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Social Nutrition:

Understanding the interpersonal component of subjective well-being

by

Everett Wetchler

A dissertation submitted in partial satisfaction of the

requirements for the degree of

Doctor of Philosophy

in

Psychology

in the

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of the

University of California, Berkeley

Committee in charge:

Professor Dacher Keltner, Chair
Professor Oliver John
Professor Serena Chen

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Abstract

Social Nutrition: Understanding the interpersonal component of subjective well-being

by

Everett Wetchler

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University of California, Berkeley

Professor Dacher Keltner, Chair

As scientific research on human happiness has flourished over the past 40 years, so has the evidence for the supreme importance of social connection to its cultivation. Scientific measurement of this connectedness, however, has been relatively coarse and porous. The field lacks clarity in our definition of what it means to be socially "healthy," which aspects of social life are most crucial to well-being, and what interventions might improve it. In other words, we lack a comprehensive science of "social nutrition." This dissertation reviews approaches to the conceptualization and measurement of social health to date, identifies two key gaps impeding its development, and describes the results of three studies to address them.

The first gap is a lack of granularity. Research is limited on the differential consequences of interacting with various types of people (family vs. friend vs. strangers, etc.), over various media (in-person vs. video vs. phone, etc.), and in various quantities. To this lacuna I offer the results of two studies which find that only *in-person* contact with *close others* is reliably and positively related to well-being. Video chat and phone calls with close others are experienced positively in the moment, but do not relate to how subjects later evaluate their day. This suggests, but does not causally establish, that these may be something of a "simple sugar" in terms of social nutrients; one enjoys them, but they provide no enduring nourishment. Text messaging, and any contact with strangers, colleagues, and others, had no association with well-being at all.

The second obstacle to a full science of social nutrition is a lack of comprehensive theory. Each research direction to date has emerged from a hypothesized aspect of social need – interpersonal support, loneliness, and the like. This top-down approach begins with a construct in the researcher's mind and ends with a validated instrument for its measurement. These instruments that can be quite useful, but do not purport to encapsulate human social health in its entirety. To date, no approach has agnostically sought to identify, in a bottom-up fashion, all of the aspects of social life that might influence well-being. Without such a procedure, we can never be certain that our instruments capture the true breadth of what makes a person socially well. To this need, I develop a semi-structured interviewing procedure that aims to surface the attributes of social life that are of greatest cognitive weight in subjects' minds. Findings from such interviews may unearth previously unconceived constructs and hypotheses. I defend the design of this procedure, describe the results from an initial study, speak to its limitations, and articulate the path from here to a reliable and valid instrument for psychological research.

The ultimate aim of this body of work is to illuminate what it means for a human to be socially well, thereby unlocking doors to its improvement.

To two exemplary human beings:

Mary Kay and Stewart

Acknowledgements

To my parents: Mary Kay and Stewart

For your unflinching support, love, and wisdom through every quixotic turn in my life. My greatest luck was being born to not only two great parents, but two living examples of how to lead a moral and compassionate life. I've only come to appreciate and admire you more as I have grown.

To my little sister: Leah

For making me laugh, sending me piñata care packages and dinosaur birthday cards, curating only the finest memes for my consumption, and having an amazing dog.

To my older brother: Daniel

For challenging me, humbling me, sharing your endless enthusiasm, and also having an amazing dog.

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For your dedication, invaluable insights, and tolerance of my wild ideas. I cannot understate how much camaraderie, belonging, and joy I derived from our collaborations.

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And to my friends, my chosen family:
Ben, Anne, Andrew, Jenny, Simi, and others

For knowing me, seeing me, making me laugh, sitting with me in the darkest of times, and forever keeping me socially well.

Foreword for non-academics

Throughout, I attempt to write in ways that are accessible to people outside the narrow niche of academia that I operate in. If you can't follow my writing, that's my shortcoming. That said, certain parts are necessarily technical, particularly the Modeling components of Studies 1 and 2. Feel free to skip those, as you can glean the main message from the introduction and conclusion sections. Study 3 is a more full-throated description of my wider thinking and intentions from here, so it's worth a read.

If nothing else, read the Abstract and Introduction. They are brief, and orient you to the purpose of this entire line of research.

As always, I would love to hear your ideas.

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Introduction

What is happiness?

Among other endeavors, social psychology concerns itself with the articulation and measurement of subjective internal states, such as emotions, beliefs, and the sense that one's life is going well. This last sense is often called "happiness" in everyday conversation, but in psychology it is deliberately and more precisely termed "subjective well-being." The "subjective" qualifier is crucial, distinguishing itself from objective measures of well-being like disease, disability, wealth, and longevity. The core axiom of subjective well-being is that it is the individual herself who has the authority to declare herself well or unwell (Pavot & Diener, 2008). Or, in the words of Marcus Aurelius, "No man is happy who does not think himself so." This is an elegant solution to the challenge of defining happiness, well-being, or "the good life" – concepts debated since time immemorial, whose perspectives display dazzling variety by culture, time period, and secular/philosophical belief.

In psychological science, general consensus has emerged around three key dimensions of subjective well-being, interrelated but separable: frequent positive affect (feeling good moment-to-moment), infrequent negative affect (not feeling bad moment-to-moment), and life satisfaction (thinking highly of one's life when reflecting on it as a whole) (Diener, Suh, Lucas, & Smith, 1999). The first two (positive and negative affect) are often referred to as "hedonic" well-being, implying that one feels well within a specific moment. By contrast, life satisfaction is a form of "evaluative" well-being, which is how one feels when reflecting upon their life altogether. While the "best" instruments continue to be debated, and new instruments continually emerge, a number of stable and accepted measures exist. For example, the Satisfaction With Life Scale measures life satisfaction (Diener, Emmons, Larsen, & Griffin, 1985), and the Positive And Negative Affect Schedule measures the preponderance of positive and negative affective states (Clark & Tellegen, 1988).

A few more words are in order on the facet of "life satisfaction." On surveys that measure it, questions are roughly of the form, "Taking all things together, how satisfied are you with your life?" Note that the question gives no indication of *how* one should determine their satisfaction. This is an intentional design choice, and as decades of studies have borne out, it is an advantage, not a flaw (Diener, Suh, Lucas, & Smith, 1999). When asked such a question, the respondent can make their evaluation from the perspective dearest to them – be it cultural, spiritual, or otherwise. An adventure-seeking extrovert may think about how exciting and socially vibrant their life is; a driven professional may think about their career success and meaning in their work; and a devout Muslim may think about how well they have honored their articles of faith. In practice, people think about many such things in evaluating their life, but some aspects may loom larger for some than for others. Life satisfaction questions are agnostic to the respondent's framework of judgment - the questions simply prompt the individual to determine for herself how well she believes her life is going. This allows such questions to be applied across diverse cultures, groups, and individuals who may have widely varying philosophies of life.

The preponderance of good and bad moments (the other two facets of subjective well-being) are intuitively sensible measures, and are not mere mirrors of one another. An individual can have frequent positive but infrequent negative emotions, or they can have frequent positive *and* frequent negative emotions, or any other combination. They do correlate negatively, in that more frequent positive emotion is generally associated with less frequent negative emotion, but they do not correlate perfectly. Further, research shows that positive affect, negative affect, and life

satisfaction correlate somewhat differently with attributes of life and personality. For example, the personality trait of Extraversion is associated with greater positive affect, but unrelated to negative affect, while Neuroticism is associated with greater negative affect, but is unrelated to positive feelings (Keltner & Shiota, 2021). Hence, life satisfaction, positive affect, and negative affect come together to form a holistic picture of the "happiness" of one's life.

What is "social nutrition"?

Measurement of "happiness" is only the beginning, as the utility of subjective well-being research depends on the determination of its correlates, causes, and consequences. To intervene, we must know what might cause greater and lesser happiness, or for what kinds of people happiness seems more prevalent. One of the most scientifically established contributors to subjective well-being, and agreeable to lay theories of happiness, is having fulfilling social relationships.

Decades of scientific study make clear that happy people and happy relationships go hand in hand. Both subjective well-being and physical health are associated with innumerable indicators of interpersonal prosperity: social support (Sarason & Sarason, 2013); companionship (Rook, 1987); a sense of belonging (Baumeister & Leary, 1995; Lambert et al., 2013); secure attachments (Ainsworth & Bowlby, 1991; Kafetsios & Sideridis, 2006); and a lack of loneliness (Cacioppo & Patrick, 2008; Vanderweele, Hawkley, & Cacioppo, 2012). In a 2005 review, Lyubomirsky and colleagues synthesized some 225 papers that spoke to any association between well-being and "success," widely construed, including social success (Lyubomirsky, King, & Diener, 2005). They evaluated 40 years of cross-sectional, longitudinal, and experimental research, finding robust convergent evidence for the association between well-being and a range of measures of social connection. Namely, they found that well-being covaries with marital status and satisfaction, number of friends and friendship satisfaction, loneliness, general desire to socialize, frequency of socializing, and extraversion. Their meta-analytic estimates of median effect size, from longitudinal and experimental evidence, found "social relationships" and "sociability and activity" to have the strongest associations with well-being of all the factors examined. In short, the quality of our social life matters for our well-being.

The robustness of these high level findings begs more specific questions, several of which are the focus of this dissertation.

Problem 1: Granularity

We begin with the intuitive sense that social contact with (say) a friend "feels" different from contact with a sibling or a colleague (for a related theoretical view, see Clark & Mills, 1979; Fiske, 1992). This lends itself to a hypothesis that different *kinds* of relationships may offer different provisions for, and effects on, our well-being.

Second, even if socializing is clearly beneficial on the whole, its benefits are unlikely to be a simple multiple of one's quantity of social encounters. For example, dinner with a friend may be less beneficial on a day when one has already visited many friends. More technically, there may be a nonlinear response to varying *doses* of social contact (that reflect, for example, adaptation or habituation processes). Baumeister and Leary speak to this in their theory of belonging, noting, "the belongingness hypothesis entails that people should strive to achieve a certain minimum quantity and quality of social contacts but that once this level is surpassed, the motivation should diminish" (Baumeister and Leary, 1995).

Third, the modern era offers a kaleidoscope of means of social contact beyond meeting in-person. It seems likely that the richness and texture of social contact varies across *media*, with face-to-face contact having effects that differ from (say) a video call or text messaging conversation.

All of these questions are oriented toward more precise claims about the relationship between social behavior and well-being.

Finally, just as not all social contact is identical, neither are the individuals who engage in it. This raises a critical question: how do individuals *differ* in their social needs? We focus on differences by personality, gender, race, and social class..

In the most general sense, these inquiries raise the broader question that animates the title of this dissertation: what makes for healthy "social nutrition"? Like culinary nutrition, perhaps people need a range of interpersonal nutrients that combine to form a socially healthy life, needs that vary by individual but with many commonalities across geographies, life stages, and cultures. What these nutrients are, and how much people need, is largely an open question. Studies 1 and 2 focus on the four aspects of social nutrition outlined above: dose, kind, medium, and individual differences.

Problem 2: Comprehensiveness

Even with the examinations of Studies 1 and 2, an even more fundamental question looms over the field: what does it even mean to be doing "well," socially? Over the decades, researchers have examined pieces of the puzzle with constructs like loneliness, belonging, and interpersonal support.

Loneliness, for example, asks subjects how much they agree with statements like, "I have nobody to turn to" (Russell, 1996). Measures of loneliness are very predictive of both subjective well-being and physical health (Cacioppo and Patrick, 2008), but the broad nature of the items does not readily allow for the development of targeted interventions. If one "has nobody to turn to," it is unclear who they need, for what, or how to go about forging such a relationship.

"Interpersonal support" adds to the picture, asking whether the subject has someone who could assist them financially, someone who would join them for a meal on short notice, someone they can approach for advice, and so forth (Merz, Roesch, Malcarne, Penedo, Llabre, Weitzman, Navas-Nacher, Perreira, Gonzalez, Ponguta, Johnson, and Gallo, 2014). These measures are predictive, but are they exhaustive? What key attributes of a healthy social life are not yet measured?

To date, social psychology has no definitive answer, and Studies 1 and 2 cannot address this question in full. Later in this dissertation, I describe inroads made by a novel interviewing procedure in Study 3, and lay out the path from here to a full theory of social nutrition.

Studies 1 and 2 - Social behavior and well-being in university students

Introduction - Studies 1 and 2

Studies 1 and 2 focus on the problem of granularity outlined above, adding nuance to our understanding of what kinds of social behavior relate to well-being, how strongly, and for whom. Our results: 1) replicate past studies in finding a consistent and robust positive association between social contact and well-being broadly; 2) find that only time with *family, friends, partners,* and *organized groups* (not strangers, acquaintances, or colleagues) predicts greater well-being; 3) find that *in-person* time, *video conversations*, and *phone calls* (but not text messaging) are all more enjoyable than being alone, but 4) only *in-person* time is related to how positively one recalls their day later on; 5) do *not* find evidence for diminishing returns to social contact, and 6) do *not* find evidence that the relationship between social contact and well-being differs by any personality trait, race, gender, or social class.

Our approach is divided into two complementary studies, each using different means to track social behavior and well-being of a group of individuals across 5 consecutive days. Study 1, completed in Fall 2021, follows 151 university students using a "daily diary" procedure (Kahneman et al., 2004). Each morning, participants complete a guided survey that aims to comprehensively recount all of the activities, emotions, and social behavior of the day before. This comprehensiveness is its key advantage, while the key weakness is the inherent delay between a day's events and when subjects report on them the following morning (for an investigation into this bias, see Parkinson, Briner, Reynolds, & Totterdell, 1995). Study 2, completed in Fall 2023 and Spring 2024, follows 363 university students using an "experience sampling" procedure. This simply means that participants received five brief surveys via text message at random throughout their day, to be completed immediately. The key advantage is temporal validity – by reporting on what one was just doing a moment ago, the details and emotions reported will be highly accurate. The key disadvantage is a lack of comprehensiveness, as we only receive information about a few distinct moments of their day.

Both approaches have the advantage of repeatedly measuring the same subjects over an extended time period, allowing a fuller picture of their lives and emotions. By using different tracking methods in each study, each with relative strengths and weaknesses, any findings supported by both approaches are inherently more robust. Where results diverge, our conclusions can grow more nuanced, and we gain new insight into the limitations of the methods themselves. This is valuable in its own right, as both approaches are used widely in psychological research. By conducting the same study with two methods, we can offer new perspectives to the many scientists who employ these strategies..

Studies 1 and 2 focuses on: dose, kind, medium, and individual differences. Before explicating our study methods and results, I expand on these four terms, reviewing select studies from the literature that speak to these topics. Noting where evidence is strong and where ambiguity remains, I highlight how Studies 1 and 2 were designed to address these gaps.

Conceptual Background - Studies 1 and 2

Dose

While spending time with others is widely known to increase well-being, it remains unclear if these benefits diminish when one has already been quite social recently. On a plot of "time spent with others" versus "well-being benefits," the relationship may not be a line, but a curve that flattens out or tails downward. Although many studies test for linear relationships between social contact and well-being (see below), relatively few include any examination of quadratic or other curvilinear forms. These are important in light of the literature on hedonic adaptation and well-being, namely that events that increase well-being often lose their potency with repeated occurrence (Luhmann & Intelisano, 2018). Known as "diminishing marginal utility" in economics, it describes the phenomenon whereby, for example, eating a third or fourth dessert is not as satisfying as the first. In the present investigation, we seek to know if such diminishing returns exist to social contact.

The most comprehensive consideration of the linearity of the relationship between social contact and well-being comes from work by Ren and colleagues (Ren, Stavrova, & Loh, 2022). This investigation, involving six studies spanning methodologies from diary studies to experimental interventions, yielded convergent evidence for the thesis of diminishing returns to social contact: the more contact one has had recently, the less additional contact is beneficial. As one could further imagine social contact becoming detrimental when one has socialized too much, they explored, but did not find support for, negative effects at very high levels of social contact (that is, no "inverted U shape"). Select other studies likewise find a similar pattern of diminishing returns of social contact

(e.g., Kushlev, Heintzelman, Oishi, & Diener, 2018), but the evidence relevant to the question of dose is limited.

Complicating matters, in most studies of dose effects of social contact, including those by Ren and colleagues, measures of social contact are quite coarse, if face-valid. A typical approach might ask participants "how often they meet socially with friends, relatives, or work colleagues" (Study 2 of Ren et al., 2022). These kinds of global self-report measures do demonstrate some validity in predicting individual well-being in a linear fashion, but their nonspecific, retrospective nature raises concerns of accuracy and completeness. Additional approaches are required, using methods that capture more specific details of social contact (e.g., with whom, in what context) more thoroughly.

To arrive at a more precise understanding of the relationship between the quantity of social contact and well-being, methods would be well served by capturing participants' actual social behavior within specific contexts, over some period of time. Further, empirical approaches should make the recording of behavior as accurate as possible, for example by only asking about very recent events. One approach to balancing the competing demands of temporal validity and completeness is to ask participants to recall events only from the current (or preceding) calendar day. At its simplest, participants can report how many hours (or how many times) they were social on the day in question, and indeed this is the approach Ren and colleagues took in their 4th study. This aimed for completeness, but respondents' cognition was unknown; it was unclear exactly how participants went about answering such questions. They may have approached the question in a systematic way, replaying their day and tallying hours, or they may simply have produced a quick intuitive estimate without expending cognitive effort. Hence, the accuracy and meaning of their responses are uncertain.

One improvement is to *guide* people to recall the details of their day through a structured questionnaire, as Kahneman and colleagues did in developing the Day Reconstruction Method (Kahneman et al., 2004). In this methodology, participants are instructed to mentally break their previous day down into major "episodes," like scenes in a play, by using a structured sheet of scrap paper. After dividing their day into episodes on a private sheet, the survey asks a fixed set of questions about each episode – namely, its duration, what activities the participant was engaged in, with whom, and how the participant felt. While this method is not without limitations, evidence suggests that it is valid, at minimum, as a measure of a day in aggregate (Lucas, Wallsworth, Anusic, & Donnellan, 2019). With the Day Reconstruction Method, one can gather measures of the frequency and duration of social contact for an entire day, measures that are sufficiently reliable to examine curvature in its relation to well-being. This is the procedure we employed in Study 1.

As noted earlier, this type of approach is limited by participants' ability to recall the events of the previous day with fidelity. The guided nature of the survey improves this recall, but it is not as valid as reporting in the very moments that the events are occurring. To address this, an alternative approach is the "experience sampling method" (ESM), also known as ecological momentary assessment (EMA). The concept is simple - interrupt participants at several random times throughout their day to report on what they are doing and how they are feeling right then. A typical experience sampling study involves sending text messages at random intervals, each with a short set of questions about their current state. This provides strong validity, as subjects are asked about their experience while in the moment itself (or shortly thereafter). It avoids the biases in recall of diary studies, where participants look back on the events of the day from a single time point, many hours later. Experience sampling is the approach followed in Study 2.

There are drawbacks to ESM, however, as participants are not reporting on every part of every day - only the moments when they were prompted. This is a tradeoff between accuracy and comprehensiveness, hence the dual-method approach here: one diary study, one experience sampling

study. These two approaches flank a single problem from complementary angles, leading to greater confidence in the conclusions reached. Divergences spur nuance in our interpretations, and enable learning about the assumptions and limitations of each approach.

Kind

The question of the relative effects of spending time with different types of people (friend, family, colleagues, and so on) is an old one, but modern methods are beginning to shed new light (e.g., Clark, Armentano, Boothby, & Hirsch, 2017). The topic is approached quite directly in a study by Hudson and colleagues (Hudson, Lucas, & Donnellan, 2020), who refer to the literature's findings on the subject to date as "mixed and somewhat inconclusive." With some degree of consistency, there was a tendency for previous work (e.g., Kahneman et al., 2004) to find that time with friends shows stronger associations with well-being than time with family, partners, and others. In a more focused fashion, Hudson and colleagues gathered data with the Day Reconstruction Method from a community sample with repeated measures spread out over several months: participants completed one DRM on three different days, each about one month apart. With some complexities, the authors find that, after controlling for the activities engaged in (e.g., eating together, exercising), participants reported equivalently elevated hedonic (in-the-moment) well-being while in the company of friends, partners, and children. Global evaluative well-being (life satisfaction - Diener, Emmons, Larsen, & Griffin, 1985), however, was only found to be associated with the total amount of time participants spent with romantic partners.

Data in the Hudson study, and others like it, were derived from retrospective self-reports, albeit guided ones. Experience sampling methods can buttress these data with immediate assessments. In a 2019 study by Quoidbach and colleagues, data from some 30,000 users of a French mobile app were examined (Quoidbach, Taquet, Desseilles, de Montjoye, & Gross, 2019). Through the app, participants were surveyed at random moments throughout the day, inquiring about their immediately recent behavior, who they were with, and their experience of a number of emotions. Because it was an observational study of app users, not an app designed for specific research questions, it has limitations. Users had no incentive to participate more than they felt willing, and thus the amount of data collected varied considerably across users: most have only a few observations, a few have hundreds. Nevertheless, the total data volume is impressive, with hundreds of thousands of surveys recorded. In their examination, the authors found that participants reported improved well-being after spending time in the company of partners, friends, and family (but not others). Results were strongest for friends, though this analysis did not control for the activities people engaged in. This study also did not assess individual differences, as demographics and trait data were simply not collected. This leaves open the possibility that the obtained results are complicated by unobserved variables that affect the propensity to connect with others and feel more satisfied with life.

Still other studies with other methodologies raise intriguing possibilities about the well-being benefits of contact with strangers. Experimental evidence demonstrates positive well-being effects of engaging in small talk and other short, cheerful interactions with strangers (Epley & Schroeder, 2014; Van Lange & Columbus, 2021). However, these were studies where subjects were explicitly instructed to engage in contact with others, which is perhaps different from the spontaneous contact of quotidian life. Further, these results remain to be reconciled with the findings from the studies discussed above, which generally fail to find associations between social contact with strangers and evaluations of well-being.

We offer a focused test of this issue in Studies 1 and 2. Guided by the concerns above, our investigation uses multiple methodologies that each track individuals over time, but also measure global traits at intake (e.g., demographics, personality, well-being). One advantage of this approach is

that we can answer both between-person questions (e.g., "Do people with higher global well-being tend to systematically choose different kinds of company?") as well as within-person questions (e.g., "Is a person likely to report higher well-being on days where they socialize more than usual?").

Medium

Of central importance today is the question of social contact mediated by technology. The means of initiating, enjoying, and maintaining relationships have exploded in step with the ever-accelerating technological boom of the past few decades. The key conduit for new contact media is the internet, often delivered over cell phone networks to ever-more-capable devices in ever-more-individuals' pockets. This phenomenon is not limited to the West: 55% of the global population are now mobile internet users, with figures growing rapidly — especially in low- and middle-income countries (GSM Association, 2022). In the culture where our studies were conducted, the United States, some 96% of young adults own smartphones (Pew Research Center, 2021), and nearly half of teens report being online "almost constantly" (Pew Research Center, 2022). To speak nothing of the laptop or desktop computer, the smartphone alone enables not only the humble phone call, but also live video conversation, asynchronous text and other direct messaging (which can include images, videos, etc), and the innumerable bespoke interfaces of applications like Snapchat, TikTok, and Instagram.

The effect of social media use on well-being in adolescent populations has received considerable attention (e.g., Lin et al., 2016; Panova & Lleras, 2016; Twenge et al, 2022). However, much less work exists on other digital communication like video chat, text message, and phone calls. The sparse studies that do exist (Gonzales, 2014; Shen et al., 2017) indicate, if nothing else, the complexity of the topic, but also the possibility of beneficial use of these media among the young.

The consequences of digital communication for older populations has also received significant consideration (Chopik, 2016; Sims, Reed, & Carr, 2017). A hypothesis that ties many such studies together is that these technologies may empower connections in those who might readily become isolated or have limited social options. Supporting this hypothesis are findings that show the efficacy of video-chat-based psychotherapy for depression (e.g., Andrews et al., 2018). A publication by Macdonald and colleagues reviews some of this work, and generally finds digital social contact to have positive effects for older adults (Macdonald & Hülür, 2021). The authors also introduce their own study, in which 115 older Swiss adults tracked "any daily spoken interactions that lasted longer than 5 min and any text-based conversations," completing a survey as soon as each interaction happened, for 21 days. They were given an iPhone with an app for completing the questionnaire after each interaction, as well as an end-of-day questionnaire about feelings of positive emotions, negative emotions, and loneliness. The study authors found positive associations for *face-to-face* interactions and nearly all well-being measures, both between persons and within persons. That is, people who reported more face-to-face interaction across the course of the study tended to report higher well-being than people who had less face-to-face contact during the study, and a given individual tended to report higher well-being on days they engaged in more face-to-face contact than they usually did. However, telephone and digital interactions were almost entirely unrelated to any well-being measure.

Hence, the question of medium of social contact and well-being is far from settled for any demographic group. Building upon these preliminary findings, in Studies 1 and 2 we examined the relative association of in-person and digitally-mediated social contact with well-being.

Individual Differences

It is well-established that individual differences in personality are associated with well-being, with Extraversion and Neuroticism being positively and negatively associated with it, respectively

(Costa & McCrae, 1980; Keltner & Shiota, 2021; Diener et al, 1992). Thus, in exploring any relationship between social contact and well-being, it is important to not only control such trait confounds in examining the main effects, but also to explore interactions. For example, do extraverts and introverts differ in the intensity of their response to social contact? In other words, are there traits that *moderate* the effects of social contact on well-being?

In one illustrative study, Sun, Harris, and Vazire (2020) used surreptitious audio recording (small audio samples as participants go about their day) to objectively quantify social behavior. Naturally, the study found that extraverts were more likely to socialize, and that more socializing was related to higher well-being, but the latter had no interaction with the former. That is, while extraverts socialized more, introverts seemed to benefit similarly when they did interact with others. Overall, the study concludes, "the quantity of social interaction was similarly related to well-being for introverts and extraverts, at both the within- and between-person levels."

With respect to demographics, the study by Hudson and colleagues examined moderation by age, income, marital status, and gender, finding that, "demographic characteristics moderated our findings in inconsistent ways that may or may not be meaningful" (Hudson et al., 2020). In other words, it is still unclear how various identity groups differ in their reaction to social contact. Given the known associations between income, education, and social class with well-being (Killingsworth, 2021; Oishi & Kesebir, 2015), in the present study we examined whether one's optimal "social diet" differs by demographics and personal traits.

Approach - Study 1

Guided by the aforementioned issues, in Studies 1 and 2 we asked whether the dose, kind, and medium moderate the influences of social contact upon well-being. We also examined the critical issue of individual differences.

In Study 1, building upon work by Kahneman, Lucas, and others reviewed above, we tracked participants' social contact and well-being over five consecutive days with a daily "day reconstruction" diary. In Kahneman's original Day Reconstruction Method study, participants completed only a single day's survey. In our study, by tracking individuals for multiple consecutive days, we enable within-person analysis by comparing an individual's days across the study period. Further, by gathering five days' worth of diary data, we nearly encapsulated a one-week cycle of participants' lives, aligning with natural rhythms of life behavior and activities. Because participants were enrolled on a rolling basis, they varied in the day of the week they begin the experiment, hence in total we have ample data for weekdays and weekends. Lastly, with repeated measures we can examine carry-over effects: specifically, if the amount of social contact on day i predicts well-being on day $i+1$. Or, if social contact during episode j of day i predicts well-being during episode $j+1$ (of day i). This is not possible in spaced longitudinal studies where responses are separated by many days or years.

The survey procedure aimed to capture a rich and multifaceted picture of a person's social contact each day. Importantly, we recorded details about the nature of the relationship between the subject and the people with whom they socialize. Guided by recent advances in the study of emotions and social relationships (Keltner, Sauter, Tracy, Wetchler, & Cowen, 2022), we took care to record the contact medium (video, in-person, etc.), activities performed, and present emotions in each episode of each day.

To examine individual differences, and to control for confounders, participants completed extensive measures at intake. Demographics were included as control variables in statistical models (see below) and were explored as moderators. Traits like personality and interpersonal support were examined for both predictive power and moderating effects. Finally, given the well-established

relationship between global well-being and socializing (Lyubomirsky et al., 2005), we controlled for the individual's trait well-being, measured the day before a participant's study period began. In addition to controlling for confounders, these measures enable the comparison of various identity groups and traits in terms of their response to different types of contact.

Procedure - Study 1

Overview

Study 1 spanned seven days in total and was conducted on a diverse group of university students for psychology course credit. Students completed an intake survey (day 1) with demographic and trait measures. For each of the next five days (days 2-6), they completed a "daily diary" survey upon waking (using the Day Reconstruction Method), which asked about experiences and emotions of the *previous* day. On the final day (day 7), they completed an exit survey which repeated some of the trait measures from intake (life satisfaction, loneliness, etc) and offered space for free-response feedback. On all surveys, wherever possible, measures were ordered to minimize item-order effects (e.g., asking demographic questions last to avoid activating self-concepts that might bias subsequent responses). Figure 1 below describes the study experience visually, with full written details to follow.

Figure 1: Study 1 procedure overview
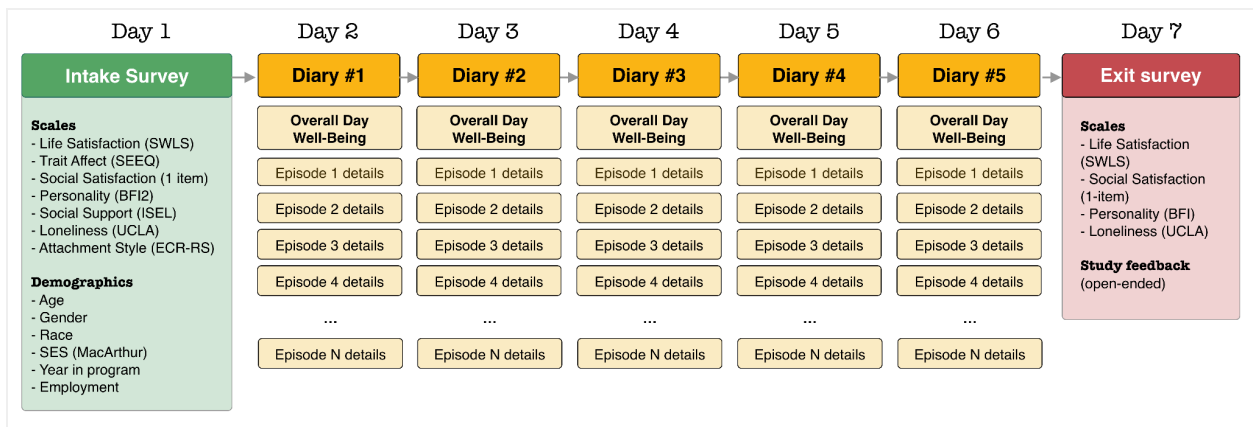
Recruitment

Undergraduate students were recruited from a major public university in the United States in exchange for course credit. At the start of the Fall 2021 semester, our study information was posted to the general board from which students could find and register for studies. With relation to the COVID-19 pandemic, at this time the university was fully "open," but with a mask mandate indoors, and nearly all classes were conducted in-person.

Intake Survey

Following online registration, and giving informed consent, students completed the intake survey. First, to measure aspects of global well-being, we administered the 5-item Satisfaction With Life Scale (Diener, Emmons, Larsen, & Griffin, 1985), tapping evaluative satisfaction with one's life on the whole. Then subjects completed a survey of their general preponderance of positive and negative emotion (9 items each) from the Specific Emotion Experience Questionnaire (Ocampo 2022).

To measure personality traits as potential moderators, we used the 15-item version of the Big Five Inventory-2 (BFI-2XS, Soto & John, 2017). To measure domain satisfaction with social life, we asked a single item: "How satisfied are you with the social relationships in your life, overall?" (Likert scale, 7-point).[1] To establish discriminant validity, we also measured loneliness with the 8-item short form of the UCLA Loneliness Scale (Russell, 1996), social support with the 12-item short form of the Interpersonal Support Evaluation List (Merz et al., 2014), the presence of a romantic partnership (1 item, yes/no), and attachment style via the 9-item Experience in Close Relationships Scale (Payne et al., 2012).

Finally, demographic information was collected: socioeconomic status rated from 1 to 10 (MacArthur Ladder; Adler, Stewart, & others, 2007), gender (male, female, non-binary), employment (unemployed, employed part time, employed full time), year in their degree program, and age. Race was also collected, collapsed for analysis into Asian, White, Hispanic, others, with "Asian" being the most common racial group. See the Final Sample section for sample size by race and other traits.

Daily Diaries

For five mornings following completion of the intake survey, students received an email at 5am with a link to complete their daily diary, having been instructed to look for the email and complete the survey "soon after waking." These surveys asked about the previous day, following the Day Reconstruction Method as closely as possible (Kahneman et al., 2004).

Upon opening the survey each morning, students were asked to reflect on the day before, beginning with a single item: "On the whole, how did you feel yesterday?" They were presented with a slider from 0-100, with text indicating that lower numbers were "worse," higher numbers "better." Next, they were asked for the time at which they awoke and went to sleep on the target day, then given instructions for completing the diary. They were told to take out a sheet of scrap paper and prepare it in a specific fashion (for convenience, they were offered a pre-prepared PDF to print, or a link to a prepared google spreadsheet that they could copy). They were informed that this sheet was private to them, and after completion we would ask questions about it. They were instructed to reflect on the previous day as "a series of scenes or episodes in a film" with some suggestions on natural ways to break up the day into episodes. Typically students reported about 7 episodes per day (mean = 7.2). Still on their private sheet of paper, for each episode, they were instructed to write its start and end time, plus a few words about what they were doing and how they felt. When all episodes were noted in this fashion, they proceeded with the survey.

For each episode in their day, the survey collected: the start and end time, how they felt overall during the episode (0-100, as before), what activities they were engaged in (a list of 16 checkboxes[2]), and if they were interacting with other people during most of the episode (yes/no). If so, participants were asked what type of relationship(s) they had with their company, e.g., "parent" or "coworker." Relationships were presented as a list of 11 checkboxes[3], and were generally collapsed into four groups for analysis (family, friend, romantic partner, and others). Participants were asked through which medium they were interacting (single choice of: in-person, video chat, phone, text messaging). Finally, they were asked which emotions they felt during the episode, such as joy, anger,

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[1] This is not a validated item from any scale, but rather a quick face-valid measure of social satisfaction for exploratory purposes. The full text of the item was: "How satisfied are you with the social relationships in your life, overall? (Consider all together your friends, family, coworkers, and any other people/groups who you are social with)"

[2] Participants could select one or more of: Caring for *your* children, Chores / cleaning / errands, Cooking / preparing food, Eating, Exercising / hiking / playing sports, Hobbies, In class / watching lecture or presentation, In transit (walking, driving, commuting, etc), Napping / resting, Passive leisure (watching tv/movie, scrolling social media, etc), Playing (non-athletic) games, Romantic or sexual contact (kissing, sex, masturbation, etc), Socializing, Something else (specify), Studying, Working (not studying)

[3] Participants could select one or more of: Friend, Romantic partner, Acquaintance, Stranger, Parent, Sibling, Your child, Other family, Coworker, Work client / customers, Other people not listed

and pride. A list of 18 checkboxes was presented[4], and respondents could select one, more, or none. Emotions were collected in the original 2004 DRM study (Kahneman, Krueger, Schwarz, et al., 2004), but in our case, we used a more contemporary, empirically driven list of emotions that better cover the high dimensional space of emotions (e.g., Cowen & Keltner, 2021). That is, we asked about high-arousal (high energy) positive emotions like joy, low-arousal positive emotions like peace, high-arousal negative emotions like anger, and low-arousal negative emotions like boredom. This is the same list of emotions for which we gathered trait measures at intake (how often they felt such emotions in general). To reduce participant burden, we provided only checkboxes (not an intensity scale) to simply indicate if they did or did not feel the emotion during the episode.

Exit Survey

On the day following the final diary entry, participants were emailed a link to an exit survey that repeated some of the assessments from intake (life satisfaction, affect, social satisfaction, personality, and loneliness) as well as free-response feedback items reflecting on their experience. These free response items were important, probing to see if participants' experience of the study was roughly as intended, what data we might want to interpret with caution, and searching for ways we might sharpen the procedure in future iterations. These responses proved insightful, inspiring several small alterations employed in Study 2.

Data preparation

Data filtering

156 students registered for the study, gave consent, completed the intake survey, and completed at least one diary. This yielded 668 total diary entries spanning 4840 "episodes" (distinct parts of a day). Because our analysis depends on both between- and within-person comparisons, we dropped students with fewer than two diary entries. This left 151 users and 664 diary entries, spanning a total of 4808 episodes. We re-ran analyses with several alternative filtering criteria, and the conclusions did not meaningfully change.

Final Sample

We proceeded with data from 151 students spanning 664 diaries (mean = 4.4 per participant) and 4808 "episodes" (mean = 31.8 per participant, mean = 7.2 per diary). Demographics were as follows. Race: 54% Asian (N=82), 17% White (N=26), 18% Latinx (N=27), and 11% others (N=16). Gender: 72% female (N=108), 27% male (N=41), and 1% non-binary (N=2). Employment: 60% unemployed (N=90), 26% part-time (N=40), 15% full-time (N=21). Partnership: 30% reported having a romantic partner (N=46), while 70% did not (N=105). Year in degree program: 38% were first-year (freshman) students (N=57), while the remaining 62% (N=94) were dispersed roughly evenly among other years. Age: 85% (N=128) were aged 18-21, while the remaining (N=23) were older (overall mean 20.0, median 19.0, range 18-35). Socioeconomic status was measured with the MacArthur ladder on a 0-10 scale. Because subjects were university students, the question was framed with themselves and families in mind, asking participants to "think about [themself] and [their] immediate family" in terms of status, money, and education (ladder mean 6.2, median 7.0, standard deviation 1.8; Adler et al., 2007).

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[4] Participants could select zero, one, or many of the following emotions: Afraid, Amused, Angry, Anxious, Ashamed, Awe, Confused, Contented, Disgusted, Embarrassed, Grateful, Interested, Joyful, Love, Pain, Proud, Sadness, Triumphant

Normalization

All psychological scales (personality, trait well-being, etc) were z-scored before analysis. That is, a value of 0 indicates that the individual was exactly at the sample mean for the scale in question, while a value of 1.0 indicates that the individual was 1 standard deviation above the sample mean, and so forth.

Modeling approach

We explore two primary questions. First, what makes for a good moment (episode) of a day? And second, what makes for a good day overall? Recall that, in completing each day's diary, participants first evaluate their day as a whole, then are asked for details of the many episodes of their day. Each person completes multiple diaries in the course of the study, and each diary entry describes multiple episodes over the course of the day. Hence, the data have a doubly-nested structure, with episodes nested within diary days, and diaries nested within person.

We use linear mixed effects models (also known as "multilevel models" or "hierarchical linear models") to mathematically account for the fact that two diary entries by the same participant are not fully independent, and further that two episodes by the same person on the same day are less independent than two episodes by the same person on different days. Analyses are conducted at two different levels: the episode level, and the person-day (diary entry) level.

Episodes

We primarily focus on the episode level, as this allows comparability with Study 2 (described later), and further makes for more natural comparison to previous Day Reconstruction Method studies discussed earlier, where typically only a single day was measured. Our data here have one row per episode.

In addressing the first question, "What makes for a good moment (episode)," we model episodic well-being with a random intercept by person and by person-day. See Equation 1 below:

Equation 1: Study 1, episodes model

$$y_{ijk} = \beta_0 + x_{1ijk}\beta_1 + x_{2ijk}\beta_2 + \ldots + \zeta_i + \upsilon_{ij} + \epsilon_{ijk}$$

Where $\zeta_i \sim N(0, \sigma^2_\zeta)$; $\upsilon_{ij} \sim N(0, \sigma^2_\upsilon)$; $\epsilon_{ijk} \sim N(0, \sigma^2_\epsilon)$

- y_{ijk} is the reported well-being of person i on day j during episode k
- β_0 is the global intercept.
- x_{1ijk} x_{2ijk} ... are the values of fixed effect variables for person i on day j during episode k
  - These could be attributes of the episode (e.g., whether or not one is socializing), the day (e.g., the day of week) or the individual (e.g., age).
- β_1 β_2 ... are coefficients for these fixed effects.
- ζ_i is the random effect for individual i
- υ_{ij} is the random effect for individual i on day j
- ϵ_{ijk} is the error term (random effect person i on day j during episode k)

Days

        We turn to the second question, "what makes for a good day," in part to corroborate any findings from the study of episodes above, and in part to examine between- and within-person differences.

        We aggregate our data such that we have one row per person-day. The key dependent variable is the participant's response to the first question of the diary, rating how they felt about their day overall, on a slider from 0 to 100. Because a participant's day contains many episodes, we aggregate them, taking into account that episodes differ in duration. In other words, the row for person 1 on day 1 has columns like "total time spent interacting with friends" or "total time spent studying." As the data is now only singly-nested, with days nested within persons, the model includes only a random intercept by person. See Equation 2 below:

Equation 2: Study 1, person-day model

$$y_{ij} = \beta_0 + x_{1ij}\beta_1 + x_{2ij}\beta_2 + \; ... \; + \upsilon_i + \epsilon_{ij}$$

Where $\upsilon_i \sim N(0, \sigma^2_\upsilon); \epsilon_{ij} \sim N(0, \sigma^2_\epsilon)$

- y_{ij} is the reported "day overall" well-being of person i on day j
- β_0 is the global intercept
- $x_{1ij} \; x_{2ij}$ ... are the values of fixed effect variables for person i on day j
- $\beta_1 \; \beta_2$ ... are coefficients for these fixed effects.
- υ_i is the random effect for individual i
- ϵ_{ij} is the error term (random effect person i on day j)

In all cases, model parameters were estimated in R with the nlme package with restricted maximum likelihood estimation (REML). Models were re-fit with standard maximum likelihood estimation (ML) when comparing the fit of two different models (e.g., ANOVA).

Covariates

Across models, we included fixed effects for:

- *Race.* While participants were allowed to choose from a list of some 10 racial identities, due to the small sample size in several races, we group races into four simplified categories: Asian, White, Latinx, and Others.
- *Gender* (male, female, or non-binary). As there were only two non-binary participants in our sample, we cannot make accurate estimates for associations with non-binary gender identity. Hence, we remove these two participants when conducting analyses that require gender.
- *Romantic partnership status* (single, partnered, or long-distance partnered). While previous research has found broadly positive associations between having a romantic partner and well-being (e.g., Lucas, 2007), it is important to disentangle any benefit of simply having a partner from the benefit of the actual time spent together. Further, while our survey only asked if the student *has* a romantic partner, in this college (largely freshman) sample it may be relevant if that partner is local (e.g., a fellow student at the university) or distant (e.g., at another university or in another city). While this was not asked explicitly, we chose to infer

this simply by noting if *any* in-person time with a partner was reported across a participant's data. Those who reported having a partner, but did not report any in-person time spent with them during the study, were coded as having a long-distance partner (N=17), while others were coded as having a local partner (N=29). This proved to be relevant to well-being and how the participant interacted with their partner.

- *Well-being at intake.* This is a measure of trait well-being, before the participant completed any diaries. It controls for the fact that happier people have happier days and moments, independent of the events. This is a composite measure, computed as the sum of (z-scored) life satisfaction and positive affect frequency, minus their negative affect frequency. These composites are then z-scored afresh to ensure they have zero mean and unit variance.
- *Day of week.* In the weekly rhythm of life, some days may be intrinsically more pleasant than others, irrespective of the measured events of the day. As we'll see, weekends are especially positive, even after controlling for activities and social behavior.
- *Diary day number.* It is possible that participant behavior systematically varies over the course of the study, perhaps due to fatigue or habituation. To control for such trends, we include the diary day number (1-5) as a linear predictor.

Results - Descriptive - Study 1

Each participant's data is given equal weight in the analyses below.

Time and social behavior

Figure 2 shows that an average day for an average student has about 7 hours of social contact: about 4 hours with friends, about 1 hour with each of family and partners, and about 2 hours with others. This adds up to more than 7, because a given social encounter might involve multiple people from multiple relationship types.

The overwhelming majority of this time (81%) is in-person. The next most common medium was video chat (12%), followed by text messaging (4%) and phone calls (4%). The contact medium varied only slightly by relationship type.

Figure 2: Student time use, social partners, and contact medium (Study 1)
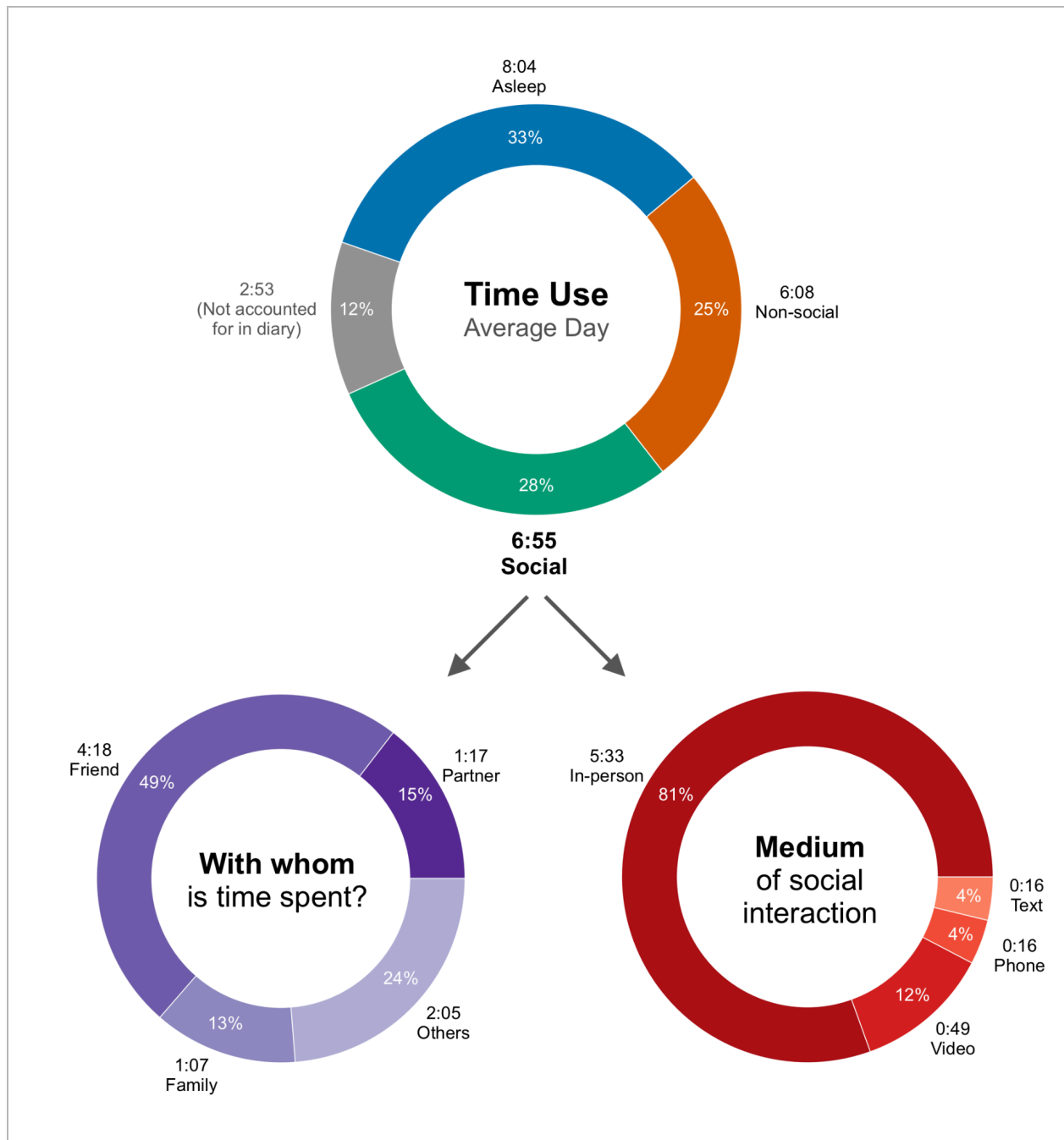
Activities: frequency and sociality

Figure 3 shows the fraction of time participants spent engaging in each activity on average. The top activities, unsurprising for university students, were studying, socializing, passive leisure (e.g., watching tv), and eating. Least frequent were engaging in personal hobbies, playing (non-athletic) games, romantic/sexual contact, and caring for one's child.

Activities: fraction of waking time (Study 1)

Activity	Fraction
Studying	17%
Socializing	15%
Passive leisure	13%
Eating	9.5%
Napping / resting	8.1%
In class	7.6%
In transit	5.1%
Chores / errands	4.6%
Working (not studying)	4.4%
Cooking	2.6%
Physical activity	2.3%
Hobbies	2.0%
Playing (non-athletic) games	1.6%
Romantic or sexual contact	1.1%
Caring for *your* children	0.1%

Fraction of waking time (average across persons)
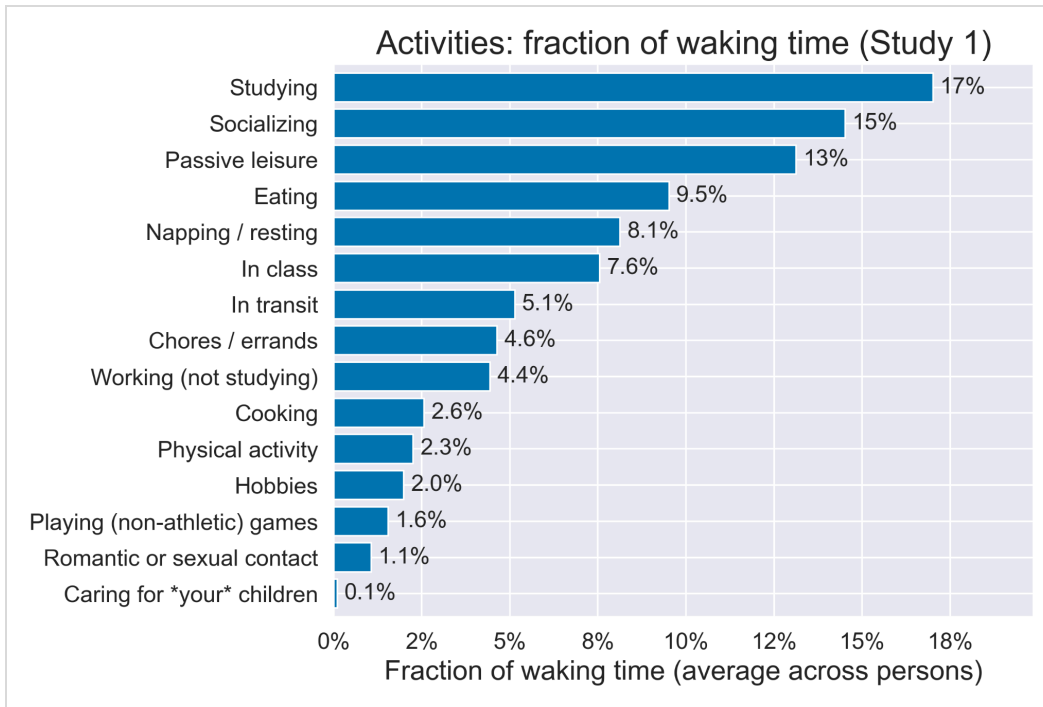
Further, some activities are inherently more social than others. Figure 4 shows which activities are likely to be performed with others versus alone. For example, eating is 1.8 times more likely to occur with others than by oneself. Mathematically, this means that the odds of being with others when eating is 1.8 (chance of eating when with others / chance of eating when alone = 1.8). Significantly more likely to be performed with others are: romantic or sexual contact (7.5x), playing (non-athletic) games (2.8x), working (not studying) (2.0x), and eating (1.8x). Significantly more likely to be performed alone are: napping / resting (4.0x), studying (2.4x), chores / errands (1.6x), and passive leisure (1.4x).

Figure 4: Activity Sociality (Study 1)[12]
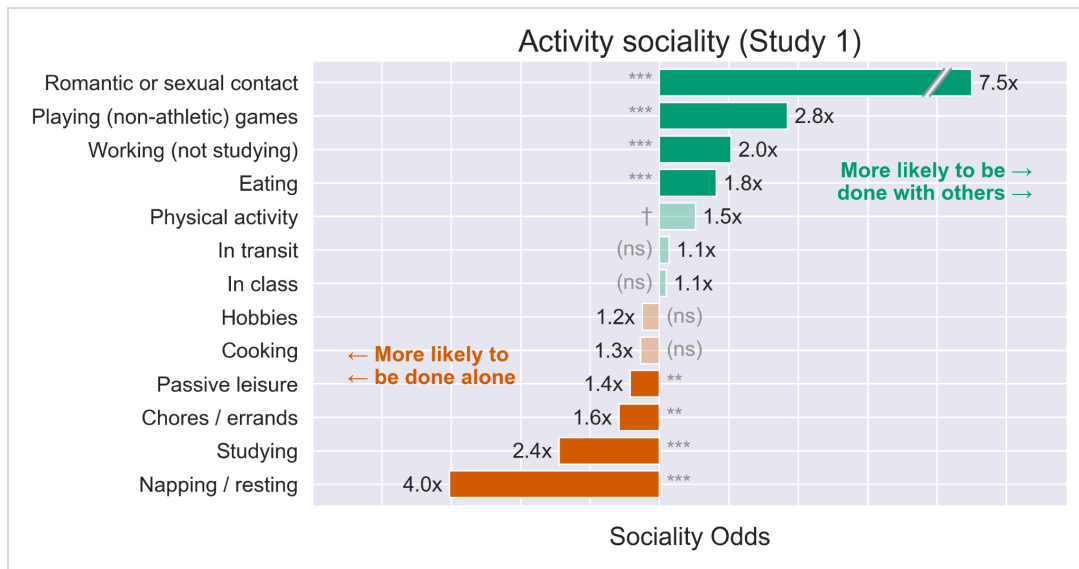
Activity sociality (Study 1)

Activity	Sociality Odds
Romantic or sexual contact	*** 7.5x
Playing (non-athletic) games	*** 2.8x
Working (not studying)	*** 2.0x
Eating	*** 1.8x
Physical activity	† 1.5x
In transit	(ns) 1.1x
In class	(ns) 1.1x
Hobbies	1.2x (ns)
Cooking	1.3x (ns)
Passive leisure	1.4x **
Chores / errands	1.6x **
Studying	2.4x ***
Napping / resting	4.0x ***

More likely to be → done with others →

← More likely to ← be done alone

Statistical significance is annotated symbolically in gray (*** p < 0.001; ** p < 0.01; * p < 0.05; † p < 0.10), and bar opacity also indicates significance.

[1] "Romantic or sexual contact" includes masturbation. The full choice text seen by participants was "Romantic or sexual contact (kissing, sex, masturbation, etc)." Hence not all such episodes are with others.

[2] The activity of "socializing" was not included in this graph, as it is essentially 100% social by definition.

We explore the well-being associations of these activities in the Modeling section, where they can be included as variables in a larger model alongside measures of social contact.

Emotions: frequency and sociality

Figure 5 shows the fraction of time participants spent in episodes where they reported feeling a given emotion. The most common emotions were contentment (26%), anxiety (11.4%), joy (10.9%), interest (10.7%), gratitude (7%), confusion (6.5%), and amusement (6.3%).

Emotions: fraction of waking time (Study 1)

Emotion	Fraction
Contented	26%
Anxious	11.4%
Joyful	10.9%
Interested	10.7%
Grateful	7.0%
Confused	6.5%
Amused	6.3%
Sadness	3.6%
Love	3.5%
Proud	2.8%
Pain	2.1%
Triumphant	1.9%
Angry	1.6%
Afraid	1.5%
Ashamed	1.4%
Embarrassed	1.2%
Disgusted	1.1%
Awe	1.0%

Fraction of waking time (average across persons)
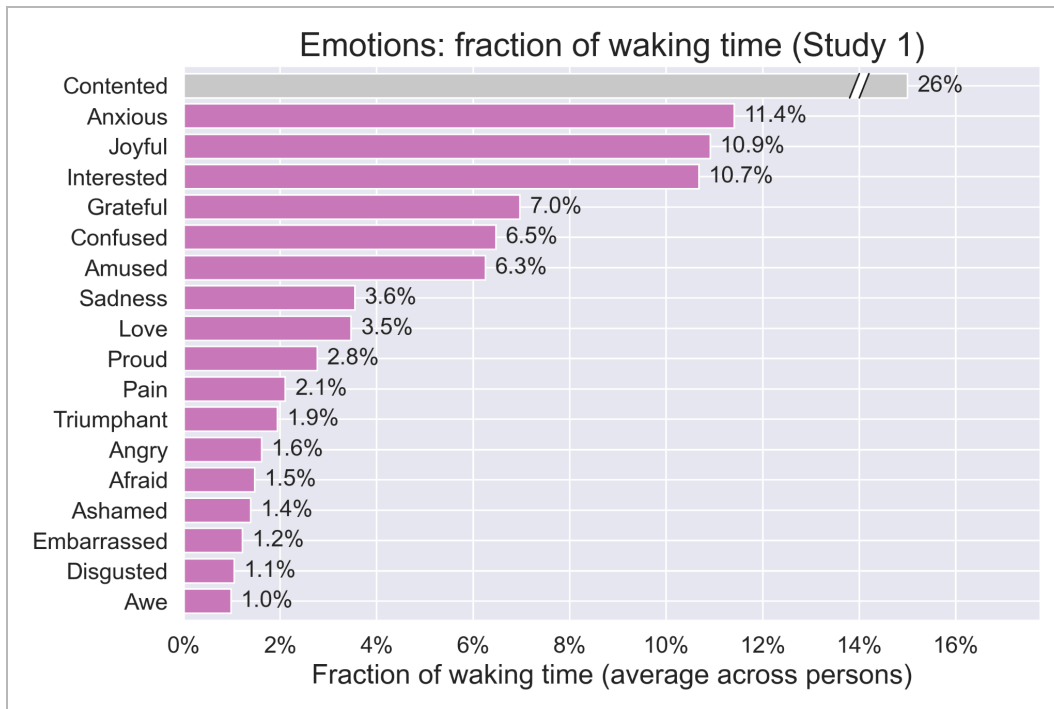
A note is in order on the 'contentment' item. While participants were free to choose as many emotions as they liked for a given episode, or no emotions at all, in the exit survey feedback a number of participants expressed a belief (despite instructions) that they "had to pick at least one," and often chose "contentment" for lack of a better option. Hence, we should interpret "contentment" with caution, and this term was removed in Study 2.

We also examined if certain emotions are inherently more "social" in nature, defined by their frequency in social situations relative to their frequency when alone. As Figure 6 below shows, emotions *in general* are far more common in the company of others. Sometimes dramatically so. "Love" is a staggering 12 times more likely to be felt when with others, but so are gratitude (3.0x), joy (2.9x), awe (2.8x), amusement (2.7x), embarrassment (2.1x), interest (1.9x), pride (1.6x), and triumph (1.4x). Only one emotion was significantly more common when alone, and mildly so: anxiety (1.3x more likely when alone).

Emotion sociality (Study 1)
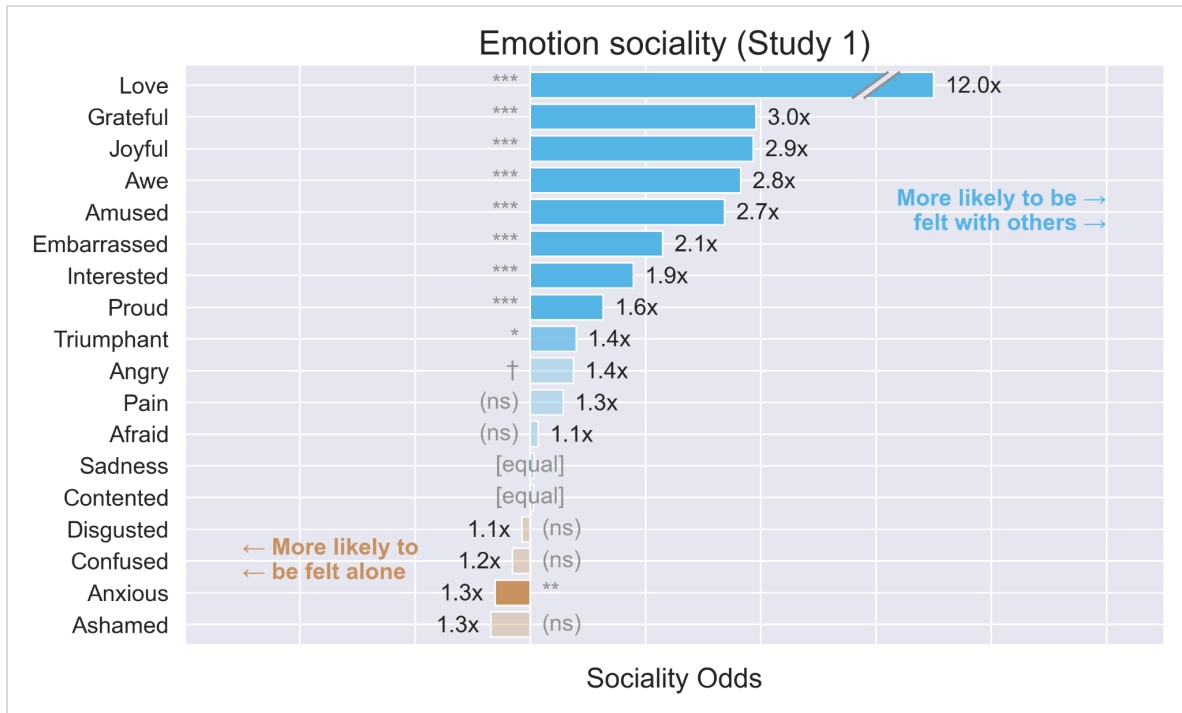
	Sociality Odds	
Love	***	12.0x
Grateful	***	3.0x
Joyful	***	2.9x
Awe	***	2.8x
Amused	***	2.7x
Embarrassed	***	2.1x
Interested	***	1.9x
Proud	***	1.6x
Triumphant	*	1.4x
Angry	†	1.4x
Pain	(ns)	1.3x
Afraid	(ns)	1.1x
Sadness	[equal]	
Contented	[equal]	
Disgusted	1.1x	(ns)
Confused	1.2x	(ns)
Anxious	1.3x	**
Ashamed	1.3x	(ns)

More likely to be → felt with others →

← More likely to be felt alone

Statistical significance is annotated symbolically in gray (*** p < 0.001; ** p < 0.01; * p < 0.05; † p < 0.10), and bar opacity also indicates significance.

As it is not the focus of the present investigation, we do not explore specific emotions further here. However, the data can provide rich fodder for future study of the emotional experience of various social relationships, activities, and types of individuals.

Results - Modeling - Study 1

We fit and compared many models in the development of this research, but in this main text we focus on the subset that most parsimoniously describe the results.

Modeling: episode-level

Model Ep1 - Episodes Baseline

We begin simply, modeling individual well-being in a given episode as a function of the covariates mentioned earlier (race, gender, etc), plus a single binary predictor: whether or not the person was interacting with others at the time. Fitted model information is in Figure 7 and accompanying Table 1. Even in this very simple model, we see a clear positive association between interacting with others and higher well-being, where social contact predicts an approximately 7-point increase in well-being, on our 0-100 scale (β = 7.4, t = 22.0, p < 0.001). This is in keeping with a robust literature linking social time with well-being (e.g., Lyubomirsky et al., 2005).

Examining the covariates, we see no significant main effect of gender (β_{female} = -2.79, t = -1.49, p = 0.13) nor race (β_{asian} = 0.35, t = 0.15, p = 0.88; β_{latinx} = 5.62, t = 1.95, p = 0.053; β_{others} = 3.18, t = 0.96, p = 0.34; "white" is the comparison group). Having a long-distance partner is associated with a 5.9-point decrease in well-being (β = -5.89, t = 2.22, p < 0.028), while having a local partner has no significant association. The participant's trait well-being at intake was

significantly associated with well-being each day: a one-standard-deviation increase in well-being at intake is associated with a 3-point increase in well-being during all episodes of the study ($\beta = 3.00$, t $= 3.39$, $p < 0.001$). As a final check, this model has far superior fit to a model without the social contact term ($\chi2(1) = 225.2$, $p < 0.001$).

The day of week was significant, with Friday and Saturday being associated with a 4-5 point increase in well-being relative to Monday. Also, the "diary day" variable has a positive and significant coefficient, suggesting a trend of participants to report greater well-being as the study progresses. As participants began the study on a wide range of dates across Fall 2021, this is unlikely to be due to external events affecting all participants. Rather, it likely reflects a complex process of adaptation or fatigue to the procedure itself. While we won't speculate further on this finding, it is evidence that it is an important confound to control for in our models.

Figure 7: Episode well-being and any social contact (Study 1)
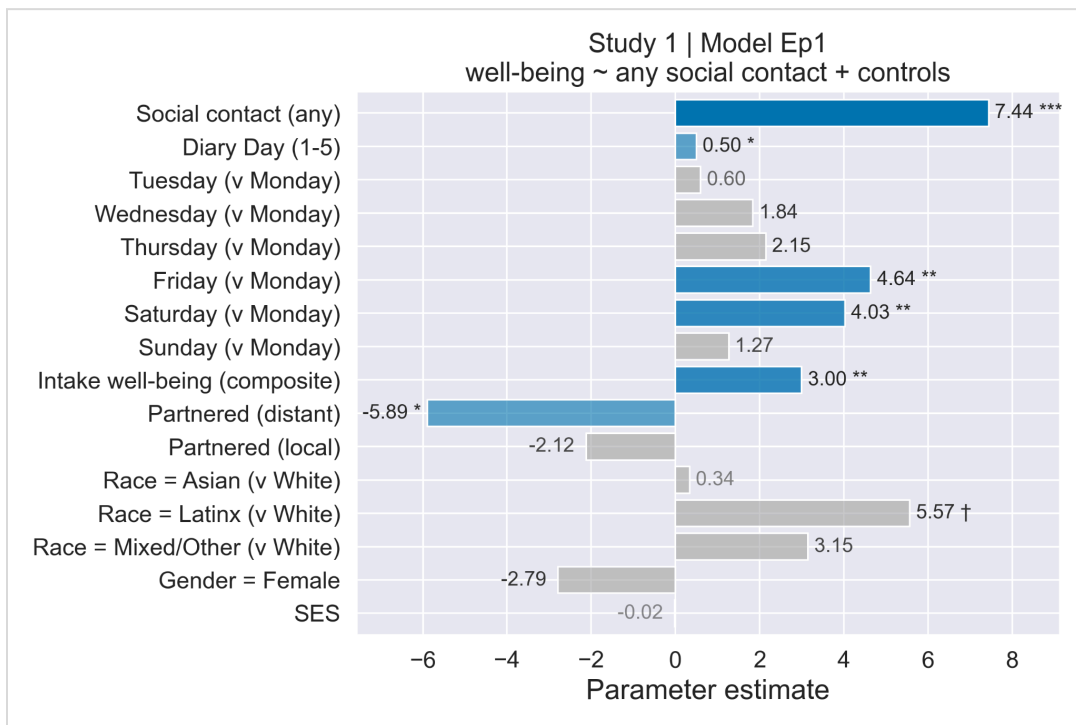
The dependent variable (episode well-being) is on a 0-100 scale
Statistical significance is annotated symbolically (*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; † $p < 0.10$), and bar color and opacity also indicate significance.

Table 1: Episode well-being and binary social contact (Study 1)

Table

term	Beta	SE	t	p
Social contact (any)	7.44	0.49	15.18	< 0.001
Diary Day (1-5)	0.5	0.25	2.02	0.044
Tuesday (v Monday)	0.6	1.27	0.47	0.64
Wednesday (v Monday)	1.84	1.31	1.4	0.161
Thursday (v Monday)	2.15	1.33	1.62	0.106
Friday (v Monday)	4.64	1.35	3.43	0.001
Saturday (v Monday)	4.03	1.4	2.88	0.004
Sunday (v Monday)	1.27	1.35	0.94	0.348
Intake well-being (composite)	3	0.89	3.39	0.001
Partnered (distant)	-5.89	2.67	-2.21	0.029
Partnered (local)	-2.12	2.21	-0.96	0.339
Race = Asian (v White)	0.34	2.33	0.14	0.885
Race = Latinx (v White)	5.57	3.14	1.77	0.079
Race = Mixed/Other (v White)	3.15	3.4	0.93	0.355
Gender = Female	-2.79	1.88	-1.48	0.14
SES	-0.02	0.54	-0.04	0.968
(Intercept)	58.87	4.66	12.63	< 0.001

Note: The dependent variable (episode well-being) is on a 0-100 scale

Model Ep2: Episode well-being and carryover effects (Study 1)

Next, we explore carry-over effects. That is, does social interaction induce changes in well-being that carry forward into the rest of the day? Mathematically, does sociality at time t predict well-being at time $t+1$? To answer this, we fit the same model as in Model Ep1, but with an additional binary term indicating if the person was interacting with others in the preceding episode.[5] We find that this carryover term is not significant ($\beta = 0.23$, t = 0.44, p = 0.66), and a likelihood ratio test does not find significant improvement in fit over the model without this term ($\chi2(1) = 0.20$, p = 0.65). In short, in Study 1, we find no evidence that the benefits of social contact extend into the hours beyond.

Model Ep3: Episode well-being and granular social measures (Study 1)

One of our central hypotheses is that it matters *with whom* one is interacting (e.g., family vs. friend), and through what *medium* (e.g., in-person vs. phone). Further, participants may tend to interact with different people through different media: perhaps students are more likely to interact with parents on the phone, but friends in-person. To approach this question, we create a combined model that considers the interaction of medium and relationship type. We cross the 4 (grouped) relationship types and 4 media to create 16 variables of social contact. For example, "interacting with

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[5] Note that we do not include the first episode of each day, as its "preceding" episode occurred the night before, many hours ago.

friends over text message" and "interacting with parents over video chat," yielding 4 x 4 = 16 combinations in total.

  Figure 8 and Table 2 show the fitted values for the predictors of interest. From these data, it is quite clear that in-person time with friends, family, and romantic partners are robust predictors of higher well-being. In-person time with friends is associated with an 11.4-point increase in well-being, romantic partners 11.1 points, and family 8.8 points. Video chat contact is also quite positive for these groups, and phone calls are positive for friends and partners. Notably, contact with strangers is either non-significant or negative across media.

  In short, being with family, friends, and partners is reported as more enjoyable than being alone. This holds for contact that is in-person, on video chat, or on the phone, but not over text messaging.

Figure 8: Episode well-being and granular social measures (Study 1)
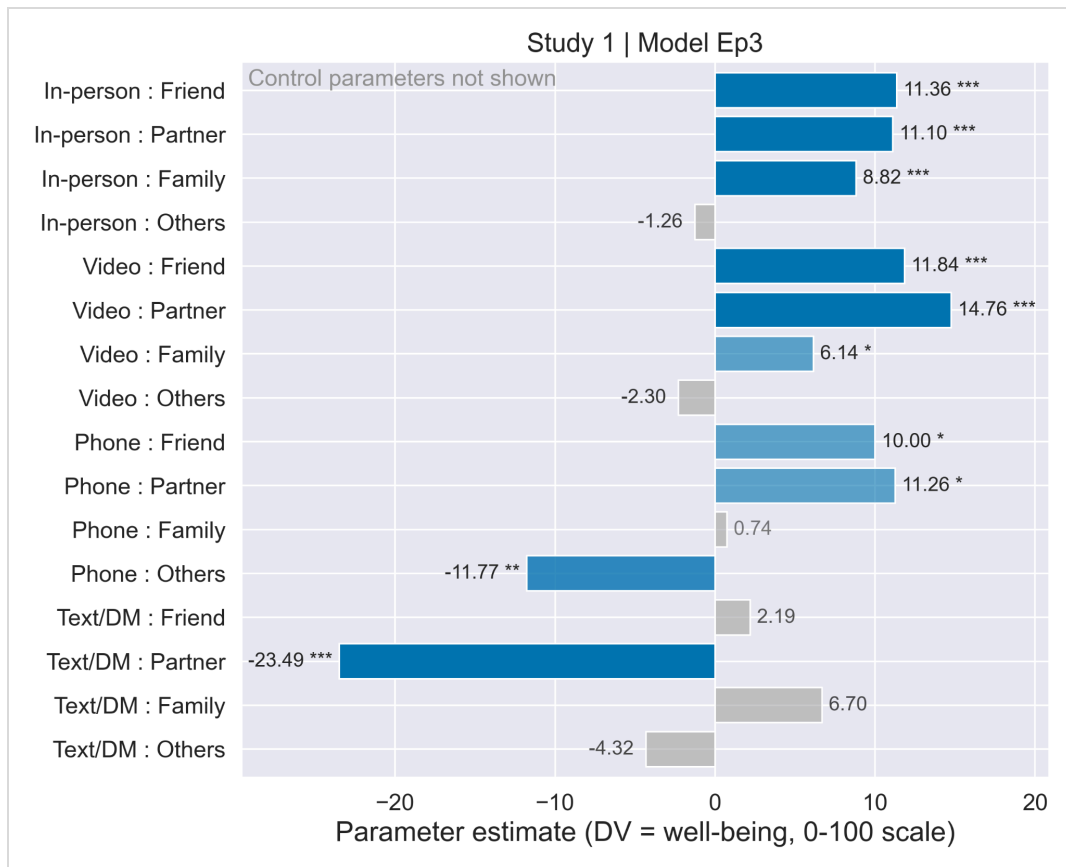
Statistical significance is annotated symbolically (*** p < 0.001; ** p < 0.01; * p < 0.05; † p < 0.10), and bar color and opacity also indicate significance.

Table 2: Episode well-being and granular social measures (Study 1)

Table

term	Beta	SE	t	p
In-person : Friend	11.36	0.64	17.65	< 0.001
In-person : Partner	11.1	1.49	7.46	< 0.001
In-person : Family	8.82	1.2	7.34	< 0.001
In-person : Others	-1.26	1	-1.25	0.21
Video : Friend	11.84	2.07	5.71	< 0.001
Video : Partner	14.76	2.58	5.73	< 0.001
Video : Family	6.14	2.43	2.52	0.012
Video : Others	-2.3	1.52	-1.51	0.132
Phone : Friend	10	3.94	2.54	0.011
Phone : Partner	11.26	4.48	2.52	0.012
Phone : Family	0.74	3.2	0.23	0.818
Phone : Others	-11.77	4.07	-2.89	0.004
Text/DM : Friend	2.19	2.82	0.77	0.439
Text/DM : Partner	-23.49	5.76	-4.07	< 0.001
Text/DM : Family	6.7	7.37	0.91	0.363
Text/DM : Others	-4.32	4.59	-0.94	0.346

*Note: The dependent variable (episode well-being) is on a 0-100 scale

The figures for phone and text messaging must be interpreted with caution, as they are rare compared to the other types of media (about 4% of episodes each). Text messaging, in particular, may not be accurately captured here due to the nature of the Day Reconstruction Method. Participants rarely report entire "episodes" where they are texting with someone, likely because text messaging is often a very brief, asynchronous means of contact, peppered throughout the day. That said, reported episodes involving texting with a romantic partner predict a striking 23.5 point *decrease* in well-being (p < 0.001). Upon investigation, this is driven by the mere handful of participants who reported these episodes, but the effects were large enough to be quite significant. Further, these episodes were rife with reported negative emotions (anxiety, anger, shame), perhaps reflecting extended, difficult relationship conversations. Study 2 provides an additional means to assess text messaging and these findings.

Model Ep4: Episodic well-being and activities (Study 1)

One of the key conclusions of previous work (e.g., Hudson, Lucas, & Donnellan, 2020) is that the observed higher well-being when in the company of friends may be partly explained as follows: one tends to engage in more pleasant activities with friends. With family and romantic partners, one must often engage in the less pleasant necessities of life, such as chores and errands. To address this, we extend Model Ep3 above by adding binary predictors for each of the 13 activities that participants could report engaging in. The full list of these activities are shown earlier in Figure

3, but they include eating, studying, working, socializing, and physical activity. Participants can indicate more than one activity in a given episode, so to avoid over-weighting episodes with many activities chosen, these binary columns are divided by the total number of activities in an episode. For example, if a participant reports eating, working, and playing games in a given episode (3 activities), each of these variables will be set to 0.33 (the rest zero). If they report only studying in a particular episode, that variable is set to 1.0 (and the rest zero).

With these additional predictors, we can answer two questions. First, do our findings about social contact and well-being hold after controlling for the activities engaged in? Second, which activities are most associated with well-being? We explore the results of this model in two parts.

To address the first question, whether our findings hold in light of activity type, the answer is a clear "yes." Table 3 compares the estimates for social contact parameters in a model without (Ep3) and with (Ep4) activities as covariates. The social contact parameters remain significant, with somewhat attenuated values. Worth noting is that one of the activity types is "socializing," which undoubtedly correlates with measures of social activity. The "socializing" term itself is associated with a 10-point increase in well-being. Even with this confounding control variable, the model parameters show the same pattern of results, albeit reduced in magnitude. For example, in this model, in-person contact with friends is associated with a 7.2-point greater well-being, compared to 11.4 points in the model above, where activities are not controlled for (Model Ep3). Similarly, video chatting with a romantic partner is associated with an 8.8-point increase in this model, versus 14.8 in Model Ep3 without activities.

It remains clearly true that interacting with family, friends, and partners – especially in-person, but also over video chat or phone calls – are all robustly associated with greater momentary well-being. And it remains true that interacting with non-close others (e.g., strangers and coworkers) has zero or a negative association with well-being. Thus, the core of our findings do not change.

Table 3: Episodic well-being and social contact, controlling for activities (Study 1)

Table

Parameter	β without activity controls	β with activity controls
In-person: Family	8.82 *	4.90 *
In-person: Friend	11.36 *	7.16 *
In-person: Romantic Partner	11.1 *	5.62 *
In-person: Others	-1.26 (ns)	0.20 (ns)
Video: Family	6.14 *	1.13 (ns)
Video: Friend	11.84 *	8.71 *
Video: Romantic Partner	14.76 *	8.76
Video: Others	-2.3 (ns)	0.68 (ns)
Phone: Family	0.74 (ns)	-2.10 (ns)
Phone: Friend	10.01 *	4.71 (ns)
Phone: Romantic Partner	11.27 *	8.06 (ns)
Phone: Others	-11.77	-10.60
Text/DM: Family	6.7 (ns)	1.20 (ns)
Text/DM: Friend	2.19 (ns)	-0.52 (ns)
Text/DM: Romantic Partner	-23.49 *	-24.42 *
Text/DM: Others	-4.32 (ns)	-4.67 (ns)

*Note: The dependent variable (episode well-being) is on a 0-100 scale

Next we examine the model coefficients pertaining to the activities themselves, illustrated in Figure 9. This model inherently controls for social behavior and other covariates, so these estimates are more valid measures of association of the activity itself with well-being. Consistent with the findings of Kahneman et al. in the original Day Reconstruction Method study, intimate relations have the strongest association with episodic well-being (+18.6 points). This is followed by engaging in hobbies (+14.7), physical activity like exercise or sports (+11.2), games and socializing (+10.6 and +10.4), cooking and eating (+8.1 and +7.7). The only significant negative association was with studying (-2.3), while being in class was not predictive of well-being in either direction.

Figure 9: Episodic well-being and activities, controlling for social contact (Study 1)
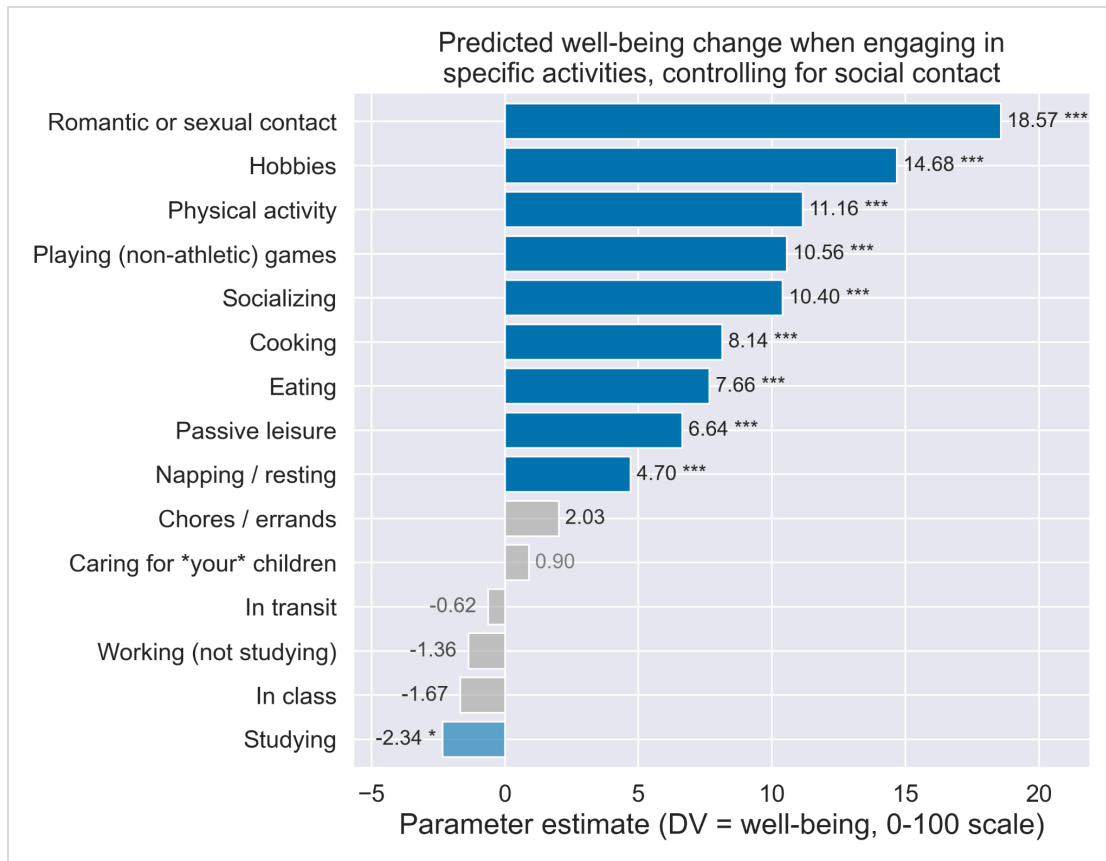
Predicted well-being change when engaging in specific activities, controlling for social contact

Activity	Parameter estimate
Romantic or sexual contact	18.57 ***
Hobbies	14.68 ***
Physical activity	11.16 ***
Playing (non-athletic) games	10.56 ***
Socializing	10.40 ***
Cooking	8.14 ***
Eating	7.66 ***
Passive leisure	6.64 ***
Napping / resting	4.70 ***
Chores / errands	2.03
Caring for *your* children	0.90
In transit	-0.62
Working (not studying)	-1.36
In class	-1.67
Studying	-2.34 *

Parameter estimate (DV = well-being, 0-100 scale)

Statistical significance is annotated symbolically (*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; † $p < 0.10$), and bar color and opacity also indicate significance.

In short, what one is doing matters, but it does not change the fundamental nature of how social contact relates to well-being.

Models Ep5+: Episodic well-being and individual differences (Study 1)

What remains is the question of individual differences. Do different types of people benefit differently from social contact? We fit a series of models, each examining the interaction of one specific personal trait with our measures of social contact. We tested: gender, race, age, socioeconomic status, romantic partnership status, each of the Big Five personality dimensions in turn, well-being at intake, loneliness, and social support (ISEL). Each model began from Model Ep3 above, adding the interaction of a single trait/demographic with each of the 16 types of social contact.

In short, *none* of these models produced meaningful interaction terms, nor substantially improved model fits. Rarely were any of the 16 interaction terms significant, and these few "significant" terms were inconsistent across models, suggesting no meaningful narrative. Given the dimensionality and number of models fitted, this is unsurprising. In short, there is no evidence that social contact has different consequences for different types of participants in this study. Men, women, introverts, extroverts, and so forth all seem to benefit similarly from social contact. This is in keeping with the conclusion of Hudson and others, that "demographic characteristics moderated [the] findings in inconsistent ways that may or may not be meaningful" (Hudson et al., 2020).

Modeling: Person-day level (Study 1)

The results above speak to the question of what attributes of an event ("episode") predict higher well-being while it is happening - a type of hedonic well-being. As a convergent examination, we can ask how social behavior relates to participant reflections on their day as a whole - evaluative well-being. "How was your day overall?" was the first question on each diary entry, answered by each participant before any reporting any details of the day. In this approach, we aim to predict this overall day well-being from the portfolio of social interactions and activities throughout the day. To achieve this, all episodes for a person within a day are aggregated, producing a single record per person per day. These aggregations produce variables like "time spent with friends" and "time spent on video chat with parents" and "time spent studying." We follow much the same modeling approach as before.

Models D1: Overall day well-being and social contact (Study 1)

Akin to Model Ep3 above, but looking at days in aggregate, we can estimate the association between overall day well-being and time spent in different forms of social contact. Figure 10 shows these results. Again, we see significant results for time in-person with family, friends, and partners (but not others), with each additional hour predicting an approximately 1-point increase in overall day well-being. However, no other contact medium (video, phone, text) shows any significant association with how one evaluates their day overall. This is a curious contrast to the episode-level data, where video chat and phone calls had positive associations with episodic well-being. We explore possible explanations in the discussion.

Figure 10: Model D1: Overall day well-being and social contact time (Study 1)

Overall DAY well-being ~ social contact

Control parameters not shown

Contact type	Estimate
In-person : Friend [hours]	1.10 ***
In-person : Partner [hours]	1.41 **
In-person : Family [hours]	1.58 ***
In-person : Others [hours]	0.38
Video : Friend [hours]	-0.22
Video : Partner [hours]	-0.89
Video : Family [hours]	-0.69
Video : Others [hours]	-0.52
Phone : Friend [hours]	2.03
Phone : Partner [hours]	1.06
Phone : Family [hours]	-1.66
Phone : Others [hours]	-1.65
Text/DM : Friend [hours]	-0.73
Text/DM : Partner [hours]	-2.35
Text/DM : Family [hours]	1.88
Text/DM : Others [hours]	1.36

Parameter estimate (DV = well-being, 0-100 scale)

Statistical significance is annotated symbolically (*** p < 0.001; ** p < 0.01; * p < 0.05; † p < 0.10), and bar color and opacity also indicate significance.

Models D2: Overall day well-being and social contact with nonlinear terms (Study 1)

We examine if social time shows diminishing returns - that is, if social time is less associated with well-being after one has already socialized a great deal that day. We aggregate all types of social time into a single variable: total hours socializing that day (with anyone, through any medium). Adding the square of this variable term to this model, the term is not significant (t = -1.58, p = 0.11) and the model fit is not improved ($\chi 2(1) = 2.56$, p = 0.11). We repeated this procedure with a logarithmic term and reach the same conclusion.

This finding also holds if, instead of "any" social time, we restrict to only the kinds most robustly associated with overall day well-being in earlier models (in-person time with family, friends, and partners). Again the nonlinear term is not significant.

In short, there do not appear to be diminishing returns to social contact within a single day, at least in our sample of university students. That is, in contrast to the results of some other studies (e.g., Ren et al., 2022), no matter how much time one has spent socializing in a given day, additional socializing predicts similar increases in well-being.

Models D3: Carryover effects, person-day well-being and social contact (Study 1)

Akin to Model Ep2, we explore if the benefits of a highly social day carry over to the following day. That is, if time spent socializing on day *i* predicts well-being on day *i+1*. Again aggregating all types of social time into a single variable, we add a term for the social time on the preceding day. When fitted, this term is not significant (t = 0.30, p = 0.76) and the model fit is not

improved ($\chi 2(1) = 0.09$, p = 0.76). This finding, too, holds if we restrict to only the kinds of social time most strongly associated with well-being (in-person with family, friends, and partners).

In short, there do not appear to be carryover effects of social contact in Study 1 – social behavior is only associated with well-being on the day in which it occurs.

Results Summary - Study 1

Study 1 finds that in-person time with family, friends, and romantic partners is both more enjoyable while it is happening and predicts a more positive reflection on one's day overall. Relative to being alone, participants report roughly 10-12 points greater well-being (on a 0-100 scale) while engaging with these types of relationships in-person. In evaluating their day overall, each hour of this time predicts a roughly 1-point increase in their evaluation of their day on the whole.

Video chat and phone calls with family, friends, and romantic partners were similarly enjoyable in the moment, associated with 10-12 points greater well-being than when alone. However, video and phone calls were unrelated to later evaluations of one's day overall. This is intriguing, as it suggests that digital contact is quite enjoyable, but its well-being benefits may not last. In the context of "social nutrition," time with close others on video chat or the phone might be described as a type of "simple sugar," in that it is enjoyable in the moment but provides no enduring nutritional benefit. More research is needed to corroborate this finding.

Time with other types of relationships - strangers, acquaintances, colleagues, etc – was at best unrelated to well-being, and in some ways negatively related. Text messaging was largely unrelated to well-being in this sample.

Approach - Study 2

Overview

One limitation of Study 1 was the retrospective nature of reporting: participants were asked to recall what they were doing and how they felt on the day before. While participants are guided, and this method has precedent, it is difficult to be certain how accurately one can report on the events and emotions from many hours before (Parkinson et al., 1995)

Such results can be buttressed by a study capturing *in vivo* emotions and behavior via experience sampling methods (ESM). This approach is in keeping with the ESM experiments reviewed earlier (Sun, Harris, and Vazire, 2020; Quoidbach, Taquet, Desseilles, de Montjoye, and Gross, 2019; Killingsworth, 2021), but with a more nuanced measurement of the kind of relationship, the contact medium, and individual traits.

Study 2 begins identically to Study 1, with an intake survey measuring demographics, personality traits, global well-being, loneliness, and so forth. The study spanned the same time frame, with an intake survey on day 1, five days of measurement (days 2-6), and an exit survey on day 7.

However, instead of completing a diary each day (as in Study 1), participants received 5 text messages at random times spread throughout each day. The text message provided a link to a (very short) survey to complete immediately. In keeping with the items of Study 1, the survey begins with a simple rating of how the participant is feeling in that moment (0-100 slider), followed by questions about what they are doing, if they are interacting with others, and what emotions they are experiencing.

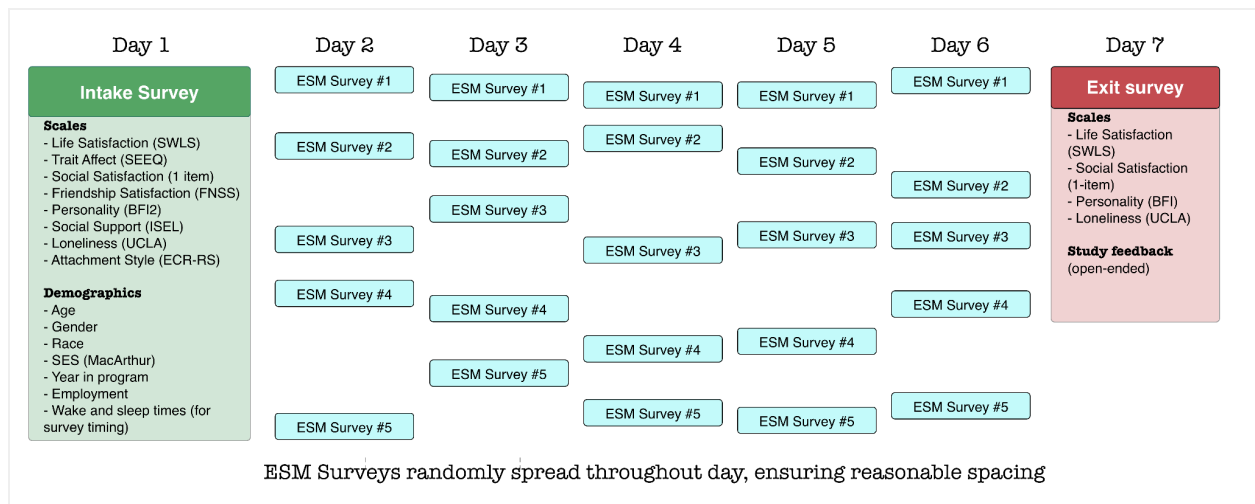If they were interacting with someone, they reported the type of relationship (parent, close friend, classmate, etc), the contact medium (in-person, phone, etc), and a rating of how "close" their relationship is (a one-item visual scale, Inclusion of Other in Self; Aron, Aron, & Smollan, 1992). All surveys only take 1-2 minutes to complete (median = 78 seconds), and after submitting each survey,

participants received a confirmation text with information about their progression in the study. Participants expressed appreciation for this feature in their exit survey feedback, and we recommend thinking about these small user engagement details when running such a study. The surveys lasted for 5 days (with 5 surveys each day), after which participants were texted a link to complete an exit survey akin to that of Study 1.

Study 2 took place in Fall 2023 and Spring 2024 – two years after Study 1 (Fall 2021). Recruitment, intake, and exit survey procedures for Study 2 follow Study 1, as described above. Participants were told they would need to complete at least 4 out of 5 surveys each day for full credit, and would receive partial credit for lesser completion.

Figure 11: Study 2 procedure overview

Day 1 — Intake Survey
Scales
- Life Satisfaction (SWLS)
- Trait Affect (SEEQ)
- Social Satisfaction (1 item)
- Friendship Satisfaction (FNSS)
- Personality (BFI2)
- Social Support (ISEL)
- Loneliness (UCLA)
- Attachment Style (ECR-RS)

Demographics
- Age
- Gender
- Race
- SES (MacArthur)
- Year in program
- Employment
- Wake and sleep times (for survey timing)

Day 7 — Exit survey
Scales
- Life Satisfaction (SWLS)
- Social Satisfaction (1-item)
- Personality (BFI)
- Loneliness (UCLA)

Study feedback
(open-ended)

ESM Surveys randomly spread throughout day, ensuring reasonable spacing

Data Filtering

Participating for course credit, N = 387 students registered for the study and completed the intake survey, yielding a total of 8251 experience sampling surveys collected. N = 343 participants completed the exit survey. As a data integrity check, in the exit survey, participants were told that while they will receive credit for their participation irrespective of data quality, they were asked to be honest and report if they were not taking the study seriously, and hence their data should not be scientifically analyzed. This removed 7 participants and their data. To ensure valid analysis, further participants were removed if they did not complete at least 3 surveys on each of at least 3 days. The constraint removed a further 20 participants (5%), 127 experience sampling surveys (2%), and 9 exit surveys (3%).

Final Sample

We proceeded with data from 363 participants spanning 7,878 experience sampling surveys (mean = 21.7 per participant). Demographics were as follows. Race: 48% Asian (N=176), 17% White (N=62), 21% Latinx (N=76), and 13% others (N=49). Gender: 82% female (N=297), 17% male (N=60), and 2% non-binary (N=6). Employment: 53% unemployed (N=191), 45% part-time (N=165), 15% full-time (N=7). Partnership: 40% reported having a romantic partner (N=144), while 60% did not (N=219). After examining whether any in-person time was spent with a romantic partner, 26% (N=94) participants were inferred to have a partner living locally, while 14% (N=50) were inferred to have a partner living farther away. Year in program: 13% were first-year (freshman) students (N=47), 18% were second-year (sophomore) students (N=64), 36% were third-year (junior)

students (N=132), 33% were fourth-year or later (senior) students (N=120), while the remaining 87% (N=316) were dispersed roughly evenly among other years. Age: 79% (N=288) were age 18-21, while the remaining (N=75) were older (mean 20.9, median 20.0, range 18-40). Socioeconomic status was measured with the MacArthur ladder (0-10; mean 6.2, median 6.0, standard deviation 1.8; Adler et al., 2007).

Normalization

As in Study 1, all psychological scales in the intake and exit surveys (personality, trait well-being, etc) were z-scored before analysis. That is, a value of 0 indicates that the individual was exactly at the sample mean for the scale in question, while a value of 1.0 indicates that the individual was 1 standard deviation above the mean, etc.

Modeling approach

Again our data has a doubly-nested structure, with experience sampling surveys nested within days, nested within participants. Hence, we use mixed effects models with a random effect by participant and a random effect by participant-day. The equation is identical in structure to Equation 1 above from Study 1. Covariates are as described in Study 1, with a new item in Study 2 asking if the participant was born in the United States. Finally, Study 2 added one new type of interaction partner: organized groups, such as student clubs, sports teams, and religious organizations. This was inspired by early results from Study 3, the interviewing study discussed later, from which we deemed "organized groups" to be a unique and relevant type of interaction partner, in line with theories of collective identity and group selection (Brewer & Gardner, 1996; Wilson, Van Vugt, & O'Gorman, 2008).

Our analysis parallels Study 1 whenever possible, to allow comparability across the two portions of the study.

Descriptive Results - Study 2

Time and social behavior

The average participant was interacting with others 53% of the times when we surveyed them. This is nearly identical to Study 1, where of their reported waking hours, participants were interacting with others 53% of the time. This convergence adds validity to both methods as a means of assessing time use.

In examining who time was spent with, Study 2 shows very similar results to Study 1 (see Table 4 below). Time spent with friends represented 49% of social time in Study 1, and 41% in Study 2. Time with romantic partners was 13% in Study 1 and 16% in Study 2. Family was similarly comparable. The new "organized group" option represented a substantial 22% of experience sampling surveys, which largely consumed the "other" choice offered in Study 1.

Table 4: Social contact time by relationship type; Study 1 vs 2

Relationship	Study 1	Study 2
Friend	49%	41%
Romantic partner	13%	16%
Family	15%	17%
Others	23%	4%
Organized group	(not asked)	22%

In examining the medium through which participants interacted (Table 5 the fraction of social time that was in-person is largely unchanged (80% vs 76%). Participants in Study 2 were somewhat less likely to report video chatting (9% in Study 2, versus 13% in Study 1) and somewhat more likely to report talking on the phone (6% in Study 2 vs. 4% in Study 1). Worth noting is that, in Study 2, participants could choose more than one contact medium, hence the percentages add up to slightly more than 100%. With this caveat in mind, the results between the two studies seem quite comparable, with one exception: text messaging.

Table 5: Social contact time by medium; Study 1 vs 2

Medium	Study 1	Study 2
In-person	79.9%	76.1%
Video	13.4%	9.4%
Phone	3.7%	5.7%
Text / DM	3.0%	8.8%

There is a marked increase in reported text messaging[6] in Study 2 (9%) compared to Study 1 (3%). However, this is expected given the different modalities. Because Study 1 requires the partitioning of a day into "episodes," and text messaging is a behavior likely to be scattered throughout the day instead of comprising an entire reportable episode, we don't see many reports of text-messaging in Study 1. However, Study 2 is based on randomly-timed surveys, asking the participant what they were doing in the moment when they received the survey (which was delivered by text message itself). Hence, Study 2 is more likely to catch participants in a shorter text messaging period.

Activities: frequency and sociality

The list of activities that participants could choose was very similar to Study 1, removing some of the options that were rarely chosen in that study. As seen in Figure 12 below, the ordering and proportions of activities are largely similar to Study 1, shown earlier in Figure 3 earlier.

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[6] Here and elsewhere, "text messaging" implies either SMS or direct messaging on any one of a number of apps (WhatsApp, Facebook Messenger, Instagram, etc.)

Figure 12: Activity frequency (Study 2)
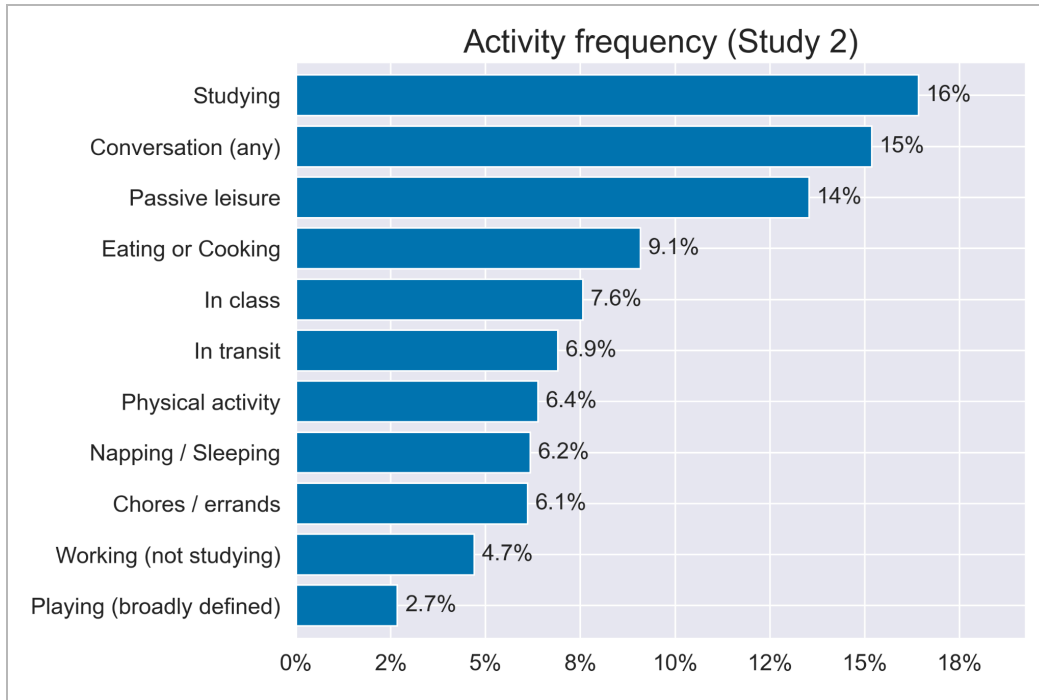
We also explore the sociality of activities, examining which are more likely to be performed with others versus alone. Figure 13 below shows very similar results to Figure 4 from Study 1 above. Recall that the activity choices were slightly different in Study 2.

Significantly more likely to be performed with others are: working (not studying) (3.2x), playing (broadly defined) (2.3x), eating or cooking (1.6x), physical activity (1.5x), in transit (1.3x), and in class (1.3x). Significantly more likely to be performed alone are: napping / sleeping (4.8x more likely when alone), passive leisure (1.7x), studying (1.4x), and chores / errands (1.2x).

Figure 14: Activity sociality (Study 2)
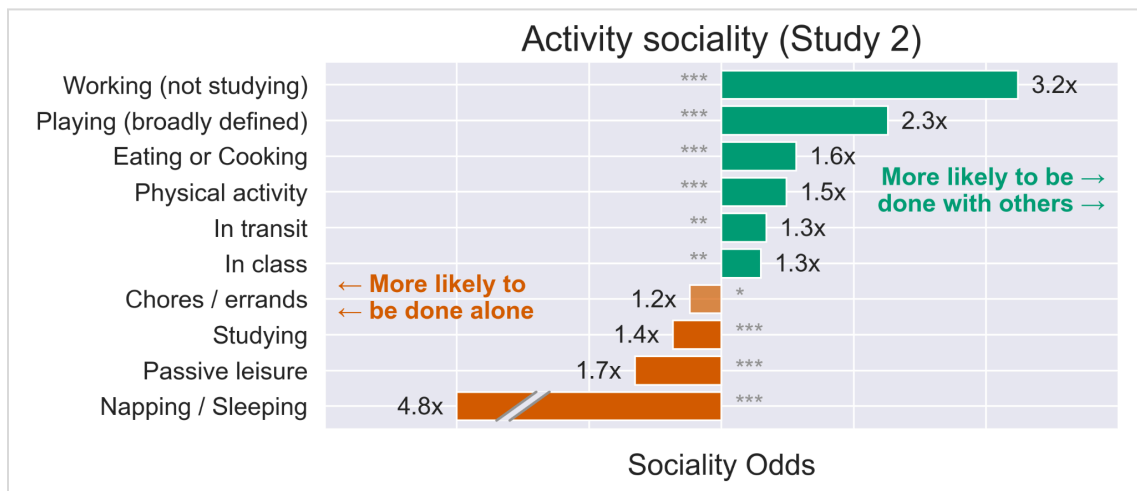
Emotions: frequency and sociality

Feedback in the exit survey of Study 1 alerted us to additional emotion terms that participants wished were present ("tired" being the most requested term, even though emotion science does not generally consider this to be an emotion). We also removed terms that were rarely chosen in Study 1 (e.g., "triumphant"), but the final list is still quite similar. This time, some of the emotions were presented in triplets, e.g., "Interested / engaged / curious" instead of simply "interested." For brevity, we use only one of the terms in our figures and tables below.[7]

"Tired" was far and away the most frequently chosen term (26% of surveys), followed by relaxed (13%), interested (12%) and bored (6.5%). Least frequent were shame (0.7%), affection/compassion (1.3%), loneliness (1.3%), and pride (2%).

Figure 15: Emotion frequency (Study 2)
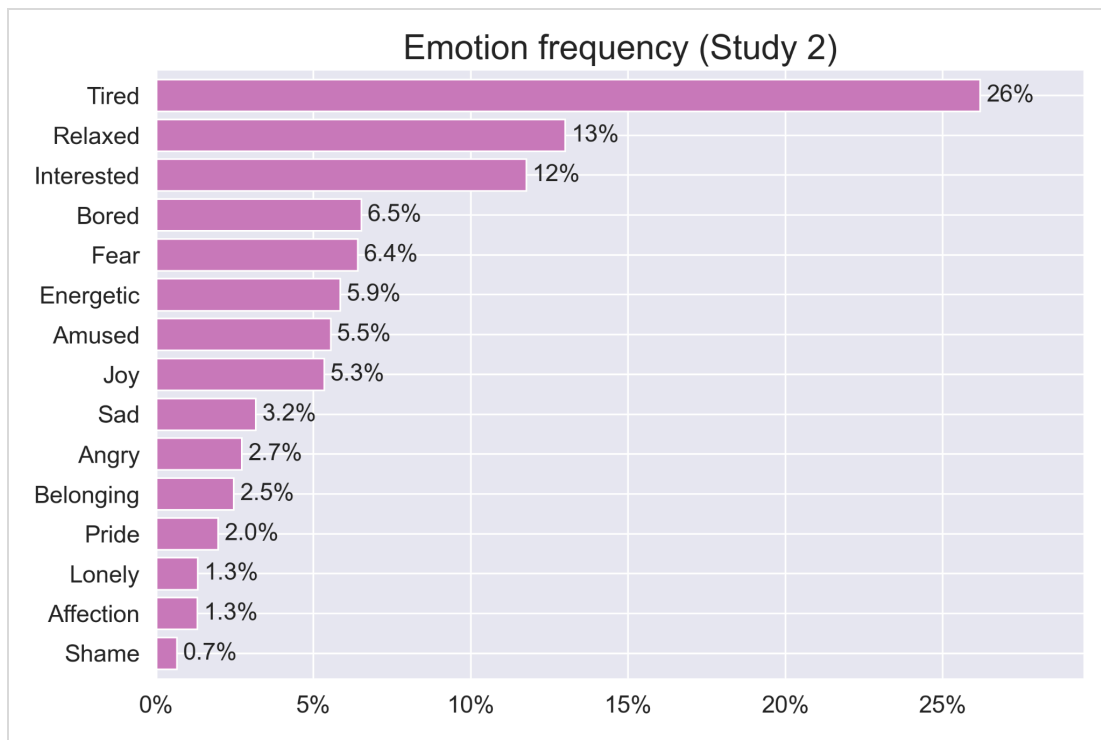
We explore the sociality of emotions as well. In Figure 16 below, we again find that emotions, broadly, are much more likely to be experienced in the company of others than alone. "Belonging" is a staggering 13 times more likely to be felt when with others, but so are amused (5.2x), affection (5x), joy (3.7x), energetic (3x), interested (2.5x), pride (1.7x), and relaxed (1.2x). Only 3 emotions were significantly more common when alone, and even then the difference was mild: lonely (2.1x more likely when alone), bored (1.5x), and tired (1.3x). "Lonely" is understandably felt more when alone, but the modest figure of 2.1x implies that about one-third of the time people feel

---

[7] Full list of emotion choices: affectionate/compassion | amused/laughing | annoyed/angry/frustrated | anxious/nervous/afraid | ashamed/embarrassed | belonging/companionship | bored | down/sad/deflated | energetic | interested/engaged/curious | isolated/lonely | joyful/excited/fun | proud/accomplished | relaxed/peaceful/pleasantly low-key | tired | nothing, really

lonely, they are in the company of others. This echoes the item from the UCLA loneliness scale: "People are around me but not with me" (Russell, 1996).

Figure 16: Emotion sociality (Study 2)
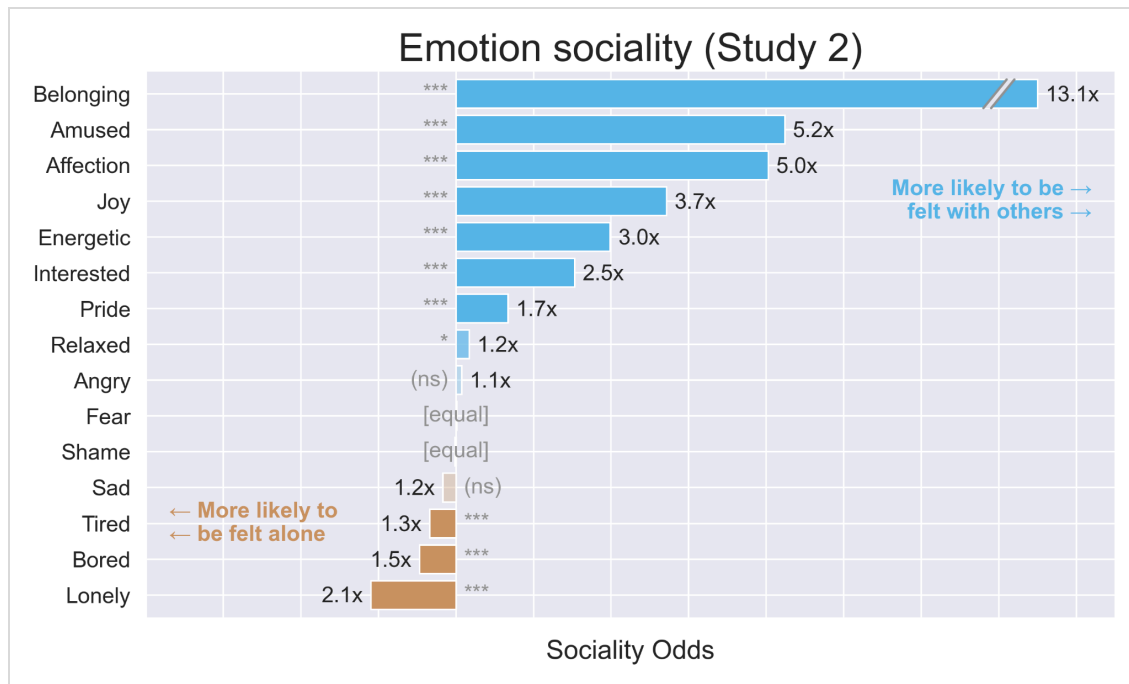
Modeling Results - Study 2

Again, our analysis here parallels Study 1 as closely as possible.

Model ESM1: Momentary well-being and any social contact (Study 2)

As before, we begin with a model using a single binary measure of social behavior: whether or not the individual was interacting with anyone at the moment of assessment, through any medium. We include individual covariates as before. Fitted model information is in Figure 17 and accompanying Table 6.

Again, we see a clear positive association between interacting with others and higher well-being, where social contact predicts an approximately 6.7-point increase in well-being ($\beta = 6.67$, $t = 19.6$, $p < 0.001$), which is well in line with the value of 7.4 found in Study 1 (Model Ep1).

Examining the covariates, we again see no significant main effect of gender or race. Unlike Study 1, having a romantic partner was not associated with well-being, whether local or distant. In Study 2, we also captured whether the person was born in the US, which was marginally negatively associated with well-being ($\beta = -2.64$, $t = -2.1$, $p = 0.036$).

The participant's trait well-being at intake was, again, significantly associated with well-being: a one-standard-deviation increase in well-being at intake is associated with an estimated 5.4-point increase in well-being in each of the participant's surveys ($\beta = 5.36$, $t = 10.4$, $p < 0.001$), greater than the 3-point increase found in Study 1.

The day of week was significant, with Friday, Saturday, and Sunday being associated with a roughly 2-point increase in well-being relative to Monday. These day-of-week effects are smaller than in Study 1, where Friday and Saturday were associated with a 4- to 5-point increase in well-being. However, Sunday was significantly positive in Study 2, but not Study 1. This perhaps reflects a bias

in recall due to the methodology of Study 1, where reports for Sunday were collected Monday morning.

Finally, unlike Study 1, we do not see any systematic trend in reported well-being over the course of the study ("Day of study" below).

Figure 17: Momentary well-being and binary social contact (Study 2)
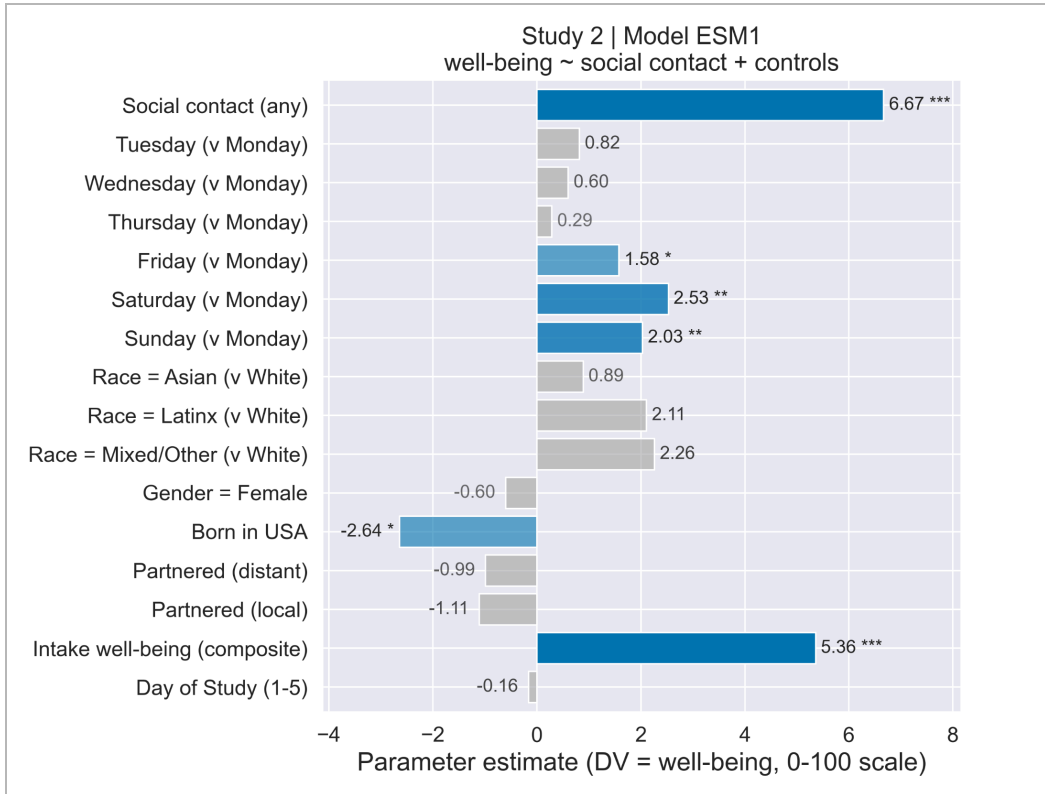
Statistical significance is annotated symbolically (*** p < 0.001; ** p < 0.01; * p < 0.05; † p < 0.10), and bar color and opacity also indicate significance.

Table 6: Momentary well-being and binary social contact (Study 2)

Table

term	Beta	SE	t	p
Social contact (any)	6.67	0.34	19.64	< 0.001
Tuesday (v Monday)	0.82	0.78	1.06	0.289
Wednesday (v Monday)	0.6	0.83	0.72	0.469
Thursday (v Monday)	0.29	0.83	0.35	0.725
Friday (v Monday)	1.58	0.79	2.01	0.045
Saturday (v Monday)	2.53	0.77	3.28	0.001
Sunday (v Monday)	2.03	0.76	2.68	0.007
Race = Asian (v White)	0.89	1.48	0.6	0.55
Race = Latinx (v White)	2.11	1.69	1.25	0.213
Race = Mixed/Other (v White)	2.26	1.9	1.19	0.236
Gender = Female	-0.6	1.41	-0.43	0.668
Born in USA	-2.64	1.25	-2.11	0.036
Partnered (distant)	-0.99	1.58	-0.63	0.529
Partnered (local)	-1.11	1.21	-0.92	0.358
Intake well-being (composite)	5.36	0.52	10.39	< 0.001
Day of Study (1-5)	-0.16	0.15	-1.06	0.289
(Intercept)	64.44	2.13	30.32	< 0.001

*Note: The dependent variable (momentary well-being) is on a 0-100 scale

Model ESM2: Carryover Effects (Study 2)

Again we explore whether the benefits of social contact at one time carry over into the hours that follow. That is, we examine whether social behavior at time t predicts well-being at time $t+1$. We fit the same model as in ESM1, but with an additional binary term indicating if the person was interacting with others in the *preceding* episode.

In contrast to Study 1 (Model Ep2), we *do* find that having interacted with others at time $t-1$ significantly predicts greater well-being at time t, by 1.3-points ($\beta = 1.33$, t = 3.5, p < 0.001). The term for social contact at time t itself is similar, 6.86 (compared to 6.56 in Model ESM1, which lacks this carryover term). A likelihood ratio test confirms superior fit compared to Model ESM1 ($\chi2(1) = 12.0$, p < 0.001). It is possible that the disparity with Study 1 is due to methodology; Study 2 measures well-being very soon after an event, while Study 1 involves recall from the following day. Hence, Study 2 is likely the more valid data source in evaluating carryover effects.

Models ESM3: Momentary well-being and granular social measures (Study 2)

As in Study 1 (Model Ep3), we created a model that considers all combinations of medium and relationship type. Recall that in this study, we introduced a new type of interaction partner: "organized group" (which could be a student group, sports team, religious group, and so forth). We cross the 5 major relationship types and 4 media types to create 20 variables of social contact.

Figure 18 and Table 7 show the fitted values for the predictors of interest (omitting covariates for brevity). From these data, it is again clear that in-person time with friends, family, and romantic partners are robust predictors of higher well-being. In-person time with friends is associated with a 9.3-point increase in episodic well-being (vs. 11.4 in Study 1), romantic partners 11.8 points (vs. 11.1), and family 6.6 points (vs. 8.8). Organized groups, however, were associated with a striking 11-point increase in well-being, which may reflect the preponderance of friends in these groups, or a unique benefit of group contact. In contrast to Study 1, in-person contact with others (acquaintances, strangers, coworkers, etc) *was* significantly and positively associated with well-being (3.1-point increase), albeit less-so than closer relationship types. This only held for in-person time, however, as contact with such persons via other media showed no relationship to well-being. The positive association for contact with "other" relationship types was driven by the "acquaintance" group, as another model separating this variable into its constituent types (acquaintances, coworkers, and strangers) showed only acquaintances to be positive.

Video chat contact was again positively associated with well-being for family, friends, and romantic partners, but again more mildly than in Study 1. Phone calls were more mixed. Calls with friends were associated with greater well-being, as was found in Study 1. Calls with family were associated with marginally *lower* well-being, whereas Study 1 found no association. Calls with partners had no association with well-being, whereas Study 1 found a positive association. And calls with others were unrelated to well-being, as was found in Study 1.

Figure 18: Momentary well-being and granular social measures (Study 2)

Study 2 | Model ESM1
well-being ~ granular social contact + controls

Control parameters not shown

Category	Estimate
In-person : Friend	9.31 ***
In-person : Partner	11.80 ***
In-person : Family	6.57 ***
In-person : Group org	10.92 ***
In-person : Others	2.72 ***
Video : Friend	7.85 ***
Video : Partner	5.40 **
Video : Family	6.46 ***
Video : Group org	4.48
Video : Others	2.64
Phone : Friend	6.61 **
Phone : Partner	-0.88
Phone : Family	-3.06 *
Phone : Group org	-9.72
Phone : Others	4.17
Text/DM : Friend	2.21
Text/DM : Partner	2.83 †
Text/DM : Family	2.57
Text/DM : Group org	-8.84 †
Text/DM : Others	-2.22

Parameter estimate (DV = well-being, 0-100 scale)

Statistical significance is annotated symbolically (*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; † $p < 0.10$), and bar color and opacity also indicate significance.

Table 7: Momentary well-being and granular social measures (Study 2)

Table

term	Beta	SE	t	p
In-person : Friend	9.31	0.49	19.19	< 0.001
In-person : Partner	11.8	0.78	15.07	< 0.001
In-person : Family	6.57	0.87	7.53	< 0.001
In-person : Group org	10.92	1.38	7.89	< 0.001
In-person : Others	2.72	0.64	4.27	< 0.001
Video : Friend	7.85	1.68	4.68	< 0.001
Video : Partner	5.4	1.71	3.16	0.002
Video : Family	6.46	1.7	3.8	< 0.001
Video : Group org	4.48	3.25	1.38	0.169
Video : Others	2.64	1.68	1.56	0.118
Phone : Friend	6.61	2.13	3.1	0.002
Phone : Partner	-0.88	2.53	-0.35	0.727
Phone : Family	-3.06	1.53	-2	0.045
Phone : Group org	-9.72	11.72	-0.83	0.407
Phone : Others	4.17	3.82	1.09	0.275
Text/DM : Friend	2.21	1.39	1.59	0.113
Text/DM : Partner	2.83	1.62	1.75	0.08
Text/DM : Family	2.57	2.33	1.1	0.27
Text/DM : Group org	-8.84	5.33	-1.66	0.097
Text/DM : Others	-2.22	2.93	-0.76	0.449

*Note: The dependent variable (momentary well-being) is on a 0-100 scale

Model ESM4: Momentary well-being and subjective "closeness" to interaction partners (Study 2)

One way to explain the superiority of social contact with family, friends, and romantic partners is simply that these are the persons with whom one feels closest: the "type" of relationship may be a mere proxy. To test this directly, in addition to indicating the type of relationship and the medium through which they are interacting, subjects also indicated how "close" they felt to their interaction partners. This was assessed with the "Inclusion of Other in Self" scale (IOS; Aron, Aron, & Smollan, 1992). The question appears as shown below:

Figure 19 Inclusion of Other in Self (IOS) scale

How close do you feel to the person/people you were interacting with? If it was multiple people, just pick the one that best represents your relationship to all of them in general.

Choose the picture below which best describes your relationship
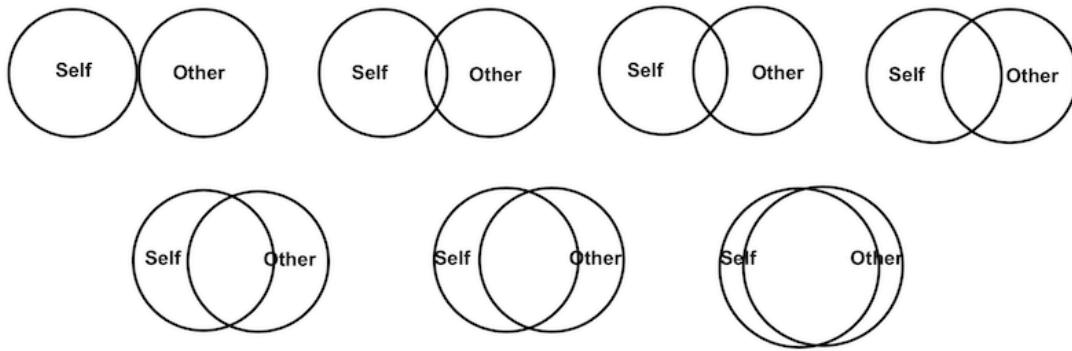
Responses were coded numerically, with 1 for the two non-overlapping circles, 2 for the next (slightly overlapping) circles, and so forth, up to 7 for the most overlapping circles. These were coded as a factor, so as not to assume that each step in the scale is equivalent.

We model well-being as a function of the usual covariates, plus the (factor-coded) level of closeness. Figure 20 and Table 8 below show predicted increases in well-being when interacting with others, depending on the perceived closeness of the subject to their interaction partner(s). Interacting with distant others (closeness = 1) has no significant relationship to well-being; interacting with slightly closer others (closeness = 2) predicts a 3.9-point higher well-being than being alone; and interacting with closer others (closeness = 3+) predicts a roughly 8-point greater well-being than being alone.

Importantly, we find that subjective closeness explains well-being *better* than an equivalent model using relationship type instead ($\chi2(2) = 43.8$, $p < 0.001$). Hence, the objective category of relationship matters less than its subjective closeness.

Figure 20: Momentary well-being and subjective "closeness" to interaction partners (Study 2)
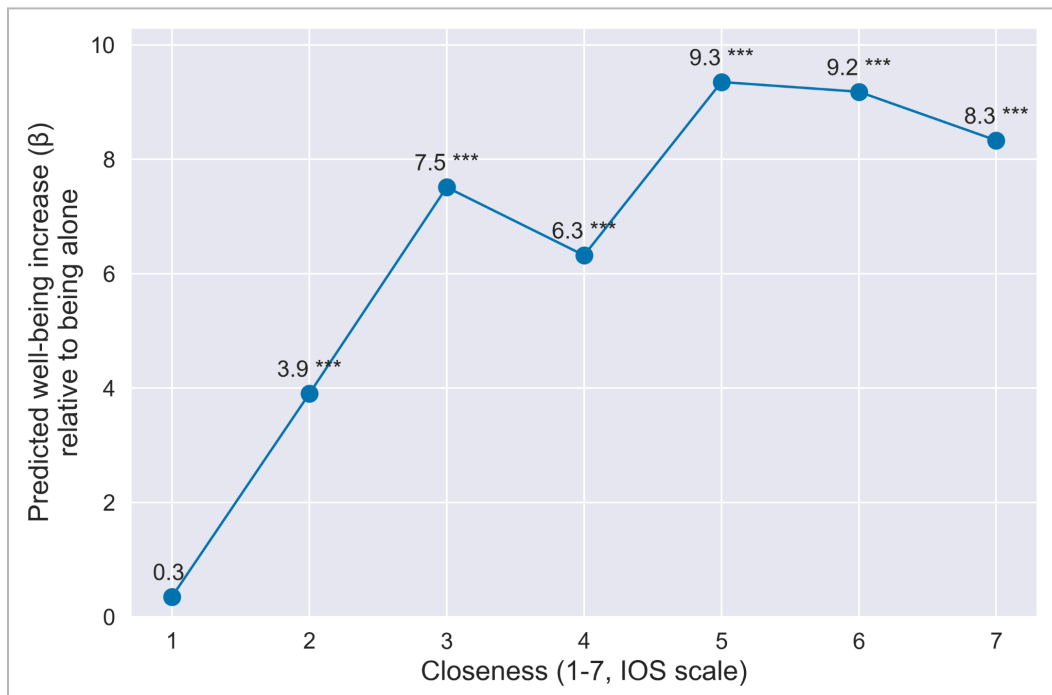

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Table 8: Momentary well-being and subjective "closeness" to interaction partners (Study 2)

Table

term	Beta	SE	t	p
Closeness = 1	0.43	0.77	0.56	0.575
Closeness = 2	3.95	0.72	5.46	0.000
Closeness = 3	7.59	0.71	10.70	0.000
Closeness = 4	6.37	0.69	9.19	0.000
Closeness = 5	9.65	0.70	13.71	0.000
Closeness = 6	8.80	0.68	12.88	0.000
Closeness = 7	8.06	0.72	11.22	0.000

Note: A "closeness" of zero indicates that the participant was not interacting with anyone at all, hence these parameters are in comparison to being alone.

Model ESM5: Momentary well-being, considering activities (Study 2)

We extend model ESM3 to include variables for the 11 activities participants could report engaging in. These are similar to the 13 activity choices in Study 1, excluding rarely chosen activities. Again, we ask two questions. First, do our findings of the positive association between certain types of social contact and well-being hold after controlling for the activities engaged in? Second, which activities are most associated with well-being? We explore the results of this model in two parts.

To the first question, if our results hold after controlling for activities, the answer is still a clear "yes." It remains true that interacting in-person is robustly associated with greater well-being, especially for family, friends, and partners. However, video conversations are no longer significantly associated with well-being for anyone (versus a positive association for friends and family when activities were not a part of the model).

Worth noting is that one of the activities in the model is "conversation" (akin to "socializing" in Study 1), which is undoubtedly confounded with measures of social contact. This "conversation" term (see next tables) is associated with a 7.4 point increase in well-being. Even with this confounding variable, the social contact terms show the same pattern of results, albeit reduced in magnitude.

Table 9 below compares the estimates for social contact parameters in this model to the same parameters in Model ESM3 above. After controlling for activities in the current model, these coefficients are changed somewhat, but the overall narrative of results remains unchanged. This adds to the robustness of our findings, as it shows the incremental value of social contact, above and beyond what one is "doing."

Table 9: Momentary well-being by interaction partner, controlling for activities (Study 2)

Table

term	β without activity controls	β with activity controls
In-person : Friend	9.31*	6.39*
In-person : Partner	11.80*	9.10*
In-person : Family	6.57*	4.09*
In-person : Group org	10.92*	7.74*
In-person : Others	2.72*	2.76*
Video : Friend	7.85*	4.40
Video : Partner	5.40	2.59
Video : Family	6.46*	2.86†
Video : Group org	4.48	3.74
Video : Others	2.64	2.49
Phone : Friend	6.61	3.40
Phone : Partner	-0.88	-3.05
Phone : Family	-3.06*	-6.00*
Phone : Group org	-9.72	-17.77
Phone : Others	4.17	1.44
Text/DM : Friend	2.21	0.88
Text/DM : Partner	2.83†	2.20
Text/DM : Family	2.57	0.87
Text/DM : Group org	-8.84†	-8.34
Text/DM : Others	-2.22	-2.13

*Note: The dependent variable (momentary well-being) is on a 0-100 scale

Clearly what one is doing moderates the relationship between social contact and well-being, but only partially. We next examine the estimates for the activities themselves, inherently controlling for social contact. Results appear in Figure 21 and Table 10 below. We find that engaging in "play" is most strongly associated with well-being (+10.2 points). Also significant and positive are conversing (+7.4), eating or cooking (+6.6) physical activity (+5.8), passive leisure like watching TV (+3.9), and chores/errands (+2.6). The only significant negative association was sleeping and resting (-2.4), though we should interpret this with caution as it is unclear how to interpret self-reported well-being while sleeping.

Figure 21: Momentary well-being by activity, controlling for social contact (Study 2)
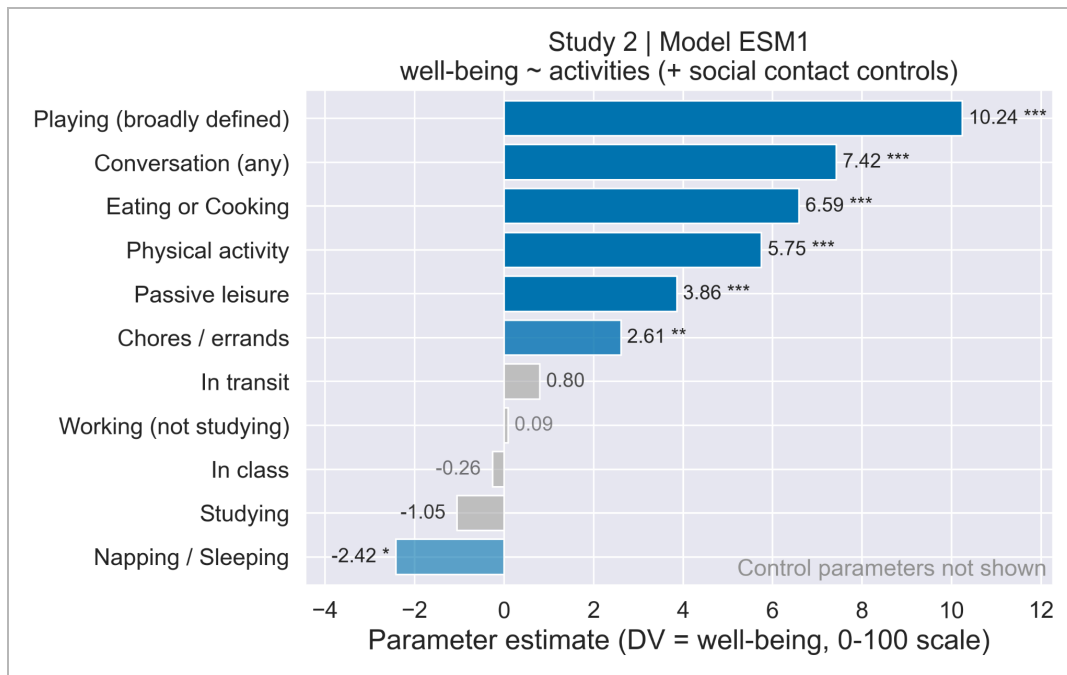
Table 10: Momentary well-being by activity, controlling for social contact (Study 2)

Table 10

Momentary well-being by activity, controlling for social contact (Study 2)

term	Beta	SE	t	p
Playing (broadly defined)	10.24	1.29	7.92	< 0.001
Conversation (any)	7.42	0.89	8.33	< 0.001
Eating or Cooking	6.59	0.91	7.26	< 0.001
Physical activity	5.75	0.98	5.87	< 0.001
Passive leisure	3.86	0.83	4.66	< 0.001
Chores / errands	2.61	0.97	2.70	0.007
In transit	0.80	0.94	0.85	0.397
Working (not studying)	0.09	1.11	0.08	0.933
In class	-0.26	0.93	-0.28	0.777
Studying	-1.05	0.80	-1.31	0.192
Napping / Sleeping	-2.42	0.94	-2.56	0.01

*Note: The dependent variable (momentary well-being) is on a 0-100 scale

Again, what one is doing matters, but it does not change the fundamental nature of how social contact relates to our well-being.

Models ESM6+: Momentary well-being and individual differences (Study 2)

Again we ask if social contact has different associations with well-being for different types of people. We fit a series of models, each examining the interaction of one specific personal trait with

our measures of social behavior. We tested: gender, race, age, socioeconomic status, romantic partnership status, each of the Big Five personality dimensions in turn, well-being at intake, loneliness, and social support (ISEL). Each model began from Model ESM3 above, adding the interaction of a single trait/demographic with measures of social contact.

Again, we do not find meaningful evidence for individual differences in response to social contact. For example, to test if gender alters the pattern of results, we add an interaction term between gender and the binary variable indicating if the participant is being social or not. Such a value would indicate that the relationship between well-being and social contact is stronger for some genders over others. However, this interaction term is not significant (β = -0.26, t = -0.25, p = 0.80) and the model fit does not improve ($\chi2(1)$ = 0.07, p = 0.80). Similarly, no significant interactions are found with age, race, partnership status, well-being at intake, loneliness, interpersonal support, nor any of the Big Five personality dimensions.

Discussion - Studies 1 and 2

While it is widely understood that social relationships are a keystone to human well-being, it is much less understood how different *kinds* of relationships and contact *media* influence well-being. This is in large part due to methodological tendencies in the field; in the review by Lyubomirsky and colleagues (Lyubomirsky et al., 2005), the overwhelming majority of studies used measures that were simple retrospective questions on a narrow section of social life: number of friends, number of close friends, friendship satisfaction, or (by far the most common) marital status and marital satisfaction. The coarseness of these measures prevents a more nuanced understanding of social behavior and its relationship to well-being.

Studies 1 and 2 aimed to open new investigatory lines by capturing more detailed social measures. Study 1 used the Day Reconstruction Method, wherein participants reported in detail upon their events, emotions, and social contacts for five consecutive days. Study 2 used experience sampling, surveying participants at random moments throughout their day about their current emotions, activities, and social behaviors. The design of these studies allowed us to test several hypotheses related to how daily well-being relates to four features of social contact: the quantity (dose), the kind of relationship, the medium of contact, and the traits of the individual.

Findings on Dose

In keeping with the ample literature on the positive relationship between social contact and well-being (Lyubomirsky et al., 2005), we find a positive relationship between time spent socializing and daily well-being. Roughly speaking, we find that interacting with others predicts a roughly 7-point increase (on a 0-100 scale) in one's well-being in the moment, relative to being alone. The association is stronger (11 points) for family, friends, and romantic partners. For context, the average participant's well-being fluctuated by about 14 points throughout the day (standard deviation in well-being ratings across diary episodes or experience samples), implying an effect size of roughly d=0.5 for any social contact, and d=0.8 for contact with family, friends, and partners (a large effect).

In Study 1, where participants also rate each day holistically ("Overall, how did you feel yesterday?"), each additional hour spent with family, friends, and partners predicts a 1.4-point increase in this summary judgment. For context, the typical with-person variation in overall day well-being was also about 14 (within-person standard deviation of overall day well-being reports), meaning each hour has an implied effect size of d = 0.1. This is additive, hence (say) six hours of social contact would have an estimated effect size of d = 0.6.

In contrast to some studies (Ren et al., 2022), we find no evidence for diminishing returns – the idea that the benefits of social contact asymptote at some point. Our results suggest, at least in our college student sample, greater social contact is always associated with greater well-being.

Findings on Kind

Previous research has been somewhat equivocal in its conclusions on how different types of relationships influence well-being. Does it matter if social contact is with romantic partners, work colleagues, family, or friends? Several studies have found, in exploratory fashion, that time with friends is the most uniquely positive (Kahneman et al., 2004; Quoidbach et al., 2019). In keeping with this intriguing possibility, our study finds that time with friends is consistently highly related to well-being in the lives of our sample of young adult students. However, in our study, contact with family and romantic partners were also positively related to well-being, to approximately the same degree as contact with friends. In Study 2, where "organized group" was an option for participants to select, these group interactions were experienced as similarly positive to time with family, friends, and partners.

In contrast to much research on contacts with strangers (e.g., Van Lange & Columbus, 2021), we find little relationship between time spent with strangers and well-being. This may, in part, be due to the fact that the aforementioned studies often look at contact so brief that they would not appear in our data. A three-minute conversation with a stranger on a train, or a warm "hello" to a bus driver, is unlikely to be noted as an "episode" in their diary data in Study 1, and is also infrequently coincidental with a randomly-timed text survey in Study 2. Nevertheless, the contact that our participants reported with strangers (a term we use to encompass classmates, colleagues, teachers, as well as true strangers) did not relate to well-being, except for a modest positive association for acquaintances in Study 2. In some instances, the relationship was negative.

To square this with the intervention work of Epley and others, perhaps the social *intentions* of the participants (e.g., to make small pleasant talk vs. to complete a work project) may determine whether or not the time itself is beneficial to well-being. This is roughly consistent with the work of Hudson and colleagues that finds suggestive evidence that time with co-workers is not beneficial to well-being per se, but accomplishing work (which involves contact with co-workers) can be a source of meaning and purpose (Hudson et al., 2020).

Findings on Medium

Human social behavior is increasingly mediated by technology, and in ever-evolving forms. Well-being science struggles to keep up with the abundance of new media that become staples of communication. Our research sought to measure the use of broad classes of these technologies for social purposes: video chat (encompassing platform giants like Zoom, Skype, and Facetime), phone calls (a global staple for decades), and text messaging (including direct messaging on platforms like WhatsApp, Instagram, and Messenger). Studies that systematically document social behavior *and* the medium through which it occurs are few (reviewed earlier, e.g., Macdonald & Hülür, 2021) and often equivocal in their findings on digitally-mediated social contact (Gonzales, 2014; Shen et al., 2017). Hence, there is need for fresh studies that measure these interactions in new samples with new methods.

In Studies 1 and 2, we found robust positive associations for in-person social contact, but also for video chatting and (to a lesser extent) phone calls. This is in keeping with positive findings for technological communication and well-being, for example in older adults (Chopik, 2016). However, our results revealed a curiosity: participants reported greater well-being while they were video chatting or on the phone with close others, but it did not appear to affect how they later evaluated their day overall. While subsequent research is needed, such findings are in line with

well-established theory of subjective well-being, wherein momentary affect is related to, but distinct from, broader evaluations of one's life as a whole (Diener, Suh, Lucas, & Smith, 1999). In the context of "social nutrition," such video and phone contact may be something of a "simple sugar" – enjoyable in the moment, but with short-lasting effects.

These findings contribute to the conversation around well-being and online behavior, particularly among the young. Namely, large-scale survey data tends to reveal that the more time young people, particularly adolescents, spend online, the lower their well-being, and the greater the likelihood for anxiety and depression (Lin et al., 2016; Twenge et al., 2022). This association, it should be noted, depends substantially on how the technology is used and the intentions of the user (Kross et al., 2021). And we note that different results might be observed with differently-aged participants (e.g., the elderly making contact with distant family), people in different cultural contexts, and in different historical periods (Study 1 took place after the end of a shelter-in-place period of the COVID pandemic). Our findings suggest that, to the extent that we could measure it, social contact through technology *does* have positive associations with well-being, at least in the moment.

Findings on Individual Differences

Given that trait differences among people relate to social behavior (e.g., extraversion, agreeableness), it stands to reason that social needs, and responses to contact, vary among people as well. We examined whether the relationship between social contact and well-being differed as a function of personality (each of the Big Five traits), global psychological trait measures (e.g., global well-being at intake, social support), and demographics (e.g., race and gender).

We conclude in the negative. While there are main effects of some of the psychological scales as predictors of well-being, there were no meaningful interactions with social contact. Hence, we did not find any evidence to support the idea that different types of people get different benefits from different types or amounts of social contact. This is in keeping with related studies that generally failed to find such interactions (Sun, Harris, and Vazire, 2020; Quoidbach, Taquet, Desseilles, de Montjoye, and Gross, 2019; Killingsworth, 2021).

Conclusion - Studies 1 and 2

Social connection has long been understood to be an enormous factor in human well-being, but the differential effects of varying kinds of social contact are underexplored. We used two convergent five-day studies to explore how several dimensions of social contact are related to well-being in a university sample. We find that spending time in-person with friends, family, and romantic partners has a positive linear association with well-being, both in the moment and in evaluating one's day overall. Contact through video chat and phone calls was associated with greater momentary well-being, but had no effect on one's evaluation of their day overall. Text messaging was effectively unrelated to well-being, though the results for text messaging should be interpreted with some caution for the reasons noted earlier.

Hence, it is clear that social time, in-person, with close others has a distinctly positive effect on well-being that is not seen in contact with strangers and more distant others. Temporary benefits were found to video and phone conversations, again only with close others.

Study 3: An inductive interviewing approach to conceptualizing social health

Foreword

This study, and its results, aim to be a stepping stone towards the development of a theory of human "social nutrition." The ultimate ends of which are to inform interventions that facilitate social health and thereby the enjoyment of and satisfaction with life. The results of Study 3 serve as fodder for subsequent work, and many more studies will be required to make meaningful progress on this heretofore intractable problem.

Background on measuring social health

Many aspects of social health have been researched over the years, but together they comprise a somewhat confused position on what it means to be flourishing interpersonally. The field lacks a comprehensive theory of human social need, and building such a theory has formidable obstacles. Below, we review investigations into various theorized *pieces* of social health, what their results establish, and what is left unexplained.

Loneliness

Loneliness is the subjective experience that befalls a person when she perceives a discrepancy between her desired and actual levels of social connection. Measures of loneliness correlate robustly with all three dimensions of subjective well-being (in Study 1, loneliness correlated with life satisfaction at $r = -0.46$, positive affect at $r = -0.44$, and negative affect at $r = 0.45$). Even for scientists and policymakers skeptical of the intrinsic value of affective states, there is extensive empirical research on the dire consequences of loneliness for a person's physical health. John Cacioppo is perhaps the best known researcher of the biological processes of loneliness and its health consequences. While not the focus of this dissertation, it is important to review the stakes of this topic, which are well summarized in Cacioppo and Patrick's book on the subject (2008). Among other things, loneliness is associated with all-cause mortality, hypertension, sleep problems, mental illness, diminished sensitivity to rewards, social withdrawal, and being subject to negative social stigma. A 2010 publication about the relative mortality risks of loneliness compared to other factors revealed that having high (vs. low) social integration was of comparable benefit to quitting smoking (Holt-Lunstad, Smith, & Layton, 2010). Or, in terms the media latched onto, loneliness was a similar health risk to smoking some 15 cigarettes a day (e.g., Leland, 2022).

Loneliness is commonly measured with the UCLA Loneliness Scale (Russell, 1996). Examining its specific items is important to our discussion here, as we will see what aspects of social health it does and does not appear to assess. Table 11 lists the eight items in the short form, such as, "I lack companionship" and "There is no one I can turn to." These two items are roughly representative of the tone of this instrument - a general sense of not having enough connection, or that the connection is superficial. Like most scales, the items themselves emerged from researchers and psychologists' minds based on theory and clinical experience (Russell & Peplau, 1978; Russell, Peplau, & Cutrona 1980). Like most efforts in scale development, they began from a larger pool of candidate items and selected those with superior psychometric properties.

Table 11: UCLA Loneliness Scale, 8-item
1. I lack companionship.
2. There is no one I can turn to.

3. I am an outgoing person. (Reverse-scored)
4. I feel left out.
5. I feel isolated from others.
6. I can find companionship when I want it. (Reverse-scored)
7. I am unhappy being so withdrawn.
8. People are around me but not with me.

Belonging

The opposite of loneliness is, perhaps, "belonging." In 1995, the now-widely-known paper by Roy Baumeister and Mark Leary was published in which they argued that the "need to belong" is a core human motivation, analogous to hunger or thirst. They described the need as having "two criteria: first, there is a need for frequent, affectively pleasant interactions with a few other people; second, these interactions must take place in the context of a temporally stable and enduring framework of affective concern for each other's welfare." While this is a parsimonious definition of belonging, the idea of belonging as a need is not new. Maslow (1943), in attempting to explain *all* of human need (not just social), describes a belonging/love stage of development as such:

> *If both the physiological and the safety needs are fairly well gratified, then there will emerge the love and affection and belongingness needs, and the whole cycle already described will repeat itself with this new center. Now the person will feel keenly, as never before, the absence of friends, or a sweetheart, or a wife, or children. He will hunger for affectionate relations with people in general, namely, for a place in his group, and he will strive with great intensity to achieve this goal.*
>
> -   *Maslow, 1943*

Maslow's words exemplify not only the timelessness of questions of social health, but also the coarseness with which it is typically explicated ("friends" "a wife" "children" "group"). Nevertheless, there is excellent evidence for the value of social connections and group membership to support Maslow, Baumeister, and Leary. Beyond the obvious evolutionary imperative of any sexually-reproducing species to find a mate and propagate one's genes, their work is consistent with theories of collective identity wherein people naturally seek to affiliate with, and blend identities with, other people and groups (Brewer & Gardner, 1996). It is also consistent with theories of multilevel selection, which posit that it is advantageous for a species to have adaptations that encourage forming and maintaining groups with conspecifics (Wilson, Van Vugt, & O'Gorman, 2008). However, instruments measuring a sense of belonging are few (for a review, see: Allen, Kern, Rozek, McInerney, & Slavich, 2021), and there is no research (to our knowledge) that attempts to quantify the extent to which a sense of belonging drives well-being, above and beyond other measures of social health. Most importantly, belonging is not, and does not aim to be, a holistic explanation of all human social need; it is merely one well-supported facet.

Social Support

"Social support" takes a more exchange-oriented view of social needs. It is commonly measured with the Interpersonal Support Evaluation List or ISEL (Merz, Roesch, Malcarne, Penedo, Llabre, Weitzman, Navas-Nacher, Perreira, Gonzalez, Ponguta, Johnson, & Gallo, 2014). Items were generated by the researchers, rooted in four theoretically grounded facets of social support – reduced to three in many short forms. In this short form, ISEL assesses "tangible" support (e.g., someone who could lend you money), "appraisal" support (e.g., someone who will listen and console you when upset), and "belonging" support (e.g,. someone who would go to the movies with

you today). This last facet, "belonging," is perhaps closest to Baumeister and Leary's definition of "belonging," but considering the items (e.g., "If I wanted to have lunch with someone, I could easily find someone to join me"), one could argue that it would be better termed "companionship" – that is, merely having others with whom to do enjoyable activities, irrespective of the enduringness of the relationship. In fact, when measures of companionship and social support were pitted directly against each other (Rook, 1987), companionship emerged as the stronger predictor of health and lack of loneliness. Rook argues that social contact is a crucial end in itself, not merely a means of obtaining help or affirming one's worth.

Table 12: Items of the Interpersonal Support Evaluation List - Short Form
Appraisal Facet:
1. I feel that there is no one I can share my most private worries and fears with. (Reverse-scored)
2. There is someone I can turn to for advice about handling problems with my family.
3. When I need suggestions on how to deal with a personal problem, I know someone I can turn to.
4. If a family crisis arose, it would be difficult to find someone who could give me good advice about how to handle it. (Reverse-scored)

Belonging Facet:
1. If I wanted to go on a trip for a day (for example, to the country or mountains), I would have a hard time finding someone to go with me. (Reverse-scored)
2. If I decide one afternoon that I would like to go to a movie that evening, I could easily find someone to go with me.
3. I don't often get invited to do things with others. (Reverse-scored)
4. If I wanted to have lunch with someone, I could easily find someone to join me.

Tangible Facet:
1. If I were sick, I could easily find someone to help me with my daily chores.
2. If I had to go out of town for a few weeks, it would be difficult to find someone who would look after my house or apartment (the plants, pets, garden, etc.). (Reverse-scored)
3. If I was stranded 10 miles from home, there is someone I could call who could come and get me.
4. If I needed some help in moving to a new house or apartment, I would have a hard time finding someone to help me. (Reverse-scored)

Companionship (and talking to strangers)

Rook's view dovetails with a variety of experiments demonstrating positive consequences from pleasant interactions with strangers (Epley & Schroeder, 2014; Van Lange & Columbus, 2021). For example, Epley and Schroeder (2014) had participants strike up a conversation with fellow passengers on their morning train commute, and subjects reported positive affective results relative to a control group. Clearly such interactions do not "take place in the context of a temporally stable and enduring framework of affective concern for each other's welfare," as Baumeister and Leary defined a sense of belonging. Hence, these interactions must serve some other social function. The items in the ISEL also do not require any type of enduring bond, merely the availability of others to fulfill a particular need. Hence, something more is at play than the mere affirmation of reliable social bonds.

Attachment Theory

The idea that relationships must be "temporally stable and enduring" in order to promote belonging is reminiscent of attachment theory (Ainsworth, 1979). Initially, this field focused on the child-caregiver bond, usually mother-infant. A "securely attached" infant views their caregiver as someone who will reliably bring protection and care, and be responsive to the infant's needs. The caregiver becomes a "secure base" from which the child can explore the world. If caregiver responsiveness is inconsistent, absent, or harmful, the infant adapts with an "anxious," "avoidant," or "anxious-avoidant" style of relating their attachment figure. These attachment styles in infancy are predictive of patterns in attachment in adult relationships, particularly romantic relationships (Levine and Heller, 2010). Related to Baumeister and Leary, one might view the adult human as also needing a "secure base" of relationships - one that is "affectively pleasant" and "enduring." That is, the concept of "belonging" suggests that the need for secure attachment persists throughout the life course, albeit in evolved form.

Needs Theory

Further scholarship has brushed up against the same topic. Henry Murray (1938), and later David McClelland (e.g., 1985), enumerated three core human motivations: a need for achievement, a need for power, and (most relevant here) a need for affiliation. Importantly, they stressed that individuals differ in the intensity with which each need is felt. This echoes not only the "need to belong" concept, but also instruments like the Need to Belong Scale (Leary, Kelly, Cottrell, & Schreindorfer, 2013), which measures the different intensities with which people feel a need for belonging. Note that this is measuring the trait of "needing" to belong, not actual experienced belonging. David McClelland is known for his attempts to explain core human motivations like these (specifically: achievement, affiliation, and power), perhaps not so different from Maslow – though his focal context was the workplace, particularly managers. Further, McClelland (and Murray's) approach to enumerating these three motivations does not appear to derive from an attempt to comprehensively survey the space of possible motivations and deduce the primary factors, but rather the theories and intuitions of the researchers themselves and their truly expansive range of studies.

For example, Murray (1938) famously put a group of men through an impressive battery of interview procedures involving 36 total hours of assessment (and a 15-page personal history statement). This included many blunt personal questions (e.g., "What are your chief faults from a social standpoint?" and "Have you ability with mechanical or electrical apparatus?"), projective tests (Thematic Apperception Tasks, and a strange one where subjects stared at a blank card and were told to "try to see or imagine a picture there," then describe it), performance and artistic tests (e.g., the "musical reverie test"), and more. The population of study was small, and the number of assessments enormous, but bold explorations like these can produce truly original hypotheses that develop into novel constructs (such as the need for achievement, power, and affiliation) that are valid and predict behavior. This approach is not entirely unlike the procedure to be proposed here in Study 3, except the procedures are more scoped and methodical. In the semi-structured interviewing protocol to be described here, subjects only expend 1.5 total hours, not 36. Our data includes 130 subjects of all genders, not just 50 men; and the research question is scoped to university students only, avoiding some very large potential sources of human variability (at a cost in generalizability).

This theme of making good, theory-informed guesses about the regions of a possible psychological space comes up again and again in the history of psychology. The results can be quite useful when done well, but one cannot be sure of what one might have missed with a more atheoretical search. This is the primary shortcoming of the many aforementioned theories and measures. There has been no successful attempt to map the entire space of possible social needs and

sources of satisfaction, likely because it is immensely unclear how to begin such an undertaking. We would be remiss, however, to ignore several theories of social relations that *do* purport to explain the full typology of human ties.

Relational Models Theory

Perhaps most famous is Fiske's (1992) Relational Models Theory. With an impressive number of citations, and the eloquence of Fiske's writing, it is surprising that few measures inspired by his schema have come into vogue in our field. In brief, Fiske groups all human relations into four basic types and theorizes that people tend to seek out or spontaneously establish one of these types. And not strictly for selfish gain, Fiske claims – humans simply seem to understand and prefer these types, meaning they have a deep-set place in our neurological wiring. Fiske also has mathematical analogues for each type of group organization that add a sense of profundity to the theory, but as we will see, the typology is problematic in both design and practicality.

The four types of relations described by Fiske are as follows. Communal Sharing (CS) involves a perception that we are all part of a larger whole, that we share a collective fate. There is liberal sharing of resources (what's mine is yours), spontaneous working for the self and group, and taking what resources you need with minimal accounting. Egalitarianism prevails, hierarchy is anathema. It is inherently collectivistic (or communistic) in nature. A marriage or romantic partnership may fit this mold, as the couple sees their fates entwined and share money, work, and responsibilities with little accounting. Identity lines are blurred, and individuals view one another as extensions of themselves.

This aligns well with theories of the self, for example the research and development of the Inclusion of Other in Self (IOS) scale (Aron, Aron, & Smollan, 1992), which we used in Study 2 in our measurement of the perceived "closeness" of social contact partners. See Figure 22 below for the essence of this scale.

Figure 22: Inclusion of Other in Self

"Which picture best describes your relationship with [specific person/group]?"
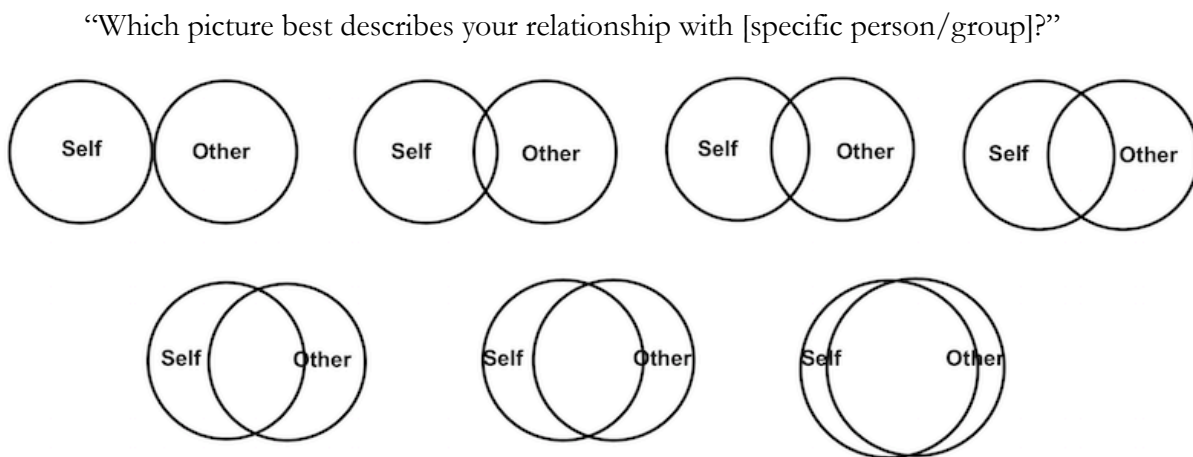
Returning to Fiske's theory, on the opposite end of the spectrum from Communal Sharing is the Authority Ranking (AR) style of relation. This archetype believes in the "right"ness of hierarchy and inequality, and that everyone has a place and a role. Superiors have control and preferential access to resources, but have a "*noblesse oblige*" to protect subordinates. In some cases, what a superior dictates is seen as inherently "right." A bureaucracy or military unit may fit this mold, with the entire

population of the group operating as a single unit where orders are sent down the chain, and they are perceived to be just. This fits with ample research showing that, being a social species, humans do have natural tendencies toward hierarchy in many environments as an efficient means of organization and resource allocation (Rubin, 2000).

Fiske's third type, Equality Matching (EM), is closer to Communal Sharing than Authority Ranking, and it involves a rough score-keeping of in-kind exchanges with others. The goal is predominantly to preserve the relationship itself, meaning it's okay if the balance is imperfect (but not overly so). I help you move, you help me move – but there is no rigorous tabulation of hours spent. It's a medium-trust form of organization. This might occur among groups of friends or same-rank coworkers, where people are generous and share some fate, but have individual interests too and a need for a certain amount of proportionality of outcomes. This clearly fits with reciprocity norms in humans and other social species, emotional responses to trust and cheating, most colorfully demonstrated by Franz de Waal's work with capuchin monkeys (e.g., Brosnan and de Waal, 2014).

Finally, Fiske's relational type involving the least trust and the maximum individuality is Market Pricing (MP). Here, goods and services are exchanged according to conversion to a universal measure, e.g., money. This is a more formal system, requires few preexisting relationships and little trust. Going to a store and exchanging money for food with a stranger you've never met is a classic market pricing example. Markets and currency are the foundation of capitalistic enterprise, which (at its best) can enable great surplus and efficient resource allocation amongst strangers in one-time interactions with minimal trust required. Clearly this type of relationship has ample evidence in both economic scholarship and one's everyday life. Arguably, humans' ability to develop systems (e.g., markets, money) where strangers can interact safely and for mutual benefit is a keystone to our success (Harari, 2014).

There is ample reason to believe that Fiske's four types do exist in human behavior. However, he does not put forth any theory of relational *needs* and what leads to well-being, but rather focuses on types of attitudes to the sharing of goods and support. It does not offer an explanation of the intrapersonal needs being met, nor the intrinsic value of human relationships beyond material exchange (e.g., need to belong, companionship). Hence, it is not a theory of human social need, but rather a descriptive taxonomy of orientations to resource sharing with conspecifics.

Even so, it is problematic. The categories put forth are broad, flexible, and do not clearly establish that human interaction is typological rather than dimensional. For example, if Alice sells her car to her brother, Bob, and gives him a "friendly" price that is somewhat less than she could have gotten on the open market, what kind of relation is this? Communal Sharing could fit if you could argue that they are maximizing group fitness by shuffling resources. Authority Ranking could fit if you argue that she is exerting *noblesse oblige* by selling to a younger sibling at a discount to help them out (or submissiveness if selling to an elder sibling to whom she defers). Equality Matching could fit if you imagine this as a lifelong sequence of trading favors when one another are in need. And Market Pricing could fit if they are searching for a "fair" standard to split the economic surplus of doing business. Most importantly, what utility does it serve to debate which Fiskeian bucket a given interaction belongs to? What does this system enable us to predict about human behavior, let alone social needs?

The exceptions to the theory are also problematic. Fiske allows asocial/null interactions (where we don't care or think about others, though he does not speak to how this is already an aspect of Market Pricing relations). He dismisses a suite of context-specific schemata as esoteric and not needing to fit ("chess etiquette, asking for dances at a prom, introducing colloquium speakers, and communicating with controllers during a space shuttle mission"). And he permits unique "cultural implementations," which means that similar pairs of people in similar relationships in

similar situations, but different cultures, are allowed to behave completely differently. In short, there are too many "degrees of freedom" in this model of human behavior, which is perhaps why it is yet to be sculpted into an instrument for the study of human relations and well-being. Consistent with this perspective, few empirical papers test this framework or leverage it towards meaningful explanatory end (the ones that exist are by Fiske himself, e.g., Fiske, Haslam, & Fiske, 1991).

Empirical review

Let us briefly touch again upon the empirical research on what aspects of social life seem to be associated with subjective well-being. While this topic was discussed at length in study 1, recall the meta-analysis by Lyubomirsky, Diener, and King (2005). After a review of over 200 papers, the authors found strong evidence that well-being covaries with marital status and satisfaction, number of friends and friendship satisfaction, loneliness, general desire to socialize, frequency of socializing, and extraversion. Hence, it is unambiguous that the quality and vivacity of our social lives greatly influence our well-being *in general*, but we are left without an understanding of which aspects of which relationships matter to which degree. In Studies 1 and 2, we make inroads with more granular measures of social contact and multiple convergent methodologies, finding that only in-person time with close others is consistently related to well-being. Even so, we are left without a sense of comprehensiveness, a sense that we have considered the full space of possible social nutrients.

Methodological influences

The method of Study 3 is one of semi-structured interviewing. It is inductive by design, as we seek to discover things about which we might not think to ask. It takes inspiration from other branches of psychological research that have two features in common: 1) attempt to map a truly expansive construct space, and 2) they perform iterative searches for the *right questions to ask*.

Allport and Odbert

An early breakthrough in personality science came from the so-called lexical hypothesis. Namely, "those individual differences that are most salient and socially relevant in people's lives will eventually become encoded into their language; the more important such a difference, the more likely is it to become expressed as a single word" (John, Angleitner, and Ostendorf, 1988). This line of inquiry began with Gordon Allport and Henry Odbert's perusal of some half-million words in the dictionary, eventually identifying a "mere" 4,500 terms of plausible relevance to personal trait measurement.

This dissertation does not aim to recount the development of modern personality from this inception, but rather to highlight the ambition of attempting to *fully* examine the question of human personality, permitting a small axiom (the validity of their approach rests on the validity of the lexical hypothesis itself). But within this axiom, a complete corpus of *items* is defined, wherein individuals can be asked how much they believe each term applies to them. From there, it is a matter of extensive experimental surveying to identify the terms that most distinguish one person from another - principal components, factors, whatever you might call them.

We should also not understate the enormity of work on the subject in the nearly 100 years since Allport and Odbert, as decades of personality scholars conducted research that eventually resulted in the modern Big Five model of personality. With its extensive track record of validity and utility (Soto & John, 2017), Big Five personality tests are administered routinely in studies throughout psychology as a meaningful form of individual difference worth studying – alongside the likes of sex, race, and education. We will return to the development of personality later, as it serves as a template for developing a theory of human social needs.

Taxonomizing Psychological Situations

Other big questions do not have a ready corpus to draw from. For example, while personality science seeks to develop a taxonomy or dimensionality of *personal traits*, Rauthmann and colleagues attempted to develop a taxonomy of psychologically-relevant *situational traits* (Rauthmann & Sherman, 2015). This is an altogether new challenge for several reasons, not the least of which is this: there is no dictionary of "situations." That is, the lexical hypothesis is less obviously permissible in this domain. The authors' approach, roughly speaking, was to temporally sample individuals by asking them to describe what was happening at, say, 7pm the evening before. Using a Q-sort technique, they established eight psychologically-relevant dimensions of situations following the acronym DIAMONDS - Duty, Intellect, Adversity, Mating, pOsitivity, Negativity, Deception, and Sociality. While not directly relevant to our aim of mapping the space of human social need and its relation to well-being, approaches like this inspire creativity in how one might attempt to chart a seemingly unbounded space.

Narrative Approaches

Human beings, with our elaborate capacity for language, are perpetual storytellers in every culture (Gottschall, 2012). Perhaps relevant to our self-concepts, then, is how we tell the story of ourselves, of our lives. Narrative methods in psychology are not new, but I want to highlight the work on *life story interviewing* by Dan McAdams (1999). It is ambitious in its attempt to induce, through a semi-structured interview, the chapters, arcs, and overall *form* with which one conceives their life as a story. The interview begins with the following instructions: "Please begin by thinking about your life as if it were a book or novel. Imagine that the book has a table of contents containing the titles of the main chapters in the story. To begin here, please describe very briefly what the main chapters in the book might be." It then steers the participant to flesh out these chapters, with guidance to identify "key scenes," "key characters," "turning points," and other instructions to help the participant paint a rich portrait.

MacAdams has had success in developing this procedure, which is perhaps the most directly analogous to my own proposed line of discovery. By prompting people, in an open ended fashion, to talk about their lives, needs, and desires, their responses can later be quantified with thematic coding. For example, MacAdams (2006) examined how the life stories people tell relate to their trait "generativity" - the drive in some individuals to be a force for good in the world, to "give back," and to improve conditions for future generations. They found, for example, that more generative individuals were more likely to have "redemptive arcs" in their stories (where a bad situation turns out well) and to have experiences of "early blessing" (being identified at a young age as gifted, promising, or otherwise marked for success). These findings would have been impossible were it not for the venturing of McAdams into open-ended interviews about personal lives, not knowing what might or might not be found.

The present study - Study 3

The fact remains that psychological science is flatly unsure how to measure how the social health of a human being, does not have a solid empirical understanding of how people conceive of their social worlds, has no bottom-up theory of social need nor strife, and does not know what aspects of social life most relate to health and well-being. Most importantly, *we are not yet certain what questions to ask* to address these gaps. Inspired by the creative endeavors described above, I developed an interview-based procedure to make inroads into this shrouded land.

The ideal end result of this line of research might be a survey with Likert-style questions, aiming to measure the principal dimensions of social fulfillment. A hypothetical example item might

ask subjects how much they agree that "I have a good group of friends that I see consistently." However, without a comprehensive exploration of the space of possible items, such questions would have the same drawbacks as their predecessors – being mere informed guesses as to what matters, limited by the creativity and experience of merely mortal researchers.

One way forward is to converse with people openly. Ask what is on their minds, what ails and fulfills them socially, and press them to expound on their statements. Such an interview method is not tightly constrained, nor driven by a priori hypothesis - it is dynamic and emergent (Siedman, 2006). A human interviewer must be emotionally and socially intelligent, attuned to nuance, careful in the phrasing of questions, and avoid leading the subject or injecting the interviewer's ideas into the conversation. The interviewer does not even know exactly what they want to know - they are guided by a need for a holistic portrait of the subject, how she makes sense of her social world, and what she believes makes her socially well or unwell.

Developing the interview structure is an endeavor in itself, and later I articulate more detail of the approach I took with my research team in arriving at a maximally generative protocol. Briefly here, in the Fall of 2022, my research assistants and I iteratively experimented with interview protocols. Using friends and convenient others as test subjects, we were able to identify which lines of inquiry were generative, and which fell flat. I *cannot understate* the importance of these pilot interviews, to which we owe the success of the rich data collected in the full study to follow.

We conducted Study 3 in 2023 and 2024. We completed some 130 interviews, each one hour in length and preceded by an extensive intake survey of traits and demographics. Once completed, many approaches could be taken to search for a taxonomy of social needs, and I describe two such approaches here - thematic coding and item-corpus generation. I explain the successes and challenges in our execution of each approach, and highlight the path forward.

The present study focused on a population of undergraduate students. While convenience sampling of college students is a perpetual source of critique of psychological studies, in this case we believe it is a highly valid population from which to begin our work. First, undergraduates at a large public university are quite diverse in themselves, covering a broad range of races, gender identities, socioeconomic strata, and cultural backgrounds. Second, it seems likely that the social needs of humans vary considerably across the lifespan and across cultures, so by limiting ourselves to a population who are relatively homogeneous in certain ways (age, education, geography, etc), we eliminate some large sources of confounding variation. Accordingly, the end result cannot be a comprehensive understanding of *human* social need, rather only of undergraduate students at a single university, at a particular moment in history. While these subjects are not fully representative of the human species, if the procedure is successful, this method could be repeated in other populations – older adults in assisted living facilities, single urban mothers, working-class immigrants, professional adults in two-parent households with children, etc. By repeating the study on each of these sub-populations, the commonalities of the human social experience across groups can begin to be charted, as well as systematic differences along the lines of sex, age, and culture. Beginning with a single, relatively narrow population is an efficient means to test this procedure and determine if it can, indeed, be an effective means for mapping the fundamental social needs of a study population.

Method

Part I - Intake Survey

While the core of the study is an interview, the content of the conversation will invariably involve discussion of many specific individuals in the subject's life. For this and other reasons enumerated below, the first step in the study is an intake survey, completed by the participant immediately after registering for the study, and several days before the interview itself. The most

obvious reason for an intake survey is to take many demographic and established psychological measures, which comprise the first part of the survey.

Psychological measures include personality (Big Five Inventory), life satisfaction (Satisfaction With Life Scale), affect balance (Specific Emotion Experience Questionnaire), social support (Interpersonal Support Evaluation List), loneliness (UCLA Loneliness Scale), stress (Perceived Stress Scale), and attachment style (Relationship Structures Questionnaire). Demographic measures include age, race, gender identity, sex, country of birth, religion and religiosity, socioeconomic status (MacArthur ladder and parent education attainment), employment status, and several measures specific to students: major, transfer status, year in program, and living situation (shared dorm with others, apartment alone, etc).

Some measures, like subjective well-being, are essentially dependent variables that we aim to predict from the content of the interviews. We measure personality to allow for the controlling of traits known to correlate with these outcomes (e.g., Extraversion), as well as to examine moderation by traits like Openness that may influence what one seeks in a social relationship. Participants also complete established measures of social health like loneliness, social support, and attachment style, as we aim to find incremental explanatory power in measures derived from conversational content.

The second major section of the intake survey is an exercise in enumerating the major people that constitute the subject's social world. In line with personal networks research, participants are guided through a *name generation* process to list family members, close friends, coworkers, organized groups, and anyone else who is either "a meaningful connection or a frequent presence" in their life. Unlike most personal networks research, which generally ask about many connections, but very few questions about the nature of each (e.g., Fischer, 1982; Antonopolis, 2022), we collect some detail about each Alter. For example, the type of relationship (friend, sister, roommate, etc), how "close" the subject feels to the Alter, how much distress the relationship causes the subject, how often they see each other in various forms (in-person, video chat, etc), and how long they have known each other.

The purpose of the name generation process is two-fold. First, it lets the subsequent interview begin from an informed perspective where the interviewer already "knows" the subject somewhat, has a map of the major individuals in their life, who they are spending time with, who is causing them stress, etc. The conversation can then focus its time in open, creative discussion, as many of the objective facts are stipulated beforehand. Second, the intake items themselves are worthy measures of social health. We can determine, for example, how participation in formal groups predicts well-being, including what kinds of groups, and what frequency of gathering is needed to impact well-being. We can see, for example, if those higher in extraversion require more high-contact relationships to be fulfilled than those low in extraversion. In other words, these intake surveys comprise highly valid data for analysis on their own.

Part II - Semi-structured interview

Creation and protocol

As briefly described earlier, the interview procedure here is the end product of several months of pilot testing over some 30 pilot interviews. Myself and a team of four research assistants collaborated to design an initial pilot interview, each performed the interview on a few known others, then regrouped to discuss what questions and approaches went well, and which were unfruitful. We would then make informed alterations of the protocol for the next round of pilot interviews, continuing until we felt confident in the procedure's ability to generate rich and comprehensive data. This iterative process is critical to ensuring validity for our research aims, as a first protocol draft is merely a guess as to what would generate the desired conversational content.

Through trial and error, we were able to hone in on a small set of highly generative questions, with interviewers trained to prompt for further, richer information in response to each.

The protocol is also the product of consultation with several experienced qualitative interviewers (Josh Brahinsky, teaching faculty UC Santa Cruz, religion, anthropology, and social movements; Aakash Chowkase, post-doctoral scholar, UC Berkeley Greater Good Science Center) and the wisdom of widely-used texts on qualitative interviewing (*Interviewing as qualitative research: A guide for researchers in education and the social sciences* by Irving Seidman, 2006; *Interpretative phenomenological analysis: Theory, method and research* by Larkin, Flowers, & Smith, 2021).

The interview is inductive in nature, meaning that while interviewers have some initial "probes" to begin from, the interviewer is expected to react to the participant's responses and generate new questions spontaneously. The core probe questions are listed in Table 13 below. These probes provide the scaffolding for the conversation, leaving the interviewer and subject to color in more detail.

Table 13: Core interview protocol questions

1. To start off, one of the questions on your intake survey asked how satisfied you were with the social relationships and human contact in your life. You said you were [X] out of 10 satisfied. Why do you think you picked that number?
2. What would have to change in your life for your social satisfaction to improve to a 9 or 10?
3. Were there times in your life when you were more or less than [X]? What was different then?
4. Could you tell me about your transition to this university, socially? What did you do before starting your freshman year, and how did things unfold from there?
5. "How did COVID affect your life, socially and otherwise?"
6. "Do you have conflict with any people in your life? Tell me about that."
7. "Tell me about your relationships with your family. What's going well, and what isn't going so well?"
8. "Tell me about your friendships and social groups. What's going well, and what isn't going so well?"
9. "Tell me the story of your best friend. How did you meet? How did you become close? What's it like when you hang out?"
10. "Looking at a few of your close relationships, let's say [insert a few names, e.g., Alice, Bob, and Cali]. How does it 'feel' different when you hang out with each of them? What's unique about what it's like to be with each of them?"
11. (If appropriate) "Tell me more about your romantic partner. What's going well, and what isn't going so well?"
12. (If appropriate) "You said that you do not have a romantic partner in your life. How important is looking for a partner for you right now? And whenever it might happen, what do you hope a partner might add to your life?"

The overarching goal is to get a holistic picture of how the subject conceives of her social life, which aspects she finds full and rewarding, and which she finds wanting. Within this goal, the subject will be prompted for details and examples often. For example, if a subject states, "My friends really understand me," this can mean many different things. Interviewers are trained to ask them to expound – perhaps with an anecdote of a time when they felt deeply understood. By soliciting detail, we can see more clearly into the affective or cognitive processes underlying the experience.

The first question in the interview is always the same, and aims directly at the heart of the phenomenon that we wish to understand. It looks back at the subject's response to a single-item question on the intake survey, which asks, on a 1 to 10 scale, how satisfied they are with their social world. The interview thus begins, "To start off, one of the survey questions asked how satisfied you were with the social relationships and human contact in your life. You said you were [X] out of 10 satisfied. Why do you think you picked that number?" The interviewers have been trained on how to probe for additional information, how to avoid leading questions, and how to respond to relatively taciturn subjects. Interviewers are encouraged to follow this initial question as far as it will take them. After that, the other probes will be covered in due course, aiming to ensure that the interview, in its entirety, alights upon the major categories of social relations in life (family, friend, romantic, etc).

Finally, the interview ends with a few moments of reflection, where the subject is asked to think back on the experience and offer her comments and perceptions. The reflection questions are in Table 14 below, and serves several purposes. First is a comprehensiveness check. For example, the question, "Do you feel like I got a fair impression of your social world? Why or why not?" examines if the subjects felt that the interview was relatively exhaustive or felt superficial. (The responses overwhelmingly support that it was quite comprehensive.) The other questions were more exploratory in nature and are discussed in more detail below.

Table 14: Reflection questions at the end of the interview
1. "What was this conversation like for you?"
2. "Do you feel like I got a fair impression of your social world? Why or why not?"
3. "Are there any questions I didn't ask that you think we should have? Or a question that you would have liked to answer?"
4. "What do you think makes people more or less satisfied with their social worlds?"

Training interviewers

In September 2022 I advertised Research Assistant (RA) positions for a project around happiness and human social life. 15 students responded, and I selected 4 to work with me on what was still a very nascent project. We met weekly, drafted early interview protocols, and everyone experimented with each iteration as discussed above. I listened to the interview recordings and coached the RAs. For example, they learned that this is not a typical friend-to-friend conversation - they themselves should be largely quiet, leaving maximum room for the subject to think and elaborate. RAs were taught how to not ask leading questions; e.g., instead of asking, "Do you think you seek out people who are creative types like you?" they learned to ask, "What kinds of people do you tend to seek out?" They were taught to probe for clarity on broad terms. For example, "When you say you like 'intentional time' with people, what does that mean to you?" They were taught to gently encourage subjects to expound with phrases like, "Could you tell me more about that?" Or by simply repeating what the subject said in a question form; e.g., if a subject says, "My parents and I fought all the time," the interviewer might respond with simply, "You fought all the time?" Techniques like these take practice, and by reviewing the recordings and offering feedback, the RAs responded well and I grew confident in their ability to handle these interviews. When the full study began, the five of us split the interviews roughly equally, each of us performing 20-30.

Study Populations

As alluded to earlier, we begin with the assumption that social lives and social needs will vary substantially across human groups, especially by life stage, culture, and gender. This assumption,

coupled with the highly experimental nature of the procedure, leads us to prefer an initial study population that is relatively homogeneous in terms of life stage and major circumstances. Hence, we begin with a study of undergraduates at a single university. The results of the study, then, hope to yield conclusions of the form, "Students who are doing well socially tend to make statements like X and Y about their relationships, while students who are doing less well tend to say Z and W," or perhaps, "Students seem to vary most in whether or not they have a core group of friends based in an organized group." In addition to informing a potential new psychological scale, one hope is that some of these findings are actionable at either an individual or institutional level - recommendations could be made on how to improve social fulfillment in the university's students.

If successful in this fashion, the entire procedure could be repeated on a different, relatively homogeneous population (e.g., retirement home residents in Sacramento, parents of young children in San Jose, farm workers in the Central Valley, or another university). Each will produce its own picture of what it means to be "well" in that social ecosystem, but patterns of universality may emerge across contexts. And because these findings will have emerged from neutral, open-ended questions that ask individuals to find their own words to express their social needs, satisfactions, and wants, the results should be highly valid, lend themselves to advice and intervention, and offer a richer explanation of how human connection ties into one's subjective sense of well-being.

Before discussing the 130 interviews in the study itself, there are several notes worth mentioning about the pilot interviews that were conducted in developing the protocol. Among the 30 pilot interviews, some subjects were graduate students or working adults of varying ages. This was done for contrast, to gain exposure to the potential breadth that such conversations might take in other populations. Overall, these interviews were affirming of our assumption that social lives and desires vary dramatically across the life course. For example, one mid-30s woman's entire social world revolved around her three small children, the children's friends, and the parents of those friends. Another early 60s woman was single and living alone, with minimal family ties, but cheerful and quite satisfied with a "low hum" of social contact, mostly with neighbors. An investigation into the range of social lives of other categories of person would make for promising follow-up studies. We expect that each social niche will have its own dimensionality, but by exploring many such niches, human universals can emerge.

Anonymization and Privacy

One important note to data handling and privacy is in order. All interviews were transcribed, cleaned for errors, and then anonymized. To anonymize, all names were changed, as were personally identifiable details. For example, if a subject says, "I met my best friend Felipe in grade school in Sacramento," we might change the transcript to say, "I met my best friend [Jamie] in grade school in [city in California]." Hence, the entirety of our corpus of interview transcripts can be shared readily with other scholars, with no risk of tracing any statement back to any particular individual. Subjects were assured of this at the start of the interview, expressing relief upon hearing the extent of the measures taken to ensure their anonymity.

Interview Samples

Between Spring 2023 and Spring 2024, 130 interviews were conducted. To give the reader a sense of these conversations, several excerpts appear below.

Excerpt 1:

Interviewer: *To start off with, one of the questions in the survey asked how satisfied you are with the social relationships and human contact in your life overall. And you said nine out of 10. So my question is, why do you think you pick that number?*

Subject: *Why pick nine out of 10? Um, just because I do make an effort to make friends and I do make an effort to put myself out there so the relationships that I do gain from that does come from my effort. So looking back and looking at how many good friends I've made in college versus high school in like a year, I just feel that, they're more genuine friendships and good relationships. Versus in high school, where I only had like three friends. So that's why I'm pretty satisfied with the amount of people I have in my life, and that doesn't say I have 100. It's like, probably less than 20. But the relationships that I did make and the friendships that were created are just way better and more genuine, and to me more satisfying.*

Here, the subject is contrasting the texture and subjective fulfillment experienced in different social circles at different life stages. This response prompted the interviewer to ask further questions about what the subject means by "genuine" and "satisfying," as a core component of the research agenda is to understand the nature of subjective satisfaction in relationships.

Excerpt 2 (different subject):

Interviewer: *Could you talk to me about your relationships with your family, your siblings, your parents? What's going well, and what's a little more problematic?*

Subject: *I'm very close with all my siblings. We get along together, and we always do super fun things when I'm there. We'll go to the movies for my mom, we'll always have dinner together. The real part of me comes a lot because… I'm relying on confidentiality here… there's been a good amount of trouble lately with parents and stuff. I know that when I come they try not to do that so I come as a way to interrupt any tension. They don't want me to feel it as much but my brother has told me what's been going on behind the scenes. I'm hoping that when I come, things get better for at least a little bit. That tension goes away. Even though the tension has been increasing even when I'm there, it's not going to stop me from coming. It's still an enjoyable time there.*

Here the subject both shares positive experiences with family and touches on a sensitive subject: marital difficulties between the subject's parents. This response prompted the interviewer to ask for expansion on the "trouble" mentioned, but only focused on how it affects the subject emotionally and why. We do not need to know all private details, only enough to understand the subject's perceptions, desires, and internal experience. When asking for examples, interviewers are trained to pose the question along these lines: "Do you have an example of this 'trouble'? You can share a real anecdote, or a made-up one that gives me the flavor of it. We are most interested in how you think about it and how it affects you." This approach allows us to get the important essence of a sensitive social dynamic without intruding unnecessarily upon delicate subjects. Subjects are also told, at the start of the interview, that they can decline to answer any question that they would prefer not to. In practice, declining a question was extremely rare.

Excerpt 3 (different subject, who does not have a romantic partner):

Interviewer: *When or if it does happen, what do you hope that a partner might add to your life, if anything?*

Subject: *I don't know specifically. Maybe this is what society has brainwashed me to believe, but in some sense, as much as I hate it, people judge you for not being with someone eventually. If you're not with someone eventually, there must be something wrong with you. I don't actually know what having another person, a romantic partner in my life, would add to my life. Maybe it's an experience we all need to go through.*

Here the subject touches on social expectations with respect to romantic partnership. Similar statements emerge in other interviews, speaking to a sense of feeling "judged" for having or not having certain types of relationships. This particular question about romantic partners frequently yielded responses that were, as the subject here demonstrates, uncertain. Typically generic statements were given, about having "another friend" that has a special priority, or a source of consistent support throughout life's ups and downs. A very different set of responses might be expected from divorced adults in their 50s, which would highlight the evolution of romantic expectations across the life course.

Analytical Approach I - Thematic Coding

A classic approach to qualitative interviewing is to develop a set of "themes" expressed in the interviews, coding each interview for the presence or absence of each theme. We take inspiration from this approach, except that our goal is not to merely describe the conversations thematically, but to highlight patterns in social needs.

We began with discussion among the research team of each interview, with the interviewer offering a summary and the team engaging in open-ended discussion of its contents. These were exploratory conversations to generate intuition and hypothesize social needs that we might use in coding the transcripts. For the reader's intuition, below is a sample of common topics and statements we identified.

The transition to campus:

- "Josh" is a freshman who is doing very well socially. In late high school, after being accepted to university, he managed to connect with other future freshmen via online platforms like Instagram long before arriving on campus. By simply reaching out to others and initiating conversations, he "just came to know a lot of people," and when the time came, "was ready to transition to college."
- "Alvin" is a junior who is somewhat struggling socially. Reflecting on his freshman year, he was taken aback by "how many people there are in college compared to [his] high school." Accustomed to a small, tight-knit group of friends, Alvin says, "I tried to recreate [something like] my high school friend group, and that didn't really work here." We heard statements like this, about the overwhelming size of the university, over and over in the course of our interviews.
- "Anne" is a senior, who noted how daunting it was to find that forming social networks was so much less structured than high school, "where so many things are facilitated for you." She also was a freshman when the first COVID lockdown began, and didn't feel she had the right social network formed yet. This was a large motivator for her in subsequently joining a sorority.

Relationships with parents:

- Most students were regularly in touch with parents, and felt supported, but there was a bit of a bifurcation.
- Some talked to their parents often. For example, "Mindy" speaks to her mother daily and says she is "a good listening ear." She thinks they have a friendship in addition to a parent-child relationship, and they golf together when she goes home.
- "Sarah" also speaks to her mother daily, calling the relationship "codependent" in that they both leaned on each other for emotional support in different ways. Sarah also mentioned

that in addition to appreciating the support of her parents, "I've come to respect my parents as people."

- Others, like "Anne" and "Marie," say they feel supported by their parents, but really only talk to "check in" periodically.
- A nontrivial minority of students had one or more parents who they were estranged from, for reasons ranging from drugs to personality disorders to abandonment.
- Siblings were often discussed only briefly, and usually seemed to play a peripheral role in subjects' social networks (with some notable exceptions). Similarly with cousins and grandparents, who were only rarely mentioned. When they were, it tended to be in very positive terms, likely reflective of the minority of students for whom such extended family ties were strong. In short, parents dominated the conversation about family.

Ethnic or cultural identity groups were a mixed bag:

- "Sarah," a senior, joined a Filipino group. She grew up in an area with few Filipinos, and thought it might be a good way to connect. However, the others in the group seemed to have grown up in denser Filipino communities and felt a bit different from her, carrying an energy and understanding that she felt she lacked.
- "Josh" joined a Korean student group, but found their focus on partying and transient interactions was not a good fit for him.
- "Mindy" very much wanted a church-centered community. In her words, "My faith is my identity." However, she is a transfer student, and had trouble finding a place in a student Christian group. However, Mindy also joined a Vietnamese student group, and found it refreshing that there were certain common experiences and understandings that didn't have to be explained. This made it more easeful and less effortful to forge relationships.

Organized student groups in general were very helpful

- "Nolan" found great community in his Christian group. They spent intentional time together, went on excursions, and shared vulnerable conversations.
- "Fiona" co-founded a dance team and became very close with her co-founders. Also, as a leader in the organization, she feels well-known in a positive way. She has personally interviewed/picked many of the members, so she had a good sense that she would get along with them.
- "Fiona" lives in a sorority house, which she says has been "good for [her] mental health." Namely, that there's "always life in the house" and she "can hang out with almost anyone." At the same time, Fiona sometimes feels anxious when she hears social activity around her (e.g., people going out) that she was not invited to. "You can feel the FOMO." A similar sentiment was expressed by another subject living in a sorority house.

Social efficacy and anxiety

- Several students mentioned the effort and intimidation of approaching people to start conversations and form new relationships. Subjects who voluntarily identified as socially anxious or lacking in social skills were more common than we expected.
- For example, "Alvin" says that one impediment to forming 1-on-1 relationships is his own inhibitions. "I'm not really good at social skills, so 1 on 1 is harder for me. It's easier in a group." He went on, "I'm not good at prolonging conversations," saying that it's difficult if the other person is not very talkative, as he is "more comfortable listening than talking." He repeatedly expressed nostalgia for his close high school friends, where they could "sit in a car for 4 hours and just talk." He expressed wariness of new people, "I want to know that they

want to be my friend, and not that we're just friends by association." His close high school friends, he said, became especially tight during COVID when they all made great efforts to be in touch while they couldn't be together physically, and this intentionality was very moving to Alvin and bound him tightly to the others.
- "Julia," a self-identified introvert, says that she was doing worse in a period when her boyfriend lived next door. Due to the convenience of the situation, she was prone to "only hang[ing] out with him" or spending time with people who reached out to her. She wished she could take more initiative to seek out the people she wanted, and the situation improved when her boyfriend moved to another city.

The interview experience was positive.

At the end of the interview for reflection, we asked a few questions reflecting on the interview experience itself (see table 14), leading with "What was this experience like for you?" Nearly all responses expressed positivity (subjects enjoyed the interview), and many commented on how they were not used to reflecting on their social lives in full.
- "Natalie": *It was interesting. I noticed things that I didn't even really sort through in my head through this conversation, and there are certain things that I feel less inclined to discuss in detail.*
- "Alice"- *It felt a little therapeutic. I also feel a little exposed.*
- "Nora"- *It was nice. I rarely get to, you know, say my piece about some of these things.*
- "Jacob"- *It was great. I think I needed to reflect, especially since my thesis is due in like, three weeks, so I've been really stressed. So to sit back and reflect on all these years of my relationships with people makes me more grateful for the people in my life and makes me more grateful for even my own decisions that I made. Yeah, like I have some regrets, but I wouldn't change anything, you know. So I would say this conversation and this whole study was pretty fulfilling.*

Coding

From these conversations, we generated a list of 23 items to "code" each interview for. A sample appears below in Table 15.

Table 15- Coding Items - Sample
1. Subject values reciprocation of investment in friendships.
2. Subject says they are not good about reaching out to others.
3. Subject expresses a reluctance to be vulnerable or open with others.
4. Subject often finds themself in lopsided relationships - where they are making more effort than the other person.
5. Subject expresses a clear preference for in-person social interaction over digital interaction.
6. Subject states that they don't prioritize making friends, focusing on academics or other things.

To test the inter-judge reliability of our coding procedure, all 5 members of the research team coded the same 5 interviews for the presence or absence of each of the 23 items. Examining the results of this test set, inter-judge agreement was disappointingly poor. In discussion, we concluded that many of these items were much more subjective than they appear, and often subjects would make a number of statements germane to each item - often in conflicting directions.

While there is promise in pursuing the thematic coding approach further, we explored an alternative method that I believe is more valid, more comprehensive, and lays a superior foundation for the development of an instrument to measure social health.

Analytical Approach II - Item-corpus generation

This approach, which I am calling "item-corpus generation," follows the lead of personality science. In both cases, the aim of the initial "generation" process is to identify a large number of candidate items that cover as much of the construct space as possible. With such a corpus in hand, subsequent studies can administer these items (in carefully-designed batches) to subjects to explore their factor structure and uncover their principal dimensions. While Allport and Odbert used the dictionary to extract several thousand terms plausibly descriptive of human personality traits, the dictionary is less obviously a valid source of items of social needs. To generate a corpus of items, we would read the interviews, tag a number of direct quotes from a subject, and write an item for each that directly reflects the need or preference expressed by the subject. Several examples appear below:

Quotation 1: *A lot of the psych majors are girls and usually I want to hang out with guys.*
Item 1: "I prefer to spend time with people who share my gender / gender identity."

Quotation 2: *After [religious service] I played basketball and then I usually end up hanging out with [Giovani].*
Item 2: "A lot of the organized activities I attend (club meetings, religious services, sports games, etc) turn into hanging out with people afterwards."

Quotation 3: *My parents want me to go to med school and become a doctor, but that's not what I wanted. That's the biggest thing.*
Item 3: "My parents and I disagree on what goals I should pursue, and that causes conflict."

These items have high validity because they are rooted directly in the voices of subjects. The subjects' statements were spontaneous responses to broader questions (they were not "led" to say any particular thing). This stands in contrast to many psychometric instruments, where a researcher believes that a certain question might be revealing, and subjects are asked to confirm or deny that the statement applies to them. Here, the statements all emerge from subjects themselves.

We tested this procedure on a sample of 10 interviews. A typical one-hour interview would generate between 20 and 40 items. As expected, some items were repeated or overlapped, which is expected. Once continued to all interviews, the entire item pool will span some 4,000 items, similar in size to Allport and Odbert's initial corpus or personality trait terms. Part of the theory of our approach is that any sufficiently important human social need or belief will be expressed in more than one way by more than one subject. Hence, the researcher reading the interview and generating items need not be perfect nor exhaustive – by combining items across interviews, the entire body of questions should be quite comprehensive.

Rare items are also crucial. Some needs may only be expressed by one or two observant or insightful subjects, but other subjects would readily agree with those needs if they were asked directly. Hence, a statement by even a single subject might prove insightful for understanding all subjects.

Next Steps

The fundamental aim of Study 3 is the empirical generation of a corpus of items (hence, "item-corpus generation"). Specifically, the goal is to identify items that maximally cover all aspects of social health spoken to by our participants. Completing the corpus generation procedure on the sample in Study 3 requires either considerable human labor (it takes approximately 2 hours to read and generate items for a single interview, meaning some 200 hours of labor remain) or

well-engineered prompting of AI tools (experimentation with Large Language Models like ChatGPT is underway).

Whatever the method, once the pool of items is generated, overly similar items will need to be collapsed, through a combination of natural language processing (automated - e.g., vector embeddings and topic modeling) and manual review. In the end, I expect a body of at most 2,000 candidate items, from which the process of scale development can begin.

Precedent exists on this front, particularly in the personality literature (Wood et al., 2021; Block, 1995; Yarkoni, 2010). To begin, we must identify items that have high test-retest reliability. The entire pool of, say, 2,000 items can be broken into working chunks of perhaps 100 items. In a large study, each participant will respond to a random selection of 100 items, re-taking the items at several time intervals (a few minutes later, a few days later, a few weeks later, and so forth). Low-reliability items are, by definition, invalid as measures of our construct, which purports that humans have a latent level of social health that is relatively stable across time. If 20 ratings are needed for each of 2,000 items, this implies a total of 40,000 item ratings, which can be obtained by 400 participants rating 100 items each. At the same time, we can ask participants a short set of items from related scales, namely subjective well-being, interpersonal support, and loneliness. Items that show no meaningful correlation with subjective well-being can be eliminated. After filtering for reliability and predictive validity, I estimate the item pool will be reduced to at most 500.

The factor structure can be identified similarly, as the core currency of factor analysis is covariance. For any given pair of items, some large number of individuals must have given their own ratings for both. It need not be the case that all participants rate all items, only that all co-occurrences are adequately covered. With a 400-item pool, there are ~80,000 (400 choose 2) unique item pairs. Further, we need many ratings for each pair (20 will be sufficient for a first pass), necessitating a startling 1.6 million item-pair ratings. However, if each participant rates 100 items, they implicitly give data for ~5,000 such pairs (100 choose 2). This means that at most 320 participants will be required to ensure every item-pair receives 20 ratings. After an initial factor analysis pass, additional ratings can be obtained for promising items to fine-tune the scale, and the list can be reduced to only the most predictive and valid items. Eventually, we arrive at a draft instrument that can be administered and evaluated with confirmatory factor analysis.

Finally, if successful, the entire procedure can be repeated on a new population, as discussed earlier. I assume that the social needs of human beings will vary considerably by culture, age, family structure, and other life circumstances. Hence, the items derived from a population of university students may be quite different from the items derived from a population of retirees, working class immigrants, or single parents. However, commonalities are likely to emerge, allowing for the identification of core human social needs as well as cultural variability within them.

I believe that this approach, begun in Study 3 above, could unlock an expansive new field of the study of human social health. Both detailing the social nutrients we need, and developing interventions to address deficiencies. Scientific progress depends on measurement, and by forging new instruments, we may empower breakthroughs in our understanding of that which matters most for human happiness: our connection to others.

Conclusion

Through two lines of inquiry - one more conventional, one novel - my research aims to illuminate previously-shadowed facets of what it means to be socially well. The research also hopes to buttress existing research by adding new evidence, and new nuance, to our current consensus on these topics.

Studies 1 and 2 bring crisp and established methods to inch forward several well-specified questions of social health - specifically how much time we need with others, with whom, the effect of digital media, and how individuals differ on these fronts. It finds that in-person time with family, friends, and romantic partners (but not strangers and acquaintances) are both enjoyable in the moment and lead us to believe we had a good day, while video chat and phone calls are enjoyable in the moment, but their benefits do not appear to last long.

Study 3, by contrast, relies on an original methodology that has limited precedent in psychological research. It requires flexible procedures by trained interviewers who must be creative in their own right, and generates data requiring considerable labor to analyze, but it generates expansive and highly valid data ore from which new gems may be extracted. I outlined a number of steps to follow in the wake of Study 3, steps which work towards new and powerful instruments to assess critical questions of human social health – and, therefore, happiness.

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