



Why extraverts are happier: A day reconstruction study



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ARTICLE INFO

Article history:

Available online 12 February 2014

Keywords:

Affective-reactivity
Person-by-Situation Fit
Day Reconstruction Method
Extraversion
Momentary happiness

ABSTRACT

The study contributes to the literature on extraversion and momentary happiness by examining processes that might underlie this robust effect. The affective-reactivity hypothesis suggests that extraverts react more positively to rewarding situations as compared to introverts. According to the person-by-situation model, extraverts should enjoy social interactions more than introverts do. Global reports of extraversion were combined with an ecologically valid Day Reconstruction Method (DRM) to assess time spent and happiness of 1364 participants during 13,973 activities. Multilevel results confirm that extraverts (versus introverts) experience a higher boost in momentary happiness when spending time on rewarding – but not pleasurable – activities, especially when rewarding activities are executed with others. These processes partly explain why extraverts are happier in the moment.

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1. Introduction

Research shows that extraverts are happier both in general and on specific moments as compared to introverts (DeNeve & Cooper, 1998; Diener & Lucas, 1999; Lucas & Fujita, 2000). The direct relationship is very robust, which has led some authors to suggest that positive affect is the core of extraversion (Lucas, Diener, Grob, Suh, & Shao, 2000; Tellegen, 1985; Watson & Clark, 1997). However, others have argued that the relationship between extraversion and happiness can be explained by additional processes. For instance, the Affective Reactivity Hypothesis (ARH) states that variations in the magnitude of affective reactions to pleasurable and rewarding stimuli may explain why extraverts experience higher momentary happiness in such situations (Larsen & Ketelaar, 1991; Strelau, 1987; Tellegen, 1985). Recent laboratory studies (e.g., Smillie, Cooper, Wilt, & Revelle, 2012) further indicate that the stronger affective reactivity of extraverts (versus introverts) may only occur in rewarding (e.g., engaging in financially rewarding tasks), but not in pleasurable situations (e.g., watching a humorous video clip). However, these recent advances in the ARH have not been examined in everyday life situations. In addition, the Person-by-Situation Fit (PSF) perspective emphasizes that extraverts enjoy social interactions more than introverts do, which could account for an extraverts' greater happiness (Pavot, Diener, &

Fujita, 1990). However, empirical tests of the PSF in everyday life situations are rare, and those that do so show weak empirical support (e.g., Lucas, Le, & Dyrenforth, 2008; Srivastava, Angelo, & Valereux, 2008).

The main aim of this study was to contribute to the literature on extraversion and momentary happiness by examining processes that might underlie this robust effect. First, in line with recent insights into the ARH, we argue that extraverts experience a higher boost in momentary happiness as compared to their introverted counterparts when spending time on rewarding activities, but not when spending time on merely pleasurable activities. Second, in line with the PSF perspective, we argue that extraverts may experience a higher boost in happiness in social situations as compared to introverts, but that this effect may also depend on the type of activity involved (e.g., pleasurable or rewarding activities). Third, we examined if the time individuals spent on pleasurable and rewarding activities, and in social situations, explains why extraverts are happier in the moment.

We combined global survey reports of extraversion with an ecologically valid Day Reconstruction Method (DRM; Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004) in order to accurately capture the trait of extraversion, as well as the time spent and happiness experienced during activities in everyday life. The DRM technique provides a detailed account of a person's time spent on daily activities, social interactions, and related affective experiences. We analyzed this information with multi-level modeling techniques, so that differences in momentary happiness on both the between person and the within person level are taken into account. We included a large sample of individuals ($N = 1364$)

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who answered a global questionnaire on extraversion and reconstructed their time spent and momentary happiness experienced during everyday activities ($N = 13,973$).

Momentary happiness can be defined as a pleasurable and mildly activated emotional state experienced during everyday activities (Oerlemans, Bakker, & Veenhoven, 2011; Russell, 1980, 2003), whereas the global trait of extraversion refers to stable, between person differences in the general tendency to be sociable, active, fun-loving, outgoing, friendly, and talkative (Costa & McCrae, 1980). Dozens of studies have reported a significant positive relationship between measures of trait extraversion and happiness (Diener & Lucas, 1999; Lucas & Fujita, 2000; Watson & Clark, 1997). In addition, experience sampling studies and diary studies suggest that this relationship is causal, that it exists over short time periods, and even in the moment (Wilt & Revelle, 2009). Because of this robust relationship, some authors have suggested that happiness is the core of extraversion (Lucas et al., 2000; Tellegen, 1985; Watson & Clark, 1997).

However, studies also showed that, depending on one's personality traits, individuals may react differently in specific situations (e.g., Boyce & Wood, 2011a, 2011b; Boyce, Wood, & Brown, 2010). Two temperamental, but situation specific approaches for extraversion are the affective-reactivity Hypothesis (ARH; e.g., Gross, Sutton, & Ketelaar, 1998; Larsen & Ketelaar, 1991), and the Person-by-Situation Fit (PSF; Pavot et al., 1990) perspective. The ARH links extraversion to the functioning of the Behavioral Activation System (BAS; e.g., Carver & White, 1994; Elliot & Thrash, 2002). In particular, when individuals are exposed to either positive or rewarding situations, extraverts (due to a strong reactive BAS) would react more positively to such stimuli than do introverts. Consequentially, extraverts would be happier in situations that are characterized as either rewarding or pleasant. However, laboratory studies that tested the ARH have yielded mixed results. Lucas and Baird (2004) reported in their meta-analysis across six mood induction studies in the laboratory that there was evidence for a reactivity effect, but the effect was not large and it varied across different types of studies.

Howell and Rodzon (2011) were the first to test the ARH using a Day Reconstruction Methodology in the field among undergraduate students. Individuals were asked to fill out an hour-by-hour reconstruction of their behaviors throughout the day, as well as hourly ratings of positive affect. The authors composed a daily positive affect score (i.e., aggregated ratings of hourly positive affect), as well as a normative positive affect score (i.e. the average positive affect individuals derived from their reported activities). Results showed that extraversion was positively related to daily positive affect. However, high (versus low) extraverted individuals did not experience a higher boost in daily positive affect as compared to the normative positive affect score, which the authors interpreted as a rejection of the ARH.

Recently, Smillie et al. (2012) argued that the functionality of the BAS might be misinterpreted in studies that test the ARH. In particular, the BAS might be better described as a system that regulates appetitive motivation, facilitating the direction of approach behavior toward desired goals, rather than consumption of reward (e.g., Depue & Collins, 1999; Depue & Morrone-Strupinsky, 2005; Gray, 1970; Gray, 1981). Smillie et al. (2012) argued that if the BAS is engaged primarily in the context of reward pursuit, it is likely that the ARH will be supported in appetitive situations (e.g., during actual pursuit of rewards or desirable goals), but not in situations that may be characterized as merely pleasant, without motivationally salient or rewarding characteristics. Smillie et al. (2012) found evidence for these hypotheses in a series of laboratory studies. No significant differences in positive affect between extraverts and introverts occurred after merely pleasant positive mood inductions (e.g., watching a humorous video clip). However,

after highly appetitive mood inductions (e.g., performing cognitive tasks which hold financial rewards), extraverts did experience stronger positive affective reactions than introverts. Moreover, differences in affective reactivity were only found for highly activated positive states (e.g., vigor, excitement), but not for low activated positive states (e.g., contentment, satisfaction; Smillie, Geaney, Wilt, Cooper, & Revelle, 2013; Smillie et al., 2012). One explanation could be that neural processes connected with the BAS (i.e., the mesolimbic dopamine system) are potentially involved in the experience of activated affect (Berridge, 2006; Lu, Jhous, & Saper, 2006; Nishino, Mao, Sampathkumaran, & Shelton, 1998), but do not directly relate to experiencing pleasant affect (Leyton et al., 2002; Panksepp, 2006).

The developments in the affective-reactivity literature – although intriguing – have yet to be confirmed in everyday life situations. Waterman (2005) proposed an activity framework that could be useful to distinguish merely pleasurable from highly appetitive activities in real life. Waterman asked college students to report six types of activities students regularly engage in, that are characterized by different combinations of effort and enjoyment. Based on this exercise, Waterman (2005) generated a specific list of low-effort but pleasurable (hedonic) activities, including watching TV, reading, music-related activities, solitary activities, shopping, and recreational activities. Moreover, a high-effort and pleasurable (eudaimonic) list of activities included athletic activities, dancing, and work activities. Waterman (2005) first validated this empirical framework of activities by asking individuals to rate each of the reported activities on a seven point scale in terms of effort and pleasure. Consistent with expectations, analyses of variance showed that eudaimonic activities were rated significantly higher on effort as compared to hedonic activities, whereas results showed no significant differences in the level of pleasure between eudaimonic and hedonic activities. In addition, Waterman (2005) further validated his framework by showing that eudaimonic (versus hedonic) activities were more strongly associated with subjective experiences that may be described as indicative of reward pursuit, such as flow, personal expressiveness, balance of challenge and skills, and importance. For example, flow (Csikszentmihalyi, 1990) includes experiences of having clear goals, being in control, knowing how well one is doing, feeling fully involved in the activity, and experiencing high levels of concentration.

In the present study, we used the framework of Waterman (2005) to distinguish between merely pleasurable, hedonic activities (watching TV, reading, listening to music, relaxing, and shopping), and rewarding, eudaimonic activities (sports/exercise, and financially rewarding work activities). Based on recent literature on the affective-reactivity process, it was hypothesized that:

Hypothesis 1. Extraverts (versus introverts) experience higher momentary happiness when spending time on activities that are characterized by reward pursuit (sports/exercise, financially rewarding work activities), but not when spending time on activities that are characterized as merely pleasurable (watching TV, reading, listening to music, relaxing, and shopping).

A second possible explanation for the extraversion – happiness relationship is the *Person-by-Situation Fit* perspective (PSF; Pavot et al., 1990). Pavot and colleagues argued that society requires both extraverts and introverts to participate in social activities regardless of whether such activities are enjoyed. People are required to interact with one another many times during a normal day (e.g., at work, or with family and friends). Because of their sociable nature, extraverts would experience a greater PSF during social situations than introverts do, which would explain why extraverts are happier as compared to introverts.

Lucas et al. (2008) examined the PSF approach with diary-based and momentary reports of various types of social interactions and positive affect. Findings showed that extraverts and introverts both reported more positive affect in social situations as compared to being alone. Moreover, contrary to expectations based on the PSF, the size of the boost in positive affect during social situations was similar for high and low extraverted individuals in all of the diary-based reports. However, Lucas et al. (2008) did find a significant interaction – be it modest in size – in one of their moment-based reports, where high (versus low) extraverts did experience a modestly higher boost in positive affect on moments when they spent their time with family or friends. Similarly, Srivastava et al. (2008) tested the PSF using a Day Reconstruction Method among 110 college students who reported on interactions with others and positive affect experienced during all of the activities from a single day. Using multi-level analyses, the authors found no significant differences in (aggregated) daily positive affect between high and low extraverted individuals in social versus nonsocial situations.

Importantly, previous studies (Lucas et al., 2008; Srivastava et al., 2008) did not take into account the various types of activities that were pursued by individuals. However, some activities are known to lead to higher levels of positive affect as compared to others (e.g., Kahneman et al., 2004). We therefore argue that analyses should correct for the time individuals spent on various activity types when testing the PSF. Moreover, previous studies did not correct for the lagged effect of positive affect experienced during a previous activity on subsequent affective experiences. However, studies have demonstrated that positive affective experiences during the day affect positive experiences later that day (e.g., Rodríguez-Muñoz, Sanz-Vergel, Demerouti, & Bakker, in press). In everyday life, we should rule out potential confounds, in order to accurately analyze momentary effects (Wickham & Kne, 2013).

Another point is that the cross-level interaction effect between extraversion at the between-person level and time spent with others (versus alone) on a daily or momentary basis is probably rather subtle, and that a larger sample size may be required to detect such an effect (e.g., Maas & Hox, 2005). Based on the above issues, we argue that the final verdict on the PSF is still out. In the present study, we accounted for the time individuals spent on various activities, as well as spillover effects of momentary happiness from the previous activity to the next. Also, the present study includes a larger sample size ($N = 1364$ participants, and 13,973 activities). In line with the PSF, we hypothesize that:

Hypothesis 2. Extraverts (versus introverts) experience higher momentary happiness when performing activities with others rather than alone.

Interestingly, the PSF and the ARH hypotheses are not necessarily mutually exclusive. Extraversion is a broad personality trait defined by multiple lower-order characteristics (e.g., being sociable, active, outgoing, and so on; Costa & McCrae, 1980). When specific situations accommodate both rewarding and social elements, it may be that extraverted individuals – because of a better Person by Situation Fit – enjoy such situations more as compared to situations that are either rewarding or social. For example, a recent study of Walker (2010) showed that individuals enjoyed ‘flow’ activities more when such activities were performed with others as opposed to alone. Flow is an intrinsically rewarding, highly absorbing state in which people lose a sense of time and awareness to self (Csikszentmihalyi, 1990). Flow is likely to occur in highly challenging activities that provide clear feedback. As such, flow activities may be considered highly rewarding. For instance, running, cycling, playing soccer, making music, dancing, and working were some examples of activities that were mentioned by

respondents that generated flow in Walker’s (2010) study. In the present study, we argue that rewarding activities in a social context will result in a higher Person-by-Situation Fit for highly (versus low) extraverted individuals, leading them to experience a higher boost momentary happiness. We hypothesize that:

Hypothesis 3. Extraverts (versus introverts) will experience higher momentary happiness when spending time on rewarding activities (sports/exercise, paid work activities) together with others (versus alone).

Most researchers initially believed in the rationale that extraverts enjoy, are more competent in, and are more likely to participate in social activities (Eysenck & Eysenck, 1985; Pavot et al., 1990), which could explain why extraverts are happier as compared to introverts. Surprisingly, only a small number of studies tested whether time spent on social activities would mediate the direct relationship between extraversion and positive affect. Argyle and Lu (1990) used mediational analyses to show that global, retrospective reports of social activity could account for half of the association between extraversion and positive affect. However, such retrospective reports of activities are often only moderately accurate, and thus a stronger test comes from studies that use experience sampling-based measures of social activity. Lucas et al. (2008) used more accurate experience sampling reports and daily reports over the course of seven days to assess whether time spent on specific activities (e.g., being with friends or family, with partner, leading others, or helping others) would mediate the association between trait extraversion and positive affect (rated as a combination of feeling pleasant, happy, active, and excited). Using structural equation modeling, results showed that extraverts indeed engaged more in social activities, and that social activities were positively related to positive affect. However, extraversion was still significantly and moderately related to positive affect after controlling for engagement in social activities. Similarly, Srivastava et al. (2008) found that extraverts interact more with others on a specific day, and that social interaction was related to positive affect. However, social participation only partially accounted for the direct association between extraversion and positive affect.

As social interaction appears to only partly explain the positive relationship between extraversion and happiness, it may be possible that some other aspect of extraverts’ behavior is responsible for their greater happiness. Given the recent developments in the affective-reactivity literature (e.g., Smillie et al., 2012), it might be that extraverts (also) enjoy, are more competent in, and are more likely to participate in rewarding activities. If so, then a combination of greater time spent in both social interactions and rewarding activities may fully mediate the direct relationship between extraversion and happiness. Based on the above reasoning, we formulated our final hypothesis:

Hypothesis 4. The direct effect of trait extraversion on momentary happiness will be mediated by the time spent on rewarding activities and social interactions.

2. Method

2.1. Procedure

Dutch participants were recruited via magazines and social media (e.g., Facebook, LinkedIn, Twitter) to participate in this online study. Upon agreement, participants completed an online survey and filled out their age, gender, educational level, employment, and trait happiness. Next, participants were given the option to

create a personal account. This personal account gave participants access to an online personality questionnaire (Costa & McCrae, 2004) and a personal happiness diary. Participants could freely choose to fill out the personality questionnaire, the happiness diary, or both. Moreover, participants could choose the frequency of reminders via e-mail (monthly, weekly, or daily) to log on and fill out their happiness diary.

The online “happiness diary” was based on a Day Reconstruction Methodology (DRM) which makes optimal use of a persons’ recall memory (Kahneman et al., 2004). In particular, individuals encode and store their affective experiences into their memory when one episode ends and another episode starts (Kurby & Zacks, 2008). The DRM methodology facilitates this recall process by asking participants to reflect on their activities by indicating in chronological order what kind of activities they had been doing from waking up until bedtime. Specifically, participants were asked to report in chronological order what activity types they were engaged in during the previous day (yesterday). For each reported activity, participants indicated a) the time at which an activity began and ended, b) a further description of the activity, c) whether there was any kind of social interaction with others during the activity, and d) in what life domain the activity took place. The chronological order of the activities and the additional questions (time spent, where, with whom) for each of the activities help respondents to vividly recall into memory their activities of the previous day, as well as their affective reactions to those activities (Kahneman et al., 2004). After this exercise, participants were presented with a chronological overview of their reported activities and were asked to indicate how happy they had felt during each of the reported activities, using a one item scale ranging from 0 (extremely unhappy) to 10 (extremely happy).

2.2. Participants

In total, 1364 participants created a personal account and filled out a personality questionnaire and a happiness diary for one or multiple days. The average number of happiness diaries filled out was 4.11 ($SD = 11.08$); 44% ($N = 602$) of the participants who participated in the happiness diary reconstructed their day once, 19% ($N = 260$) twice, 9% ($N = 125$) three, and 28% ($N = 377$) four or more times. The total number of days was 5595, including 56,002 within-day scores of activity types and happiness scores during activities.

The average age of the participants in the study sample was 44.84 years ($SD = 13.43$), and 86.4% of the participants were female. About 19% held a university degree, 35% finished a higher professional education, 29.8% a lower professional education, 14.4% finished a higher secondary education, and 1.8% finished primary school. On average, participants reported to work 28.61 h ($SD = 11.24$), and 4.01 days ($SD = 1.27$) per week. A comparison on participants who filled out the diary once versus those who filled out the diary multiple times yielded no significant differences in age, gender, educational level, and trait happiness.

2.3. Measurements

Extraversion was measured using the 12 items of the Neuroticism–Extraversion–Openmindedness Five Factor Inventory (NEO-FFI; Costa & McCrae, 2004). Two examples are “I really enjoy talking to people”, and “I am a very active person”. The items were rated on a 5-point Likert scale ranging from 1 (*strongly disagree*) up to 5 (*strongly agree*). Cronbach’s alpha was .81, indicating good internal consistency.

Activity types Main activities reported in this study were similar to activity types described in other DRM studies (e.g., Dockray et al., 2010; Kahneman et al., 2004), including eating, commuting

to/from work, paid work activities, athletic activities (sports, exercise), watching TV, reading a book, doing household chores, relaxing, care activities, religious activities, and other types. In line with Waterman’s (2005) framework, we selected the following activities as ‘pleasurable’ activities that are low on effort and lack clear goals: watching TV; reading a book; listening to music; shopping; and relaxing. In addition, we included two activity types that, according to Waterman’s framework (2005), are highly effortful and highly indicative of reward pursuit: work-related activities with financial rewards; and athletic activities (i.e. exercise, dancing, sports). Out of a total number of 56,003 reported activities, 13,973 reported activities (25%) corresponded with the selected activities based on Waterman’s framework, with 25.7% referring to watching TV ($N = 5424$), 12% reading a book ($N = 2523$), 10% paid work activities ($N = 2074$), 8% relaxing ($N = 1627$), 6% listening to music ($N = 1261$), 4% athletic activities ($N = 764$), and 1% shopping ($N = 300$). These activity types were used in subsequent analyses.

Social contact during activities: For every activity, respondents answered the question: “With whom did you engage in the activity?”. Response categories included alone; with friends; with partner; with children; with family members; with colleagues; with boss; or with others. A dummy variable was created to distinguish activities executed alone (0) from activities that were executed with others (1).

Duration of activity: Start and end times were asked for each reported activity in an ‘hour: minute’ format. The difference between the reported begin and end time of each activity was calculated as an indicator for the duration of a particular activity.

Momentary happiness during activities: For each activity, respondents answered: “How happy did you feel during this activity?”. The answering categories ranged from 0 (extremely unhappy) to 10 (extremely happy) and each number included a corresponding smiley face. Note that a one-item measure to assess momentary happiness by situation is commonly used in DRM studies (e.g., Dockray et al., 2010; Kahneman et al., 2004).

Control variables: We corrected for time-related variables (hour of the day, weekend versus weekday), as previous studies showed such factors to influence momentary happiness (e.g., Csikszentmihalyi & Hunter, 2003). Also, as affective experiences spillover from one domain to another (e.g., from work to home; Song, Foo, & Uy, 2008), momentary happiness is likely to spillover from one activity to the next. We corrected for this spillover effect of momentary happiness experienced during the previous activity.

2.4. Strategy of analysis

The DRM data have a hierarchical structure with activities nested within days, and days nested within persons. Therefore, hierarchical linear modeling was used to distinguish between three levels of analyses: The between person level (level 3), the day level (level 2) and the activity level (level 1). The substantive focus of interest in hypotheses 1, 2, and 3 is on the cross-level moderation effects of trait extraversion (a between person variable), and time spent of activities (within person, level 1 variables) in explaining the extraversion – momentary happiness relationship. To accurately address such cross-level interaction effects, extraversion was centered on the grand mean, and the variables for time spent on all of the activity types were centered on the person mean (also called Centering Within Cluster). Centering Within Cluster (CWC) of level 1 variables is preferred instead of grand mean centering when examining cross-level interactions that involve a pair of Level 1 variables (Enders & Tofghi, 2007). Specifically, Grand Mean Centering (GMC) of level 1 variables instead of CWC can produce significant cross level interaction effects, when no such effects exist in the population (Cronbach & Webb, 1975; Hoffman & Gavin, 1998). Also, the predictor dummy variable for social (versus

nonsocial) contact during activities was centered on the person mean (CWC), as multilevel interpretations of dummy variables are identical to the continuous variables (Enders & Tofghi, 2007). The three control variables for hour of day, weekday, and the lagged effect of momentary happiness experienced during the previous activity were centered at the grand mean to correct for potential influences of these variables on all of the levels in predicting momentary happiness (Enders & Tofghi, 2007).

We tested the improvement of each nested multi-level model over the previous one by computing the differences of the respective log-likelihood statistic $-2 \log$ and submitting this difference to a chi squared (χ^2) test. Model 1 was compared to an intercept only model which does not hold any predictor variables, but it does indicate the percentage of variance for the outcome variable, momentary happiness, on the different levels of analyses.

For our fourth hypothesis, we used Multilevel Structural Equation Modeling to assess whether being more with others (versus alone), and time spent on rewarding activities would mediate the direct association between trait extraversion and momentary happiness during activities. The use of traditional Multilevel Modeling (MLM) to analyze mediation effects suffers from a conflation of between and within effects (Preacher, Zyphur, & Zhang, 2010). Alternatively, aggregating within person data to a higher level to conduct traditional multilevel mediation analyses is also highly problematic, because it assumes that the within-group variability is zero (Barr, 2008). Moreover, aggregation effectively gives small groups and large groups – e.g., a person who filled out the diary once versus a person who filled out the diary more times – equal group weight in determining the parameter estimates. As Multilevel Structural Equation Modeling (MLSEM) can overcome these limitations, we performed MLSEM analyses as proposed by Preacher et al. (2010) to assess the hypothesized mediation effects.

3. Results

3.1. Preliminary analyses

Table 1 shows means, standard deviations and correlations of the study variables. Please note that the table shows aggregated correlations on the person level ($N = 1364$) below the diagonal, and within person, activity level correlations above the diagonal ($N = 13,973$). The means and standard deviations for time spent on activities were aggregated to the person level, and are reported in an 'hour: minute' format. As expected, the aggregated, person level correlation between extraversion and momentary happiness during activities was positive ($r = .28, p < .001$). Also, the within person momentary correlations showed that most of the activities

in this study were positively related to momentary happiness ($.04 \leq r \leq .12$), except for relaxing ($r = -.13$). An intercept-only multilevel model for momentary happiness was setup to examine if momentary happiness indeed fluctuates substantially on a within person, and a within-day level. A three level intercept-only model, comprising a person-level, a day-level, and a within-day, activity level was setup. Results showed that 37% of the variation for momentary happiness rests at the person level, 24% at the day level, and 39% at the within-day, activity level. These figures emphasize the need to conduct multilevel analyses in order to correctly interpret results.

3.2. Testing Hypotheses 1 through 3

Table 2 shows results of three nested multilevel models predicting momentary happiness during activities. As a first step, extraversion and the control variables were included in Model 1, as well as the main effects of three predictor variables of time spent on pleasurable activities (a summed score of time spent on watching TV, reading, listening to music, relaxing and shopping), time spent on rewarding activities (a summed score of time spent on paid work activities and athletic activities), and a dummy variable for social interaction during activities. Note that extraversion is positively related to momentary happiness. In addition, the control variables of happiness during the previous activity, day of the week, and hour of the day were also positively related to momentary happiness.

The second, nested model in Table 2 included all two-way interaction terms of the predictor variables. Confirming Hypothesis 1, the interaction effect of extraversion and time spent on rewarding activities on momentary happiness was significant ($t = 4.50, p < .001$), whereas the interaction effect of extraversion and time spent on pleasurable activities on momentary happiness was not ($t = .55, p = .58$). To further interpret this interaction effect, we created an interaction plot (Fig. 1) and performed simple slope analyses for multilevel models (Preacher, Curran, & Bauer, 2006). Simple slope analyses revealed that individuals high (one standard deviation above the mean; $t = 6.82, p < .001$) and low (one standard deviation below the mean; $t = 5.70, p < .001$) on extraversion both became significantly happier when spending time on rewarding activities. However, the relationship is significantly stronger for high (versus low) extraverts ($t = 4.50, p < .001$), which confirmed hypothesis 1.

In addition, we performed similar multilevel analyses as reported in Table 2, but analyzed interaction effects of extraversion and time spent on each activity type in Table 3. Results showed that the interaction terms for extraversion and time spent on the paid work activities ($t = 2.00, p < .05$) and athletic activities

Table 1
Means, standard deviations and correlations of the study variables.

	Variables	Correlations												
		Mean	SD	1	2	3	4	5	6	7	8	9	10	
1	Extraversion	3.29	0.57	–										
2	Time spent watching TV	13:19	64:23	–.11	–									
3	Time spent listening to music	8:50	13:42	.00	.38	–								
4	Time spent relaxing	4:09	07:22	–.14	.59	.34	–							
5	Time spent reading	11:15	08:01	–.15	.55	.36	.48	–						
6	Time spent shopping	4:44	05:09	.07	.59	.27	.42	.23	–					
7	Time spent on paid work activities	15:55	26:29	.02	.41	.28	.13	.52	.09	–				
8	Time spent on athletic activities	3:53	07:03	.11	.19	.20	.11	.40	.26	.48	–			
9	Social interaction during activities (yes/no)	0.53	0.28	.17	.07	.05	.14	.08	.08	.00	–.05	–		
10	Happiness during activities	7.74	1.42	.28	.07	.02	–.15	.09	.12	.05	.07	.23	–	

Note: Correlations below the diagonal are person-level correlations ($N = 1364$) with correlations $r |.06|$ being significant at $p < .05$ and $r |.07|$ being significant at $p < .01$. Correlations above the diagonal are within person, momentary correlations at the activity level ($N = 13,973$) with correlations $r |.03|$ being significant at $p < .05$ and $r |.05|$ being significant at $p < .01$. Means and standard deviations of activity types are person-level means in an hour:minute format.

Table 2
Multilevel estimates of trait extraversion, pleasurable activities, rewarding activities, and social interaction on momentary happiness.

	Model 1			Model 2			Model 3		
	Estimate	SE	t	Estimate	SE	t	Estimate	SE	t
Constant	6.774	0.024	282.250***	6.778	0.024	282.417***	6.778	0.024	282.417***
Extraversion	0.450	0.040	11.250**	0.450	0.040	11.250**	0.450	0.040	11.350**
Happiness previous activity	0.313	0.004	78.250***	0.313	0.004	78.250***	0.313	0.004	78.250***
Weekday	0.010	0.004	2.500*	0.010	0.004	2.500**	0.010	0.004	2.500**
Hour of the day	0.003	0.001	3.000**	0.003	0.001	3.000**	0.003	0.001	3.000**
Time spent on pleasurable activities	0.046	0.008	5.750***	0.040	0.009	4.444***	0.042	0.008	5.250***
Time spent on rewarding activities	0.045	0.005	9.000***	0.062	0.008	7.750***	0.056	0.008	7.000***
Social interaction (yes/no)	0.385	0.012	32.083***	0.065	0.017	3.824***	0.383	0.012	31.917***
<i>Two-way interactions</i>									
Extraversion × pleasurable activities				0.006	0.011	0.545	0.007	0.011	0.636
Extraversion × rewarding activities				0.045	0.010	4.500***	0.069	0.013	5.308***
Extraversion × social contact				0.065	0.017	3.824***	0.071	0.017	4.176***
Pleasurable × rewarding activities				-0.017	0.025	-0.680	-0.017	0.025	-0.680
Pleasurable × social interaction				0.030	0.019	1.579	0.032	0.021	1.524
Rewarding × social interaction				0.112	0.020	5.600***	0.081	0.024	3.375***
<i>Three-way interactions</i>									
Extraversion × pleasurable × social							-0.005	0.029	-0.172
Extraversion × rewarding × social							0.097	0.038	2.553**
$-2 \cdot \log(1h)$	165979.047			165910.695			165904.418		
Diff $-2 \cdot \log$	16595.865***			68.352***			6.277***		
Df	7			6			2		
Level 1 intercept variance (person)	0.428	0.025		0.428	0.026		0.427	0.026	
Level 2 intercept variance (day)	0.299	0.009		0.300	0.009		0.300	0.009	
Level 3 intercept variance (activity)	1.125	0.007		1.113	0.007		1.103	0.007	

Notes: SE = standard error; t = T-value. Model 1 was compared to a Null Model with the intercept as the only predictor ($\gamma = 6.842$; SE = 0.036; $t = 190.056$; $-2 \cdot \log = 182574.912$; Level 3 variance = 1.185, SE = 0.065; Level 2 variance = 0.763; SE = 0.020; Level 1 variance = 1.225; SE = 0.008). Time = time spent on activity. Happiness = happiness during activity.

* $p < .05$.
** $p < .01$.
*** $p < .001$.

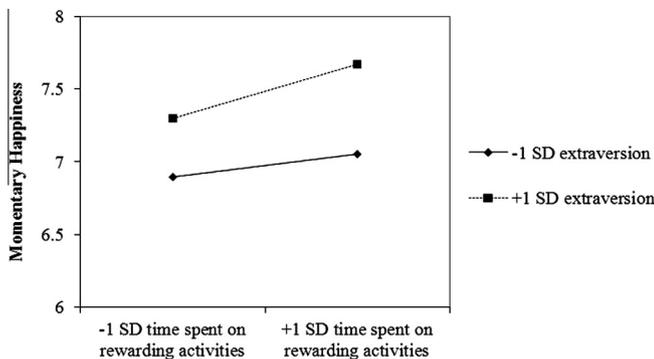


Fig. 1. Two-way Interaction effect of extraversion and time spent on rewarding activities on momentary happiness during activities. $-1 SD$ = one standard deviation below the mean. $+1 SD$ = one standard deviation above the mean.

($t = 4.97, p < .001$) were both significant. Simple slope analyses (Preacher et al., 2006) revealed that individuals low on extraversion experienced a significant decline in momentary happiness when spending more time on work activities ($t = -2.35, p < .05$), whereas highly extraverted individuals did experience a small, but significant increase in momentary happiness ($t = 1.96, p = .05$). In addition, both extraverted ($t = 7.59, p < .001$) and introverted individuals ($t = 6.89, p < .001$) became significantly happier when spending time on athletic activities, with the boost in happiness being significantly higher for high (versus low) extraverted individuals ($t = 4.97, p < .001$). Also, four out of five interaction terms for extraversion and pleasurable activities were not significant (time spent watching TV, $t = .11, p = .46$; listening to music, $t = -1.00, p = .16$; relaxing, $t = -.91, p = .18$ and shopping,

$t = -.96, p = .17$). Thus, no differences in momentary happiness were found between high and low extraverted individuals who spent more of their time on these four activities. However, one interaction effect of extraversion and time spent reading, categorized as a pleasurable activity, was positive and significant. Simple slope analyses showed that both highly ($t = 13.36$) and low ($t = 13.36$) extraverted individuals became happier when spending time on reading, with the boost in momentary happiness being stronger for highly (versus low) extraverted individuals ($t = 4.82, p < .001$).

In addition, hypothesis 2 predicted that extraverts (versus introverts) experience higher momentary happiness when performing activities with others rather than alone. Table 2, Model 2 showed that the interaction term between extraversion and social contact was indeed significant ($t = 3.93, p < .001$). Thus, extraverts (versus introverts) showed higher levels of momentary happiness when performing activities together with others as opposed to performing the activity alone. To further interpret the significant interaction effect between extraversion and social contact, we created an interaction plot (see Fig. 2) and performed simple slope analyses for multilevel models (Preacher et al., 2006). Slope analyses revealed that both individuals high ($t = 4.47, p < .001$) and low ($t = 4.23, p < .001$) on extraversion became significantly happier when engaging in activities together with others versus alone, but the effect is significantly stronger for highly extraverted individuals ($t = 3.93, p < .001$).

Hypothesis 3 stated that extraverts (versus introverts) will experience higher momentary happiness when spending time on rewarding activities (sports/exercise, paid work activities) together with others (versus alone), but not when spending time on pleasurable activities with others (versus alone). To test this hypothesis, two three-way interaction effects of (1) extraversion,

Table 3
Multilevel estimates of trait extraversion, time spent on activities and social interaction on momentary happiness.

	Model 1			Model 2			Model 3		
	Estimate	SE	t	Estimate	SE	t	Estimate	SE	t
Constant	6.777	0.024	282.38***	6.773	0.024	282.21***	6.773	0.024	282.21
Extraversion	0.448	0.040	11.20***	0.451	0.040	11.28***	0.449	0.040	11.23***
Happiness previous activity	0.320	0.004	80.00***	0.313	0.004	78.25***	0.312	0.004	78.00***
Weekday	0.018	0.004	4.50***	0.012	0.004	3.00**	0.012	0.004	3.00**
Hour of the day	0.006	0.001	6.00***	0.003	0.001	3.00**	0.003	0.001	3.00**
Time spent watching TV				0.022	0.006	3.67***	0.027	0.006	4.50***
Time spent listening to music				0.056	0.010	5.60***	0.047	0.011	4.27***
Time spent relaxing				-0.042	0.015	-2.80**	-0.042	0.015	-2.80**
Time spent reading				0.029	0.009	3.22***	0.041	0.009	4.56***
Time spent shopping				0.141	0.027	5.22***	0.153	0.030	5.10***
Time spent paid work activities				-0.011	0.005	-2.20*	-0.015	0.006	-2.50**
Time spent athletic activities				0.353	0.023	15.35***	0.289	0.026	11.12***
Social interaction (yes/no)				0.369	0.011	33.55***	0.361	0.011	32.82***
Extraversion × TV							0.001	0.009	0.11
Extraversion × music							-0.014	0.014	-1.00
Extraversion × relaxing							-0.019	0.021	-0.91
Extraversion × reading							0.053	0.011	4.82***
Extraversion × shopping							-0.054	0.056	-0.96
Extraversion × paid work activities							0.020	0.010	2.00*
Extraversion × athletic activities							0.169	0.034	4.97***
Extraversion × social interaction							0.059	0.015	3.93***
-2 * log (lh)	167052.00			165475.50			165391.39		
Diff -2 * log	15522.92***			1576.50***			84.11***		
Df	4			8			8		
Level 1 intercept variance (person)	0.430	0.025		0.430	0.026		0.431	0.026	
Level 2 intercept variance (day)	0.297	0.009		0.299	0.009		0.301	0.009	
Level 3 intercept variance (activity)	1.130	0.007		1.114	0.007		1.092	0.007	

SE = standard error; *t* = *T*-value. Model 1 was compared to a Null Model with the intercept as the only predictor ($\gamma = 6.842$; *SE* = 0.036; *t* = 190.056; $-2 * \log = 182574.912$; Level 3 variance = 1.185, *SE* = 0.065; Level 2 variance = 0.763; *SE* = 0.020; Level 1 variance = 1.225; *SE* = 0.008). Time = time spent on activity. Happiness = happiness during activity.

* *p* < .05.
** *p* < .01.
*** *p* < .001.

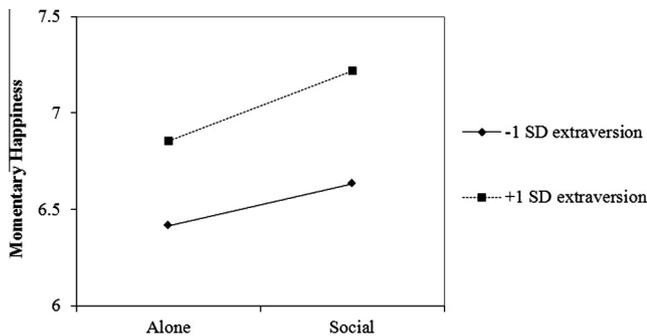


Fig. 2. Two-way interaction effect of extraversion and activities performed with others versus alone on momentary happiness during activities. -1 *SD* = one standard deviation below the mean. +1 *SD* = one standard deviation above the mean. Alone = activities performed alone. Social = activities performed with others.

time spent on rewarding activities, and social contact, and (2) extraversion, time spent on pleasurable activities, and social contact were added in a third nested model of Table 2. Note that the first three-way interaction regarding was significant ($t = 2.55$, $p < .01$) whereas the second interaction effect was not ($t = -.17$, $p = .43$). To better interpret the significant three-way interaction term, an interaction plot was created (see Fig. 3) and slope difference tests (e.g., Dawson & Richter, 2006) were calculated to examine if the slopes shown in the interaction plot were significantly different from one another. Results showed that highly extraverted individuals experienced higher levels of momentary happiness when spending more time on rewarding activities and being in contact with others (slope 1), as compared to spending more time

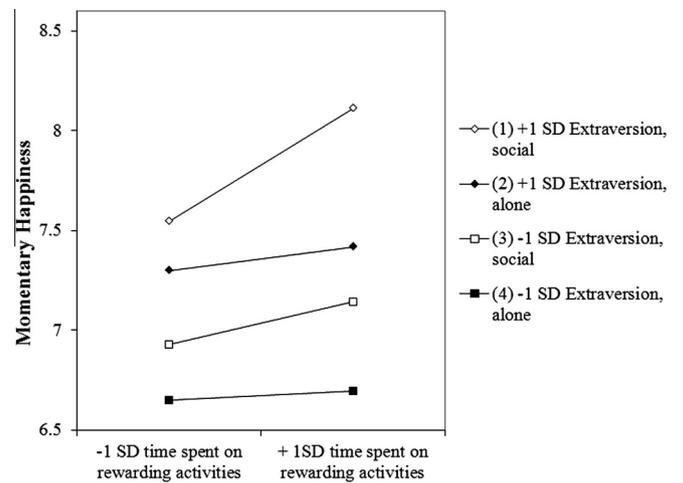


Fig. 3. Three-way interaction effect of extraversion, time spent on rewarding activities, and social contact on momentary happiness during activities. -1 *SD* = one standard deviation below the mean. +1 *SD* = one standard deviation above the mean. Alone = activities performed alone. Social = activities performed with others.

on rewarding activities alone (slope 1 versus slope 2; $t = 2.96$, $p < .01$). However, low extraverted (one standard deviation below the mean of extraversion) also experienced higher levels of happiness when spending more time on rewarding activities with others, as compared to spending more time on rewarding activities alone (slope 3 versus slope 4; $t = 2.91$, $p < .01$). When comparing the two slopes of spending time on rewarding activities in a social context of high versus low extraverted individuals, results showed

that high extraverts experience a significantly higher boost in happiness as compared to low extraverted individuals (slope 1 versus slope 3; $t = 2.57, p .01$), which confirmed hypothesis 3.

In sum, hypotheses 1 through 3 are confirmed. As previous studies did not correct for lagged effects of happiness during the previous activity to the next one, we also performed the same types of analyses without correcting for this effect. Results showed that hypotheses 1 through 3 were confirmed when the lagged effect of happiness was not included in the multilevel models. Please note that the size of the interaction effects is rather subtle. The nested interaction model in Table 2, Model 3 explains an additional 1% of the variance on the activity level as compared to Model 2 where all main effects are included. Similarly, Table 3, Model 3 which includes the interaction effects of extraversion and all individual activity types (Model 3) explains an additional 2% of variance on the activity level as compared to the main effects model in Table 3, Model 2.

3.3. Testing hypothesis 4

Hypothesis 4 stated that the direct effect of trait extraversion on momentary happiness would be mediated by the time spent on rewarding activities and by the time spent on social (versus a non-social) situations. To test this hypothesis, we performed Multilevel Structural Equation Modeling (MLSEM) as proposed by Preacher et al. (2010), using the statistical software package of Mplus version 6.12 (Muthén & Muthén, 2011). In particular, a 2–1–1 model was setup, with trait extraversion as the main predictor on the between person level, the two mediators (i.e. time spent on rewarding activities and social interaction during activities) and the outcome (i.e. momentary happiness during activities) at the within person level. In addition, we explored whether time spent on pleasurable activities would serve as a mediator in the relationship between trait extraversion and momentary happiness. As recommended by Preacher et al. (2010), both extraversion and all mediator variables were centered at the grand mean, and extraversion was identified in the model as a variable on the between level. We performed multilevel random analyses. A within model was defined with all mediators predicting the outcome variable. The between model held pathways of (a) the direct effect of extraversion on momentary happiness, (b) extraversion on the three mediators (i.e. time spent on rewarding and pleasurable

activities, and performing activities with others), and (c) the effect of all mediators on momentary happiness. Indirect effects were calculated in the model constraint section for each of the three mediator variables to assess the significance of the proposed mediation effects of extraversion on momentary happiness via the mediators.

The model fit well to the data ($\chi^2 = 82.15(6), p < .001$; CFI = .98; TLI = .95; RMSEA = .01; RMR within = .001; RMR between = .07). Fig. 4 shows unstandardized estimates and significance levels of the relationships presented in the Multilevel Structural Equation Model. In line with hypothesis 4, results showed that extraversion was positively and significantly related to time spent on rewarding activities ($estimate = .04, se = .01, t = 2.55, p < .05$) and performing activities together with others (versus alone; $estimate = .07, se = .01, t = 6.11, p < .001$). In turn, both time spent on rewarding activities ($estimate = .03, se = .01, t = 5.74, p < .001$) and performing activities together with others ($estimate = .55, se = .01, t = 53.03, p < .001$) related positively to momentary happiness. Moreover, both indirect effects calculated for extraversion on momentary happiness via (a) time spent on rewarding activities ($estimate = .01, se = .00, t = 2.35, p < .05$) and via (b) performing activities together with others ($estimate = .04, se = .01, t = 6.08, p < .001$) were positive and significant. Thus, individuals high (versus low) on extraversion indeed spend more time on rewarding activities, and are more in the company of others during their everyday activities, which partly accounts for their greater momentary happiness as opposed to low extraverted individuals. This confirmed hypothesis 4.

However, please note that after taking into account these mediation effects, extraversion still had a strong and positive direct effect on momentary happiness ($estimate = .60, se = .06, t = 10.32, p < .001$). In comparison, a MLSEM model with only the direct relationship of extraversion on momentary happiness included showed a slightly stronger and positive association ($estimate = .68, se = .06, t = 11.58, p < .001$). Put differently, the estimate between extraversion and momentary happiness was reduced by 13.33% when including the mediational paths. Additional exploratory analyses showed that trait extraversion was unrelated to time spent on pleasurable activities ($estimate = -.00, se = .01, t = -.17, p = .87$). In sum, the results in Fig. 4 show that time spent on rewarding activities and being in the company of others during activities can partly, but not fully account for the direct relationship between trait extraversion and momentary happiness.

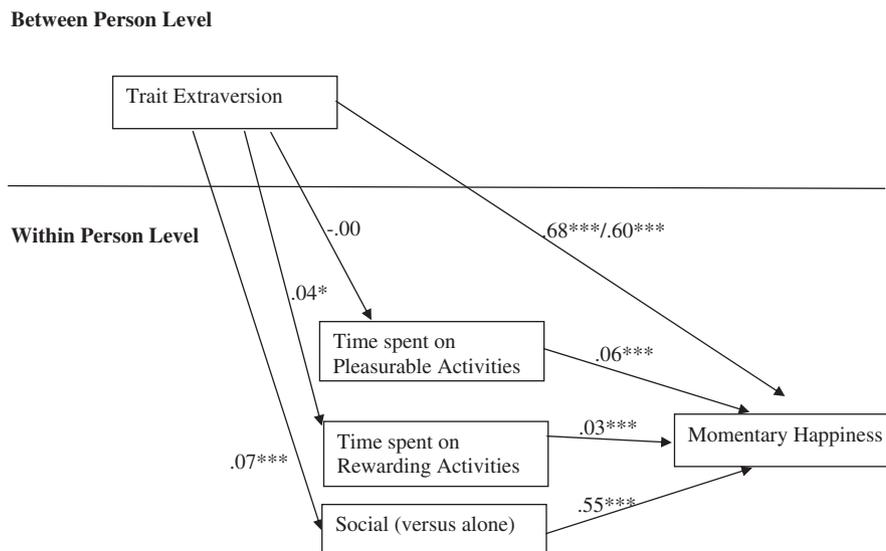


Fig. 4. Multi-level Structural Equation Model (MLSEM) of trait extraversion, time spent on pleasurable activities, rewarding activities, and social interaction, on momentary happiness during activities ($\chi^2 = 82.15(6), p < .001$; CFI = .98; TLI = .95; RMSEA = .01; RMR within = .001; RMR between = .07).

4. Discussion

One of the most robust findings in personality research is that extraverts are happier than introverts. The main aim of this study was to examine temperamental, situation specific processes that might underlie this robust effect. Specifically, this study examined if the affective-reactivity hypothesis (ARH) and the Person-by-Situation Fit perspective (PSF), both separately and in combination, can explain why highly (versus low) extraverted individuals are happier in the moment during their everyday activities. An ecologically valid Day Reconstruction Method (DRM; Kahneman et al., 2004) was used to collect the data. The most important findings are that individuals high (versus low) on extraversion experience a higher boost in momentary happiness when spending time on rewarding activity types, but not when spending time on merely pleasurable activity types. Moreover, high (versus low) extraverted individuals experience higher momentary happiness when spending more time on rewarding activities with others (versus alone), but not when spending more time on merely pleasurable activities with others (versus alone), with the exception of reading. Also, high (versus low) extraverted individuals spend more of their time on rewarding activities and have more social contact during their everyday activities, which can partly explain why highly (versus low) extraverted individuals feel happier in the moment. However, the extraversion – momentary happiness relationship remains significant and moderately strong, even after taking these differences into account. We discuss the theoretical and practical implications of the findings below, together with limitations and possibilities for future research.

4.1. Affective-reactivity hypothesis

The present study shows that high (versus low) extraverted individuals experience higher momentary happiness when spending more time on rewarding activities (paid work activities, athletic activities), but not when spending more time on merely pleasurable activities (relaxing, watching TV, shopping, and listening to music). These findings have important theoretical implications. The classical assumption of the ARH is that extraverted individuals experience greater positive affect in pleasurable situations, due to a more sensitive Behavioral Activation System (BAS; e.g., Gross et al., 1998). However, the description of the BAS system as synonymous with a 'pleasure system' (e.g., Tellegen, 1985) may be inaccurate. Recent neurophysiological studies indicate that the BAS may be more appropriately characterized as a desire system which may react more strongly to reward approach rather than pleasure (Kringelbach & Berridge, 2009; Treadway & Zald, 2011). The present study is, to our knowledge, the first to examine such new insights in real-life. By doing so, the results support the laboratory findings of Smillie et al. (2012). Highly (versus low) extraverted individuals experience a stronger boost in momentary happiness when spending more time on rewarding activities, but not when spending more time on merely pleasurable activities.

However, we have to be cautious, as the affective-reactivity findings of Smillie et al. (2012 and 2013) were limited to positive activated emotional states (e.g., vigor, enthusiasm) and were not significant for low activated positive states (e.g., contentment, satisfaction). Momentary happiness is somewhere in between, as it represents a positive, mildly active state (e.g., Russell, 1980, 2003). Future studies should further examine if higher affective reactivity is observed in terms of momentary happiness among high (versus low) extraverted individuals in rewarding situations.

Also, a noticeable exception was that high (versus low) extraverted individuals experience a higher boost in momentary happiness when spending time on reading, which was categorized

as a merely pleasurable activity based on the activity framework of Waterman (2005). One explanation for this unexpected finding may be that reading may also be associated with rewards. For example, when people read in order to pass a course, or with the aim to increase certain skills, reading may also hold rewards. Future studies should include questions about particular reasons to spend time on different activities (e.g., for fun, or instead to pursue rewards). With the exception of reading, however, the present findings support the idea that rewarding, rather than pleasurable activities lead to stronger affective-reactivity among high (versus low) extraverts.

Our findings are different from one earlier DRM study who failed to find support for the ARH (Howell & Rodzon, 2011). The authors of this study did not distinguish between appetitive and pleasant situations, which could explain why the authors failed to find support for the ARH. As the present findings on the ARH are relatively new, we recommend that future studies replicate the findings of the present study. The results are important, as they provide a promising explanation for the lack of empirical support regarding the ARH in studies that used pleasurable instead of rewarding mood inductions (Lucas & Baird, 2004; Smillie et al., 2012).

4.2. Person-by-Situation Fit perspective

Next, the present study shows that extraverted (versus introverted) individuals experience a higher boost in momentary happiness when spending time on activities with others (versus alone). This finding supports the PSF, where it is argued that extraverted individuals enjoy social situations more as compared to their introverted counterparts. Two field studies that also used diary, DRM, or momentary-based reports did not find evidence for such a relationship (Lucas et al., 2008; Srivastava et al., 2008). This is most likely explained by the broader (i.e., not only students) and larger sample size of individuals ($N = 1364$) and reported activities ($N = 13,973$ activities) in the present study as compared to previous studies. Also, the present study corrected for possible confounding influences of time spent on activities (e.g., Kahneman et al., 2004), as well as influences of momentary happiness experienced during the previous activity (Wickham & Knee, 2013) whereas previous studies did not. However, additional analyses showed that the extraverted (versus introverted) individuals enjoyed social interactions more, even when not correcting for time spent on other types of activities and happiness during the previous activity.

In addition, high (versus low) extraverted individuals were happier during rewarding activities when in the company of others (versus alone). This finding has important theoretical implications. It shows that situations characterized by both reward pursuit and social interaction lead to higher affective-reactivity among extraverted (versus introverted) individuals as compared to situations that are characterized as either rewarding or social. Walker (2010) showed that rewarding activities that generate flow (e.g., athletic activities) are generally more enjoyed when such activities are performed with others. As extraverts (versus introverts) are more sociable and have a more sensitive 'reward' system (BAS), a likely explanation is that extraverted individuals react more positively to situations that are both rewarding and social in nature. Most laboratory studies have used rewarding scenario's that are nonsocial in nature, such as engaging in financially rewarding go/no go tasks on a computer (e.g., Smillie et al., 2012). An interesting avenue for future research may be to differentiate between rewarding mood inductions in the lab that are either non-social or social in nature. Based on the present findings, we would expect that a combination of social and rewarding mood inductions lead to higher positive affect among extraverted individuals as opposed to scenario's that are rewarding, but nonsocial.

4.3. Mediation model

The present study examined multiple processes as possible mediators (i.e., time spent on rewarding activities, time spent on pleasurable activities, and being in the company of others versus alone) that could account for the extraversion and momentary happiness relationship. Results from Multilevel Structural Equation Modeling show that extraverts spend more of their time on rewarding activities, and are more in the company of others (versus alone) during their daily activities. In turn, time spent on rewarding activities and social contact both positively predict momentary happiness. Also, social contact and time spent on rewarding activities partly mediate the direct association between trait extraversion and momentary happiness. These findings are theoretically important, as most studies have exclusively focused on social situations (e.g., Lucas et al., 2008; Srivastava et al., 2008), but not rewarding situations, as a potential mediator for the extraversion – happiness relationship. The present study replicates earlier empirical findings showing that time spent in social situations is a partial mediator in the extraversion – momentary happiness relationship (Lucas et al., 2008; Srivastava et al., 2008). This study is – to our knowledge – the first to show that time spent on rewarding activities acts as a second mediator in this relationship, which may be explained as follows. Extraverts, because of their active nature, are more likely to seek and spend more time on rewarding activities. When they do so, they also experience a higher boost in momentary happiness as compared to their introverted counterparts. This partly explains the direct relationship between extraversion and momentary happiness.

Importantly, the relationship between trait extraversion and momentary happiness remains significant and moderately strong after taking into account differences in time spent social and rewarding activities. One may therefore argue that the relationship between extraversion and happiness is – for the most part – a direct one. Gross et al. (1998) argued that in order to prove that a direct relationship between extraversion and happiness exist, this direct person-affect relation should be observed at “...almost any point in time in nearly any circumstance, be it nonexperimental situations, a baseline condition, or an experimentally manipulated condition” (p. 279). The present study suggests that such a direct relationship exists, after taking into account indirect processes such as time spent on rewarding activities and being in the company of others during daily activities. Of course, there might still be undiscovered, additional processes which may explain why extraverts are happier in the moment. On the other hand, as the relationship between trait extraversion and momentary happiness remains moderately strong, another explanation may be that extraverts have higher tonic levels of positive affect, and are happier across a great variety of situations than introverts (e.g., Gross et al., 1998; Lucas & Baird, 2004). Still, such temperamental models also invite further research into where such higher tonic levels of positive come from in the first place. Therefore, future studies should examine if the mediational processes of time spent on rewarding activities can be replicated. Moreover, future studies should investigate if additional processes may account for the strong and positive relationship between trait extraversion and momentary happiness.

4.4. Limitations

This study has its limitations. The data was dependent on self-report raising concerns about common-method variance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). The DRM (Kahneman et al., 2004) – although a step forward as compared to global survey techniques – is still a self-report instrument, and self-reports may be subject to social desirability or a self-serving bias.

However, by using person-centered scores in the analyses, we eliminated the potential influence of response tendencies stemming from individual differences, and we thereby reduced the problems often associated with common-method data (Binnewies, Sonnentag, & Mojza, 2009). Moreover, the DRM relates closely to affective experiences during specific activities with a great deal of accuracy, as indicated by their convergence with concurrent mood reports used in experience sampling methods making social desirability less likely (Dockray et al., 2010; Kahneman et al., 2004; Stone et al., 2006).

Females were overrepresented in our sample (86%). However, we established in this study that differences in gender did not affect momentary happiness. This finding is consistent with other research showing that gender differences are usually not associated with differences in happiness (Seligman, 2002). Still, it could be that females, as opposed to males, react more intensely to similar stimuli or activity types (Fujita, Diener, & Sandvik, 1991). It was not a main aim of this study to investigate gender differences, but future studies might want to examine such issues in greater detail.

Momentary happiness was measured with one item, and other types of positive affective states (e.g., enthusiasm, vigor) were not taken into account. Multiple item instruments are usually more accurate (Lucas & Baird, 2004; Smillie et al., 2012). As the DRM technique asks participants to rate emotional states on each and every individual activity type they reported, we used a one-item measure to keep participants from becoming overburdened (Abdel-Khalek, 2006). This strategy enabled us to collect a large database on extraversion and momentary happiness. Moreover, a recent laboratory study showed that during rewarding scenarios, extraverted (versus introverted) individuals experience more highly activated forms of positive affect (e.g., alertness, arousal or vigor), but equal levels of low activated positive states (e.g., contentment, satisfaction; Smillie et al., 2013). Momentary happiness is somewhere in the middle, as a positive and mildly activated state. We therefore recommend that future research differentiate between passive and activated forms of positive affect to further determine differences in emotional experiences between high versus low extraverted individuals.

The framework of Waterman (2005) was used to distinguish activity types that are ‘merely pleasurable’ from activity types that may be characterized as ‘rewarding’. Although Waterman activities’ framework was empirically validated, it remains questionable whether the actual appraisal of activities by participants is always in line with this type of categorization. For example, watching TV – although categorized as merely pleasurable – may become a rewarding activity when someone plays along in a TV quiz. As another example, work-related activities may encompass all kinds of activities, such as meetings, core tasks, administrative duties, informal communication with colleagues, and so on. We therefore recommend that future research based on the DRM include questions on the subjective interpretation of activities by participants as either pleasurable, rewarding, or both.

4.5. Concluding remarks

Researchers have argued at great lengths as to what would constitute the ‘core’ element of extraversion in explaining the extraversion – happiness relationship. Some argued that sociability is the core element of extraversion (e.g., McCrae & Costa, 1987), whereas others claimed that positive affectivity would be the core (e.g., Tellegen, 1985; Watson & Clark, 1997). Recent literature on the ARH (e.g., Smillie et al., 2012) suggested that sensitivity to rewards may be the key in explaining the extraversion – happiness relationship. Results from the present study confirm that reward pursuit and sociability explain to some degree why extraverted

individuals are happier in the moment as compared to their more introverted counterparts. Moreover, the results reject the classic notion of the ARH, in which it is argued that extraverts react more positively to pleasurable situations (Gross et al., 1998). In addition, we were able to show that time spent on rewarding and social activities partly explain why highly (versus low) extraverted individuals are happier in the moment. However, the above processes cannot fully account for the robust association between trait extraversion and momentary happiness.

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