



## Beyond the heritability of life satisfaction – The roles of personality and twin-specific influences



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### ABSTRACT

In a behavior genetic design, we investigated individual differences in life satisfaction and its relation to personality with respect to both internal and external influences. We questioned the absence of shared environment and examined the specific contribution of additive and non-additive genetic influences. We also tested for twin-specific environmental influences in a total sample of 1308 dyads including identical and fraternal twins, siblings, mother–child and grandparent–child pairs. The results showed substantial shared environmental influences on life satisfaction that varied between twins and non-twins, supporting twin-specific environmental influences. Additive and non-additive genetic influences on life satisfaction were completely shared with personality. The remaining variance could be explained by unique non-shared environmental influences for life satisfaction independent of personality.

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### 1. Introduction

Why are some individuals more satisfied with their lives than others? This is one of the most interesting and challenging questions in the field of Positive Psychology (Seligman & Csikszentmihalyi, 2000). Life satisfaction is a global evaluation of the quality of life and is part of the broader construct of subjective well-being (SWB). Diener (1984) described SWB as the total sum of people's cognitive and emotional responses to their lives. The concept of SWB encompasses four relatively distinct components: life satisfaction and domain-specific satisfaction representing the cognitive aspect of SWB, as well as positive and negative affect representing the emotional aspects (Diener, Suh, Lucas, & Smith, 1999). Many studies have labeled, used, and interpreted different measures of SWB (e.g., life satisfaction, quality of life, happiness and self-esteem) interchangeably because of intercorrelations among them. However, multi-method studies have demonstrated discriminant validity with regard to the cognitive and emotional components of SWB (Lucas, Diener, & Suh, 1996). The present study focused on life satisfaction, which is a comprehensive judgment of life as a whole, whereas domain-specific satisfactions refer to particular life domains, such as marriage, work, family, and leisure.

Studies examining sources of individual differences in life satisfaction can be categorized in two main research directions. One implicates environmental factors, such as life circumstances and

life events, and another emphasizes personality traits and genetic influences as important for life satisfaction. On the one hand, life events (e.g., marriage, divorce, unemployment, birth of a child), life circumstances (e.g., cultural influences) and demographic factors (e.g., income, education) constitute external environmental factors. For instance, life satisfaction has shown contemporaneous negative relations to unemployment (Blanchflower, 2001; Clark & Oswald, 1994) and a positive relation to marriage (Lucas, Clark, Georgellis, & Diener, 2003). Moreover, the experience of unemployment had lasting negative effects on life satisfaction (Clark, Diener, Georgellis, & Lucas, 2008) whereas the long-term effect of marriage tended to be marginal, because most individuals return to their previous life satisfaction value after the event of marriage (Lucas et al., 2003). Cross-cultural research has shown consistent mean-level differences in life satisfaction ratings across nations (for a review, see Diener, Oishi, & Lucas, 2003). Investigating specific cultural characteristics that might contribute, Diener, Diener, and Diener (1995) concluded that high income, individualism, human rights, and societal equality encouraged greater SWB and greater life satisfaction. Also, life satisfaction was generally positively related to income and education within a country (Salinas-Jiménez, del Artés, & Salinas-Jiménez, 2011).

On the other hand, several studies have shown that life satisfaction is consistently related to personality, suggesting the existence of a so-called “happy personality” (DeNeve & Cooper, 1998). Assessing the top 10th percentile of satisfaction ratings in their sample, Diener and Seligman (2002) tried to describe characteristics of the most satisfied people. These individuals had higher scores on measures of Extraversion and Agreeableness and lower

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Neuroticism scores. A meta-analysis (DeNeve & Cooper, 1998) reported the highest correlations between life satisfaction and the personality domains of Neuroticism (–.24), Conscientiousness (.22), and Extraversion (.17). Also, Steel, Schmidt, and Shultz (2008) investigated the relation between personality and different components of SWB. Neuroticism (–.38), Extraversion (.28) and, to a lesser extent, Conscientiousness (.22) showed the highest relations with life satisfaction. Overall, studies have found stable and substantial relations between life satisfaction and especially Neuroticism and Extraversion. Although the specific correlations between personality traits and life satisfaction are moderate, the results of a meta-analysis by Steel, Schmidt, and Shultz (2008) showed that as much as 39% of the variance in quality of life measures can be explained by personality.

McCrae and Costa (1991) proposed that links between personality and satisfaction were direct for some traits and indirect for others. According to this view, Extraversion and absence of Neuroticism lead directly to satisfaction, whereas Agreeableness and Conscientiousness exert effects indirectly on specific life situations that in turn impact satisfaction. For example, rather than contributing directly to life satisfaction through emotional pathways, people's agreeableness and conscientiousness could create positive conditions, such as personal bonds or high achievements, which contribute to higher satisfaction (McCrae & Costa, 1991). Diener, Sandvik, Pavot, and Fujita (1992) also found support for this explanation in that more extraverted people experienced more positive affect both when alone and when with others than less extraverted people, and this positive affect in turn led to higher life satisfaction. However, there was also a direct link between positive affect and life satisfaction (DeNeve & Cooper, 1998). Moreover, people with elevated Neuroticism perceived life as stressful and were dissatisfied with their social support, a finding that can account for lower life satisfaction ratings (McCrae, 1990). However, overlapping item content should be taken into account. Currently, the literature suggests that both, internal (e.g., personality, genetics) and external (e.g., life events, environment) factors, as well as interaction effects appear to contribute to individual differences in life satisfaction.

Besides these specific internal and external factors, actual evaluation of life satisfaction involves cognitive processes at all time. In this manner, Festinger (1954) proposed that people compare their own situations, opinions and abilities with others to the extent that objective criteria are not available. Also, Campbell et al., 1976 described a cognitive comparison with other people, one's own past, future prospects and ideal. The difference between what one has and what one wants, for example because other people have it, contributes to one's judgment of life satisfaction. People tend to be more satisfied with their own lives when they can compare them favorably with those of others (Buunk, Oldersma, & De Dreu, 2001). For example, Johnson and Krueger (2006) found that seemingly objective indicators such as income had important subjective components. This means that life satisfaction is about perceptions and expectations surrounding environmental circumstances, perhaps to a larger degree than it is about those circumstances themselves.

### 1.1. Exploring the nature and nurture of life satisfaction

In a sample of biological relatives, the phenotypic variance in a trait can be divided into variance components attributable to additive genetic influences (A; i.e., influences of genes acting independently of each other), non-additive genetic influences (D; i.e., influences of genes that transact with each other, though generally estimated solely as dominance, hence the label 'D'), shared environmental influences (C; i.e., environmental characteristics common to family members that tend to make them similar) and non-shared environmental influences (E; i.e., environmental

characteristics leading to differences among family members). The heritability (H) of a trait comprises A and D influences.

The majority of such studies on life satisfaction have relied on the Classical Twin Design (CTD), which is based on the comparison of similarities between monozygotic (MZ) and dizygotic (DZ) twins (Plomin, DeFries, McClearn, & McGuffin, 2008). A number of these studies have reported that genetic influences account for as much as 35–50% of the phenotypic variance in life satisfaction (Bartels & Boomsma, 2009; Franz et al., 2012; Lykken & Tellegen, 1996; Nes, Czajkowski, & Tambs, 2010; Nes, Røysamb, Tambs, Harris, & Reichborn-Kjennerud, 2006; Røysamb, Harris, Magnus, Vittersø, & Tambs, 2002; Røysamb, Tambs, Reichborn-Kjennerud, Neale, & Harris, 2003; Stubbe, Posthuma, Boomsma, & De Geus, 2005; Tellegen et al., 1988), depending on different measurements and research designs. Additionally, the long-term stability of SWB (including life satisfaction as a component) across intervals of 6 and 10 years was mainly attributable to stable genetic factors (Lykken & Tellegen, 1996; Nes et al., 2006). These findings may largely explain why life satisfaction and well-being show reasonable stability across situations and the life span (Diener & Lucas, 1999).

Several studies have supported the idea that there are non-additive genetic influences on SWB in general and life satisfaction in particular (Bartels & Boomsma, 2009; Nes et al., 2006; Nes et al., 2010; Stubbe et al., 2005). By contrast, other studies have found that D influences were negligible and that A influences were of primary importance (Røysamb et al., 2002; Weiss, Bates, & Luciano, 2008). The distinction between A and D is not only an academic issue, but has practical implications as well. Parents and their children share approximately 50% of their segregating genes, but shared genetic influences are primarily A, not D, in nature.<sup>1</sup> If genetic influences are in part or mostly non-additive rather than additive, family resemblances should be smaller. Moreover, the existence of non-additivity has implications for studies attempting to identify specific genetic variants contributing to traits, whose methods rely on assumptions of additivity. Therefore, it is important to disentangle the relative contributions of A and D type influences.

Furthermore, Weiss et al. (2008) found that genetic influences on distinct personality traits accounted for the genetic influences on general SWB, supporting the theory of personality-based genetic influences on subjective well-being (Diener & Lucas, 1999). They identified no specific genetic influences on SWB independent of personality. In particular, Neuroticism, Extraversion and, to a lesser extent, Conscientiousness showed high genetic overlap with global SWB. However, these analyses focused on general SWB and were based on a reduced AE model which did not include D and C influences. The ability to detect shared environmental influences is often limited in twin studies due to the statistical power of the particular test and small sample sizes. In addition, C and D influences are confounded in the CTD, which means that either C or D influences have to be fixed at zero even if both influences are present (Ozaki, Toyoda, Iwama, Kubo, & Ando, 2011). Moreover, studies often constrain both C and D influences to zero because of statistical reasons or a lack of power, which does not mean that they do not exist.

For personality, genetic influences commonly account for approximately 40–50% of variance (Bouchard & Loehlin, 2001). Influences of the shared environment typically explain only a small amount of variance, and non-shared environmental influences account for the remaining part. However, recent studies have reported evidence for substantial non-additivity especially for Neuroticism and Extraversion (Eaves et al., 1999; Hahn et al., 2012; Kandler, Riemann, & Kämpfe, 2009; Keller, Coventry, Heath,

<sup>1</sup> Linkage disequilibrium (i.e. non-random association of alleles at different loci) can also lead to similarity between unrelated people in a population.

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