interactiveness with social others, factors known to enhance the effectiveness of digital health interventions (Brennan et al., 2020; Lazard et al., 2020). In addition, some study participants did not have clear ideas of specific behaviors they could undertake to cultivate moments of connection to others. Providing more specific examples of connection-building behaviors may help participants build an execution plan (Webb & Sheeran, 2008) to more successfully translate their intentions to connect into effective actions. Nevertheless, despite these flaws, Study 3 provides a proof of concept for a Social Connectedness Intervention

which, with some optimization, offers a scalable and low-cost digital wellness solution to improve social connection and resources.

Another limitation of the current research is that three out of four studies used correlational designs. Although the results of Study 3 partially support causal interpretation regarding a social outcome (i.e., changes in perceived social resources), there was no randomization of antecedents. Therefore, it is uncertain whether hypothesized antecedents such as perceived safety and real-time sensory connection cause positivity resonance. Future research that randomizes participants to varying levels of antecedents (i.e., perceived safety and real-time sensory connection) will be needed to test causal claims for the hypothesized antecedent directly. Future research is also needed to test the assumption that incivility and empathy impact perceived safety, and that these conditions indirectly influence perceived positivity resonance through shifts in felt safety.

Other Limitations and Future Avenues

Although the current research recruits from a variety of age ranges and populations (college students, community, online community), the samples were not diverse in terms of race and ethnicity. Participants were predominantly White (Studies 2 and 3) or almost exclusively White (Studies 1 and 4). These drawbacks limit the generalizability of the findings to different groups, as well as prevent well-powered statistical comparisons among races. Social interactions and emotional processes are powerfully shaped by gender (Brody & Hall, 1993) and culture (e.g., Tsai, 2007), perhaps especially so in cross-gender, cross-race, and cross-culture episodes of interaction. Future research should recruit more diverse samples and study the experiences, perceptions, antecedents, and outcomes of positivity resonance across genders, ethnicities, and cultures.

For example, an important topic to investigate is possible gender differences in the objective experience (as indicated by affective, behavioral, and physiological synchrony) and perception (as indicated by self-report) of positivity resonance. Men are often stereotyped and expected to be agentic (confident, independent, and controlling), whereas women are often stereotyped to be caring (warm, kind, and focused on relationships; e.g., Kite, 2001). These differences in gender roles and expectations of agency versus care have been found to influence men's and women's behaviors and decision-making (Ellemers, 2018). For example, occupations that emphasize agency (such as policing) are dominated by men, whereas occupations that emphasize warmth and care (such as nursing) are dominated by women (Jarman et al. 2012). These gender differences may explain the low enrollment rates for male participants (and higher rates for female participants) in Study 2 (the Daily Wellness Study) and Study 3 (the Classroom Study), which were described to participants as related to wellness and social interaction. Due to the same gender differences, men and women may experience positivity resonance at different intensities and frequencies in various contexts. They may also respond to the self-report measures differently; e.g., women may endorse certain items such as "mutual care and concern" more strongly relative to men.

Regarding culture and ethnicity, culturally ideal affect (Tsai, 2007) may also influence the objective experience and perception of positivity resonance. Members of many collectivistic, interdependent cultures in Asia (Tsai, 2007) tend to prefer experiencing low arousal positive affect (e.g., calm, content) whereas those in individualistic, independent cultures (Tsai, 2007) and Latin American countries (Ruby et al., 2012) have tended to prefer high arousal positive affect (e.g., excitement, elation).

These preferences have wide-ranging and consequential social implications, for example, in selecting job candidates (Bencharit et al., 2019), donating to charities (Park et al., 2017), and making health decisions (Sims et al., 2014). Similarly, the perception of positivity resonance (especially concerning mutual responsiveness and being "in-sync") may be enhanced by cross-person matching of arousal in moments of shared positive affect as well as intrapersonal matching between ideal positive affect and shared positive affect. Further, moments of positivity resonance that involve the co-experience of culturally desirable (vs. less desirable) positive emotions may be more beneficial for relational and personal well-being (De Leersnyder, 2014; Tsai & Park, 2014). For example, building on Tsai's theorizing (2007), co-experiencing low arousal positive affect may better promote social resources in East Asian countries, whereas co-experiencing high arousal positive affect may be more beneficial in Western and Latin American cultures. On the other hand, Western cultures may encourage self-focused, other-distancing positive emotions such as pride (De Leersnyder, 2014) in specific contexts, and co-experiencing these positive emotions with others may neither promote positivity resonance (which involved other-focused care and concern) nor build social bonds and resources. Yet another nuance exists: within interdependent, collectivistic cultures, the boundaries between ingroups and outgroups may be stronger relative to parallel boundaries within independent, individualistic cultures (Markus and Kitayama, 2010), which may have implications for social interactions and positivity resonance with strangers. For example, relative to a neutral prime, priming interdependence in Chinese-American individuals promoted cooperation with friends but reduced cooperation with strangers (Wong & Hong, 2005). As such, people may experience more positivity resonance with weak ties in individualistic, independent cultures relative to collectivistic, interdependent

cultures. Future research thus should examine how various factors discussed above may shape the experience and outcomes of positivity resonance within, across, and between cultures.

A relatively unexplored area of research is how the experience of positivity resonance unfolds within small group contexts, such as group work or group conversation. Group dynamics impact conversations in terms of airtime, turn-taking, and backchanneling feedback (Cooney, 2020), often in complex ways. These factors may vary depending on the dominance of certain group members, gender composition, group size, and more. Positivity resonance also unfolds continuously in real-time alongside shifting group dynamics and formation of group norms, and global assessments over long periods of time may not be able to capture these processes. Therefore, researchers can use methods such as analyzing video recordings of real-time group interactions which occur in the lab, in naturalistic in-person work teams, or on video-based conference platforms (e.g., Zoom, Gather). Future work should investigate how the experience and perception of positivity resonance are shaped by the group's gender composition and the presence of dominant members, as well as complex group dynamics in terms of speaking time, eye contact, backchanneling feedback, and turn-taking coordination. Additionally, researchers should also investigate how behavioral synchrony and affective responses change with increasing group size and how online versus offline contexts influence positivity resonance and social interaction in groups.

Another interesting research avenue would be studying the potential downsides of positivity resonance in specific contexts. For example, positivity resonance may promote group cohesiveness and stronger group identity, which potentially benefits group

performance. However, high positivity resonance may also be detrimental to performance in some contexts. For example, when a work team has a high positive affective tone and a high amount of trust, members may be less likely to express differing opinions and thoroughly explore different options, leading to lower team creative performance (Tsai et al., 2012). Research has also shown that groups that have too strong an identity and cohesiveness may succumb to groupthink, suboptimal decision-making (Baron, 2005; Janis, 2007), and even extremism under the wrong circumstances (Hogg, 2004). Therefore, it will be important to determine the optimal amounts of and timings for positivity resonance across different tasks, situations, and groups.

Practical Implications

Lacking social connection is a modern malaise (McPherson et al., 2006) and has become even more common during the COVID-19 pandemic due to social distancing measures prescribed to reduce viral spread (Killgore et al., 2020). Loneliness not only causes mental health issues (Erzen & Çikrikci, 2018) but also predicts poorer health and shorter lifespans (Hawkley & Cacioppo, 2010). The current findings can be applied to nudge people toward more frequent experiences of positivity resonance through the built environment. One can design physical and digital environments to boost the two antecedents—perceived safety and (the perception of) synchronous sensory connection—to promote positivity resonance among people. For example, improving neighborhood physical environments (Loewen et al., 1993) is a viable way to enhance perceived safety and encourage more frequent interaction with neighbors. Based on the current research, encouraging empathy and civility in groups and communities are potential ways to enhance positivity resonance presumably through creating a sense of psychological safety. A systematic review of the psychological safety literature (Newman et al., 2017) also suggests a

multitude of antecedents of perceived safety in work teams, such as supportive leadership behaviors (e.g., being open and transparent, providing support and coaching), supportive organizational practices (e.g., access to mentoring, diversity practices), and team characteristics (e.g., team rewards, a continuous quality improvement climate). Organizations and communities can promote these group-level qualities to foster more positivity resonance among their members and ultimately build collective resources. The social environment, especially on message-based online social platforms, can be designed to maximize real-time sensory connection or perceived synchrony among members by creating opportunities for people to perform synchronous actions such as through live events. Such design choices that aim to nurture human social connection can be consequential for promoting the health and well-being of individuals as well as of communities.

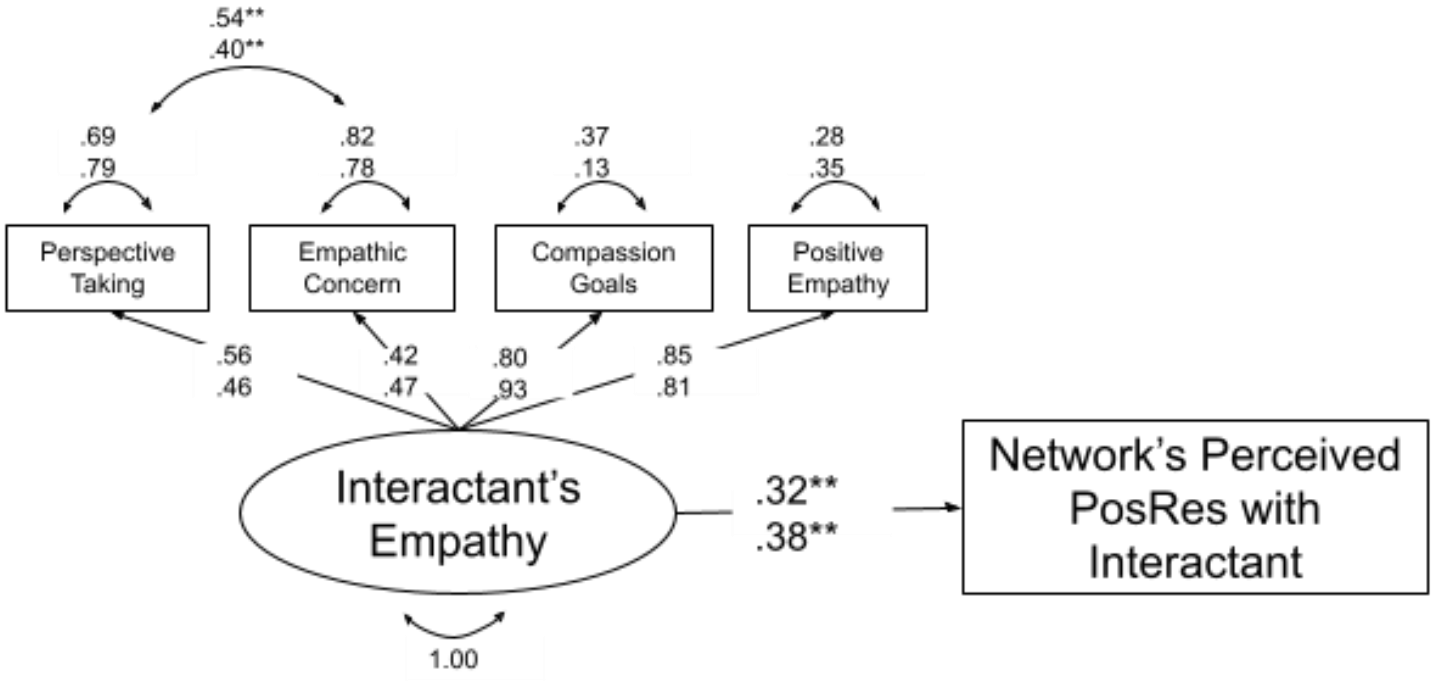
Conclusion

An interaction filled with "irresistibly contagious" "laughter and good humor" (Dickens, 1995) between two people aptly describes positivity resonance, an interpersonal experience characterized by shared pleasant feelings, synchronous caring nonverbal gestures, and synchronous biological rhythms across individuals. The current program of research examines these (and milder) moments of positive connection from different angles and thus contributes to the literature in important ways. First, by exploring the contexts surrounding perceived positivity resonance, the four studies paint a more detailed picture of perceived positivity resonance while also situating it in new social contexts. Notably, I developed and preliminarily established the validity of assessments of individuals' perceived positivity resonance in a group context (Study 2,

the Classroom Study) that can be used for future research. In addition, evidence from Study 3 (the Daily Wellness Study) substantiates a core claim that positivity resonance can be experienced with any social partners regardless of closeness (Fredrickson, 2016). Second, this series of four studies helps build the empirical support for the two theorized antecedents of positivity resonance. Specifically, Studies 1-4 provide the first evidence that perceived safety (and its assumed precursors) is a precondition for perceived positivity resonance. In addition, I not only confirmed the link between real-time sensory connection and perceived positivity resonance (Study 2) but also identified a novel distant proxy of real-time sensory connection, perceived mutual speedy response, that potentially generates perceived positivity resonance in an asynchronous online context (Study 4, the WW Connected Community Study). Third, the four studies provide the first substantial correlational and experimental evidence outside of the romantic relationship context that positivity resonance builds personal and collective social resources that have nonsocial real-world impacts such as promoting community-specific health behavior. Further, all the studies establish the contribution of the collective-level construct of positivity resonance as distinct from that of individual-level positive affect. These findings support the shift in focus of affective science as a field beyond studying intrapersonal emotions to investigating collective emotional phenomena. Overall, these findings demonstrate the social and well-being benefits of moments of positive connections with others, which, unfortunately, may be on the decline across the globe (McPherson et al., 2006; Ortiz-Ospina & Roser, 2020). Nevertheless, through the lens of positivity resonance, opportunities are plentiful for people to cultivate “micro-moments” of connection with others in everyday life and harvest the ensuing social and well-being benefits.

Figure S1.1

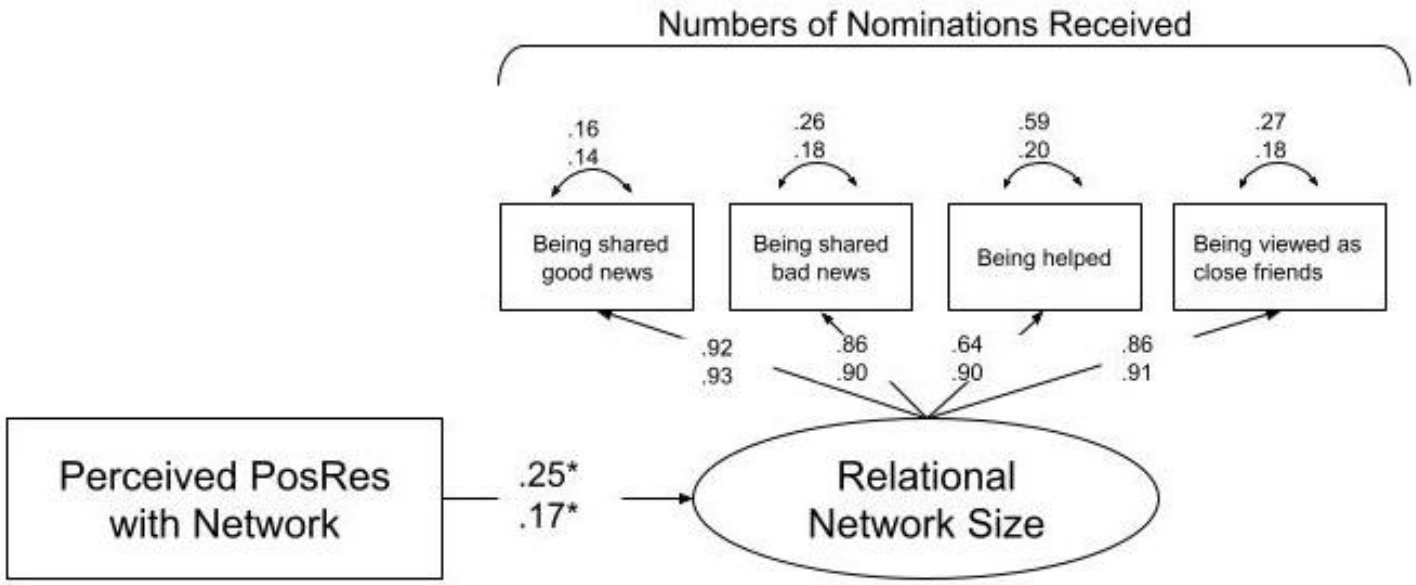
Effect of Interactant's Empathy on Network's Mean Perceived Episodic Positivity Resonance with the Interactant (Study 1)



Note. Standardized coefficient estimates are reported for both samples in a column of text, with the upper coefficients for Sorority 1 and the lower ones for Sorority 2. Although the unstandardized regression coefficients were fixed to be equal across groups for all paths, standardized coefficient estimates differed as standardization was done within groups. PosRes = Positivity Resonance. ** $p <$ .01. All factor loadings were significant at $p < .001$.

Figure S1.2

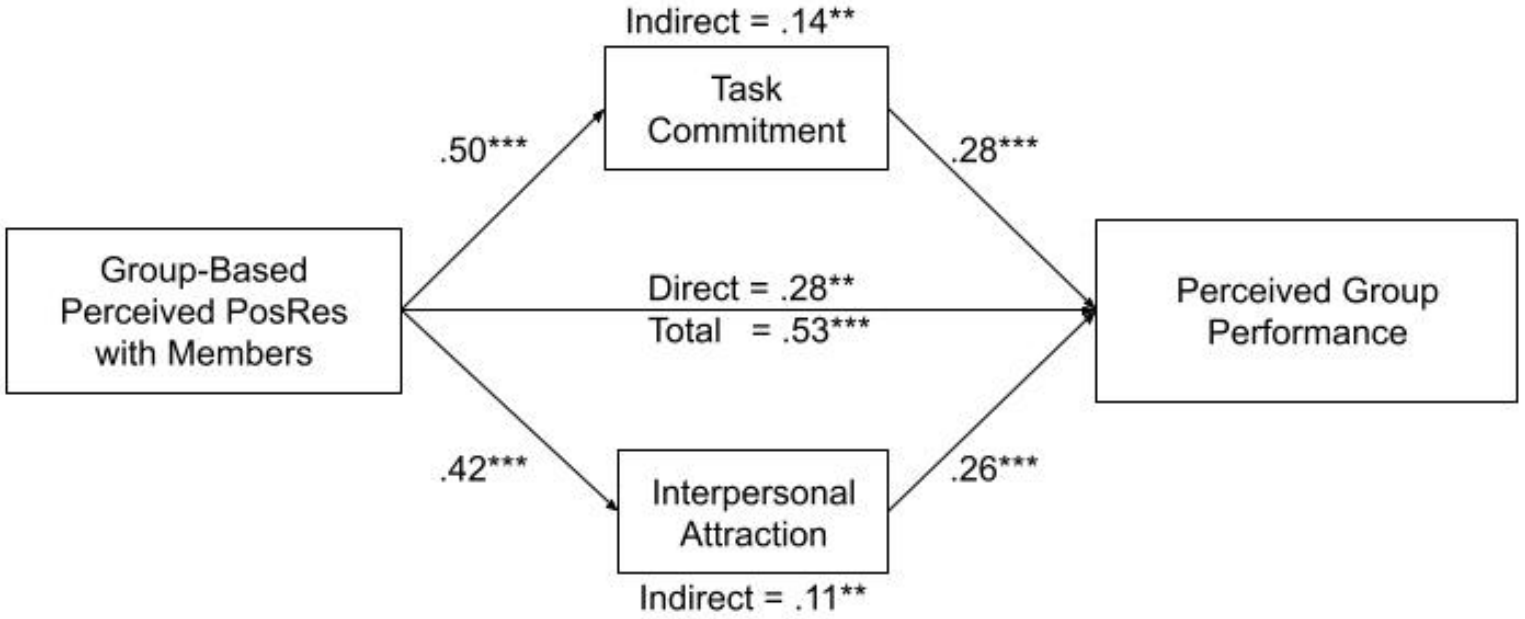
Effect of Individual's Perceived Episodic Positivity Resonance with Network on Relational Network Size (Study 1)



Note. Standardized coefficient estimates are reported for both samples in a column of text, with the upper coefficients for Sorority 1 and the lower ones for Sorority 2. Although the raw regression coefficients were fixed to be equal across groups for all paths, standardized coefficient estimates differed as standardization was done within groups. PosRes = Positivity Resonance. * $p < .05$. All factor loadings were significant at $p < .001$.

Figure S2.1

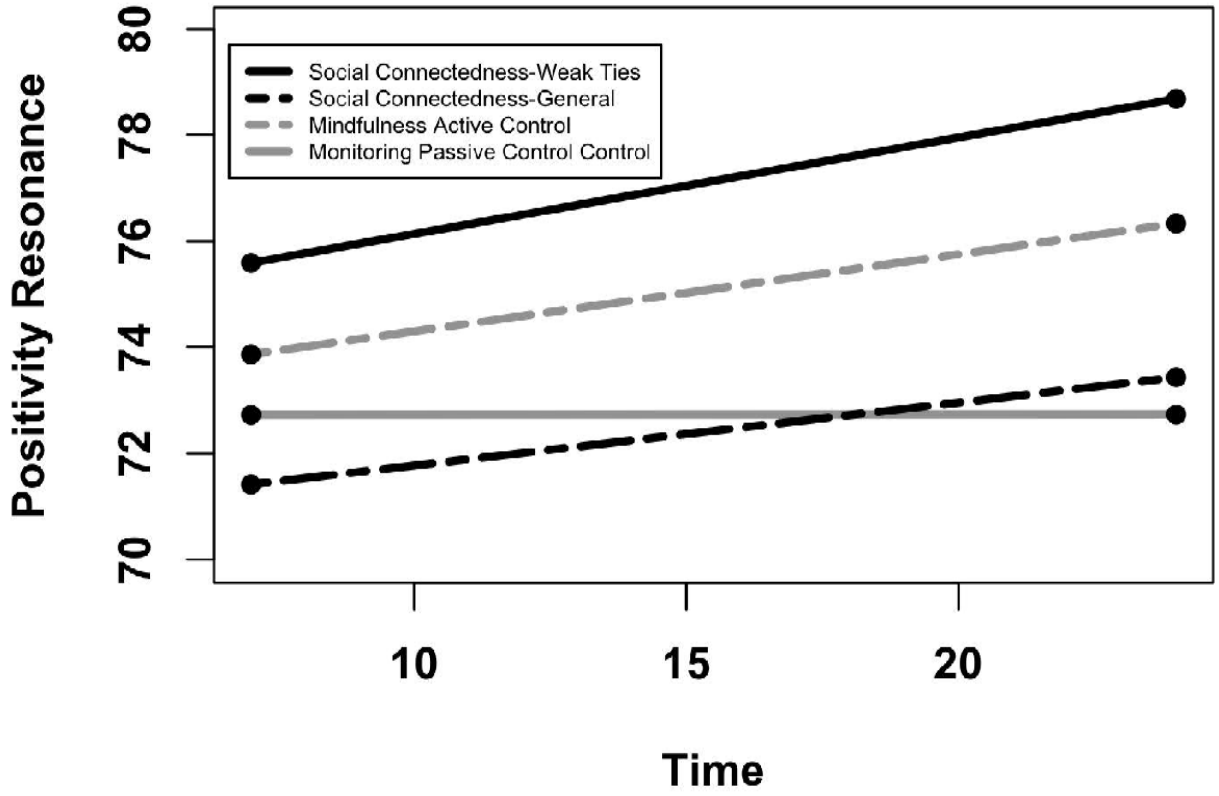
Effects of Group-Level Perceived Global Positivity Resonance on Group Cohesiveness and Group Performance (Study 2)



Note. Standardized coefficient estimates are reported. There were two indirect effects of group-level perceived positivity resonance with members on Perceived Group Performance, one through Task Commitment and one through Interpersonal Attraction. PosRes = Positivity Resonance. ** $p < .01$, ***$p < .001$

Figure S3.1

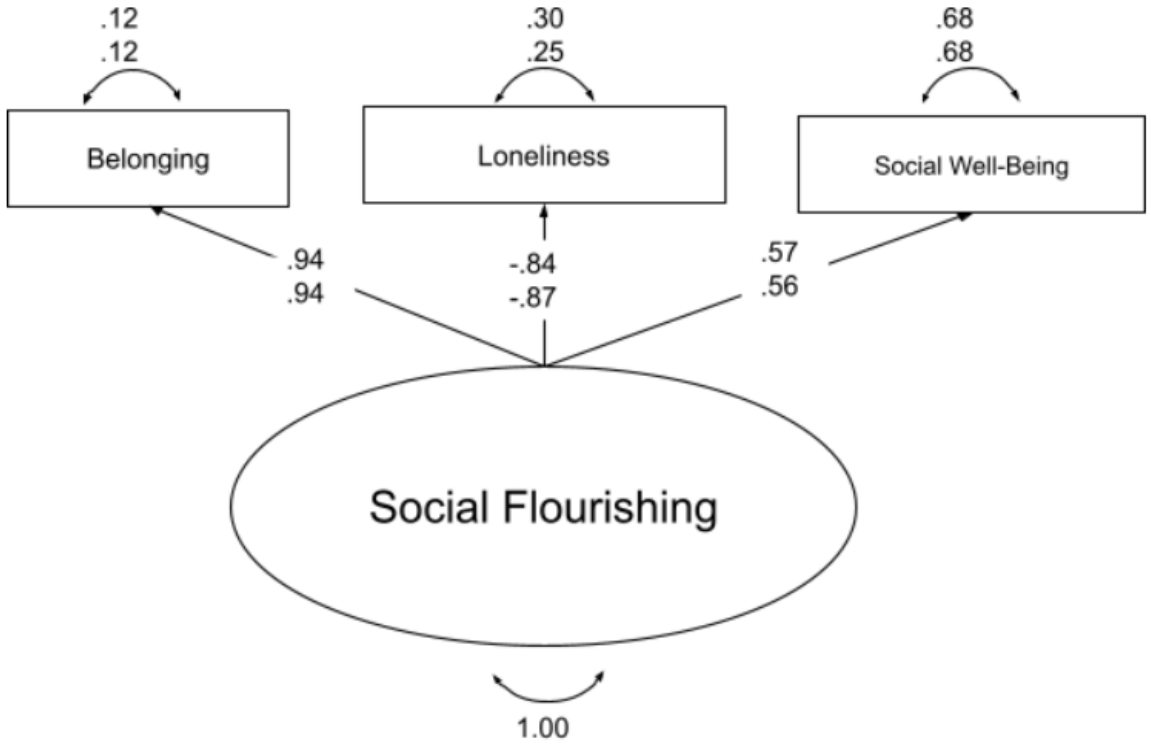
Illustration of the Group X Time Interaction across 35 Nightly Reports of Positivity Resonance (Study 3)



Note. Adapted from "The Goods in Everyday Love: Positivity Resonance Builds Prosociality," by J. Zhou et al., 2020, manuscript under review, pg. 50. Pending Copyright. Reprinted with permission.

Figure S3.2

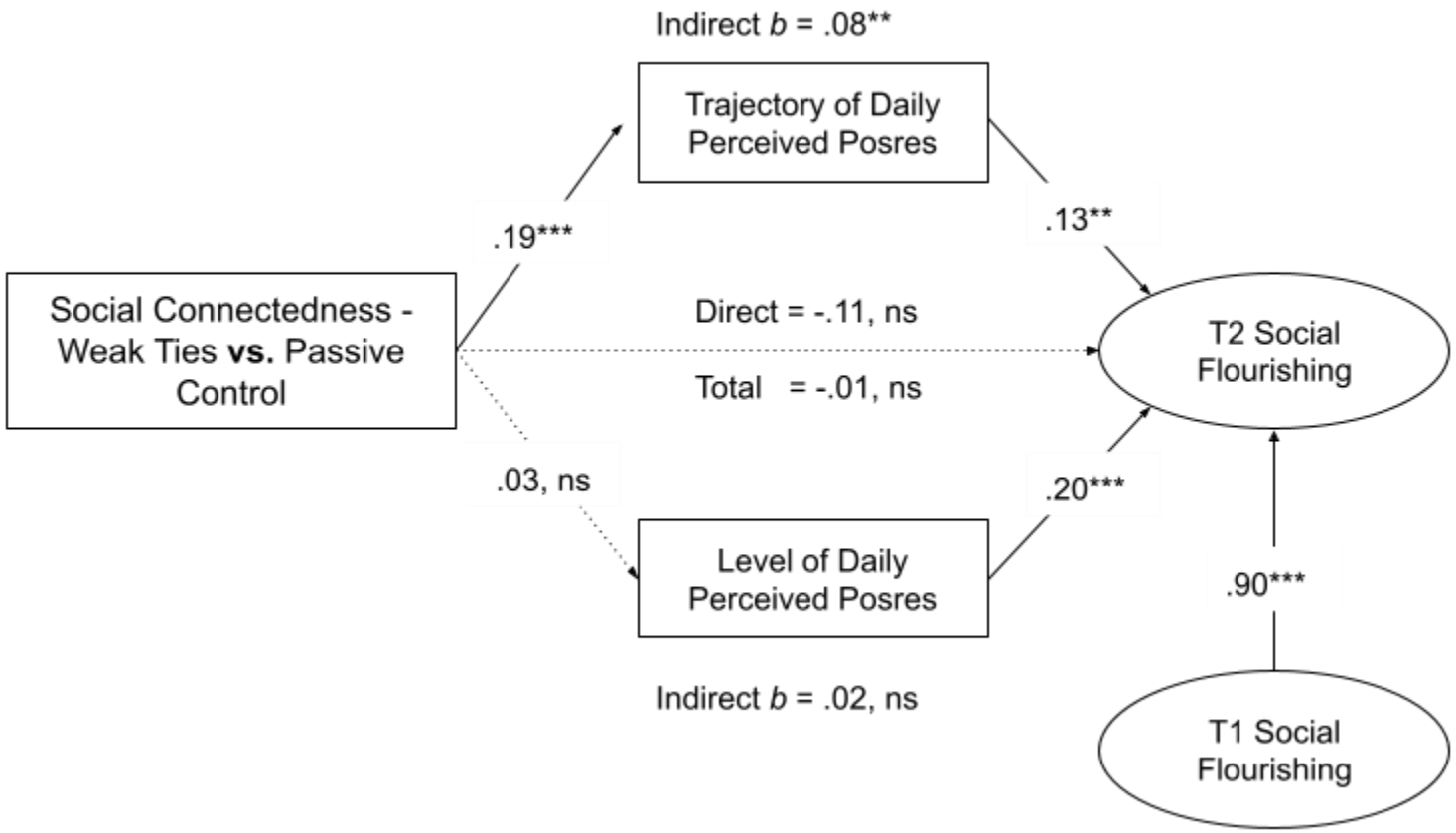
Metric-Invariance Measurement Model of Social Flourishing across Time 1 and Time 2 (Study 3)



Note. Standardized loadings are reported for both samples in a column of text, with the upper coefficients for Time 1 measures and the lower ones for Time 2 measures. Although the unstandardized loadings were fixed to be equal across time points, standardized loadings differed as standardization was done within individual time points. All factor loadings were significant at $p < .001$.

Figure S3.3

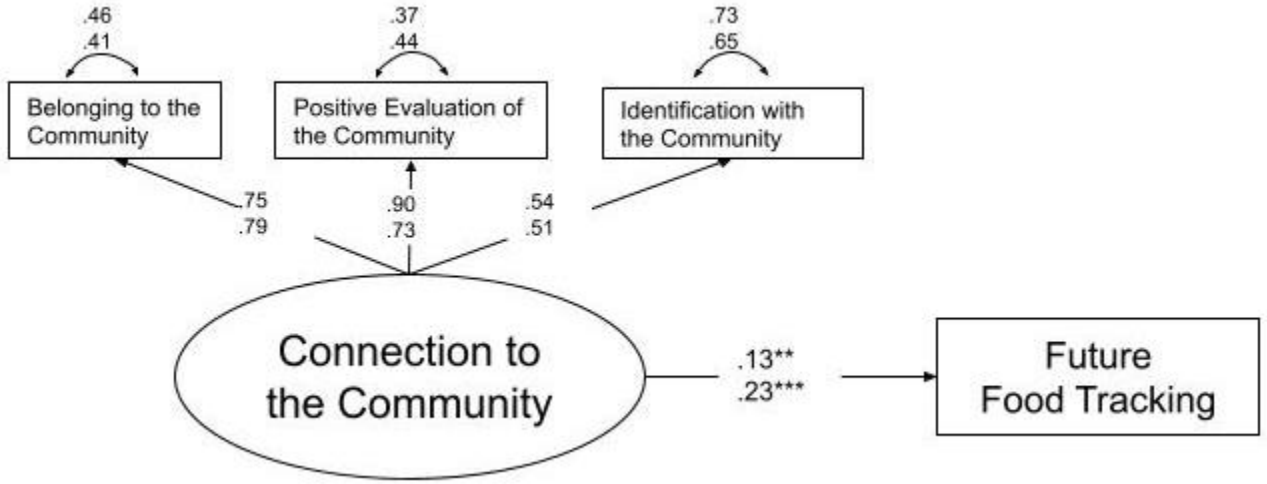
Effects of Social Connectedness - Weak Ties Condition on Changes in Social Flourishing, as Mediated by Daily Perceived Episodic Positivity Resonance (Study 3)



Note. Standardized coefficient estimates are reported for direct effects, although they are not available for indirect effects. Therefore, unstandardized coefficients are reported for indirect effects, indicated by *b*. PosRes = Positivity Resonance. ** $p < .01$, ***$p < .001$

Figure S4.1

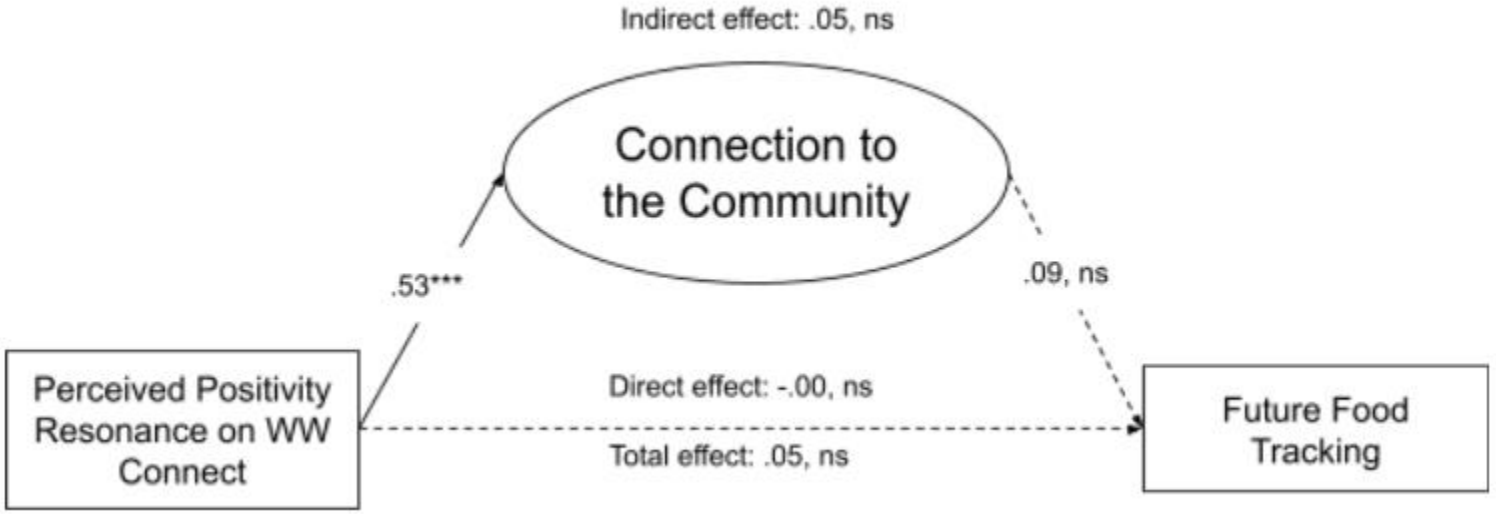
Effect of Connection to the Community on Food Tracking for Current Connect Users and Nonusers (Study 4)



Note. The analyzed sample size is 2840. Standardized coefficient estimates are reported for both samples in a column of text, with the upper coefficients for current Connect users and the lower ones for nonusers. Although the raw regression coefficients were fixed to be equal across groups for factor loadings, standardized coefficient estimates differed as standardization was done within groups. ** $p < .01$, ***$p < .001$ All factor loadings were significant at $p < .001$.

Figure S4.2

Effects of Perceived Positivity Resonance on Connection to the Community and Food Tracking for Current Connect Users (Study 4)



Note. The analyzed sample size is 699. Standardized coefficient estimates are reported. ***$p < .001$

Table S1.1

Descriptive Statistics and Correlation Matrix of Variables (Study 1)

Data source	Variable	*n*	*min-max*	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Self-report	1. PosRes with network	134	3.1-10.0	8.47	1.31															
	2. Compassionate goals	157	2.0-5.0	3.75	0.52	.46**														
	3. Positive empathy	156	1.6-5.0	3.96	0.69	.44**	.60**													
	4. Empathic concern	156	2.3-5.0	4.16	0.65	.31**	.44**	.51**												
	5. Perspective-taking	156	1.8-5.0	3.80	0.74	.27**	.42**	.45**	.58**											
	6. Positive affect	133	1.7-5.0	3.28	0.63	.23**	.31**	.39**	.17*	.32**										
	7. Sociability	150	0-10.0	4.33	2.85	-.01	.14	.10	.09	.00	.02									
	8. Closest friends	151	0-10.0	4.52	2.73	.06	.22**	.11	.09	.06	.12	.82**								
	9. Share bad news	148	0-9.0	4.28	2.76	.08	.16	.23**	.13	.06	.16	.67**	.61**							
	10. Share good news	154	0-10.0	4.90	2.91	.13	.16	.23**	.04	.02	.12	.59**	.57**	.62**						
	11. Help someone	149	0-12.0	5.03	2.98	.00	.15	.19*	.01	.15	.20*	.54**	.55**	.56**	.70**					
Other-report	12. Network's PosRes w/ interactant	80	5.8-10.0	8.63	0.91	.11	.35**	.31**	.18	.16	.06	.12	.05	-.05	.14	.02				
	13. Being nominated as close friend	151	0-9.0	2.27	1.75	.16	.05	.09	.00	.05	.23**	.07	.12	.15	.16	.20*	.02			
	14. Being shared bad news	148	0-10.0	2.20	1.84	.20*	.11	.13	.09	.08	.16	.20*	.26**	.25**	.28**	.30**	.05	.78**		
	15. Being shared good news	154	0-8.0	2.42	1.93	.21*	.12	.10	.06	.01	.13	.17*	.26**	.17*	.25**	.26**	.02	.81**	.78**	
	16. Being helped	149	0-12.0	2.47	2.09	.14	.11	.12	.09	.11	.09	.15	.23**	.29**	.32**	.25**	-.02	.61**	.70**	.68**

Note. Perceived PosRes with network = A participant's mean perceived episodic positivity resonance with their identified network, Network's PosRes w/ Interactant = Network's mean perceived positivity resonance with a specific interactant. Variables 7-11 represent the numbers of nominations individuals made for four categories (closest friend, share bad news, share good news, and helping), whereas Variables 13-16 represent the numbers of nominations individuals respectively received from others for the same four categories. * indicates $p < .05$. ** indicates $p < .01$.

Table S1.2

Model Fits of Multi-Group CFAs and SEMs for the Testing of H1 and H2 (Study 1)

Hypothesis	Invariance type	$\chi 2$	*df*	CFI	RMSEA	SRMR	Contrast	$\Delta\chi 2$	Δdf	*p*
H1: CFA - Empathy										
Model 1	Configural	0.36	2	1.00	0.00	0.01	-	-	-	-
Model 2	Metric	1.63	5	1.00	0.00	0.03	M1 vs. M2	1.27	3	ns
Model 3	Scalar	4.78	8	1.00	0.00	0.04	M2 vs. M3	6.26	3	ns
H2: CFA - Relational Network Size										
Model 1	Configural	12.05	4	0.98	0.16	0.02	-	-	-	-
Model 2	Metric	15.56	7	0.98	0.12	0.05	M1 vs. M2	3.50	3	ns
Model 3	Scalar	19.79	10	0.98	0.11	0.05	M2 vs. M3	4.23	3	ns
Hypothesis	Constraint type	$\chi 2$	df	CFI	RMSEA	SRMR	Contrast	$\Delta\chi 2$	Δdf	*p*
H1: SEM model										
Model 1	Freed regression paths	13.06	15	1.00	0.00	0.08	-	-	-	-
Model 2	Equality constraint	13.98	16	1.00	0.00	0.08	M1 vs. M2	0.92	1	ns
H2: SEM model										
Model 1	Freed regression paths	17.35	16	1.00	0.04	0.05	-	-	-	-
Model 2	Equality constraint	17.52	17	1.00	0.02	0.05	M1 vs. M2	0.17	1	ns

Note. CFI = comparative fit index, RMSEA = root mean square error of approximation, SRMR = standardized root mean square residual, *df* = degrees of freedom.

Table S2.1

Course Characteristics for the Analyzed Sample (Study 2)

Class	Group activity characteristics	Group selection process	T2 sample size: $n_{responder}$ (n_{group})	Group size	Mean T2 quantity of interaction (hours)
IDST195.005	Students did group wellness activities and a group final project together. Students earned the same grade for the group project.	Randomly assigned	30 (15)	4-6	1.52
PSYC210.001	Students worked as a group on analyses but did separate write-ups.	Student's selection of recitation time.	13 (8)	22	2.10
PSYC270.001	Students worked as a group on analyses but did separate write-ups.	Student's selection of recitation time.	20 (11)	20-21	1.66
NSCI175.001	Students worked as a group on a series of small group assignments but make separate submissions	Randomly assigned	19 (15)	4	0.43
NSCI175.002	Students worked in group during class discussion section but received separate participation grades	Randomly assigned	9 (7)	3-4	0.79
NSCI320	Students worked in groups on a final project and received the same grade for the group project	Randomly assigned	6 (5)	3-4	2.53
BUSI500H	Students worked in groups on a final project and received the same grade for the group project	Randomly assigned	9 (3)	4-6	2.39

Table S2.2

Descriptive Statistics and Correlation Matrix of Variables (Study 2)

Variable	*n*	*min-max*	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Group-level PosRes	105	0 - 10.0	6.35	2.64													
2. Individual-Based Mean PosRes	93	0 - 10.0	6.36	2.76	.64**												
3. Perceived Safety	105	3.4 - 7.0	5.83	.87	.41**	.25*											
4. Synchronous Interaction Quant. (hrs.)	103	0 - 6.0	.87	1.10	.13	.11	-.04										
5. Task Commitment	105	-2.8 - 1.5	.08	.83	.50**	.28**	.40**	-.03									
6. Interpersonal Attraction	105	1.0 - 9.0	4.17	1.85	.42**	.54**	.37**	-.09	.30**								
7. Group Performance	105	1.7 - 5.0	3.90	.82	.46**	.43**	.35**	-.13	.52**	.45**							
8. Positive Affect	106	0 - 4.0	2.46	.84	.23*	.19	-.05	.10	.05	-.01	.11						
9. Group Size	106	3 - 22	9.65	7.59	-.19*	-.06	.05	-.13	.02	.10	.07	.15					
10. Interest in Class	89	1.0 - 7.0	5.10	1.76	.27*	.16	.06	.28**	-.06	-.02	-.09	-.11	-.54**				
11. Interest in Group Work	89	1.0 - 7.0	3.40	1.24	.15	.11	.08	-.09	-.10	.11	.00	-.02	-.21*	.17			
12. Total Interaction Quantity (hrs.)	106	0.1 - 10.5	1.49	1.52	.16	.12	.07	.65**	.08	.15	-.04	.03	.18	.03	.00		
13. Number of prior friends/acquaintances	89	0 - 4.0	.52	.88	.03	.03	.01	-.07	.03	.21*	.07	-.08	.17	-.24*	-.16	.01	
14. Last semester GPA	83	1.5 - 4.0	3.45	.49	-.07	-.17	-.09	-.13	-.04	-.11	.07	.16	.02	-.04	-.02	-.18	.17

Note. Task Commitment was computed from the z-transformed scores of two separate scales; thus, the minimum and maximum values are relative. *M* and *SD* indicate mean and standard deviation, respectively. PosRes = Perceived Global Positivity Resonance. * indicates $p < .05$. ** indicates $p < .01$.

Table S2.3

Regression of Group-Level Perceived Positivity Resonance on Individual-Level Measures of Perceived Positivity Resonance (Study 2)

Model	Predictor of Group-Level Perceived PosRes	*b*	95% CI	*β*	*r*	Fit
M1	Mean Perceived PosRes	.78**	[.62, .94]	.72	.72**	R^2 = .52**
M2a	Highest Perceived PosRes	.67**	[.48, .86]	.61	.61**	R^2 = .37**
M2b	Lowest Perceived PosRes	.56**	[.40, .71]	.62	.62**	R^2 = .39**
M2c	Highest Perceived PosRes	.43**	[.22, .63]	.39	.61**	R^2 = .50**
	Lowest Perceived PosRes	.37**	[.21, .54]	.42	.62**	
M3	Mean Perceived PosRes	.74*	[.05, 1.43]	.69	.72**	
	Highest Perceived PosRes	.04	[-.38, .45]	.03	.61**	R^2 = .52*
	Lowest Perceived PosRes	.01	[-.36, .39]	.01	.62**	

Model	Fit Comparison
M2c vs. M2a	$F(1) = 20.59$***
M2c vs. M2b	$F(1) = 17.38$***
M3 vs. M1	$F(2) = .018$, ns
M3 vs. M2c	$F(1) = 4.56$*

Note. b represents unstandardized regression weights. *β* indicates the standardized regression weights. *r* represents the zero-order correlation. * indicates $p < .05$. ** indicates $p < .01$

Table S3.1

Descriptive Statistics and Correlation Matrix of Variables (Study 3)

Variable	*n*	*min-max*	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
1. Mean PosRes	404	3.3-10.0	7.41	1.57										
2. PosRes with weak ties	404	3.4-10.0	6.65	1.88	.92**									
3. PosRes with strong ties	403	3.3-10.0	8.15	1.59	.88**	.63**								
4. Incivility	405	1.0-5.0	1.38	0.49	-.29**	-.18**	-.36**							
5. Belonging (T1)	378	1.3-7.0	5.44	1.11	.42**	.34**	.42**	-.33**						
6. Belonging (T2)	330	1.4-7.0	5.48	1.09	.49**	.41**	.49**	-.30**	.81**					
7. Loneliness (T1)	385	1.0-3.6	1.99	0.61	-.37**	-.31**	-.37**	.28**	-.78**	-.67**				
8. Loneliness (T2)	329	1.0-3.6	1.96	0.58	-.43**	-.35**	-.43**	.32**	-.68**	-.80**	.77**			
9. Social Well-Being (T1)	383	1.0-6.0	3.49	1.02	.38**	.40**	.28**	-.09	.50**	.42**	-.44**	-.40**		
10. Social Well-Being (T2)	333	1.2-6.0	3.73	1.05	.49**	.48**	.39**	-.13*	.43**	.54**	-.41**	-.52**	.68**	
11. Positive Affect	405	1.2-5.0	3.51	0.65	.55**	.45**	.58**	-.22**	.48**	.59**	-.47**	-.52**	.43**	.48**

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. PosRes = Perceived Episodic Positivity Resonance. * indicates $p < .05$. ** indicates $p < .01$.

Table S3.2

Fits of Longitudinal Invariance Measurement Models for H2 (Study 3)

	Invariance type	$\chi 2$	*df*	CFI	RMSEA	SRMR	Contrast	$\Delta\chi 2$	Δdf	*p*
Model 1	Configural	0.44	5	1.00	0.00	0.00	-	-	-	-
Model 2	Metric	1.76	8	1.00	0.00	0.02	M1 vs. M2	1.32	3	ns
Model 3	Scalar	27.67	11	0.99	0.06	0.03	M2 vs. M3	25.91	3	< .001

Note. CFI = comparative fit index, RMSEA = root mean square error of approximation, SRMR = standardized root mean square residual, *df* = degrees of freedom.

Table S4.1

Descriptive Statistics for Current Connect Users and Nonusers (Study 4)

	Current Connect Users (n = 686)		Current Nonusers (n = 2,154)		
Variable name	*M*	*SD*	*M*	*SD*	*Statistics*
Community belongingness	5.31	1.50	4.18	1.58	$t(1042.1) = 16.36$, $p < .001$
Community positive evaluation	6.13	0.95	5.42	1.13	$t(1149.7) = 15.07$, $p < .001$
Community identification	4.02	1.46	3.51	1.37	$t(928.81) = 7.42$, $p < .001$
Food tracking	6.33	1.53	5.60	2.28	$p < .001$
Positive affect	4.14	0.76	4.05	0.83	$t(1058.8) = 2.35$, $p = .019$
General PosRes	8.16	1.73	7.78	1.98	$t(1007.5) = 4.33$, $p < .001$
Age	53.51	12.63	56.28	12.89	$t(900.8) = 4.37$, $p < .001$
Current weight	198.70	44.93	191.92	44.37	$t(1044.3) = 3.19$, $p < .01$
Membership length (days)	88.86	42.39	93.20	41.33	$t(1118.9) = 2.34$, $p = .020$
	Current Connect Users (n = 686)		Current Nonusers (n = 2,154)		
Gender-Female	96.66 %		91.27%		$\chi 2$ (1) = 16.49, $p < .001$
People of Colors	16.57%		12.68%		$\chi 2$ (1) = 4.927, $p = .026$

Note. M and *SD* indicate mean and standard deviation, respectively. PosRes = Perceived Positivity Resonance.

Table S4.2

Descriptive Statistics and Correlation Matrix of Variables (Study 4)

Variable	*n*	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13
1. PosRes on WW Connect	669	7.39	2.66													
2. Perceived Safety	556	5.51	1.09	.31**												
3. Mutual Response Speed	669	4.94	1.37	.38**	.24**											
4. Injunctive prosocial norms	644	4.58	1.31	.13**	.06	.29**										
5. Descriptive prosocial norms	657	5.47	2.18	.29**	.19**	.11**	.06									
6. Community belongingness	2730	4.43	1.63	.43**	.39**	.38**	.25**	.15**								
7. Community positive evaluation	2492	5.59	1.13	.36**	.35**	.32**	.12**	.21**	.60**							
8. Community identification	2481	3.63	1.41	.24**	.12**	.23**	.19**	-.02	.46**	.45**						
9. Food tracking	2840	5.78	2.15	.03	.08	.06	-.01	.11**	.20**	.19**	.09**					
10. Positive affect	2632	4.07	0.81	.15**	.24**	.11**	-.06	.10*	.21**	.21**	.03	.21**				
11. General PosRes	2361	7.87	1.93	.35**	.20**	.20**	.01	.04	.20**	.22**	.07**	.11**	.51**			
12. Age	2187	55.61	12.88	-.16**	-.10*	.02	-.05	-.22**	-.04*	-.07**	.07**	-.04	.12**	.11**		
13. Current weight (lbs.)	2300	193.69	44.61	.02	.03	.07	.07	.05	.05*	.01	.02	-.03	-.10**	-.09**	-.15**	
14. Membership length (days)	2819	92.15	41.62	.01	-.08	.03	.05	.03	-.05**	-.06**	-.04*	-.16**	-.06**	-.02	.02	-.06**

Note. n, *M*, and *SD* are used to represent sample size, mean, and standard deviation, respectively. PosRes = Perceived Global Positivity Resonance.
* indicates $p < .05$. ** indicates $p < .01$.

Table S4.3

Predictors of Perceived Global Positivity Resonance on the Connect Platform (Study 4)

Predictor	*b*	95% CI	*β*	*r*	Fit
General Positivity Resonance	.43**	[.31, .56]	0.29	.37**	
Perceived Safety	.50**	[.31, .69]	0.22	.32**	
Speed of mutual responding	.35**	[.20, .50]	0.19	.29**	
					R^2 = .237**
General Positivity Resonance	.43**	[.31, .55]	0.29	.37**	
Perceived Safety	.44**	[.25, .63]	0.19	.32**	
Speed of mutual responding	.34**	[.18, .50]	0.19	.29**	
Descriptive norms for social participation	.22**	[.12, .32]	0.17	.24**	
Injunctive norms for social participation	-0.01	[-.17, .14]	-0.01	.07	
					R^2 = .266**

Note. b represents unstandardized regression weights. *β* indicates the standardized regression weights. *r* represents the zero-order correlation. PosRes = Perceived Global Positivity Resonance. * indicates $p < .05$. ** indicates $p < .01$.

Table S4.4

Model Fits of Multi-Group CFAs and SEMs for H2 (Study 4)

Hypothesis	Invariance type	$\chi 2$	*df*	CFI	RMSEA	SRMR	Contrast	$\Delta\chi 2$	Δdf	*p*
H2: CFA of Connection to the Community										
Model 1	Configural	0.00	0	1.00	0.00	0.00	-	-	-	-
Model 2	Metric	3.62	2	1.00	0.02	0.02	M1 vs. M2	3.62	2	ns
Model 3	Scalar	16.59	4	0.99	0.05	0.03	M2 vs. M3	12.97	2	< .01
Hypothesis	Constraint type	$\chi 2$	*df*	CFI	RMSEA	SRMR	Contrast	$\Delta\chi 2$	Δdf	*p*
H2b: SEM										
Model 1	Freed regression path	12.88	6	0.99	0.03	0.02	-	-	-	-
Model 2	Equality constraint	21.87	7	0.99	0.04	0.03	M1 vs. M2	8.99	1	< .01

Note. CFI = comparative fit index, RMSEA = root mean square error of approximation, SRMR = standardized root mean square residual, *df* = degrees of freedom.

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