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Doing Well-Being: The Role of Self-Reported Activities in Relation to Subjective Well-Being

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Abstract

Everyday activities play a fundamental part in our lives. But how do they relate to well-being? Specific types of activities, such as positive and social activities have been found to be related to subjective well-being (SWB). However, this pre-registered study aimed to investigate if self-reported everyday activities, and activities participants reported had the most impact on their SWB in the past four weeks, could predict their SWB. Participants ($N = 295$) were recruited from Prolific and answered open-ended questions regarding their activities, as well as numerical SWB scales, and the data was analysed using natural language processing. Inconsistent with the hypotheses, activities and activity level could not predict SWB, $p > .05$. Small correlations were found between predicted valence of activities and SWB, $r = (-.13)-.13)$, $p < .05$, and between perceived variation in activities and SWB, $r = .14-.15$, indicating that features of activities may be more important than activities themselves in predicting SWB. When plotting individual activities, social, active and food related activities were related to high SWB, whereas duties and passive activities were related to low SWB. In conclusion, the activities people report they partake in do not predict SWB, although the features of the activities may.

This study was pre-registered at Open Science Framework (osf.io) and the data is available here.

Keywords: *everyday activities*, *subjective well-being*, *harmony in life*, *satisfaction with life*, *PANAS*, *natural language processing*

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The relationship between subjective well-being (SWB) and activities may at first glance be a rather intuitive one. Some activities make us feel good, happy, excited or euphoric. Others make us feel bad, irritated, gloomy or outright miserable. Studying for an exam can be stressful, lying on the beach relaxing, and giving a speech can make us feel either confident or terribly nervous, depending on the circumstances. Reversibly, some activities seem to go with certain moods; the aforementioned euphoria invites us to dance and talk in a sing-song voice whereas uncontrollable anger urges us to destroy any poor object that happens to be within arm's reach. Thus, the causal relationship between SWB and activities is not one-way but rather seems to flow back and forth (for examples of studies on each causal direction, see Sheldon & Lyubomirsky, 2006; Fredrickson & Branigan, 2005).

Previous studies concerning the relationship between SWB and activities have shown that social activities and spending time with others, especially family and social relations, are related to high SWB (Okun, Stock, Haring & Witter, 1984; Diener & Seligman, 2002). Studies have shown that meaningful, pleasurable and intimate activities with others, such as sex, partying, care-giving and volunteerism (Grimm, Kemp & José, 2015; Lee, 2017), as well as intentional and regular positive activities associated with happy people, such as counting one's blessings (Emmons & McCullough, 2003; Froh, Seffick & Emmons, 2008), generate high well-being. Furthermore, the features of the activities matter. Lyubomirsky and Layous (2013) argue that, among other factors, quantity of and variation in positive activities affect SWB (for similar conclusions, see Etkin & Mogilner, 2016). However, the majority of these studies have explored the relationship between SWB and specific activities, pre-determined by the researchers, such as social or positive activities (Okun et al., 1984; Lyubomirsky & Layous, 2013), and have thus not explored the relationship between SWB and normal everyday activities, regardless of how positive or social they are.

This study has three aims. Firstly, it aims to explore the relationship between everyday activities and subjective well-being. While previous studies have focused on social or positive activities (e.g., Okun et al., 1984; Lyubomirsky & Layous, 2013), this study focuses on the everyday activities that are not necessarily particularly special or exciting, but nonetheless make up most of people's lives. Secondly, it aims to explore to what extent people seem to be aware of

which activities affect their SWB and how. Finally, it aims to explore which activities relate to low and high SWB, which activities belong to different types of SWB, and what role variation in activities plays in relation to SWB. By asking participants to report activities they have done recently using open-ended questions, natural language processing in the form of latent semantic analysis is used to analyse the relationship between activities and the participants' SWB. To our knowledge, natural language processing have not been used in this context to date. Together, the three aims seek to answer three research questions:

Can a person's self-reported activities predict their subjective well-being?
Are different subjective well-being constructs related to different activities?
Is variation in activities related to subjective well-being?

Subjective well-being

The question of what constitutes happiness, well-being and a good life is not a modern one. Throughout human history, many philosophers have given the matter substantial consideration. According to Aristotle in the Nicomachean Ethics (1985), for example, happiness, or *eudaimonia*, defined as living in accordance with oneself and one's virtues, is the only thing humans truly aspire to; all other aspirations are simply byways of achieving happiness. Of interest for this study is the fact that Aristotle viewed eudaimonia as a continuous activity, one of living well and virtuously. Thus, for Aristotle, happiness is something that you do (cf. activities), rather than something you possess. Turning from philosophy to psychology, it is only for the past four or five decades that the question of happiness has been investigated empirically (Diener, 1984; Wilson, 1967). Although modern psychology dates back well over a hundred years, it is only for the past fifty that researchers have studied the positive aspects of happiness, mainly in the form of SWB (Diener, 1984).

SWB can be briefly defined as "the level of well-being people experience according to their subjective evaluations of their lives" (Diener & Ryan, 2009, p. 391), and concerns peoples' own view of their well-being and a global evaluation of peoples' lives. SWB consists of a cognitive and an affective component (Diener, 1984; Diener, Emmons, Larsen & Griffin, 1985;

Kjell, Daukantaité, Hefferon & Sikström, 2016). The cognitive component, how one thinks about one's life, has often been defined in terms of life satisfaction (or satisfaction with life, henceforth SWL; Diener, 1984). SWL can be defined as "a global assessment of a person's quality of life according to his own chosen criteria" (Diener, 1984, p. 543). The affective component, defined in terms of experienced emotions, is comprised of positive and negative affect (henceforth PA and NA; Diener, 2000).

The SWB approach to happiness is regarded as hedonic, focusing on SWL and positive emotions (Delle Fave, Brdar, Freire, Vella-Brodrick & Wissing, 2011; Waterman, 1993; Grimm et al., 2015). On the other hand, the psychological well-being approach (as defined by Ryff, 1989) is regarded as more eudaimonic, focusing on a meaningful life and living well (Delle Fave et al., 2011, Ryff, 1989; Grimm et al., 2015). This has led researchers to look beyond SWL and PA when researching SWB. Delle Fave et al. (2011) found that satisfaction is not the most prominent way in which lay people define happiness; in a study featuring 666 participants answering open-ended questions about what constitutes happiness, they found that SWB (operationalised as happiness) is often described in terms of inner balance and harmony. Similar results were found with a larger cross-cultural sample some years later (Delle Fave et al., 2016)**.** Thus, the construct of harmony in life (HIL) acts as an addition to satisfaction with life in defining the cognitive aspects of SWB, integrating the SWB approach with the eudaimonic psychological well-being approach.

Satisfaction with life and harmony in life. SWL can be defined as the discrepancy between a person's actual life circumstances and the life circumstances the person realistically wishes for, or expected to have at this point in their life (Diener et al., 1985). Such an assessment could, for example, include whether the person is happy with his/her job situation, socioeconomic status, and social status. Sensing the need for an instrument to properly measure SWL, the *Satisfaction with Life Scale* was created (SWLS; Diener et al., 1985). As mentioned earlier, harmony is important for lay people's definition of happiness (Delle Fave et al., 2011, 2016). These findings, among others, led to increased interest in HIL as a psychological construct and to the creation of the *Harmony in Life Scale* (HILS; Kjell et al., 2016), that complements the SWLS when measuring SWB.

Compared to HIL, SWL taps into the hedonic (in contrast to the eudaimonic) aspects of well-being and thus focuses on achievement and the reaching of individual and social goals, such as self-actualisation and personal growth (Delle Fave et al., 2011). Reversibly, HIL taps into the eudaimonic aspects of well-being and thus focuses on inner harmony, balance and social relationships (Kjell et al., 2016).

When participants were asked to list words associated with their own pursuit of SWL and HIL, typical satisfaction words included *job*, *money* and *achievement*, whereas typical harmony words included *peace*, *music* and *balance* (Kjell et al., 2016) Thus, in an activity context, SWL could be expected to correlate with activities related to people's professional life whereas HIL could be expected to correlate to activities related to people's free time and relaxation.

SWL and HIL share similar features with the three orientations to happiness, *pleasure*, *meaning*, and *engagement*, identified by Peterson, Park and Seligman (2005). Pleasure is closely related to hedonism, the maximizing of pleasure over pain. Meaning is related to the concept of eudaimonia, doing what is meaningful to achieve a full life. The third orientation, engagement, represents the state of losing sense of self and time whereas engaging in activities with full focus, and is neither related to hedonism nor eudaimonia, according to Peterson et al. (2005). In turn, as mentioned earlier, SWL is related to hedonism and HIL to eudaimonia (Delle Fave et al., 2011; Henderson & Knight, 2012), indicating that SWL and HIL share similar theoretical features with pleasure and meaning, respectively. Furthermore, when measuring how closely related different psychological constructs are in terms of meaning (see the method section for a more thorough explanation of natural language processing), HIL is more closely related to psychological well-being, whereas SWL is closer to happiness (Kjell et al., 2016), which provides further support for the link between HIL and eudaimonia.

Positive and negative affect. In addition to the cognitive component, SWB also consists of an affective component - positive and negative affect (Diener, 1984). Positive and negative affect are closer to a layperson's definition of well-being in comparison to cognitive definitions, such as SWL; in everyday speech, well-being is often thought of as "a preponderance of positive affect over negative affect" (Diener, 1984, p. 543). Positive and negative affect do not represent two opposites of the same spectrum, but rather distinct dimensions that are only weakly

correlated (Watson, Clark & Tellegen, 1988). While positive affect concerns enthusiasm, concentration and energy level, negative affect concerns general distress, unpleasurable engagement and nervousness (Watson et al., 1988).

It has been argued that the affective component of SWB mainly encompasses moderate to high arousal positive emotions such as *happy, excited* and *enthusiastic*, and taps into SWL (Lee, Lin, Huang & Fredrickson, 2013). In contrast, low arousal positive emotions such as *peacefulness. serenity* and *calmness*, are connected to HIL (Kjell et al., 2016). Harmony, operationalized as peace of mind, correlates stronger with positive emotions, the lower the level of arousal is (Lee et al., 2013). And as previously mentioned, happiness definitions across countries generate twice as many harmony responses as satisfaction responses (Delle Fave et al., 2011, 2016), indicating that low arousal positive emotions may be more important for well-being than moderate and high arousal positive emotions.

The relationship between activities and SWB

Activities may impact SWB. The causal relationship between activities and SWB seems to flow both ways. The *Sustainable Happiness Model* (SHM; Lyubomirsky, Sheldon & Schkade, 2005) claimed in its initial phase that chronic happiness can be attributed 50 % to genetic factors, 10 % to circumstantial factors (such as moving to a new place, getting married, etc.) and 40 % to intentional activity factors. Thus, 40 % of people's general happiness could depend on which activities they perform and how (Lyubomirsky et al., 2005). The model has been criticised for having overestimated the importance of intentional activities (Brown & Rohner, 2019). However, the creators recently argued that the model is still relevant and that intentional activities does have a significant impact on well-being (Lyubomirsky & Sheldon, 2019). Particularly eudaimonic activities, described as "virtuous, connecting, expansive, [and] integrative", are considered to generate SWB (Lyubomirsky & Sheldon, 2019, p. 5).

Furthermore, the *Positive Activity-Model* (PAM; developed by Lyubomirsky & Layous, 2013), regarded as the most relevant offspring of the original SHM (Lyubomirsky & Sheldon, 2019), describes how positive activities, such as kind acts or expressing gratitude, enhance positive emotions, behaviours, thoughts and need satisfaction, which in turn increase well-being

(Lyubomirsky & Layous, 2013). The model takes person and activity features into account, such as variation in activities, social support and motivation, among others (Lyubomirsky & Layous, 2013).

SWB may impact activities. Reversibly, Fredrickson and Branigan (2005) have shown that participants induced into a state of positive emotions can think of more activities they would like to do in general, but also of more activities related to the outdoors, playing, and social activities, compared to participants induced into a neutral or negative affective state. The 2005 study stems from the broaden-and-build theory (developed by Fredrickson, 2001), which states that while negative affections play an important role in short term survival (fight, flight or similar distinct actions that increases our likelihood to survive in crisis situations), positive affections urge us to broaden our thought-action repertoires, such as exploring our surroundings through playing or building and maintaining social relationships, in order to secure our long-term survival. These findings indicate that positive affect makes us creative and urges us to carry out several and various activities. Indeed, many findings confirm that positive affect goes with high creativity (Davis, 2009; Han, Feng, Zhang, Peng & Zhang, 2019). Thus, the activities a person does seem to affect SWB, whereas the person's SWB simultaneously seems to affect which activities the person would like to do, and therefore possibly does.

Social activities and SWB. There is a well-established link between social activities and SWB. A large meta-study consisting of 556 studies found that social activity is positively related to SWB (Okun et al., 1984). One notable finding is that among the top 10% happiest people, not a single one lacked close, qualitative relationships in their lives (Diener & Seligman, 2002). The same very happy people spent the least time alone, the most time socialising and were rated as very good in social relationships. Furthermore, the broaden-and-build theory of positive emotions (Fredrickson, 2001) claims that positive affect enhances one's thought-action repertoires, which include building and maintaining social relationships. Considering these findings, doing many everyday social activities may be associated with high SWB.

Activities and orientations to happiness. Different activities are related to the three different orientations to happiness. In a study asking participants to respond to how they felt about their current activity using experience sampling methods, different activities scored

differently on the three happiness orientations *pleasure*, *meaning* and *engagement* (Grimm et al., 2015). All three orientations to happiness had *sex/making love* as the number one activity. Typical pleasure activities were *drinking alcohol/partying* and *listening to music/podcast*, whereas typical meaning activities were *meditating/religious activities* and *care-giving/volunteering*, and typical engagement activities were *gardening/outdoor housework* and *hobbies/arts/crafts*. A similar study, assessing specific activities' relation to happiness, found that there is a significant relationship between happiness and engaging in meaningful activities, such as volunteering, among undergraduates in Taiwan and Malaysia (Lee 2017).

Since pleasure and meaning share similar hedonic/eudaimonic features with SWL and HIL, respectively (Delle Fave et al., 2011; Henderson & Knight, 2012), the findings of Grimm et al. (2015) led us to hypothesise that the activities reported by the participants in the current study could predict their levels of SWL, HIL, PA and NA and also how the different SWB constructs would differ in relation to specific activities.

Variation in activities and SWB. Variation in activities affects happiness; in an article consisting of eight studies about variation in activities, researchers found that variation in activities over a longer time span, such as a day, does increase happiness (Etkin & Mogilner, 2016). However, the inverse was true of shorter time spans, such as an hour. Variation in activities during longer periods of time seems to be stimulating and give rise to feelings of productivity, whereas variation during shorter periods of time is frustrating and feels unproductive. Lyubomirsky and Layous's (2013) PAM also claims that variation is one of the key features of positive activities' contribution to happiness (for further evidence see, Sheldon, Boehm & Lyubomirsky, 2012). Furthermore, activity level, as measured by number of activities participated in during a given time span, has also been found to be related to SWB (Menec, 2003; Lawton, Winter, Kleban, & Ruckdeschel, 1999).

Defining activities. A continuous trend in research on activities and well-being is the lack of definition for what constitutes an activity (Menec, 2003; Joulaine, Martinent, Taliercio, Bailly, Ferrand & Gana, 2019; Grimm et al., 2013; Etkin & Mogilner, 2016). In this study, therefore, the participants were encouraged to make their own interpretation of what constitutes an activity with the aid of a short definition. Because this study involves everyday activities, the

definition was very broad, so that the participants would not think of an activity only as something extraordinary related to leisure and free time and that we would not bias the responses by the definition. Therefore, the aiding definition was "*by activity we mean anything that you did yesterday"* (or *during the past four weeks* for the other of the two activity questions, see the method section).

Measuring and describing psychological aspects from text responses

Semantic measures allow participants to answer questions freely and naturally, which increases ecological validity; in contrast to closed-ended numerical scales, open-ended questions more closely resemble real life, since people generally answer questions about their well-being with words, rather than arbitrary numbers on rating scales. Furthermore, when analysing semantic data using natural language processing there are no researcher biases involved when coding and categorising nominal data, while the method simultaneously allows for large amounts of data to be analysed. Analysing the semantic responses from open-ended questions using natural language processing (in the form of Latent Semantic Analysis) has yielded good psychometric properties, with competitive or higher reliability and validity than their numerical rating scale counterparts (see Kjell, Kjell, Garcia & Sikström, 2019). For example, categorising various facial expressions with words rather than numbers yield a significantly higher amount of correct answers and inter-rater reliability (Kjell et al., 2019). Questions corresponding to a numerical scale, e.g. *"Are you in Harmony? Answer with words"*, have generated strong correlations to HILS score (r = .58-.72). Additionally, the question *"Write X words that you associate with your own pursuit of harmony?",* aiming to assess individuals' view and description of the construct of harmony and not to correspond directly to the HILS, as is the case with the previous question, also yields significant correlations to the HILS (r = .18-.21; Kjell et al., 2016). Other open-ended questions corresponding to a numerical scale, and questions asking participants about their view of psychological constructs have yielded similar results (e.g. SWL, depression and worry) with satisfactory test-retest reliability (Kjell et al., 2019). Although the method is new and still in development, the evidence indicates that open-ended semantic questions is a valid and reliable instrument.

In this study, participants are asked two open-ended questions regarding activities; what they did yesterday, and which activities have had the most impact on their SWB in the past four weeks. The first question aims to answer which activities people actually do on an everyday basis, and if the answers can predict their SWB. Since this question is not directed towards well-being, the prediction is expected to be weak. The second question aims to examine the relationship between activities individuals believe increase their well-being and their SWB score. This question is not a semantic counterpart of the SWB scales but is directed towards participants' well-being and is therefore expected to have a stronger correlation to the SWB scales.

Hypotheses

Hypotheses 1a and 1b concern how different everyday activities are related to different scores on the four SWB scales. Hypotheses 2a and 2b concern how the activities having the most impact on well-being in the past four weeks correlate with scores on the four SWB scales. And finally, hypotheses 3a and 3b concern how the amount of and variation in reported activities correlate with scores on the four SWB scales. The following hypotheses were pre-registered:

Hypothesis 1a. The activities participants report they did yesterday predict their SWB.

Hypothesis 1b. The valence of the activities participants report they did yesterday correlate with their SWB (positively with the HILS-3, the SWLS-3 and the PA scale, and negatively with the NA scale).

Hypothesis 2a. The activities participants report affected their well-being the most during the past four weeks predict their SWB.

Hypothesis 2b. The valence of the activities participants report affected their well-being the most during the past four weeks correlate with their SWB (positively with the HILS-3, the SWLS-3 and the PA scale, and negatively with the NA scale).

Hypothesis 3a. The number of activities participants report they did yesterday correlate with their SWB (positively with the HILS-3, the SWLS-3 and the PA scale, and negatively with the NA scale).

Hypothesis 3b. The variation in the activities reported yesterday as measured by 1) semantic coherence and 2) participants' subjective perception of variation, correlates with SWB (for coherence, negatively with the HILS-3, the SWLS-3 and the PA scale, and positively with the NA scale, and the inverse for participants' subjective perception of variation).

Exploratory analysis

In addition to the pre-registered hypotheses, pre-registered exploratory analyses relating to the research question *"Are the different subjective well-being constructs related to different activities?"* will be conducted in the form of multiple word plots, which will be interpreted qualitatively in relation to existing literature (e.g. comparing most common words, words with the largest effect size, etc).

Method

Participants

Three-hundred UK adults were recruited through Prolific (https://www.prolific.co/), an online scientific platform for recruiting research participants. Of the 300 participants, five failed to correctly answer a control question (further described below) and, as pre-registered, were subsequently excluded from further analyses, thus leaving 295 participants. Participants were compensated £0.8 to participate in the study, which took on average 7,5 minutes (*SD* = 3.8) to complete. Of the 295 participants, 202 were female and 93 were male. The mean age was 35 years (*SD* = 13, range 18-74). Of the 295 participants, 122 were working full-time, 74 were working part-time, 31 were unemployed and 68 had other employment status, such as non-paid work. 48 participants were students. Average subjective socioeconomic status was 5.02 (*SD* = 1.65) on a scale from 1 to 10.

Instruments

Subjective well-being scales. ***Abbreviated three-item versions of the Harmony in Life Scale (HILS-3) and Satisfaction with Life Scale (SWLS-3).*** The HILS-3 and SWLS-3 were recently developed (Kjell & Diener, 2019, under review) and derives from their five-item original versions (Kjell et al., 2016; Diener et al., 1985). The new versions were developed together and are shorter without compromising the psychometric properties. The scales includes three items each (e.g *I am in harmony*, *I am satisfied with my life*) answered on Likert scales ranging from 1-7 (*Strongly disagree* to *Strongly agree*). In this study, Cronbach's alpha was .91 for HILS-3 and .87 for SWLS-3. The McDonald's omega total was .93 for HILS-3 and .90 for SWLS-3.

The Positive and Negative Affect Schedule (PANAS). The PANAS (Watson et al., 1988) asks participants to indicate to what extent they feel or have felt 20 different emotions on Likert scales ranging from 1-5 (*very slightly or not at all* to *extremely*). Out of the 20 words related to various emotions in the PANAS, 10 form the *Positive Affect Scale* (*PA*; e.g. *interested*, *excited* and *proud*), and the remaining 10 form the *Negative Affect Scale* (*NA*; e.g. *distressed*, *guilty* and *upset*). The questionnaire can be used to measure experienced affect over a time period ranging from *this moment* to *in general*. In this study, the participants were asked about experienced affect for the past four weeks, primarily to correspond with the time frame in the semantic question regarding activities in the past four weeks. In this study, Cronbach's alpha was .91 for both the PA scale and the NA scale. Total McDonald's omega total was .93 for both the PA scale and the NA scale.

Semantic questions about activities. An adaptation of the open-ended Twenty Statements Test (Fredrickson & Branigan, 2005; Kuhn & McPartland, 1954) was used to assess activities participants did yesterday as well as activities that had had the most impact on participants' well-being in the past four weeks.

Activities yesterday. The question regarding activities yesterday was *"In this section, you will be asked about activities you did yesterday. By activity we mean anything that you did yesterday. Please list activities that easily come to mind. Briefly describe each activity using one or two words. Try to use only one word, if possible. Write only one activity per box."*. In total,

participants could indicate a maximum of 30 activities (10 during the morning, 10 during the day and 10 during the evening). The mean number of activities reported was 14.24 (*SD* = 6.2).

Activities the past four weeks. The questions regarding activities that had had the most impact on well-being in the past four weeks was *"Please list the activities that have had the most impact on your well-being in the past four weeks. By activity we mean anything that you have done during the past four weeks. The impact of each activity can be positive and/or negative. List activities that easily come to mind - fill in as many boxes as you want. Briefly describe each activity using one or two words. Try to use only one word if possible."*. In total, participants could list a maximum of 20 activities. The mean number of activities participants reported was 4.46 (*SD* = 2.19).

Feedback from a pilot study resulted in two changes to the two semantic questions above. Firstly, some of the respondents found the lack of a definition for what constitutes an activity confusing. Therefore, a definition was added; "*By activity we mean anything that you did yesterday"* (or "*during the past four weeks*"). Secondly, some of the respondents were confused about how to describe an activity using up to five words (which was the initial word limit). They wanted to know if they should write e.g. *sauna*, *sauna bathing*, *sat in the sauna*, etc. This was addressed by limiting the number of allowed words to two instead of five. This was also helpful for some of the statistical analyses, since limiting the allowed number of words to describe an activity also limits the number of ways to describe that activity, resulting in more statistical power in the analyses.

Other measures and control items. ***Perceived variation in activities.*** A three-item measure of perceived variation in activities was developed in a recent study and used to measure subjective perception of variation in activities (Etkin & Mogilner, 2016). The items (e.g. *How much variety is there among the activities you did yesterday?*) were answered on Likert scales ranging from 1 to 7. Cronbach's alpha has previously been .90 (Etkin & Mogilner, 2016). In this study, Cronbach's alpha was .74 and McDonalds omega total was .77.

Wake up time and bedtime yesterday. Participants were asked to indicate at what time they woke up and went to bed yesterday by writing the time as four digits. Wake up time was used as a descriptive variable in the study in order to see if participants woke up at

approximately the same time; since yesterday activities were divided into morning, day and evening activities, it was important that participants have roughly the same circadian rhythm in order to make meaningful analyses. The average wake-up time was 07:26 (*SD* = 93.1 minutes).

Control items. One control item was included in the survey: "*Please answer the alternative '4 neither agree nor disagree' below"*. Participants who did not answer this question correctly were removed from further analysis. This type of control item has previously demonstrated increased reliability and statistical power in the data set (Oppenheimer, Meyvis, & Davidenko, 2009).

Socioeconomic status was accessed through Prolific using the *Macarthur scale of subjective social status* (Adler, Epel, Castelazzo & Ickovics, 2000) in which participants place themselves on a metaphorical ladder with 10 rungs where the highest rung symbolises the richest and the most high status people in their society, and the lowest rung represents the poorest people with the lowest status.

Procedure

Participants were asked via Prolific to partake in a study regarding their lives, well-being and activities in their lives, and received a link to the online study. They began with reading the consent form, which informed participants that the information they provided would be anonymous and that they could withdraw at any moment, should they want to. They were informed about the study leaders' contact information, asked to agree to the information regarding informed consent, and were thereafter guided to the questions. The survey included semantic as well as numerical questions. First they answered the semantic questions regarding activities yesterday, as well as questions regarding subjective variation in activities, wake up and bedtime. Then, they answered the question regarding the activities that had had the most impact on their well-being in the past four weeks, followed by the SWB scales. The HILS-3 and the SWLS-3 were used together in a randomised order. Also, the order of the HILS-3 and the SWLS-3, and the PANAS was randomised. Descriptive information about the participants' was taken directly from Prolific. When participants had completed the survey, they were debriefed about the study and its aims, reminded about the contact information for the study leaders and

also reminded that the information was anonymous. All data was collected on December 4th, 2019.

Ethical consideration

This study adopted and followed the ethical rules of the Swedish Ethical Review Authority. We assured that we did not 1) collect sensitive personal data (such as political views) that could be tied to a specific person, 2) use a method that included physical intrusion, 3) use a method that aimed to affect the participants physically or psychologically, 4) implicate a risk for psychological or physical damage. Participants were informed about the ethical considerations of the study, as well as their right to withdraw at any time, in a consent form prior to the survey. Participants were debriefed about the purpose of the study after the survey.

Natural language processing

Natural language processing (NLP) was used to analyse the word responses from the semantic questions. NLP is a subfield of linguistics, computer science, information engineering and artificial intelligence, that is concerned with processing and analysing meanings of large amount of words or text data. The specific technique in NLP used in this study is called latent semantic analysis (LSA; Landauer & Dumais, 1997). The tool used for these analyses was the freely available software Semantic Excel (semanticexcel.com; for an overview of the tool see Sikström, Kjell, & Kjell, 2018). Semantic Excel is used for several different analyses of semantic data (Sikström et al., 2018). The analyses used in this study are explained below.

Semantic spaces and semantic representations. A semantic space is based on a natural language (such as English or French), and the words of the language (e.g. *cat*, *dog*) have been mapped to values on a large number of dimensions. Thus, each word is represented by a vector, and is called a *semantic representation*. The mapping is done using LSA (Landauer & Dumais, 1997), which is further explained below. The semantic space is generated using a large number of 5-grams from the Google N-gram database (*Google Ngram Viewer*; see https://books.google.com/ngrams).

To give an example of how a semantic space is constructed using LSA, and how it works in practice, let us look at one of the semantic spaces available in Semantic Excel, *English 2*, used in this study. It is the most comprehensive semantic space available for English, and was constructed by analysing 8.70e+11 words from a large amount of Google 5-grams. It consists of 120,599 unique words with associated semantic representations. These words are given numeric values on a large number of dimensions (512 for *English 2*; for more details, see Sikström et al., 2018), where the dimensions describe how the words relate to each other. Thus, the language is converted into a complex coordinate system that can be used in various statistical analyses (for more details, see; Landauer & Dumais, 1997; Sikström et al., 2018). The analyses conducted in this study are described below.

Semantic similarity and semantic coherence. Semantic similarity is a measure of the closeness of two semantic representations in the semantic space, using the cosine of the angle between the two points. This angle ranges from -1 to 1, but tends to range from 0 to 1 in practice. Higher score equals greater similarity in meaning, and 0 means that the semantic representations are unrelated in meaning.

Semantic coherence is a measure of the average semantic similarity between a group of semantic representations (Sikström et al., 2018). Semantic coherence is calculated by adding the semantic similarity of the first and second word of the phrase, the second and third, etc., and dividing by the number of words in the phrase minus one, in order to calculate the mean semantic similarity. The number and order of words play a role in the coherence value. For example, the phrase *hot dog cat* would yield a higher semantic coherence value than *hot cat dog*, since *hot* and *dog* appear together more often than *hot* and *cat*. Indeed, when in need of a snack, most people would prefer a hot dog over a hot cat. The semantic similarity of the second and third word in the two phrases is of course the same; *cat* and *dog*, and *dog* and *cat*. Additionally, analysing phrases with a large number of words decreases the probability of the phrase having high semantic coherence, since they are more likely to contain filler words, such as *a*, *the*, etc., that are not closely related to the core words of the phrase. Because of this, in addition to the previously mentioned confusion experienced by participants in the pilot study, participants' allowed number of words to answer the semantic questions was limited to a maximum of two.

Semantic-numeric correlation. Semantic-numeric correlation can be used to analyse if word responses can predict a numerical value. The function *train* in Semantic Excel is based on multiple regression for semantics where the semantic dimensions in the semantic representations work as predictor variables and a numerical score as the criterion variable. In our study, the four subjective well-being scales (HILS-3, SWLS-3, PA scale and NA scale) were used as criterion variables. The function trains how well it can predict the numerical value using different amounts of semantic dimensions from the semantic representations.
Leave-10%-out-cross-validation is applied to strengthen the model by optimising the specific amount of dimensions that provide the best prediction. The predicted values of the final model are then correlated to the numerical value (for a more detailed description, see Sikström et al., 2018).

Semantic prediction of valence and arousal. Valence and arousal can be predicted for word answers using the semantic representations and previously trained models of valence and arousal. In the *Affective Norms for English Words* (ANEW; Bradley & Lang, 1999), psychology students have ranked the valence and arousal of 1031 words that have semantic representations in the semantic spaces available for English in Semantic Excel. The rated levels of valence and arousal based on the ANEW have been used to create trained prediction models (Sikström et al., 2018; Kjell et al., 2019). Correlations between predicted and observed values for valence was $r = .76$ ($p < .001$) and for arousal $r = .57$ ($p < .001$). These statistical models were used to predict valence and arousal of the text/word data in this study.

Semantic t-test. A semantic t-test can be used to analyse if two groups of words statistically differ between each other. The semantic t-test is based on semantic similarity scores that are tested using standard t-tests. The semantic similarity scores included in the t-tests are calculated in three steps. First, the semantic representations in each group are summed into one semantic representation for each variable. Then, a *semantic comparison representation* is calculated by subtracting one of these semantic representations from the other. Second, semantic similarity between each of the original semantic representations in the two variables and the comparison representation is calculated, creating *semantic comparison scores*. This procedure is repeated several times using leave-10%-out cross-validation in order not to bias the model in

such a way that the data being analysed using the comparison score has not contributed to the creation of the comparison representation. Lastly, a regular t-test is conducted comparing the *semantic comparison scores* of the two groups of words. The results provide both a *t*-value, a *p*-value and an effect size (for more details, see Sikström et al., 2018).

Semantic t-test word plot. A word plot visually depicts statistically significant words in the data in a given analysis, e.g. how two existing groups of words differ, or how words score on a numerical variable. The semantic t-test word plot uses the procedure described above to conduct a semantic t-test but is here carried out for each word, by computing the semantic similarity score between each word and the semantic comparison representation. Since cross-validation is used, a word can be tested several times with different outcomes, and therefore the mean and standard deviation of the word are the values tested. They are compared to the mean and standard deviation of all words' semantic similarity in the data set. Single words will have their similarity score as their mean and are assumed to have the same standard deviation as the whole data set. Chi square test for independence are conducted for words without semantic representations. Bonferroni correction is employed to correct for multiple comparisons. The results provide *Z*-values, *t*-values and *p*-values for each word, and plots the words based on these scores. The colour of the word indicates their *Z*-transformed *t*-value, and the font size indicates the frequency of the word. The plots in this study are grouped into two clouds, indicating a high or low score on the scale, which is decided by median split (for more details, see; Sikström et al., 2018).

If a plot is not compared to a numerical scale, the word frequencies are compared to how frequent the words generally are in the semantic space that is used (*English 2* in this study). The result is represented by the size of the word, and the *Z*-transformed *t*-value of the word comparison is represented by the font colour.

The data was analysed in RStudio (R Core Team, 2019) using the following packages: *Hmisc* (HArrell (2019), *dplyr* (Wickham, 2019), *tidyverse* (Wickham et al., 2019), *car* (Fox & Weisberg, 2019) and *psych* (Revelle, 2018). The data is available as open source (see title page for link).

Statistical cut-off values

As pre-registered, alpha level was set to .05. Levels of good internal consistency was set to .70 for Cronbach's alpha and MacDonald's omega. Cohen's guidelines of strength of correlations was applied, where .10-.29 is seen as small, .30-.49 as medium and larger than .50 as large correlations. Acceptable levels for skew and kurtosis was set to ±2.

Results

In total, 4195 activities were reported for yesterday and 1929 activities were reported having the most impact on well-being in the past four weeks. All scales used for the analyses met the assumptions of normal distribution and were thus analysed using Pearson product moment correlations, as can be seen in *Table 1*.

Table 1. Descriptive statistics for the numerical variables.

Variables	Mean	*SD*	Skew	Kurtosis
HILS-3	12.32	4.35	-.29	-.73
SWLS-3	12.16	4,48	-.36	-.78
PA scale	30.03	8.07	-.23	-.51
NA scale	20.64	8.01	.92	.31
Subjective variation	10.30	3.67	.15	-.46
No. of activities yesterday	14.22	6.20	.63	-.03
Valence yesterday	6.45	1.18	-.43	.44
Valence past four weeks	6.08	1.49	.06	-.05
Coherence yesterday	.07	.038	.93	1.82

Note. N = 295. HILS-3 = Harmony in Life Scale three item version, SWLS-3 = Satisfaction with Life scale three item version, PA = Positive Affect, NA = Negative Affect, Valence = predicted valence.

All SWB scales yielded moderate to strong correlations to one another (see *Table 2*), the strongest being between the HILS-3 and SWLS-3, $r = .81$; $p < .01$, and the weakest between the NA and PA scale, $r = -.31$; $p < .01$.

Table 2. Correlations between SWB scales scores.

Variables	1	2	3	4
1. HILS-3				
2. SWLS-3	.81**			
3. PA scale	.53**	.57**		
4. NA scale	-.47**	-.43*	-.32**	

Note. N = 295. * $p < .05$; ** $p < .01$ (2-tailed). HILS-3 = Harmony in Life Scale three item version, SWLS-3 = Satisfaction with Life scale three item version, PA = Positive Affect, NA = Negative Affect.

The correlation between self-reported activities and SWB scales

SWB scores were predicted from self-reported activities using trained statistical models, as shown in *Table 3*; it shows the correlations between scores on the four SWB scales predicted from semantic content and the observed scores on the SWB scales, as well as the correlations between the predicted valence scores of the activities and the scores on the SWB scales.

Prediction of SWB using self-reported activities. Neither reported activities for yesterday nor the activities reported having the most impact on well-being in the past four weeks significantly predicted the SWB scale scores, all $p > .05$.

Correlations between SWB scales and predicted valence of activities. The predicted valence of the activities reported for yesterday yielded a small significant negative correlation to the NA scale, $r = -.13$; $p = .027$; two-tailed, as expected. The other scales yielded no significant correlations. The predicted valence of activities reported having the most impact on well-being in the past four weeks had a small significant correlation to the SWLS-3, $r = .13$; $p = .036$; two-tailed, as expected. The other SWB scales yielded no significant correlations.

Table 3. Pearson correlations between semantic content prediction and observed SWB scale scores.

Variables	HILS-3	SWLS-3	PA scale	NA scale
Activities yesterday	.00	-.02	.03	-.05
Activities past four weeks	-.01	.07	.04	.01
Valence activities yesterday	.08	.07	-.03	-.13*
Valence activities past four weeks	.11	.13*	.10	-.11

Note. N = 295 * $p < .05$; ** $p < .01$ (2-tailed). HILS-3 = Harmony in Life Scale three item version, SWLS-3 = Satisfaction with Life scale three item version, PA = Positive Affect, NA = Negative Affect, Valence = predicted semantic valence.

Variation in and quantity of activities in relation to the SWB scales

Pearson correlations were employed to examine the relationship between number of activities reported for yesterday, subjective variation in activities, semantic coherence of activities yesterday as a whole, and the SWB scales. The results are displayed in *Table 4*.

Subjective variation. Subjective variation in the activities reported for yesterday had significant correlations to the HILS-3, $r = .15$; $p < .05$, the SWLS-3, $r = .15$; $p < .01$ and the PA scale, $r = .14$; $p < .05$. Subjective variation yielded no significant correlation to the NA scale, $r = -.01$; $p > .05$.

Number of activities. The number of activities reported for yesterday yielded no significant correlation to any of the SWB scales, all p values > .05.

Semantic coherence. The semantic coherence of the activities reported for yesterday as a whole yielded no significant correlation to any of the SWB scales, all p values > .05.

Table 4. Correlations between SWB scales and variation in and number of activities.

Variables	HILS-3	SWLS-3	PA scale	NA scale
Number of activities	.05	.01	-.01	.03
Subjective variation	.15*	.15**	.14*	-.01
Coherence yesterday	.04	.02	.01	-.01

Note. N = 295 * $p < .05$; ** $p < .01$ (2-tailed). HILS-3 = Harmony in Life Scale three item version, SWLS-3 = Satisfaction with Life scale three item version, PA = Positive Affect, NA = Negative Affect, Coherence = semantic coherence in the activities reported.

Key activities plotted in relation to SWB

Figures 1-4 are word plots displaying activities from participants' word answers and how they relate to the four different SWB scales. The word plots are followed by short descriptions, e.g. common themes or patterns. The plots empirically illustrate the everyday activities of participants and what activities have had the most impact on well-being in the past four weeks. Furthermore, activities were plotted on high vs. low well-being, and also along the different SWB scales, where high and low SWB is divided by median split.

Figure 1 shows the most frequently answered words on the activity question regarding yesterday. *Tv*, *watched*, *ate*, *breakfast*, *lunch* and *dinner* were the most common activities for this question.

Figures 2a-d show activities done yesterday plotted on the four SWB scales. *Breakfast*, *dinner*, *ate* and several words related to food were generally associated with high SWB in all scales. On the other hand, passive activities and duties, such as *watched*, *washed* and *TV* were generally associated with low SWB.

Figure 3 shows the most frequently answered words on the activity question regarding the activities reported having the most impact on the participants' SWB in the past four weeks. The most common activities were *family*, *walking*, *shopping* and *reading*. *Figure 1* concerns word frequency only, and does not provide any information regarding if the impact on SWB is positive or negative.

Figures 4a-d show activities having the most impact on SWB plotted on the four SWB scales. Relational (e.g. *friends* and *family*) and exercising (e.g. *gym* and *walking*) activities were generally associated with high SWB. On the other hand, duties (e.g. *work* and *cooking*) and passive (e.g. *reading* and *tv)* activities were associated with low SWB.

Note that, since the training of the words did not reveal many significant results, the conclusions of the results from semantic t-tests for all the words should be interpreted with caution.

Activities yesterday.

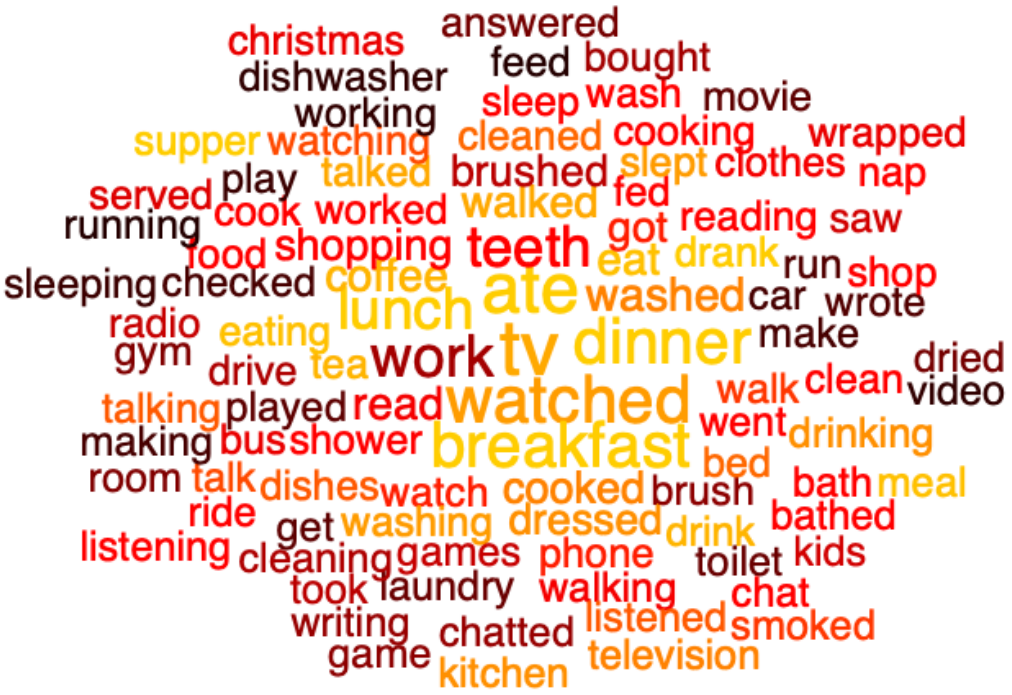
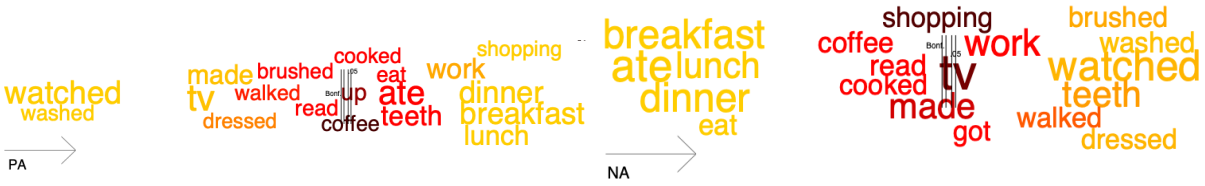


Figure 1. Activities yesterday. Semantic t-tests were computed where the words are compared to the frequency of how the words are generally used in the corpus *English 2*. Font size indicates frequency and colour indicates level of Z-transformed *t*-value. Z-values ranged from 129 to 2, darker colour indicates lower Z-value. All words were significant at $\alpha < .05$. $r = .69$, $t = 44.6$, $p < .01$, Cohen's $d = 1.35$.

2a. $r = .11$, $t = 8.94$, $p < .01$, Cohen's $d = .16$

2b. $r = .12$, $t = 9.75$, $p < .01$, Cohen's $d = .17$



2c. $r = .14$, $t = 10.79$, $p < .01$, Cohen's $d = .19$

2d. $r = .10$, $t = 8.18$, $p < .01$, Cohen's $d = .15$

Figures 2a-d. Activities yesterday plotted on the four SWB scales. Significant keywords ($p < .05$) were plotted based on semantic *t*-tests for all individual words on the semantic content of the activities yesterday between high vs. low SWB scorers. The font size indicates frequency and colour the level of the z-transformed t-values. Z-values ranged from 178 to 1.9, darker colour indicates lower Z-value. Words farther away from the middle have higher Z-values. The plots show the 20 words with highest Z-scores. Plot *2a*, HILS-3 = Harmony in Life Scale three item version, plot *2b*, SWLS-3 = Satisfaction with Life scale three item version, plot *2c*, PA = Positive Affect, plot *2d*, NA = Negative Affect.

Activities having most impact on well-being in the past four weeks.

Figure 3. Activities having the most impact on SWB in the past four weeks. Semantic t-tests were computed where the words were compared to the frequency of how the words are generally used in the corpus *English 2*. Font size indicates

frequency and colour indicates level of Z-transformed *t*-value. Z-values ranged from 82 to 2.3, darker colour indicates lower Z-value. All words were significant at $\alpha <$ .05. $r = .71.2$, $t = 41.6$, $p < .01$, Cohen's $d = 1.3$.

4a. $r = .19$, $t = 9.94$, $p < .01$, Cohen's $d = .28$

4b. $r = .18$, $t = 9.44$, $p < .01$, Cohen's $d = .26$

4c. $r = .18$, $t = 9.24$, $p < .01$, Cohen's $d = .26$

4d. $r = .17$, $t = 8.6$, $p < .01$, Cohen's $d = .24$

Figures 4a-d. Activities having the most impact on SWB in the past four weeks plotted on the four SWB scales. Significant keywords ($p < .05$) were plotted based on semantic *t*-tests for all individual words on the semantic content of the activities yesterday between high vs. low SWB scorers. The font size indicates word frequency and colour indicates the level of the Z-transformed *t*-values. Z-values ranged from 119 to 1.7, darker colour indicates lower Z-value. Words further away from the middle have higher Z-values. The plots show the 20 words with highest Z-scores. Plot *4a*, HILS-3 = Harmony in Life Scale three item version, plot *4b*, SWLS-3 = Satisfaction with Life scale three item version, plot *4c*, PA = Positive Affect, plot *4d*, NA = Negative Affect.

In addition to these results analyses concerning pre-registered exploratory analyses can be seen in the Supplementary Material. They include activities plotted on the SWB scales covaried for the remaining three scales, activities plotted with valence on the x-axis and arousal on the y-axis, trained models and semantic coherence for the different sections of the day related to the SWB scales.

Discussion

Hypotheses

Overall, self-reported everyday activities and activities having the most impact on well-being did not relate to SWB, thus H1a and H2a were not supported, which was unexpected. There are several possible explanations for this. Firstly, it is possible that there is no, or a very weak, relationship between self-reported everyday activities and SWB. The majority of the scientific literature serving as the basis of this study have not studied non-specific everyday activities but rather specific types or aspects of activities, such as (intentional) positive or social activities (see e.g. Okun et al., 1984; Lyubomirsky & Layous, 2013; Etkin & Magilner, 2016; Lee, 2017). It is therefore possible that only some types of activities can predict SWB. However, it does not seem like unintentional, everyday activities can predict SWB. A second possible explanation is that the activities themselves do not predict SWB, but rather that the features of the activities do. Previous research has found that the dosage and variety of activities, among other features, relate to SWB (Lyubomirsky & Layous, 2013; Etkin & Mogilner, 2016). Finally, regarding the activities having the most impact on SWB, it is possible that people are not very good at discerning which activities affect their SWB and how; for example, Gilbert (2007) argues that we often fail to know what will make us happy. Also, we adapt to our situations and circumstances no matter if they have changed for the better or for worse (Brickman, Coates & Janoff-Bulman, 1972). The same activities can affect people differently, indicating that features of the person affect the outcome of the activity on well-being, consistent with the PAM (Lyubomirsky & Layous, 2013).

H1b and H2b were partly supported. They focused on the valence of the reported activities and their relation to the SWB scales. Previous research has shown that valence is sometimes more efficient in predicting scale scores than training the words they are based on directly to the rating scales (Kjell et al., 2019). Since the statistical models predicting the valence of the words/activities already exist in Semantic Excel, a lack of correlation cannot be explained by sample size alone, as it could for the semantic-numeric correlations. Therefore it was not surprising that the valence of the activities was better at predicting the SWB scales than the semantic representations. However, the significant correlations were relatively few and weak.

H3a was not supported; number of activities did not yield significant correlations with any of the SWB scales. This hypothesis was based on the broaden-and-build theory (Fredrickson, 2001) and the subsequent finding that people induced into a state of positive emotions can think of more activities they would like to do than people in a neutral state (Fredrickson & Branigan, 2005), and that number of activities participated in have been correlated to SWB (Menec, 2003; Lawton et al., 1999). Also, a large number of activities indicates variation in activities, which relate to high SWB (Etkin & Maligner., 2016; Sheldon et al., 2012), further strengthening the hypothesis. We therefore believed participants experiencing high SWB would be inclined to write a larger number of activities than participants experiencing low SWB. However, there was no correlation between number of reported activities and SWB. It is possible that the definition provided to the participants of what constitutes an activity was too broad. Since an activity was defined as virtually anything one can do, participants in this study could theoretically think of an infinite number of activities they had done, reducing activities down to even breathing and blinking. Indeed, typical answers for the yesterday question included *brushed teeth* and *shower*. This broad definition of activities did not correlate with SWB. However, narrowing the definitions of the activities may be of interest for future research.

H3b was partly supported; subjective variation yielded weak correlations with three out of four SWB scales (the HILS-3, SWLS-3 and PA scale), which is in line with previous research (Etikin & Maligner, 2016; Sheldon et al., 2013). However, semantic coherence yielded no significant correlations with the SWB scales. In the PAM (Lyubomirsky et al., 2013, variation is seen as a feature of activities that is argued to be a positive factor for enhancing well-being, which our results indicate some support for.

Even though activities could not predict SWB, the plots revealed words and activities that were associated with high and low SWB. From analyses of the word plots, the clearest pattern was that high SWB was associated with mainly food related activities, and low SWB with duties and passive activities. For activities having the most impact on well-being in the past four weeks, high SWB was related to social and active activities (such as family, friends, gym and outdoors activities), whereas low SWB was associated with duties and passive activities (such as watching TV, cooking, working and cleaning). This is consistent with the broaden-and-build theory

(Fredrickson, 2001) and the study by Fredrickson and Branigan's (2005) finding that people induced in a good mood have more urges to be social, exercise and be outdoors, along with many previous findings regarding activities that are associated with high SWB (Grimm et al., 2015; Okun et al., 1984; Diener & Seligman, 2002; Lee, 2017). The findings from the word plot analyses should, however, be interpreted with caution, as the trained statistical models based on activities could not predict SWB. The activity categories mentioned (e.g social and active) are our own definitions, based on patterns found in the word plots.

Limitations

A limitation in this study, and when conducting surveys in general, is the inability to know the difference between what activities participants actually have done, and what they report they have done. To minimize this issue, participants were asked about what activities they did yesterday, since they are likely to remember in great detail what they did yesterday and report truthful and less selective answers than if asked about a day further in the past or a day in general. Additionally, yesterday was divided into three parts (morning, day and evening) to further encourage participants to report what they actually did yesterday. However, because the definition of activity was very broad, it was impossible for participants to report all activities they did yesterday and instead they had to choose the ones most relevant to them. In the process of choosing, it is possible that participants chose not to report some activities, due to reasons such as embarrassment or shame. It is therefore possible that activities they did not write could have predicted their SWB.

Asking participants what they did yesterday requires them to recall what they have done previously rather than answer what they are doing at the moment of answering. The experience sampling method, used by Grimm et al. (2015) could be used in future studies with similar research questions. This could decrease the amount of noise in participants' answers, since participants would report what they are doing at that very moment, rather than choosing activities from the whole day. Also, narrowing the focus to e.g. positive and social activities, used as the basis for this study, may be the key to finding activities that relate to SWB.

It is unclear whether the result of the semantic coherence analysis is due to there being no correlation between variation in activities and SWB, or that semantic coherence is not a valid instrument for this hypothesis. To our knowledge, semantic coherence has not been used as a measurement in any previous scientific research, making it hard to assess its validity.

Another limitation is the choice of day to conduct the survey. The data was collected on a Wednesday (2019-12-04), and activities were therefore to a large degree associated with professional life. To collect the data on a Wednesday was a deliberate choice, as most people work five days a week, making a workday, such as Wednesday, more representative of people's everyday life than a Saturday or Sunday.

Future research

If a similar study is to be conducted in the future, data could be collected on multiple occasions including the weekend, in order to yield data that is more representative of everyday life. Potential differences in activities between weekdays and the weekend could be analysed to see if voluntary activities conducted in one's free time has a bigger impact on SWB than mandatory work-related activities, for example.

This study supported the findings that variation in activities relates to SWB. However, person and activity features need more empirical evidence in order to see how well the PAM can predict SWB. Specific activities may be the key in investigating the relationship between activities and SWB, and thus the patterns shown in the word plots could act as a basis for the narrowing of activities (e.g. focusing on social or active activities).

Additionally, given that the non-significant correlations between valence of the activities having the most impact on well-being in the past four weeks and SWB were relatively high (r = .10-.11), in combination with a relatively large sample size (N = 295), it is possible we have made a type 2 error. Further research could examine whether there is support for this relationship or not.

Conclusion

This study has examined the relationship between everyday activities and SWB. To conclude, we return to answer our three research questions.

Can a person's self-reported activities predict their subjective well-being? Self-reported everyday activities collected using open-ended questions did not predict SWB, inconsistent with previous findings. When plotting individual activities, high SWB were associated with social activities and active activities, whereas low SWB seems to be associated with duties and passive activities, which is mostly consistent with previous research. However, these findings need replication and can function as a basis to build semantic questions and future research on the relation between activities and SWB on.

Are different subjective well-being constructs related to different activities? Since none of the SWB scales could be predicted by the activities, cautious conclusions should be made as to how the different SWB scales are related to specific types of activities. The plots yielded small differences in which activities were related to different SWB scales, but the similarities between the scales are of more interest than the differences.

Is variation in activities related to subjective well-being? Subjective variation in activities and the valence of the activities had small correlations to SWB. Thus, future research may be able to find significant relationships between features of activities and SWB, or between more narrowly defined everyday activities and SWB.

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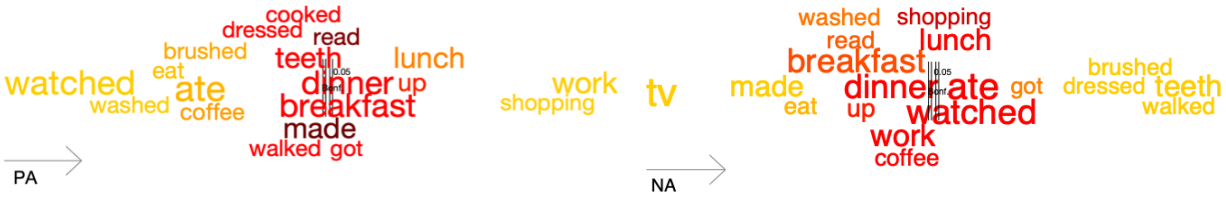
Supplementary material

Word plots covaried with the other three SWB scales

5a. $r = .15$, $t = 11.7$, $p < .01$, Cohen's $d = .21$

5d. $r = .12$, $t = 9.8$, $p < .01$, Cohen's $d = .18$.



5c. $r = .15$, $t = 11.7$, $p < .01$, Cohen's $d = .21$

5d. $r = .11$, $t = 9.0$, $p < .01$, Cohen's $d = .16$

Figures 5a-d. Activities yesterday plotted on the four SWB scales, covaried for the remaining three. Significant keywords ($p < .05$) were plotted based on semantic *t*-tests for all individual words on the semantic content of the activities yesterday between high vs. low SWB scorers. The font size indicates frequency and colour the level of the z-transformed t-values. Z-values ranged from 236 to 1.9, darker colour indicates lower Z-value. Words farther away from the middle have higher Z-values. The plots show the 20 words with highest Z-scores. Plot *2a*, HILS-3 = Harmony in Life Scale three item version, plot *2b*, SWLS-3 = Satisfaction with Life scale three item version, plot *2c*, PA = Positive Affect, plot *2d*, NA = Negative Affect.

Covaried word plots yesterday. Compared to figures 2a-d, in figures 5a-d, activities are plotted along the SWB scales but also covaried with the other three SWB scales. All scales yield similar results except the *SWLS-3,* which taps more into passive activities (*watched, tv, work* and *shopping*), which were mainly in the negative half of the non-covaried plots.

6c. $r = .16$, $t = 8.3$, $p < .01$, Cohen's $d = .23$

4d. $r = .18$, $t = 9.3$, $p < .01$, Cohen's $d = .26$

4c. $r = .19$, $t = 10.0$, $p < .01$, Cohen's $d = .28$

6d. $r = .16$, $t = 8.0$, $p < .01$, Cohen's $d = .22$

Figures 6a-d. Activities having the most impact on SWB in the past four weeks plotted on the four SWB scales, covaried for the remaining three scales. Significant keywords ($p < .05$) were plotted based on semantic *t*-tests for all individual words on the semantic content of the activities yesterday between high vs. low SWB scorers. The font size indicates word frequency and colour indicates the level of the Z-transformed *t*-values. Z-values ranged from 168 to 1.8, darker colour indicates lower Z-value. Words further away from the middle have higher Z-values. The plots show the 20 words with highest Z-scores. Plot *4a*, HILS-3 = Harmony in Life Scale three item version, plot *4b*, SWLS-3 = Satisfaction with Life scale three item version, plot *4c*, PA = Positive Affect, plot *4d*, NA = Negative Affect

Covaried word plots for activities with most impact on well-being the past four weeks. Compared to figures 4a-d, in figures 6a-d, activities are plotted along the SWB scales but also covaried with the other three SWB scales. *Friends* seems unique for high *HILS-3* and low *NA,* whereas *shopping* seems to be more unique for low NA and high PA, and even negative for the *SWLS-3* and the *HILS-3*. *Reading* seems to be negative for all SWB scales even after the covaried analysis.

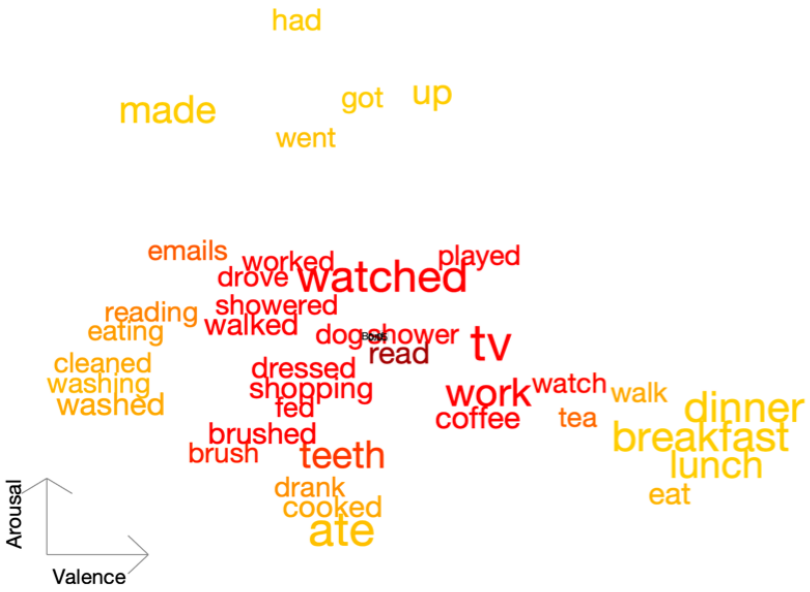


Figure 7. Activities yesterday plotted on valence and arousal. On the x-axis, words are plotted according to the predicted valence of the semantic representation of each participants all activities listed. On the y-axis, words are plotted according to predicted arousal of the semantic representation of each participants all activities listed. Font size indicates frequency and colour indicates level of Z-transformed *t*-value. Z-values ranged from 256 to 1.9, darker colour indicates lower Z-value. All words were significant at $\alpha <$ .05. $r = .27$, $t = 22.4$, $p < .01$, Cohen's $d = .39$.

Figure 8. Activities for the past four weeks plotted on valence and arousal. On the x-axis, words are plotted according to the predicted valence of the semantic representation of each participants all activities listed. On the y-axis, words are plotted according to the predicted arousal of the semantic representation of each participants all activities listed. Font size indicates frequency and colour indicates level of Z-transformed *t*-value. Z-values ranged from 129 to 2, darker colour indicates lower Z-value. Font size indicates frequency and colour indicates level of Z-transformed *t*-value. Z-values ranged from 138 to 1.7, darker colour indicates lower Z-value. All words were significant at $\alpha < .05$. $r = .35$, $t = 18.9$, $p < .01$, Cohen's $d = .53$.

Arousal and valence. Activities were plotted along arousal and valence level. For activities yesterday (*Figure 7*) participants reporting activities with a high score of predicted valence and low score of predicted arousal often wrote *dinner, breakfast* and *lunch*. Participants reporting activities with a low score of predicted valence and high score of predicted arousal often wrote *made, had* and *went*. For activities having most impact on well-being the past four weeks (*Figure 8*), participants reporting activities with a high score of predicted valence and arousal often wrote *friends* and *family*. Participants reporting activities with a low score of predicted valence and arousal often wrote *reading* and *walking*.

Sections of the day in relation to SWB. Regarding the exploratory analyses of how well the different sections of yesterday (i.e., morning, day, evening) could predict SWB, morning had a small significant correlation to the *HILS-3* ($r = .15$, $p < .01$) whereas the rest of the SWB scales and parts of the day yielded no significant results, details in *Table 4*.

Table 4. Trained predictions of how activities during different parts of yesterday predict SWB scales.

Variables	Morning	Day	Evening
HILS-3	.15**	.01	.01
SWLS-3	.03	-.07	-.11
PA	.03	-.10	.08
NA	.01	.04	-.14

Note. N = 295. * = $p < .05$; ** = $p < .01$ (2-tailed). HILS-3 = Harmony in Life Scale three item version, SWLS-3 = Satisfaction with Life scale three item version, PA = Positive affect scale, NA = Negative affect, Morning = activities reported for yesterday morning, Day = activities reported for yesterday during the day, Evening = activities reported for yesterday evening.

Semantic coherence of the different sections of the day. Coherence morning and coherence day did not meet the pre-registered assumption of normal distribution (kurtosis > 2) and were thus analysed with Spearman's Rho, details in *Table 5*. No correlations were found between semantic coherence of activities reported for the different sections of yesterday (morning, day and evening) and the SWB scales, details in *Table 6.*.

Table 5. Descriptive statistics for coherence

Variables	Mean	*SD*	Skew	Kurtosis
Coherence Morning	.064	.054	1.619	5.075
Coherence Day	.07	.06	1.204	2.550
Coherence Evening	.065	.038	.929	1.817

Note. N = 295.

Table 6. Predicting SWB from semantic coherence for different sections of yesterday.

Variables	HILS-3	SWLS-3	PA	NA
Coherence Morning^	.05	.00	-.04	.00
Coherence Day^	.11	.05	.02	-.03
Coherence Evening	-.03	-.04	-.02	.06

Note. N = 295. * = $p < .05$; ** = $p < .01$ (2-tailed). ^ = Spearman's rho, due to kurtosis > 2 (see table 5).