# Long-Term Disability Is Associated With Lasting Changes in Subjective Well-Being: Evidence From Two Nationally Representative Longitudinal Studies

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Hedonic adaptation refers to the process by which individuals return to baseline levels of happiness following a change in life circumstances. Two nationally representative panel studies (Study 1: $N$ = 39,987; Study 2: $N$ = 27,406) were used to investigate the extent of adaptation that occurs following the onset of a long-term disability. In Study 1, 679 participants who acquired a disability were followed for an average of 7.18 years before and 7.39 years after onset of the disability. In Study 2, 272 participants were followed for an average of 3.48 years before and 5.31 years after onset. Disability was associated with moderate to large drops in happiness (effect sizes ranged from 0.40 to 1.27 standard deviations), followed by little adaptation over time.

*Keywords:* happiness, subjective well-being, disability, adaptation, set-point theory

One of the most basic principles guiding psychological theory is that organisms are motivated to approach stimuli that cause pleasure and to avoid stimuli that cause pain. Presumably, this hedonic principle results from adaptive mechanisms that guide organisms toward resources and away from environmental dangers. If so, hedonic reactions should reveal important information about basic characteristics of the organism itself. For instance, psychologists have argued that by cataloging the causes and correlates of subjective feelings of happiness, researchers could identify basic human needs (Veenhoven, 1995; Wilson, 1967). Similarly, economists have suggested that subjective reports of well-being provide an important indicator of experienced utility (Frey & Stutzer, 2004; Kahneman, 1994).

If these ideas are correct, psychologists could use knowledge about the factors that influence subjective well-being to shape the environment in ways that benefit individuals. For example, psychologists and economists have suggested that national indicators of subjective well-being should be collected and that these indicators should be used to guide public policy (Diener & Seligman, 2004; Kahneman, Krueger, Schkade, Schwartz, & Stone, 2004). Yet for subjective well-being to be used in this way, the construct and its measures must be responsive to changing life circumstances. Measures of people's long-term levels of well-being would provide little information about basic human needs if people quickly adapt to external conditions. Thus, the usefulness of well-being measures to both guide policy and aid theory would be limited if individuals completely adapt to constant stimuli over time.

Research to date suggests that the effects of external circumstances on happiness are, in fact, quite weak. For instance, demographic characteristics and life circumstances account for surprisingly small amounts of variance in well-being (Diener, Suh, Lucas, & Smith, 1999). In contrast, stable personality characteristics exhibit moderate to strong correlations with well-being (Diener & Lucas, 1999). In addition, individual differences in well-being emerge early in life, they are stable over time, and they are moderately to strongly heritable (see Diener & Lucas, 1999, for a review). These findings have led some to suggest that people are able to adapt to almost any life circumstance and that long-term levels of happiness cannot change. Although this idea has come to be widely accepted within psychology, empirical evidence for adaptation effects is actually quite mixed (see Diener, Lucas, & Scollon, 2006, for a review). In the current article, I review the evidence for adaptation to disability, and I present new data on the longitudinal change in well-being that occurs as individuals react and adapt to the onset of a long-term disability.

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## Adaptation Research and Theory

Hedonic adaptation serves two important functions (Frederick & Loewenstein, 1999). First, just as homeostatic temperature regulation mechanisms prevent extreme heat or extreme cold from causing physical damage to the body, homeostatic emotion regulation mechanisms may protect the body from dangerous physiological and psychological reactions that occur with prolonged emotional states. Prolonged stress has been linked to metabolic diseases (such as adult-onset diabetes), hypertension, certain types of ulcers, reproductive problems, and the suppression of the immune system (Sapolsky, 1999). Thus, processes that reduce the emotional impact of external stressors may protect the body from this type of damage (it is unclear whether prolonged positive emotional responses would have any corresponding negative effects).

In addition, hedonic adaptation, like all adaptation processes, "enhance[s] perception by heightening the signal value of changes from the baseline level" (Frederick & Loewenstein, 1999, p. 303). In other words, adaptation processes ensure that change in the environment receives extra attention. An emotion system that was particularly sensitive to change would be adaptive for two reasons. First, threats that have persisted in one's environment for a long time are likely to be less dangerous than novel threats, and rewards that have persisted for a long time are less likely to disappear quickly than are novel rewards. Thus, novel stimuli are more likely to require quick action than are unchanging stimuli. Second, if one's actions have yet to eliminate a threat or to lead to the attainment of a reward, then it becomes increasingly less likely that these actions will do so in the future. The reduced emotional intensity that accompanies hedonic adaptation allows people to disengage from unattainable goals and to focus their resources elsewhere. If hedonic adaptation to life events tends to occur, then this might suggest that the affect system is designed to respond primarily to change and that sustainable increases in well-being are difficult, if not impossible, to attain.

Psychologists have often emphasized the strength and ubiquity of adaptation effects (Diener et al., 1999). Yet a close examination of the literature suggests that there is still a great deal that is not known about when adaptation occurs and how strong the effects are. For instance, Frederick and Loewenstein (1999) provided perhaps the most comprehensive review to date, yet they noted that their conclusions were "limited by the shortage of high-quality empirical studies" (p. 311). Furthermore, when the relatively small set of studies that met their criteria is carefully reviewed, evidence for adaptation is actually quite mixed.[1]

For instance, although Frederick and Loewenstein (1999) noted that "several studies have observed substantial adaptation to disability" (p. 312), the small set of studies they reviewed provides only weak evidence for adaptation effects. In the most famous and most frequently cited study on adaptation, Brickman, Coates, and Janoff-Bulman (1978) examined the happiness of three groups: lottery winners, patients with spinal cord injuries, and a group of controls who were matched with the lottery winners. Brickman et al. argued that the differences among these groups were not as large as one might expect, which means that some amount of adaptation must have occurred. This study has captured the attention of psychologists for almost 3 decades because it provides such a salient example of adaptation. If the standard interpretation is true, Brickman et al.'s study suggests that people can adapt to even the most extreme events imaginable. Yet as Frederick and Loewenstein noted, evidence for adaptation in Brickman et al.'s study is actually quite weak, at least in the case of the individuals with spinal cord injuries. Although these individuals reported happiness scores above neutral (2.96 on a 0–5 scale), this very small sample of patients was significantly less happy than the controls. More important, the effect size for this difference was large by traditional standards: $d = 0.78$.

Frederick and Loewenstein (1999) cited four additional studies as evidence of the existence of adaptation effects. However, like the Brickman et al. (1978) study, these studies provide mixed support for the idea that adaptation usually occurs. First, Schulz and Decker (1985) showed that individuals with paraplegia reported well-being scores that were not much lower than population norms. This study provides the strongest support for adaptation effects, but even here effect sizes varied across measures, with some as high as $d = 0.56$. Second, Tyc (1992) was reported to have found that young patients who had lost limbs to cancer reported levels of quality of life that were similar to those who had not lost limbs. However, Tyc did not directly compare these groups (in fact, she notes that her review "did not identify any comparisons of adolescents with limb deficiencies to physically healthy adolescents," p. 285). Instead, she reported that those who had lost limbs often reported relatively high levels of psychosocial adjustment. As the Brickman et al. (1978) study revealed, well-being can be high even among groups whose scores are quite a bit lower than those of control groups or population norms. Third, in a review of the lasting effects of severe burn injuries, Patterson et al. (1993) were reported to have found similar levels of psychosocial adaptation in those with and without injuries by 1 year after the accident. Yet Patterson et al.'s review focused on rates of psychological disorders following burn injuries rather than on differences in subjective well-being. Furthermore, this was a narrative review that did not have any quantitative comparison of burn victims with controls or comparisons of postevent well-being with preevent well-being. Again, the major conclusion was that these patients

[1] Although my focus is on research on adaptation to disability, research findings in other domains are also somewhat equivocal. For example, in their review of adaptation to the death of a spouse or child, Frederick and Loewenstein (1999) cited only a few studies that actually compare bereaved individuals with controls or followed bereaved individuals over time. Notably, two of those studies suggested that if complete adaptation does occur, it takes a very long time. One unpublished study by Wortman, Kessler, Bolger, and House (1992, as cited in Frederick & Loewenstein, 1999) noted that "it took almost one decade before widows and widowers approached a control group's scores on life satisfaction, and nearly two decades before differences in depression were no longer significant" (p. 312). Similarly, Lehman, Wortman, and Williams (1987) showed that people who had lost a spouse or child in a car accident reported significantly more distress than matched controls or the general population (*d*s ranged from 0.19 to 0.72). More recent longitudinal evidence does suggest that some adaptation to the loss of a spouse occurs, but it takes a long time and it may not be complete. Bonanno and colleagues have shown that after the death of a spouse or child, many individuals are remarkably resilient, adapting back to baseline levels of well-being after a relatively short time (for a review see Bonanno, 2004). Lucas, Clark, Georgellis, and Diener (2003) used a 15-year, nationally representative panel study to examine adaptation to widowhood. They showed that life satisfaction levels peak about 7 years after the loss of a spouse, although even at that point, levels for widows and widowers are lower than their preevent baseline.

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tended to be reasonably well adjusted, not that they were just as happy as population norms. Finally, Wortman and Silver (1987) were said to have found that quadriplegics reported levels of negative affect similar to those of control respondents. However, because this finding was not the major focus of Wortman and Silver's chapter, few details were reported. For instance, they did not describe any details of the control sample, and they did not provide any quantitative information about this comparison.[2] Thus, this finding is difficult to interpret.

Although this small set of studies does support the notion that most people are relatively happy, evidence regarding the extent of adaptation that has occurred is actually quite equivocal.[3] More important, a growing body of mostly cross-sectional research suggests that disability does have lasting effects on well-being. Dijkers (1997) conducted a review of studies that compared the quality of life of patients with spinal cord injuries with published population norms for quality of life. Although no meta-analytic effect size was reported, most of the individual effect sizes were in the medium to large range (exceptions included studies that compared patients with spinal cord injuries with other injured or disadvantaged groups like patients with back pain or prisoners). More recent studies have also examined the time course of reactions to disabilities. Although some studies have found support for the idea that well-being improves over time (e.g., Dijkers, 1999; Woodrich & Patterson, 1983), others have not (e.g., Krause & Crewe, 1991; Rintala, Robinson-Whelen, & Matamoros, 2005; see Livneh & Martz, 2003, for a review).

Thus, the existing body of evidence suggests that if adaptation to disability occurs, it is not complete. Instead, disability can have lasting—and quite large—effects on subjective well-being. However, these studies, along with most other studies of adaptation to life events, have several important limitations. First, most are cross-sectional, and thus, participants' preexisting levels of well-being are not known. Furthermore, those studies that are longitudinal are usually not prospective, which again precludes comparison of postevent levels of quality of life with preevent levels. Because life events are not completely exogenous, it is possible that individuals who have experienced specific life events were either more happy or less happy than average before the events occurred. For instance, Patterson et al.'s (1993) review showed that patients with burn injuries had relatively high rates of psychological disorders even before their injuries occurred. Similarly, Tyc (1992) suggested that children who lost limbs as the result of trauma (including accidents) had higher premorbid levels of psychological disorders than did those children who lost limbs as a result of cancer or other illness (suggesting that factors related to these preexisting conditions may have contributed to the accident). Thus, comparisons with published norms may provide an inadequate test of adaptation effects.

A second limitation of existing life event studies is that investigators often recruit individuals because they have experienced or are likely to experience the specific life event in question. Thus, participants are usually aware of the purpose of the study and may over- or underreport adaptation because of demand characteristics (see, e.g., Smith, Schwarz, Roberts, & Ubel, 2006).

Recently, psychologists have turned to large-scale, nationally representative panel studies to address questions about hedonic adaptation (Lucas, 2005; Lucas, Clark, Georgellis, & Diener, 2003, 2004). Such studies have a number of advantages over alternative designs. First, because the studies begin with a random sample of participants, individuals are not selected on the basis of the existence of a life event or their likelihood of experiencing that event in the future. Thus, demand characteristics and selection biases are unlikely to affect results. Second, panel studies are prospective; thus, preevent levels of well-being are known, and accurate estimates of adaptation can be obtained. Finally, because these studies are conducted over many years, long-term outcomes can be investigated. However, existing studies have looked at relatively normative events like unemployment, divorce, and widowhood. Although evidence against complete adaptation has emerged from these studies, effect sizes have tended to be small. In the current analysis, I used two large-scale panel studies to estimate the extent to which people adapt to an important nonnormative life event, the onset of a disability.

## Study 1: The German Socio-Economic Panel Study (GSOEP)

### *Method*

*Sample.* The data for this study came from Waves 1–19 of the GSOEP, a longitudinal study of German households that began in 1984 (with various subsamples added over the years; see Haisken-De New & Frick, 2003, for details). Households were selected via multistage random and systematic sampling, and all adult members of each household were asked to participate. Surveys were conducted yearly with face-to-face and paper-and-pencil interviews. The entire sample comprised 39,987 respondents who participated in at least one of the waves. Data from this study have been used to examine adaptation to marriage, widowhood (Lucas et al., 2003), divorce (Lucas, 2005), and unemployment (Lucas et al., 2004).

*Measures.* In 17 of the 19 years, participants were asked whether they had been "officially certified as having a reduced capacity to work or being severely handicapped." Those who said yes were also asked to indicate the extent of their disability. Extent of disability scores ranged from 10% to 100%. Although these data

[2] Neither author of the original article (Wortman & Silver, 1987) responded to requests for additional information about this effect.

[3] More recently, Riis, Loewenstein, Baron, Jepson, Fagerlin, and Ubel (2005) reported that patients undergoing hemodialysis were no less happy than a group of healthy controls. However, it is unclear whether this study provides support for adaptation effects. Although kidney disease is a very serious medical condition that can lead to disability or death, the condition itself is often not disabling. According to the study's authors, dialysis has few unpleasant side effects and does not significantly impair an individual's ability to carry out activities of daily living. As Riis et al. noted, "Although discomfort and nausea are possible [following treatment], they are usually minor and the patient can read, write, talk, eat, sleep, or watch TV during treatment. The patient's lifestyle can include most normal activities, including work, exercise, and leisure" (p. 5). Thus, it is unclear whether large differences between patients and controls should have been expected. Although it is true that the controls believed that patients would be less happy, such affective forecasting errors occur even with very minor life circumstances such as narrowly missing a subway train or having one's favorite football team lose. Furthermore, the two groups did actually differ in their measured mood ($d = 0.40$), but this difference was not significant. Because the patient and control samples were relatively small ($N = 49$ for each), we cannot know whether this effect is statistically reliable.

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are self-reported, they are based on official certifications, not just on the participants' opinion.

Those participants who began the survey without a disability, became disabled at some point during the study, and remained disabled for the duration of their time in the study were selected for inclusion. To ensure that the disabilities were indeed long term, I included in the analyses only those participants who remained in the study for at least 3 years after onset. In total, 679 participants (55.5% male, 44.5% female, mean age at time of disability = 53.63 years) met these selection criteria. Of those, 4 were dropped from the analyses because of missing data, resulting in a final sample size of 675. On average, individuals participated in the study for 7.18 years before and 7.39 years after the onset of disability (range = 1–17 years before and 3–18 years after disability).

Each year, participants were asked a single question: how satisfied were they with their lives as rated on a scale that ranged from 0 to 10. To account for average trends over time (particularly mean-level changes around the fall of the Berlin Wall), I centered satisfaction scores within each year of the survey and within each of the different subsamples that were added over the years (results were also checked using uncentered scores, and these results were very similar). Thus, a score of 0 reflects the average level of satisfaction for a particular year within a particular subsample.

The percentage of disability score was created by averaging an individual's self-reported extent of disability across all years during which the individual reported being disabled ($M = 58.61\%$, $SD = 21.76$). The distribution was relatively uniform, with many participants reporting very high levels or low levels of disability. For instance, 22% of people reported levels of disability greater than or equal to 80%, whereas an additional 23% reported levels at or below 40%. No additional information about the nature of the disability was recorded.

Log-transformed household income (adjusted for average sample changes over time) and a dummy-coded variable indicating whether a participant was not working were included as within-person control variables in some analyses. Participants' sex, age at time of disability, and average household income were tested as person-level moderators.

*Analytic technique.* The adaptation hypothesis was tested with multilevel models (estimated with Hierarchical Linear and Nonlinear Modeling [HLM], Version 6.0, Raudenbush, Bryk, & Congdon, 2004) to investigate trends in well-being before and after the onset of disability. At Level 1 (the within-person level), each individual's yearly well-being scores were modeled using five substantive parameters: an overall intercept ($\beta_0$), a parameter reflecting the change from baseline in the 2 years immediately preceding the onset of disability ($\beta_1$), a parameter reflecting change from baseline during the disability period ($\beta_2$), and two parameters reflecting linear ($\beta_3$) and quadratic ($\beta_4$) changes in satisfaction following the onset of disability. Two additional parameters ($\beta_5$ and $\beta_6$) were included in some models to estimate the within-person effects of income and employment. These parameters were included to test whether any lingering effects of disability were due to changes in income and employment status.

The $\gamma$ parameters reported in the Results section correspond to the weighted average $\beta$ parameters for the entire sample (e.g., $\gamma_{00}$ corresponds to $\beta_0$, $\gamma_{10}$ corresponds to $\beta_1$) and can be interpreted as follows: The estimated $\gamma_{00}$ parameter reflects the average predisability baseline level of satisfaction. The $\gamma_{10}$ parameter reflects the average drop from baseline in the 2 years before disability. The $\gamma_{20}$ parameter reflects the average drop from baseline during the 1st year of disability. The $\gamma_{30}$ and $\gamma_{40}$ parameters reflect the average linear and quadratic changes following onset of disability. Participants' sex, age at time of disability, average income, and extent of disability were included as Level-2 (person-level) moderators of the Level-1 parameters. The intercept, disability, linear, and quadratic coefficients were treated as randomly varying; all others were treated as fixed.

Standardized mean differences are reported as measures of effect size. Specifically, I standardized changes in well-being scores using the standard deviation for the average predisability level of well-being. These effect sizes indicate how much individuals changed relative to the amount of variability that existed in this sample before the disability occurred (Kline, 2004). It would also be appropriate to compare mean change with the variability in change over time. Because the standard deviation for the change parameters tended to be less than or equal to the standard deviation for the initial intercept, these alternative effect sizes would be greater than or equal to the effect sizes reported in the main text.

### *Results*

Table 1 shows results from two models estimated using the GSOEP data—a full model that includes linear and quadratic changes after onset and a reduced model in which nonsignificant terms are removed. The $\gamma_{00}$ parameter from the left column shows that individuals who eventually became disabled reported life satisfaction scores that were significantly below average more than 2 years before the official disability certification was received. This may indicate that at least some participants already had the conditions that eventually led to their disability. If so, then the effects of disability would be underestimated in this sample. Alternatively, this lower than average baseline may suggest that factors related to well-being predispose individuals to experience disability.

The $\gamma_{10}$ parameter shows that satisfaction levels dropped approximately 1/2 point in the 2 years before the disability occurred. In addition, the $\gamma_{20}$ parameter shows satisfaction levels dropped even further (more than 3/4 of 1 point) in the 1st year of disability. This decline from baseline levels represents a standardized mean difference of 0.63. Thus, participants experienced a medium-sized drop from their own baseline levels following the onset of a disability.

The critical test for adaptation theory is whether people return to baseline following their initial reaction to disability. Results show that participants who became disabled displayed very little adaptation over time. Neither the linear nor the quadratic parameter was significantly different from 0. These results indicate that participants stayed at their reduced level of well-being long after the disability occurs.

Four person-level variables were tested as moderators of the Level-1 coefficients. Two of these (sex and income) did not moderate coefficients in any of the models (when entered either together or separately). Therefore, these variables were dropped from all models and will not be discussed further. Age significantly moderated the disability intercept (which reflects change from baseline in the 1st year of disability), with older participants reacting less negatively. In addition, extent of disability (as reflected in the official certification) significantly moderated the Level-1 change parameters. This variable only moderated the drop in the 2 years before disability and in the 1st

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Table 1
*Estimated Parameters From the German Socio-Economic Panel Study (GSOEP)*

| Effect | Initial model | | | | Final model | | | |
|---|---|---|---|---|---|---|---|---|
| | $\gamma$ | *SE* | *t* | *df* | $\gamma$ | *SE* | *t* | *df* |
| Initial level, $\beta_0$ | | | | | | | | |
| Intercept, $\gamma_{00}$ | −0.16* | 0.06 | −2.60 | 672 | −0.16* | 0.06 | −2.66 | 674 |
| Extent, $\gamma_{01}$ | −0.00 | 0.00 | 0.32 | 672 | | | | |
| Age, $\gamma_{02}$ | 0.01 | 0.01 | 1.72 | 672 | | | | |
| 2 years before disability, $\beta_1$ | | | | | | | | |
| Intercept, $\gamma_{10}$ | −0.55* | 0.07 | −8.30 | 9352 | −0.55* | 0.07 | −8.27 | 9361 |
| Extent, $\gamma_{11}$ | −0.01* | 0.00 | −3.66 | 9352 | −0.01* | 0.00 | −3.59 | 9361 |
| Age, $\gamma_{12}$ | 0.01 | 0.01 | 1.02 | 9352 | | | | |
| Disability intercept, $\beta_2$ | | | | | | | | |
| Intercept, $\gamma_{20}$ | −0.83* | 0.07 | −11.45 | 672 | −0.78* | 0.06 | −12.33 | 672 |
| Extent, $\gamma_{21}$ | −0.02* | 0.00 | −4.52 | 672 | −0.02* | 0.00 | −7.00 | 672 |
| Age, $\gamma_{22}$ | 0.01* | 0.01 | 2.14 | 672 | 0.01* | 0.00 | 3.40 | 672 |
| Disability linear, $\beta_3$ | | | | | | | | |
| Intercept, $\gamma_{30}$ | 0.02 | 0.02 | 1.14 | 672 | | | | |
| Extent, $\gamma_{31}$ | −0.00 | 0.00 | −0.64 | 672 | | | | |
| Age, $\gamma_{32}$ | 0.00 | 0.00 | −0.15 | 672 | | | | |
| Disability quadratic, $\beta_4$ | | | | | | | | |
| Intercept, $\gamma_{40}$ | −0.00 | 0.00 | −1.13 | 672 | | | | |
| Extent, $\gamma_{41}$ | 0.00 | 0.00 | 0.09 | 672 | | | | |
| Age, $\gamma_{42}$ | −0.00 | 0.00 | −0.40 | 672 | | | | |

*Note.* $N = 675$. Values of −0.00 resulted from number rounding.
* $p < .05$.

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year of disability—it was unrelated to initial baseline levels and to the coefficients for the linear and quadratic terms. In other words, although individuals with severe disabilities start out with satisfaction levels that are similar to individuals with mild disabilities, the satisfaction levels of people with disabilities drop much farther and remain at these reduced levels. For instance, the levels of well-being of those individuals certified as 100% disabled are predicted to drop 1.66 points (standardized mean difference = 1.27) following the onset of disability. Thus, severe disability is associated with a large drop in well-being. Estimated parameters from the final model are presented in the right-most columns of Table 1. Predicted trajectories for individuals with an average extent of disability, along with individuals who were 25%, 75%, and 100% disabled, are plotted in Figure 1.

To determine whether the drop in satisfaction that followed the onset of disability was due to changes in income or employment status, I added time-varying income and employment status variables to the model. Both income and employment status were associated with life satisfaction, $\gamma_{income} = 0.30$, $SE = 0.07$, $t(9359) = 4.03$, $p < .05$; $\gamma_{employment} = -0.34$, $SE = 0.07$, $t(9359) = -5.01$, $p < .05$. However, after these effects were controlled, the size of the other effects in the model changed only slightly. For instance, the Level-1 intercept was no longer significantly different from 0, $\gamma = -0.05$, $SE = 0.06$, $t(674) = -0.88$, *ns*, which suggests that the below-average levels of satisfaction reported by participants before the onset of their disability might have been due to their reduced levels of employment. In addition, the size of the disability parameter dropped slightly from 0.78 to 0.65 when employment status and income were controlled. This suggests that at least some of the effect of disability may have been due to the effects of the disability on employment and income. However, even after these variables were controlled, disabled participants reported satisfaction scores that were still 0.50 standard deviations below their initial baseline level, and the coefficients for the linear and quadratic terms were not significantly different from 0, $\gamma_{linear} = 0.04$, $SE = 0.02$, $t(674) = 1.85$, *ns*; $\gamma_{quadratic} = -0.00$, $SE = 0.00$, $t(674) = -1.23$, *ns*. Thus, even after these potential explanatory variables were controlled, there was no evidence of adaptation over time.

## *Discussion*

Previous cross-sectional studies have shown that disabled individuals often report well-being scores that are substantially lower

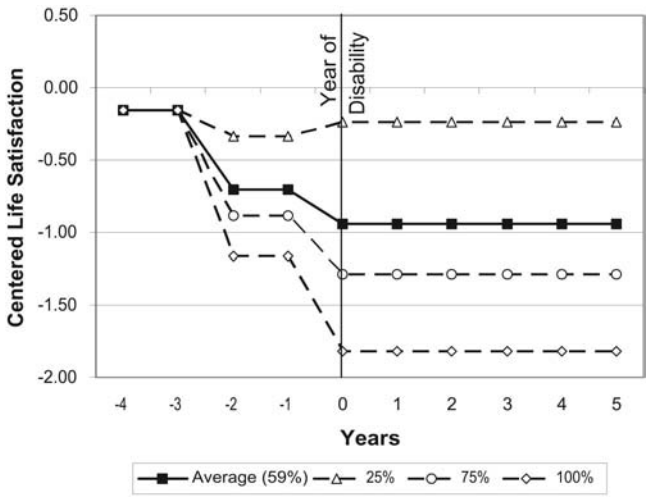


*Figure 1.* Predicted changes in centered life satisfaction before and after onset of disability in the German Socio-Economic Panel Study sample. Different lines reflect varying amounts of disability.

than population norms. However, these cross-sectional analyses cannot determine whether well-being actually changes following the disabling event. Study 1 showed that individuals who became disabled reported moderate to large drops in life satisfaction. In addition, they showed little evidence of adaptation over time. There were no significant trends back to baseline following the onset of disability.

In Study 2, I attempted to replicate this result in a separate nationally representative panel study, so that I could both assess the robustness of this effect and address two additional questions. First, Study 2 included two measures of subjective well-being: a life satisfaction measure and a measure of psychological distress. Thus, I could determine whether disability affected different components of well-being in different ways. Second, Study 2 included measures of specific health problems, which allowed me to address one alternative explanation of the results from Study 1. Because people can receive disability certification for psychological reasons, it is possible that some individuals in Study 1 became depressed and received their certification for this reason. If so, the drop in life satisfaction may not have been a result of the disability but a symptom of the underlying cause. In Study 2, I was able to address this possibility.

## Study 2: The British Household Panel Study (BHPS)

### *Method*

*Sample.* This data for this study came from Waves 1–12 of the BHPS, a longitudinal study of British households that began in 1991 (Institute for Social and Economic Research, University of Essex, 2004; Taylor, Brice, Buck, & Prentice-Lane, 2004). Households were selected by a multistage clustered probability design and systematic sampling. All adult members of selected households were asked to participate. As with the GSOEP, new subsamples were added over the years, and some attrition occurred. Thus, many individuals participated for fewer than 12 years. The entire sample comprises 27,406 respondents who participated in at least one wave.

In 11 of the 12 years (all except 2002), participants were asked whether they were registered as a disabled person. As in the GSOEP, those participants who began the survey without a disability, became disabled at some point in the study, remained disabled for the duration of their time in the study, and participated for at least 3 years after the onset of disability were included in the main analyses. In all, 272 participants (56.1% female, 43.9% male, mean age at time of disability = 59.38 years, $SD = 16.28$) met this criterion, though sample sizes vary somewhat across analyses because of missing data. On average, individuals participated in the study for 3.48 years before and 5.31 years after the onset of disability (range = 1–9 years before and 3–11 years after disability).

*Measures.* Participants completed two different well-being measures. First, in every year of the survey, participants completed the General Health Questionnaire (GHQ, Goldberg, 1992), a 12-item measure of psychological distress. This measure includes items about emotions (e.g., whether they had recently been feeling reasonably happy) and psychological symptoms that could result from distress (e.g., whether they had been losing sleep over worry). Participants responded to each item using a 4-point scale (with higher scores reflecting more distress). The average reliability of this scale across all years was .89. In 6 of the 7 most recent years, participants were also asked to rate how dissatisfied or satisfied they were with their life overall using a scale that ranged from 1 to 7. On average, this measure correlated .55 with the GHQ within each year. Because GHQ and satisfaction scores showed only slight average differences across years, scores were simply centered around the full sample mean.

Each year, participants were also shown a list of health problems and disabilities and were then asked to indicate which of the conditions they currently had. Participants could select multiple conditions. Of those listed, disability connected with arms, legs, hands, feet, back, or neck (including arthritis and rheumatism) was selected most frequently, reported in at least 1 year during the period of disability by 84.6% of the disabled participants. Problems with the heart, blood pressure, or blood circulation (57.5%); with the chest or breathing (43.0%); with anxiety, depression, or bad nerves (38.3%); with sight (not including simply needing glasses, 37.8%); and with the stomach (36.0%) were also mentioned frequently. Although these measures were not included in the main model, they were used to address alternative explanations of the effects of disability (as described below).

Log-transformed household income (adjusted for average sample changes over time) and a dummy-coded variable indicating whether a participant was not working were also included as control variables. In addition, participants' sex, age at time of disability, and average household income were included as person-level moderators of the within-person effects.

*Analytic technique.* The same analytic approach used in Study 1 was also used in Study 2. However, in the BHPS, certain aspects of the models occasionally needed to be modified. For instance, because life satisfaction was only assessed in the latter years of the study, researchers had satisfaction measures for a number of people only after the onset of disability. The data from these participants can be included in the analyses and can be used to estimate the fixed effects; but estimation problems arise when one treats the disability intercept as random. Therefore, in models with life satisfaction, only the overall intercept and the linear trends were treated as randomly varying; all other parameters were treated as fixed.[4] In the models with the GHQ, the overall intercept, the disability intercept, the disability linear parameter, and the disability quadratic parameter were treated as randomly varying, and all other parameters were treated as fixed.

### *Results*

Participants' sex, age at time of disability, and income did not moderate any of the Level-1 parameters. Thus, these variables were dropped from all models. Table 2 shows that the results from Study 1 were replicated. Again, the linear and quadratic trends were nonsignificant, which shows that there was little evidence of adaptation following onset of a disability. Furthermore, the effect size for the average drop in well-being from baseline was medium.

[4] A model that included only those individuals who provided life satisfaction data before and after onset was also tested. This model (in which the disability intercept was treated as random) resulted in very similar estimates.

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Table 2
*Estimated Parameters Predicting Life Satisfaction in the British Household Panel Study*

| Effect | Initial model | | | | Final model | | | |
|---|---|---|---|---|---|---|---|---|
| | $\gamma$ | *SE* | *t* | *df* | $\gamma$ | *SE* | *t* | *df* |
| Initial level, $\beta_0$ | | | | | | | | |
| Intercept, $\gamma_{00}$ | −0.05 | 0.18 | −0.30 | 253 | −0.10 | 0.18 | −0.59 | 253 |
| 2 years before disability, $\beta_1$ | | | | | | | | |
| Intercept, $\gamma_{10}$ | −0.46* | 0.18 | −2.57 | 1110 | −0.46* | 0.18 | −2.55 | 1112 |
| Disability intercept, $\beta_2$ | | | | | | | | |
| Intercept, $\gamma_{20}$ | −0.67* | 0.18 | −3.76 | 1110 | −0.72* | 0.17 | −4.26 | 1112 |
| Disability linear, $\beta_3$ | | | | | | | | |
| Intercept, $\gamma_{30}$ | −0.03 | 0.06 | −0.54 | 253 | | | | |
| Disability quadratic, $\beta_4$ | | | | | | | | |
| Intercept, $\gamma_{40}$ | −0.00 | 0.01 | −0.02 | 1110 | | | | |

*Note.* $N = 254$. Value of −0.00 resulted from number rounding.
* $p < .05$.

Participants' well-being dropped 0.72 points (standardized mean difference = 0.57) around the time of disability. Estimated parameters for the final parsimonious model are presented in the right-hand columns of Table 2, and the predicted trajectory is plotted as a solid line in Figure 2.

For distress, the initial effect sizes were similar to those found with life satisfaction: Participants' distress levels increased by 0.24 points (standardized mean difference = 0.62) following the onset of disability. However, with this measure, there was more evidence of adaptation over time (Table 3). Both the linear and quadratic effects were significantly different from 0. As shown by the solid line in Figure 3, distress levels dropped at first and then leveled off. However, it is important to note that the minimum level of predicted distress was still higher than baseline. For instance, 4 years after onset of disability, participants are still predicted to be 0.15 points (standardized mean difference = 0.40) above their baseline level of distress.

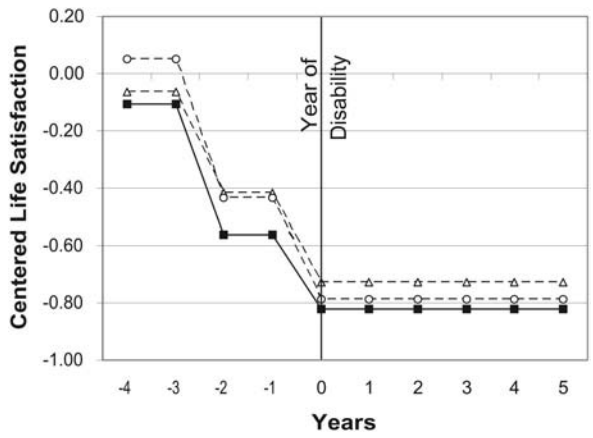


*Figure 2.* Predicted changes in centered life satisfaction before and after disability in the British Household Panel Study sample. The solid line shows predicted trajectories for the full sample. The dashed line with open triangles shows predicted trajectories after I controlled for depression. The dashed line with open circles shows predicted trajectories for individuals who report physical disabilities each year that they are disabled.

As with the German sample, within-person changes in income were associated with a change in life satisfaction, $\gamma = 0.20$, $SE = 0.08$, $t(1110) = 2.56$, $p < .05$. Employment status, on the other hand, was not significantly associated with life satisfaction, $\gamma = -0.25$, $SE = 0.14$, $t(1110) = -1.83$, *ns*, at least not when it was entered simultaneously with income (the effect was significant when entered alone). However, again, even after both effects were controlled, the significant effect of disability remained. The $\gamma_{20}$ parameter predicting life satisfaction (which reflects the drop in satisfaction during the disability period) changed only slightly from 0.72 to 0.65 after employment status and income were controlled. In addition, neither the linear nor the quadratic parameter was significantly different from 0 even with these additional covariates in the model, $\gamma_{\text{linear}} = -0.05$, $SE = 0.06$, $t(253) = 0.75$, *ns*; $\gamma_{\text{quadratic}} = 0.00$, $SE = 0.01$, $t(1108) = 0.17$, *ns*.

For the model predicting distress, the effects of both income and employment status were significant, $\gamma_{\text{income}} = -0.06$, $SE = 0.02$, $t(2241) = -2.87$, $p < .05$; $\gamma_{\text{employment}} = 0.07$, $SE = 0.03$, $t(2241) = 2.38$, $p < .05$. After these effects were controlled, the $\gamma_{20}$ parameter predicting distress only changed from 0.24 to 0.21. Thus, although income and employment status were related to well-being, changes in these variables cannot account for the effects of disability.

Table 3
*Estimated Parameters Predicting Distress in the British Household Panel Study*

| Effect | $\gamma$ | *SE* | *t* | *df* |
|---|---|---|---|---|
| Initial level, $\beta_0$ | | | | |
| Intercept, $\gamma_{00}$ | 0.13* | 0.03 | 4.53 | 271 |
| 2 years before disability, $\beta_1$ | | | | |
| Intercept, $\gamma_{10}$ | 0.16* | 0.03 | 5.46 | 2243 |
| Disability intercept, $\beta_2$ | | | | |
| Intercept, $\gamma_{20}$ | 0.24* | 0.03 | 6.89 | 271 |
| Disability linear, $\beta_3$ | | | | |
| Intercept, $\gamma_{30}$ | −0.04* | 0.02 | −2.56 | 271 |
| Disability quadratic, $\beta_4$ | | | | |
| Intercept, $\gamma_{40}$ | 0.00* | 0.00 | 2.47 | 271 |

*Note.* $N = 272$.
* $p < .05$.

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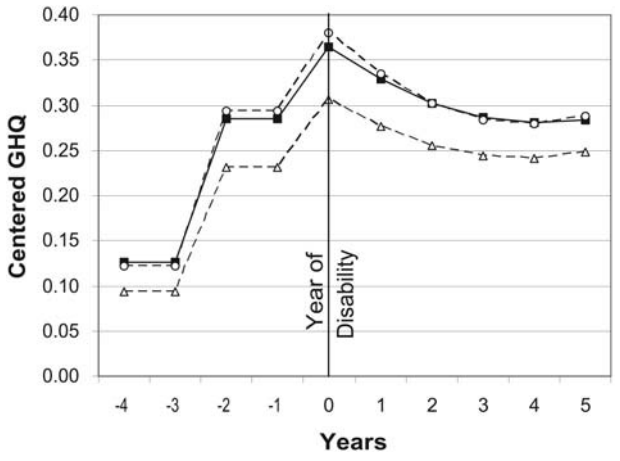


*Figure 3.* Predicted changes in centered General Health Questionnaire (GHQ)–measured distress before and after disability in the British Household Panel Study sample. The solid line shows predicted trajectories for the full sample. The dashed line with open triangles shows predicted trajectories after I controlled for depression. The dashed line with open circles shows predicted trajectories for individuals who report physical disabilities each year that they are disabled.

As noted above, individuals can receive disability certifications for psychological reasons. Thus, it is possible that some individuals received their disability certification because they were depressed. If so, the drop in well-being may not be the result of disability. Instead these changes may be a symptom of the underlying cause. This alternative explanation can be addressed in the BHPS, in which respondents were asked to indicate which disabilities and health problems they currently had (although they did not explicitly indicate which disabilities resulted in their disability certification). I should note, however, that bouts of depression rarely last 3 years (the minimum length of disability required to be included in the current analyses), and thus, it is unlikely that depressed individuals would meet the selection criteria used in this study (Kendler, Walters, & Kessler, 1997; McLeod, Kessler, & Landis, 1992). However, because it is possible, I used information about specific disabilities to address this concern.

Participants were asked whether they suffered from anxiety, depression, or bad nerves. Clearly, this single-item measure could not be used to diagnose anxiety or depression. However, it may serve as a reasonable proxy measure for whether a person had already been diagnosed with these disorders. If one simply controlled for reports of anxiety and depression, it would likely be too conservative of an approach because many individuals may experience symptoms as a result of their disability. For instance, 47.9% of individuals with disabilities endorsed the depression/anxiety item in at least 1 year during their period of disability. Discarding data of these people from the analysis might remove those who reacted most negatively to the event. Although it is difficult to find an appropriate statistic with which to compare the frequency of reported anxiety/depression in this sample, official statistics indicate that a much smaller percentage of disabled individuals are disabled because of depression or anxiety than this figure would otherwise indicate. For instance, between 13% and 15% of those who received a disability living allowance (which provides support for individuals who need help getting around or caring for themselves) in the most recent years of the current analysis did so because of mental health problems other than learning disabilities (U.K. Department for Work and Pensions, 2006a). Furthermore, between 30% and 34% of those who received an incapacity benefit or severe disablement allowance (for people who cannot work because of disability) during the most recent years of the current analysis received this benefit for all mental health problems including mental retardation (U.K. Department for Work and Pensions, 2006b). Therefore, to address concerns about this potential alternative explanation, I used two different strategies.

First, I used a strategy that does not rely on the validity of the anxiety/depression item. Specifically, I reestimated the models, restricting the analysis to individuals who appeared to have a physical cause of their disability (regardless of whether they also reported being anxious or depressed). I restricted the analyses to the 178 individuals who reported physical problems or disabilities associated with arms, legs, hands, feet, back, or neck (including arthritis and rheumatism) in all years during which they were disabled. Then, as a second strategy (estimated in a separate model), I attempted to control for anxiety/depression by identifying individuals who consistently reported being anxious or depressed during the years of disability. The rationale for this approach is that individuals who receive a disability certification for being anxious or depressed would likely be certified as disabled only as long as they experience these symptoms. Individuals who are anxious or depressed because they are disabled, on the other hand, may recover from the psychological symptoms even though their disabling condition remains. Therefore, the stability of the reports may indicate whether the anxiety/depression is the disabling factor. To address this possibility, I created a dichotomous variable indicating whether a person was consistently anxious or depressed. I then included this dichotomous variable as a Level-2 predictor of all Level-1 parameters. This allowed me to calculate separate trajectories for individuals who consistently reported being anxious or depressed and individuals who did not consistently report these problems.

Results for those participants who reported physical disabilities during each year that they were certified as having a disability are presented in Tables 4 and 5. Consistent with the results from the full sample, these participants reported a significant decline in life satisfaction following the onset of disability. As with the full sample, neither the linear nor the quadratic trend parameter was significantly different from 0. Again, this means that very little adaptation occurred over time. Furthermore, the life satisfaction effect size for this select sample was similar to (and slightly larger than) that for the full sample: Life satisfaction of participants dropped 0.66 standard deviation following the onset of the disability. Predicted life satisfaction trajectories are presented as dashed lines with open circles in Figure 2. These trajectories replicate those from the full sample.

Table 5 shows that results for which GHQ Distress score was used as an outcome were also replicated in this more select sample. Participants' distress increased 0.26 points (standardized mean difference = 0.75) in the first year of disability. They then recovered somewhat over the next few years: Both the linear and quadratic parameters were significantly different from 0. However, even at the minimum level of predicted distress (which occurs in the 5th year of disability), participants reported scores that were 0.47 standard devi-

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Table 4
*Estimated Parameters Predicting Life Satisfaction for Those Who Were Physically Disabled in the British Household Panel Study*

| Effect | Initial model | | | | Final model | | | |
|---|---|---|---|---|---|---|---|---|
| | γ | *SE* | *t* | *df* | γ | *SE* | *t* | *df* |
| Initial level, $\beta_0$ | | | | | | | | |
| Intercept, $\gamma_{00}$ | 0.09 | 0.21 | 0.43 | 165 | 0.05 | 0.21 | 0.25 | 165 |
| 2 years before disability, $\beta_1$ | | | | | | | | |
| Intercept, $\gamma_{10}$ | −0.49* | 0.21 | −2.36 | 713 | −0.49* | 0.20 | −2.38 | 715 |
| Disability intercept, $\beta_2$ | | | | | | | | |
| Intercept, $\gamma_{20}$ | −0.81* | 0.21 | −3.88 | 713 | −0.83* | 0.19 | −4.40 | 715 |
| Disability linear, $\beta_3$ | | | | | | | | |
| Intercept, $\gamma_{30}$ | −0.02 | 0.08 | −0.23 | 165 | | | | |
| Disability quadratic, $\beta_4$ | | | | | | | | |
| Intercept, $\gamma_{40}$ | −0.00 | 0.01 | −0.16 | 713 | | | | |

*Note.* $N = 166$. Value of −0.00 resulted from number rounding.
* $p < .05$.

ation above baseline. Predicted GHQ trajectories are presented as dashed lines with open circles in Figure 3. As with life satisfaction, these trajectories replicate those from the full sample.

Results for the analyses that include anxiety/depression as a Level-2 moderator are presented in Tables 6 and 7. Surprisingly, for life satisfaction, the dichotomous variable did not significantly moderate any of the Level-1 parameters. However, an examination of the estimated parameters suggests that this may be due to low power. As Table 6 shows, the anxious/depressed participants' life satisfaction scores were estimated to drop almost a full point more than those of the participants who were not anxious/depressed in the years immediately preceding onset and in the 1st year after onset. However, because only 11.9% of the sample consistently reported being anxious or depressed, these very large differences were not statistically significant. It is important to note, however, that this analysis still provides valuable information about the extent to which the results for the full sample were being driven by anxious or depressed individuals. Even after the large but nonsignificant effects were controlled, the estimated parameters for participants who were not anxious or depressed were very similar to those from the full sample. Participants' life satisfaction levels were estimated to drop 0.66 points following the onset of disability (standardized mean difference = 0.54), and they were not predicted to rebound over time. Trajectories for individuals who were not consistently anxious or depressed are presented as dashed lines with open triangles in Figure 2. As can be seen in this figure, the estimated parameters for the groups that were not anxious or depressed were very similar to the parameters for the full sample.

Table 7 shows the moderating effect of reports of anxiety and depression in the model predicting GHQ-measured distress. In this model, anxiety or depression does have a significant effect on baseline levels of distress, the drop in distress reported before the disability occurs, and the drop in distress reported in the 1st year of disability. Those individuals who reported being consistently anxious or depressed had significantly higher levels of distress before and after the onset of the disability. However, even after these effects were controlled, the estimated parameters for the model were very similar to those estimated for the full sample. Participants' distress increased 0.21 points (standardized mean difference = 0.59) in the 1st year of disability. They then recovered somewhat over the next few years. Both the linear and quadratic parameters were significantly different from 0. However, even at the minimum level of predicted distress (which occurred in the 5th year of disability), participants reported scores that were 0.40 standard deviation above baseline. Together, these results suggest that the drop in well-being following onset of disability was not due to the onset of anxiety or depression.[5]

Table 5
*Estimated Parameters Predicting Distress for Those Who Were Physically Disabled in the British Household Panel Study*

| Effect | γ | *SE* | *t* | *df* |
|---|---|---|---|---|
| Initial level, $\beta_0$ | | | | |
| Intercept, $\gamma_{00}$ | 0.12* | 0.03 | 3.69 | 177 |
| 2 years before disability $\beta_1$ | | | | |
| Intercept, $\gamma_{10}$ | 0.17* | 0.04 | 4.66 | 1443 |
| Disability intercept, $\beta_2$ | | | | |
| Intercept, $\gamma_{20}$ | 0.26* | 0.04 | 6.19 | 177 |
| Disability linear, $\beta_3$ | | | | |
| Intercept, $\gamma_{30}$ | −0.05* | 0.02 | −3.12 | 177 |
| Disability quadratic, $\beta_4$ | | | | |
| Intercept, $\gamma_{40}$ | 0.01* | 0.00 | 3.20 | 177 |

*Note.* $N = 178$.
* $p < .05$.

[5] Even when the most conservative tests are used, effect sizes are still medium. For instance, if I treat anxiety/depression as a time-varying covariate, the effect size for the effect of disability on life satisfaction is still 0.55 standard deviation, and the effect size for the long-term change in distress (after the limited amount of adaptation has occurred) only drops to 0.31 standard deviation. If I include as a Level-2 moderator a dichotomous variable that indicates whether a person ever reported being depressed, then the long-term effect of disability on life satisfaction is a 0.59 standard deviation drop from baseline, and the long-term effect on distress is a 0.29 standard deviation drop from baseline.

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Table 6
*Estimated Parameters Predicting Life Satisfaction, Including the Moderating Effect of Depression, in the British Household Panel Study*

| Effect | Initial model | | | | Final model | | | |
|---|---|---|---|---|---|---|---|---|
| | γ | *SE* | *t* | *df* | γ | *SE* | *t* | *df* |
| Initial level, $\beta_0$ | | | | | | | | |
| Intercept, $\gamma_{00}$ | 0.00 | 0.19 | 0.02 | 252 | −0.06 | 0.19 | 0.34 | 252 |
| Depression, $\gamma_{01}$ | −0.39 | 0.50 | −0.78 | 252 | −0.34 | 0.47 | −0.72 | 252 |
| 2 years before disability, $\beta_1$ | | | | | | | | |
| Intercept, $\gamma_{10}$ | −0.36 | 0.18 | −1.96 | 1105 | −0.35 | 0.18 | −1.92 | 1109 |
| Depression, $\gamma_{11}$ | −0.94 | 0.58 | −1.62 | 1105 | −0.91 | 0.56 | −1.63 | 1109 |
| Disability intercept, $\beta_2$ | | | | | | | | |
| Intercept, $\gamma_{20}$ | −0.58* | 0.19 | −3.11 | 1105 | −0.66* | 0.18 | −3.67 | 1109 |
| Depression, $\gamma_{21}$ | −0.82 | 0.57 | −1.45 | 1105 | −0.66 | 0.43 | −1.55 | 1109 |
| Disability linear, $\beta_3$ | | | | | | | | |
| Intercept, $\gamma_{30}$ | −0.06 | 0.06 | −0.90 | 252 | | | | |
| Depression, $\gamma_{31}$ | 0.07 | 0.35 | 0.19 | 252 | | | | |
| Disability quadratic, $\beta_4$ | | | | | | | | |
| Intercept, $\gamma_{40}$ | 0.00 | 0.01 | 0.19 | 1105 | | | | |
| Depression, $\gamma_{41}$ | 0.01 | 0.06 | 0.14 | 1105 | | | | |

*Note.* $N = 254$.
* $p < .05$.

## General Discussion

The results from these studies show that happiness can change and that adaptation is not inevitable. Both the life satisfaction and distress measures were reactive to changing life circumstances, and the observed effects for the initial reactions were medium to large. Furthermore, there was no evidence of adaptation over time when life satisfaction measures were examined and evidence of only partial adaptation when psychological distress was examined. Long-term effects of disability ranged from slightly less than one half to more than one full standard deviation. To put these effects in context, let us consider the following: An individual from the GSOEP who began the study without a disability but who became disabled at some point during the study would be predicted to report an initial satisfaction score that put him or her in the 38th percentile for the full sample. After experiencing an "average" disability, he or she would be predicted to drop to the 24th percentile. An individual who experienced full disability would be predicted to drop even farther, to the 13th percentile. Thus, disabilities can have strong effects on people's happiness.

Table 7
*Estimated Parameters Predicting Distress, Including the Moderating Effect of Depression, in the British Household Panel Study*

| Effect | γ | *SE* | *t* | *df* |
|---|---|---|---|---|
| Initial level, $\beta_0$ | | | | |
| Intercept, $\gamma_{00}$ | 0.09* | 0.03 | 3.42 | 270 |
| Depression, $\gamma_{01}$ | 0.29* | 0.11 | 2.70 | 270 |
| 2 years before disability, $\beta_1$ | | | | |
| Intercept, $\gamma_{10}$ | 0.14* | 0.03 | 4.65 | 2238 |
| Depression, $\gamma_{11}$ | 0.24* | 0.11 | 2.15 | 2238 |
| Disability intercept, $\beta_2$ | | | | |
| Intercept, $\gamma_{20}$ | 0.21* | 0.04 | 6.01 | 270 |
| Depression, $\gamma_{21}$ | 0.27* | 0.13 | 2.10 | 270 |
| Disability linear, $\beta_3$ | | | | |
| Intercept, $\gamma_{30}$ | −0.03* | 0.02 | −2.17 | 270 |
| Depression, $\gamma_{31}$ | −0.03 | 0.08 | −0.41 | 270 |
| Disability quadratic, $\beta_4$ | | | | |
| Intercept, $\gamma_{40}$ | 0.00* | 0.00 | 2.27 | 270 |
| Depression, $\gamma_{41}$ | −0.00 | 0.01 | −0.37 | 270 |

*Note.* $N = 272$. Value of −0.00 resulted from number rounding.
* $p < .05$.

These results, which were replicated in two very large, nationally representative panel studies, contradict the long-held belief among psychologists that adaptation is inevitable and occurs for even major life events. Because these results are so surprising, it is necessary to ask why they diverge so sharply from past research. However, the literature review showed that the findings from these two studies do not actually contradict the relatively small body of existing empirical evidence; they only contradict the standard interpretation of this evidence. Most studies that have been cited in support of adaptation did not actually compare individuals with disabilities with those without disabilities. These previous studies simply showed that individuals with disabilities are moderately happy and do not have high rates of psychological disorders. The studies that did compare individuals with disabilities with individuals without disabilities almost always found moderate to large effects (Dijkers, 1997). Thus, the current studies are actually quite consistent with the relatively small body of evidence on the association between disability status and subjective well-being.

The current studies also extend past research because a prospective design was used to examine the change in well-being that occurs during and after the onset of disability. Because factors that are related to well-being may also predispose individuals to experience certain life events (Headey & Wearing, 1992; Magnus, Diener, Fujita, & Pavot, 1993; Patterson et al., 1993; Tyc, 1992), it is important to use prospective designs to rule out the possibility that individuals who experience these events were different from population norms even before the event occurred. In two out of the three analyses (those for life satisfaction in the GSOEP and dis-

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tress in the BHPS), baseline levels of well-being were in fact lower than the averages for the full sample even many years before disability certification began. This could mean that the condition that was responsible for the disability certification already existed before certification was received (in which case the effect of disability on well being would be underestimated in these analyses), or it could mean that selection effects existed. In either case, the prospective longitudinal design allows for a more complete understanding of the nature of these adaptation effects.

The current studies also improve on previous research because the effects of disability were examined in nationally representative samples rather than in samples that were recruited explicitly on the basis of a disability. This means that demand characteristics were unlikely to affect these results. Both the GSOEP and the BHPS assessed a wide variety of variables, most of which focused on socioeconomic status. Questions about health and disability made up only a small proportion of the questions asked. Thus, participants would have had no reason to believe that the focus of the study was on health or disability. Furthermore, questions about health were separated from questions about well-being by many other topics. Thus, asking about disability was unlikely to have made this condition more salient in the respondents' minds, resulting in an overestimation of the effect of disability on well-being.

It is important to note that the failure to find complete adaptation in these studies could not be due to small sample sizes or a short period of follow-up. For one thing, sample sizes were relatively large, especially in the GSOEP. However, even if we look at the analysis with the lowest power (analyses involving life satisfaction in the BHPS), postdisability trends were actually in the opposite direction to that predicted by adaptation theory. Thus, the failure to detect significant adaptation in this analysis was not due to low power. Furthermore, the finding of a lack of complete adaptation was not due to a relatively short period of follow-up (which is often a problem in longitudinal studies of reactions to life events). Participants in the GSOEP were followed for an average of 7.39 years (and for as long as 18 years) after the onset of disability. Participants in the BHPS were followed for an average of 5.31 years (and for as long as 11 years) after onset. The fact that no trends toward adaptation emerged even though participants were assessed for such long periods of time suggests that adaptation does not occur. Of course, these findings must be placed in the context of existing work on this topic. It is true that previous studies have provided conflicting evidence regarding the extent to which some amount of adaptation occurs (see Livneh & Martz, 2003, for a review). Thus, additional longitudinal studies, along with meta-analytic summaries, will be required to resolve this question.

One interesting result that emerged from these studies is that the effect of disability differed depending on the type of well-being measure that was examined. In both studies, life satisfaction measures showed no evidence of adaptation over time. Participants reported drops in satisfaction around the time of the onset of disability, and they showed no trends back to baseline in the years following onset. Psychological distress, on the other hand, showed more evidence of adaptation. Distress levels rebounded somewhat in the years following onset; though even at their lowest, participants' reports of distress were still about 0.40 standard deviation above baseline. Subjective-well-being researchers contend that well being is not a unitary construct and that the various components may change in different ways over time (Diener et al., 2006). The current studies support this view. Thus, there probably is no single answer to the question of whether people adapt to life events. Instead, the answer may depend on the component of well-being that is assessed. It is possible that strong emotional reactions subside over time, whereas global cognitive judgments may remain permanently affected by important life events.

Of course, this is not the only possible explanation of these discrepant results. One additional difference between the life satisfaction measure and the GHQ is the response scale that is used. Unlike the life satisfaction question, the GHQ asks respondents to report symptoms relative to their "usual" level. This type of relative response scale may pull for adaptation effects. Therefore, these results must be replicated with additional measures before we can be sure these differences are due to the content of these scales.

One caveat that must be mentioned is that because these surveys were conducted yearly, some amount of adaptation may have already occurred even before the first postonset assessment was made. If, for instance, a participant's disability resulted from an accident, his or her life satisfaction may have declined quite dramatically in the weeks following the event and may have rebounded by the time of the first survey. Similarly, it is possible that individuals who acquired a disability received their certification some time after onset of the disabling condition. In either case, the amount of adaptation that had occurred would have been underestimated in the current studies. Although that is certainly possible, studies that have assessed affect immediately following a debilitating injury have shown that people are surprisingly resilient, even very soon after the event. For instance, Wortman and Silver (1987) described a study that assessed mood in the weeks following serious spinal cord injuries. Even just 1 week after the injury, participants reported what appears to be a surprisingly low frequency of negative affect and a surprisingly high frequency of positive affect (not enough information was presented to calculate effect sizes compared with control groups or population norms). Similarly, Brickman et al. (1978) reported that among participants who had been injured within the past year, the length of time since injury was not associated with reports of happiness. Thus, it is possible that trajectories derived from yearly assessments accurately reflect the amount of adaptation that occurs. Of course, future research is required to provide a definitive answer to this question.

A second concern relates to selection biases that may influence who applies for and receives disability certification. It is possible that it is only those people who fare worst following the onset of disability who apply for disability benefits. If so, the current studies may underestimate the amount of adaptation that occurs because the studies do not include disabled participants who have adapted to their condition and have chosen not to accept disability benefits. Although this is certainly a possibility, there are two reasons that the current studies are important in spite of this concern. First, even if these studies overestimate the average impact of disability, they still show that among this select sample, changes from baseline do occur and that they can be quite large. This refutes the idea that adaptation is inevitable. Second, as reviewed above, the effect size estimates from the current studies are quite comparable to effect size estimates from previous studies

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of disability that did not rely on disability certification as a criterion for inclusion. Thus, there is no evidence that these studies overestimate the long-term impact of these disabling events.

### *Implications for Research and Theory on Adaptation*

There may be no more important question within the field of subjective well-being than the question of whether happiness can change. If adaptation inevitably occurs (and this adaptation is due to internal processes), then the decades-long search for external factors that promote high levels of happiness have been conducted in vain. Programs designed to increase individuals' happiness (e.g., Lyubomirsky, Sheldon, & Schkade, 2005; Seligman, Steen, Park, & Peterson, 2005) will surely fail, and governmental policies designed to foster high levels of well-being will have no chance of success. More optimistically, the existence of adaptation processes would also mean that reactions to negative events and circumstances inevitably subside over time. However, this optimistic assessment has important applied implications. It suggests that those who have experienced trauma need no outside intervention such as therapy or support groups, because adaptation should occur on its own (at least if stronger forms of adaptation theory are correct). Thus, questions about adaptation have important implications for a variety of applied issues within psychology, economics, and public policy.

Adaptation research has important theoretical implications as well. In addition to providing information about the nature and function of the affect and evaluation systems, adaptation effects determine how subjective well-being research could be used to shape other areas of inquiry. For instance, social scientists often point to correlations with well-being to make the case that some factor is or is not essential for human survival. If income is unrelated to well-being, to take one commonly cited example, then this means that high levels of income and the material possessions that wealth can buy are probably not necessary for humans to flourish. Yet if well-being levels inevitably return to baseline regardless of people's external life circumstances, then drawing such conclusions may be inappropriate. Weak correlations may simply be a consequence of human beings' inevitable tendency to adapt.

The current studies add to a growing body of research showing that although happiness is relatively stable over time, it can in fact change. Fujita and Diener (2005), for example, showed that a relatively large minority of the GSOEP participants exhibited substantial changes over a 17-year period. In other research, I have shown that these changes are often linked with specific life events like the experience of unemployment or divorce (Lucas, 2005; Lucas et al., 2004). Even events to which people eventually adapt (like widowhood) often affect life satisfaction for many, many years (Lucas et al., 2003). Thus, this growing body of research shows that well-being can change and that well-being measures are likely to be useful in both basic and applied research settings.

An important goal for future research will be to identify the factors that contribute to individual differences in reaction to life events. Although I did not emphasize this point in the current analyses, there was considerable variability in the trajectories that were identified (see Diener et al., 2006, and Lucas et al., 2003, for a more detailed discussion of this general issue). In other words, some people reported drops in life satisfaction that were much greater than the averages reported in the text, whereas others appeared to be only slightly affected by the onset of disability. Of course, some of this variability is likely due to differences in the type of disability that was experienced, but there may also be psychological factors that can explain some of this variability. For instance, Bonanno and his colleagues have identified groups of individuals who show distinct trajectories of distress following traumatic events like the loss of a spouse or child (see Bonanno, 2004, for a review). Although some people show strong distress reactions followed by varying degrees of adaptation over time, a fairly large group of individuals show a resilient pattern that is characterized by low levels of distress even very close to the time of the event. Bonanno and other researchers have shown that a variety of psychological characteristics including hardiness, self-enhancement, and positive emotions are associated with this resilient pattern (Bonanno, 2004). Unfortunately, because the studies that were included in the current article were designed primarily to assess socioeconomic conditions, few psychological characteristics were assessed. Therefore, future research is needed to clarify the psychological predictors of the varying trajectories of well-being following the onset of disability or other traumatic events.

These studies also raise important methodological issues about the types of evidence that have been and should be used to support models of adaptation. It is now clear that most people are happy most of the time (Diener & Diener, 1996). This is true not only for the upper middle-class American college students who provide the data for many psychological studies but also for diverse individuals from a variety of backgrounds and nations (Diener et al., 2006). Thus, it should no longer be a surprise that people who have recently become disabled (or those who have become widowed, have lost their jobs, or have experienced just about any other major life event) report well-being scores that are above neutral. However, this finding alone should not be taken to mean that adaptation has occurred. Individuals with relatively high levels of happiness may still be quite far from their previous baseline levels or from population norms. At the very least, cross-sectional studies that compare the happiness of individuals in varying life circumstances with population norms are needed to provide a first step in understanding the effect of life circumstances. More sophisticated prospective designs are needed to clarify the trajectories of adaptation and to separate true change from preexisting differences.

### *Summary*

After decades of research on the correlates of well-being, evidence for strong effects of external circumstances has rarely emerged. This lack of evidence has led psychologists to suggest either that well-being measures are flawed and that global questionnaires simply do not reflect true levels of happiness (Schwarz & Strack, 1999) or that happiness is primarily determined by genetic factors and that long-term levels of happiness rarely change (Lykken & Tellegen, 1996). However, few studies have examined reactions to extreme life events with appropriately complex methodologies. The current results challenge these long-held views. Happiness can change, and well-being measures are sensitive to these changes. Thus, these results suggest that well-being measures can be used to guide understanding of psychological and economic phenomena.

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This article is intended solely for the personal use of the individual user and is not to be disseminated broadly.

## References


Bonanno, G. A. (2004). Loss, trauma, and human resilience: Have we underestimated the human capacity to thrive after extremely aversive events? *American Psychologist, 59,* 20–28.

Brickman, P., Coates, D., & Janoff-Bulman, R. (1978). Lottery winners and accident victims: Is happiness relative? *Journal of Personality and Social Psychology, 36,* 917–927.

Diener, E., & Diener, C. (1996). Most people are happy. *Psychological Science, 7,* 181–185.

Diener, E., & Lucas, R. E. (1999). Personality and subjective well-being. In D. Kahneman, E. Diener, & N. Schwarz, (Eds.), *Well-being: The foundations of hedonic psychology* (pp. 213–229). New York: Russell Sage Foundation.

Diener, E., Lucas, R. E., & Scollon, C. (2006). Beyond the hedonic treadmill: Revising the adaptation theory of well-being. *American Psychologist, 61,* 305–314.

Diener, E., & Seligman, M. E. P. (2004). Beyond money: Toward an economy of well-being. *Psychological Science in the Public Interest, 5,* 1–31.

Diener, E., Suh, E. M., Lucas, R. E., & Smith, H. L. (1999). Subjective well-being: Three decades of progress. *Psychological Bulletin, 125,* 276–302.

Dijkers, M. P. (1997). Quality of life after spinal cord injury: A meta analysis of the effects of disablement components. *Spinal Cord, 35,* 829–840.

Dijkers, M. P. (1999). Correlates of life satisfaction among persons with spinal cord injury. *Archives of Physical Medicine and Rehabilitation, 80*(8), 867–876.

Frederick, S., & Loewenstein, G. (1999). Hedonic adaptation. In D. Kahneman, E. Diener, & N. Schwarz (Eds.), *Well-being: The foundations of hedonic psychology* (pp. 302–329). New York: Russell Sage Foundation.

Frey, B. S., & Stutzer, A. (2004). *Happiness and economics: How the economy and institutions affect human well-being.* Princeton, NJ: Princeton University Press.

Fujita, F., & Diener, E. (2005). Life satisfaction set point: Stability and change. *Journal of Personality and Social Psychology, 88,* 158–164.

Goldberg, D. (1992). *General health questionnaire (GHQ-12*). Windsor, England: NFER–Nelson.

Haisken-De New, J. P., & Frick, R. (2003). *Desktop companion to the German Socio-Economic Panel Study (GSOEP).* Berlin, Germany: German Institute for Economic Research (DIW).

Headey, B., & Wearing, A. (1992). *Understanding happiness: A theory of subjective well-being.* Melbourne, Australia: Longman Cheshire.

Institute for Social and Economic Research, University of Essex. (2004). *British Household Panel Survey: Waves 1–12, 1991–2003* [computer file]. Colchester, England: UK Data Archive [distributor].

Kahneman, D. (1994). New challenges to the rationality assumption. *Journal of Institutional and Theoretical Economics, 150,* 18–36.

Kahneman, D., Krueger, A. B., Schkade, D., Schwarz, N., & Stone, A. (2004). Toward national well-being accounts. *American Economic Review, 94,* 429–434.

Kendler, K. S., Walters, E. E., & Kessler, R. C. (1997). The prediction of length of major depressive episodes: Results from an epidemiological sample of female twins. *Psychological Medicine, 27,* 107–117.

Kline, R. B. (2004). *Beyond significance testing: Reforming data analysis methods in behavioral research.* Washington, DC: American Psychological Association.

Krause, J. S., & Crewe, N. M. (1991). Chronologic age, time since injury, and time of measurement: Effect on adjustment after spinal cord injury. *Archives of Physical Medicine and Rehabilitation, 72,* 91–100.

Lehman, D. R., Wortman, C. B., & Williams, A. F. (1987). Long-term effects of losing a spouse or child in a motor vehicle crash. *Journal of Personality and Social Psychology, 52,* 218–231.

Livneh, H., & Martz, E. (2003). Psychosocial adaptation to spinal cord injury as a function of time since injury. *International Journal of Rehabilitation Research, 26,* 191–200.

Lucas, R. E. (2005). Time does not heal all wounds: A longitudinal study of reaction and adaptation to divorce. *Psychological Science, 16,* 945–950.

Lucas, R. E., Clark, A. E., Georgellis, Y., & Diener, E. (2003). Reexamining adaptation and the set point model of happiness: Reactions to changes in marital status. *Journal of Personality and Social Psychology, 84,* 527–539.

Lucas, R. E., Clark, A. E., Georgellis, Y., & Diener, E. (2004). Unemployment alters the set point for life satisfaction. *Psychological Science, 15,* 8–13.

Lykken, D., & Tellegen, A. (1996). Happiness is a stochastic phenomenon. *Psychological Science, 7,* 186–189.

Lyubomirsky, S., Sheldon, K. M., & Schkade, D. (2005). Pursuing happiness: The architecture of sustainable change. *Review of General Psychology, 9,* 111–131.

Magnus, K., Diener, E., Fujita, F., & Pavot, W. (1993). Extraversion and neuroticism as predictors of objective life events: A longitudinal analysis. *Journal of Personality and Social Psychology, 65,* 1046–1053.

McLeod, J. D., Kessler, R. C., & Landis, K. R. (1992). Speed of recovery from major depressive episodes in a community sample of married men and women. *Journal of Abnormal Psychology, 101,* 277–286.

Patterson, D. R., Everett, J. J., Bombardier, C. H., Questad, K. A., Lee, V. K., & Marvin, J. A. (1993). Psychological effects of severe burn injuries. *Psychological Bulletin, 113,* 362–378.

Raudenbush, S., Bryk, A., & Congdon, R. (2004). *Hierarchical linear and nonlinear modeling (HLM), Version 6.0* [Statistical software]. Lincolnwood, IL: Scientific Software International.

Riis, J., Loewenstein, G., Baron, J., Jepson, C., Fagerlin, A., & Ubel, P. A. (2005). Ignorance of hedonic adaptation to hemodialysis: A study using ecological momentary assessment. *Journal of Experimental Psychology: General, 134,* 3–9.

Rintala, D. H., Robinson-Whelan, S., & Matamoros, R. (2005). Subjective stress in male veterans with spinal cord injury. *Journal of Rehabilitation Research and Development, 42,* 291–304.

Sapolsky, R. M. (1999). The physiology and pathophysiology of unhappiness. In D. Kahneman, E. Diener, & N. Schwarz (Eds.), *Well-being: The foundations of hedonic psychology* (pp. 453–469). New York: Russell Sage Foundation.

Schulz, R., & Decker, S. (1985). Long-term adjustment to physical disability: The role of social support, perceived control, and self-blame. *Journal of Personality and Social Psychology, 48,* 1162–1172.

Schwarz, N., & Strack, F. (1999). Reports of subjective well-being: Judgmental processes and their methodological implications. In D. Kahneman, E. Diener, & N. Schwarz (Eds.), *Well-being: The foundations of hedonic psychology* (pp. 61–84). New York: Russell Sage Foundation.

Seligman, M. E. P., Steen, T. A., Park, N., & Peterson, C. (2005). Positive psychology progress: Empirical validation of interventions. *American Psychologist, 60,* 410–421.

Smith, D. M., Schwarz, N., Roberts, T. R., & Ubel, P. A. (2006). Why are you calling me? How study introductions change response patterns. *Quality of Life Research, 15,* 621–630.

Taylor, M. F., Brice, J., Buck, N., & Prentice-Lane, E. (2004). *British Household Panel Survey user manual: Volume A. Introduction, technical report, and appendices.* Colchester, England: University of Essex.

Tyc, V. L. (1992). Psychosocial adaptation of children and adolescents with limb deficiencies: A review. *Clinical Psychology Review, 2,* 275–291.


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U.K. Department for Work and Pensions. (2006a). *Disability living allowance quarterly statistics.* Retrieved on May 29, 2006, from *http://www.dwp.gov.uk/asd/dla.asp*

U.K. Department for Work and Pensions. (2006b). *Incapacity benefit and severe disablement allowance quarterly summary of statistics.* Retrieved on May 29, 2006, from http://www.dwp.gov.uk/asd/ib_sda.asp

Veenhoven, R. (1995). The cross-national pattern of happiness. Test of predictions implied in three theories of happiness. *Social Indicators Research, 34,* 33–68.

Wilson, W. (1967). Correlates of avowed happiness. *Psychological Bulletin, 67,* 294–306.

Woodrich, F., & Patterson, J. B. (1983). Variables related to acceptance of disability in persons with spinal cord injuries. *Journal of Rehabilitation, 49,* 26–30.

Wortman, C., & Silver, R. (1987). Coping with irrevocable loss. In G. R. Van den Bos & B. K. Bryant (Eds.), *Cataclysms, crises, and catastrophes: Psychology in action* (pp. 189–235). Washington, DC: American Psychological Association.

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