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What Happens to People After Moderate and Serious Disability?

A Longitudinal Study of Satisfaction with Different Areas of Life

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Abstract

The current study uses a large British panel data set to examine the impact of disability, and the speed and extent of adaptation to disability, in seven domain satisfactions. Results show that the onset of a severe disability has the most detrimental impact on health, income, and social life in that order. Adaptation in the domain satisfactions is complete for the moderately disabled. However, there is little evidence of adaptation to severe disability in any of the affected domains. Finally, this paper proposes van Praag et al's (2003) two-layer model as an alternative way to study adaptation.

Key words: Disability; Adaptation; Domain satisfactions; Life satisfaction; Focusing effects.

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1. Introduction

Perhaps one of the most provocative findings in well-being literature comes from studies that find only small differences in the reported life satisfaction or happiness between people with serious physical disabilities – such as paraplegics and hemodialysis patients – and normal control subjects (Brickman, Coates, & Janoff-Bulman, 1978; Sackett & Torrance, 1978; Riis et al., 2005). The highly counterintuitive result – one would expect people with a disability to be miserable with their lives – has further been bolstered by a handful of longitudinal studies that follow the well-being of chronically ill patients through time. For example, Silver (1982) finds that the affective experiences of paraplegics are significantly improved only a few weeks after their accidents. More recently Oswald and Powdthavee (2008), using large longitudinal data sets, showed that people can recover up to 30% of their well-being loss in only three years after first becoming severely disabled. What these observations indicate is that patients are highly adaptable to their situation (see Frederick & Lowenstein, 1999; Groot, 2000; Easterlin, 2005).

There is little theoretical work in this area. Graham and Oswald (2005) use the concept of hedonic capital to explain how *hedonic adaptation* – to use the Frederick and Lowenstein (1999) term – occurs. The two economists show how adaptation emerges from a model of evolution in which Nature 'rationally' uses happiness as a device to make agents value their lives efficiently. Rayo and Becker (2007) liken hedonic adaptation to the ability of the human eye to adjust quickly to changes in the amount of light. The two economists sketch out a model of how Nature might have optimally designed human beings' emotional responses to behave in the same way.

Psychologists, on the other hand, argue that hedonic adaptation is not reducible to the type of adaptation found in the sensory systems. An early psychological model of adaptation was built around the idea that human beings are endowed with happiness set points. According to this theory, people initially react to events, but then return to baseline factors that are determined by personality factors (Brickman & Campbell, 1971; Headey & Wearing, 1992).

While useful as a benchmark, the set-point theory does not explain why some people adapt much more quickly to some life events than others. For example, longitudinal evidence has shown that people are unlikely to adapt completely to unemployment (Lucas et al., 2004; Clark et al, 2008), divorce (Lucas, 2005), and disability (Lucas, 2007; Oswald & Powdthavee, 2008), whereas adaptation is more likely to be complete for income (Burchardt, 2005; Di Tella et al,, Haisken-DeNew, & MacCulloch, 2007) and marriage (Lucas & Clark, 2006). It also does not explain why people adapt more to an increase in income compared to a decrease in income (Ferrer-i-Carbonell & van Praag, 2008). In an attempt to explain such variation in the longitudinal findings, Schkade and Kahneman (1998) propose an idea in which adaptation occurs from a reduction of attention from the new circumstance. In the paraplegic case, adaptation occurs when patients' attention is withdrawn from their conditions: spinal-cord injury patients are likely at the beginning to think about their new circumstances many times each day, but the allocation of attention eventually changes, so that they spend most of their time attending to daily experiences such as having breakfast or watching TV (Kahneman et al., 2006). The extent and speed of withdrawal of attention varies, however, from experience to experience (Wilson & Gilbert, 2008; Dolan & Kahneman, 2008). For example, one reason why people adapt to a rise in income much faster than they do with the onset of a severe disability is simply because money is largely in the background, whereas being seriously disabled is full-time. We do not spend most of our waking moments thinking about how

much money we have in the bank. However, we may still be reminded about our disability from time to time if it incapacitates us from doing day-to-day activities such as climbing stairs or getting dressed by ourselves.

According to this line of reasoning, the speed and extent of patients' ability to adapt will depend largely on what they are focusing on when prompted to answer a global judgment question such as "How satisfied are you with your life these days?" Little is known, however, about how disability affects the way we response to the above life satisfaction question. Which domains of a person's life are most and least affected by the onset of a disability? Will adaptation occur in all affected life domains, and how does this shape the extent and speed of the overall adaptation in the life satisfaction scale? One could hypothesize that the evidence of adaptation in life satisfaction found in previous studies is merely a reflection of adaptation in spheres of life other than health. A paraplegic may still attend to her conditions when prompted with a question about her health, leading to little adaptation in the health domain, even some several years after her accident. However, the focus on her loss of earnings and/or her social life as a result from becoming a paraplegic may have shifted away from what it used to be a few years ago. These are important questions which have never been explored in previous studies before.

The current study uses a nationally representative longitudinal data of British households to determine which domain-specific life satisfactions are most and least affected by the onset of a disability. Empirical evidence in this area is scarce. Of the few existing cross-sectional studies, social relationships and income seem to be the domains that disabled people are least satisfied with (Kemmler et al., 1997; Post et al., 1998; Anderson and Vogel, 2003). No attempts have been made to replicate the findings using a longitudinal data set.

A second purpose of the study is to determine which domain-specific life satisfaction is adaptation after disability complete, partial, or non-existent. One hypothesis is that adaptation will be slowest and less complete in the domains where disability is most salient – like in health, for example. To the best of my knowledge, no study has examined the speed and extent of different aspects of adaptation to disability, let alone adaptation in the domain satisfactions of any kind.

And finally, I examine how hedonic adaptation (or adaptation in global life satisfaction) after disability can be determined by changes in different domain-specific life satisfactions. This is different from the assumption adopted by other papers in the literature; previous cross-sectional and longitudinal studies assume disability to have a direct impact on life satisfaction (Lucas, 2007; Oswald & Powdthavee, 2008). In other words, previous studies assumed that life satisfaction function would not have, say, health satisfaction as an argument but the underlying variables which determine health, e.g. the disability variables. This model would give difficulties, however, for disability may have a different effect on different life domains and the balance effect on global life satisfaction is difficult to measure and interpret. For example, disability may be assumed to have a negative effect on health but a positive effect on the amount of free time. Therefore, in order to get a more exact picture of hedonic adaptation in the global life satisfaction scale, this paper adopts a two-layer model outlined in van Praag et al (2003) in which disability affects life satisfaction via its effects on the domain satisfactions.

2. Implementing a test

2.1 Data

The data in this study comes from Waves 6-10 and Waves 12-15 of the British Household Panel Survey (BHPS). Wave 11 is omitted from the analysis as it does not contain a set of questions on domain-specific and global life satisfactions. This is nationally representative of British households, contains over 10,000 adult individuals, and has been conducted between September and Christmas of each year from 1991 (Taylor et al., 2002). The paper draws on two survey questions in the BHPS. These are:

(i) *What describes your current situation … long term sick or disabled?*

(ii) *Does your health in any way limit your daily activities compared to most people your age?*

One empirical category that this paper employs is "disabled but able to do day-to-day activities including housework, climbing stairs, dressing oneself, and walking for at least 10 minutes". I denote this as Moderately Disabled. The other, even more fundamentally impaired, category is "disabled and unable to do at least one of the above day-to-day activities". This group is termed as the Seriously Disabled.

In addition to answering the question on disability, participants are also asked to indicate how satisfied they were with their health, income, housing, partner, job, social life, amount of leisure time, and use of leisure time, using a scale that ranged from 1 (least satisfied) to 7 (most satisfied). Participants are then asked to indicate, immediately after the domain satisfaction questions, how satisfied they are with their life overall. Only those who answered the domain satisfaction questions, including the global life satisfaction, are used in the analysis. This includes all unmarried individuals who reported some values when prompted to

answer the partner satisfaction question. The full unbalanced sample consists of 53,023 observations (11,121 individuals). Of those, 610 observations (452 individuals) are in the Moderately Disabled category. There are 1,560 observations (581 individuals) in the Seriously Disabled category. It might seem surprising that the Severely Disabled outnumber the less seriously disabled, but that is because all these individuals are sufficiently incapacitated that they cannot work, and this is more commonly accompanied by some extreme physical handicap. Note that only 9% of those who are disabled report some values for job satisfaction. As a result, the final sample is not conditioned on whether the person also reports a level for job satisfaction. A summary of descriptive statistics are reported in Table 1.

2.2 Empirical strategy

The idea for empirical strategy is that if there is adaptation to disability then we should observe that disability hurts, but that it does so to a smaller degree the longer the individual has been disabled (Oswald & Powdthavee, 2008). To test this hypothesis on the seven different domain satisfactions (all except for job satisfaction), this paper assumes a cardinalisation of the domain satisfaction variables, *DS*, and estimates the following equation:

$$DS_{jit} = \alpha_{1j} MD_{jit} + \alpha_{2j} MD_{jit-1} + \alpha_{3j} MD_{jit-2} + \alpha_{3j} MD_{jit-3} + \alpha_{4j} MD_{jit-4} + \alpha_{5j} MD_{jit-5} + \beta_{1j} SD_{jit} + \beta_{2j} SD_{jit-1} + \beta_{3j} SD_{it-2} + \beta_{3j} SD_{jit-3} + \beta_{4j} SD_{jit-4} + \beta_{5j} SD_{jit-5} + X'_{jit}\delta + \varepsilon_{jit}, \quad (1)$$

where j = 1…7; i = 1…N; t = 1…T. The dependent variable, DS_{jit}, is recorded on the 1 to 7 scale. The variables MD_{jit} and SD_{jit} are dummy variables representing the moderately disabled (able to do day-to-day activities) and the seriously disabled (unable to do day-to-day activities) at t. The variable X_{jit} denotes a vector of standard personal and household controls,

including age-squared, income, marital status, employment status, education, household size, the number of dependent children (age<16), and year dummies (see, e.g., Ferrer-i-Carbonell & Frijters, 2004). The parameter ε_{it} is the error term. Instead of entering a proportion of time spent being disabled in the past (as in Oswald & Powdthavee, 2008), this paper splits each of the moderately disabled and the seriously disabled up to five groups: those who were disabled at *t*-1, *t*-2, *t*-3, *t*-4 and *t*-5.

The above set-up allows us to carry out simple tests of the speed and extent of adaptation in each of the seven domain satisfactions. For example, the effect of becoming seriously disabled for the first time ($SD_{jit} = 1$, and all of the lagged "*SD*" variables equal to zero) upon health satisfaction (*j*=1) is represented by the coefficient β_{11}. If by becoming seriously disabled for the first time leads to a decrease in the level of health satisfaction for the individuals, then we would expect β_{11} to be negative and statistically significant. If, on the other hand, the individuals have been seriously disabled for two consecutive years (i.e. $SD_{jit} = 1$ and $SD_{jit-1} = 1$, and all of the lagged "*SD*" variables equal to zero) and that there is no adaptation to severe disability in the health domain after two years of being disabled, then we would expect the effect of current disability to be negative and significant (β_{11}<0), and the effect of past disability at t-1 (i.e. β_{21}) to be statistically insignificant. However, if there is adaptation – and adaptation is complete within two years of being disabled – then we would expect the effect of past disability at t-1 to be positive and significant (β_{21}>0), and that the sum between β_{11} and β_{21} is equal to zero: being disabled for two years is the same as not being disabled at all. Equation (1) thus allows us to test for the speed and extent of adaptation to disability of up to six consecutive years of being disabled (for a discussion of a similar model used to test for adaptation effects, see Clark et al, 2008). Note that the sample contains

475 individuals who were seriously disabled from t-5 to t-1. On the other hand, there are only 11 individuals who were moderately disabled from t-5 to t-1, which suggests that most people recovered from moderate disability within a few years.

Each domain satisfaction equation is estimated separately using a standard fixed effects 'within' estimator, which allows us to compare, for example, the satisfaction of those who have been disabled for 2 years (i.e. from t-1 to t) to the satisfaction scores reported by the same individuals in their first year of becoming disabled. One advantage of the individual fixed effects approach over the multi-level approach often used in the analysis of adaptation by psychologists (Lucas et al., 2004; Lucas, 2007) is that it completely removes the stable personality factors from biasing the welfare impact of disability in the analysis. Some people are born with persistent personality traits that make them happy. These predispositions, noted by Headey (2006), are also likely to determine the type of life events the person will be experiencing in her life time. For example, satisfaction scores tend to be higher among extroverts. However, they are also more likely to engage in risky behaviors and, as a result, are more prone to accidents than less extravert individuals. The positive correlations between (a) personality traits and self-rated satisfaction scores and (b) between personality traits and the likelihood of becoming disabled mean that failure to allow for such heterogeneity will lead to an overestimation of the true impact of disability on subjective well-being in general.

In order to explain satisfaction with life overall, I follow van Praag et al's (2003) description of a two-layer model, which is illustrated in Figure 1, and their empirical strategy, and estimate the following global life satisfaction, *GS*, equation by a fixed effects 'within' estimator:

$$GS_{it} = \gamma_1 DS_{1it} + ... + \gamma_7 DS_{7it} + \lambda Z_{it} + \eta_{it}. \quad (2)$$

Like the *DS* variables, the dependent variable *GS* is also measured on the 1 to 7 scale. As in van Praag et al (2003), I introduce an auxiliary variable Z in the *GS* equation. This is because, despite our ability to control for unobserved heterogeneity in the fixed effects estimation, there may still be a time-varying element which influences both *DS* and *GS*. For example, a random shock in life events such as death of a loved one may affect both *DS* and *GS* simultaneously. If such a factor is present, it will be included in the error terms of the *DS* and in the error term of the *GS*. In that case the explanatory variables *DS* will be correlated with the *GS*-error term, which will result in an endogeneity bias. Hence, we will have to construct an additional variable Z, which represents the latent time-varying shocks. More precisely, we may assume:

$$\eta_{it} = \theta_j \hat{Z}_{jit} + \varepsilon_{jit}, \quad (3)$$

where the variable $\hat{Z}_{jit}$ is present in each domain error term with a domain specific effect θ_j. To construct this variable Z_{it}, which varies proportionately with the latent $\hat{Z}_{jit}$, I adopt the following method. After estimating the seven DS equations, I calculate its residuals in order to estimate the part *Z* that is common to all the residuals. This is defined as the first principal component of the (7×7) error covariance matrix. By adding this *Z* as an additional explanatory variable to the *GS* equation, we may assume that the remaining *GS*-error is no longer correlated with the *DS*-errors and that the estimators of the coefficients in (2) do not suffer from endogeneity bias. This approach is similar to the error-correction model proposed by Heckman (1976). And because the introduction of the *Z* variable eliminates the covariance

between the *GS*-error and the *DS*-errors, we may deal with the recursive system under the assumption that the error covariance matrix is diagonal (see, e.g., Greene (2000), p.675).

Using the estimates obtained from equation (2), we can calculate how adaptation in different domains determines the speed and extent of adaptation in the global life satisfaction scale. For instance, imagine that there is no adaptation to serious disability in the health domain even after six years of being disabled (i.e. change in health satisfaction<0), but there is a continuing increase in the individual's satisfaction with the amount of leisure time during that six years (i.e. change in satisfaction with the amount of leisure time>0). The shape of the hedonic adaptation will therefore depend on the relative weight between health satisfaction and satisfaction with the amount of leisure time in the *GS* equation. Equation (2) thus gives a picture of the complex phenomenon of hedonic adaptation to disability.

3. Results

Results from the fixed effects 'within' domain satisfaction equations (Eq.1) are reported in Table 2. The first column gives the estimates for the health satisfaction equation. The other columns give the corresponding estimates for income satisfaction, housing satisfaction, partner satisfaction, satisfaction with social life, satisfaction with the amount of leisure time, and satisfaction with the use of leisure time, respectively.

An examination of the effect of current disability upon health satisfaction shows that, *ceteris paribus,* becoming Moderately Disabled for the first time leads individuals to report around 0.2 health satisfaction point less than the able-bodied. The onset of a severe disability, on the

other hand, lowers health satisfaction for the individual by approximately 0.9 point on average.

Consistent with previous cross-sectional studies, disability also has a negative and consistent effect – in that the coefficients on moderately disabled and seriously disabled are both negative and significant at conventional confidence levels – on satisfactions with income, social life, and the use of leisure time. The largest drop in well-being, however, is reserved for the health domain, at least for the Seriously Disabled. For example, becoming Seriously Disabled for the first time leads individuals to report 0.9 point less than when they were able-bodied. This is equivalent to around 58% of the standard deviation in the health satisfaction. The implied effect on health satisfaction is significantly larger than the drops experienced by the same individuals in the income domain (29% of the standard deviation), the social life domain (19% of the standard deviation), and the use of leisure time domain (8% of the standard deviation). Perhaps unsurprisingly, the Seriously Disabled are almost half a point statistically significantly more satisfied with the amount of leisure time compared to the time when they were not disabled; individuals who became incapacitated for the first time will start finding themselves with more free-time than what they used to have when they were able-bodied.

There is some evidence that individuals become less satisfied with their partner as they become disabled. The Moderately Disabled report 0.09 point lower satisfaction with partners than the able-bodied. However, the same pattern is not picked up for the Seriously Disabled, which suggests that perhaps partners help in taking care of the severely disabled more. On the other hand, both moderate and severe disability variables do not appear to have a significant effect on housing satisfaction. Together, these results indicate that disability has a differential

impact on the different aspects of life. Judging by the absolute size of the estimated coefficients, health satisfaction receives the largest shock at the year of becoming seriously disabled, followed by leisure time (amount), income, social life, leisure time (use of), housing and partner. For the moderately disabled, health satisfaction continues to receive the largest shock from the onset of a disability, followed by income, leisure time (amount), social life, leisure time (use of), housing and partner.

Is there adaptation to disability in each of the affected domain-specific life satisfactions? If there is adaptation to disability, then we would expect some – if not all – of the coefficients on lagged disability to be positive and significant. Looking at the health satisfaction equation, we can see that the coefficients on lagged Moderately Disabled are positive and statistically significant at lags t-3 and t-5, suggesting that adaptation to moderate disability first occurs at the fourth year of disability and, again, at the sixth year of disability. Adaptation is complete after the first four years of being moderately disabled; the null hypothesis of complete adaptation cannot be rejected at conventional confidence levels, i.e. the sum of health satisfaction coefficients up to t-3 is $-0.180+(-0.011-0.030+0.202)=$ approximately -0.02, with a standard error of 0.158.

For those with severe disability, heath satisfaction continues to drop in the second year of being disabled and shows no sign of improvement until the fourth year of disability. In contrast to the Moderately Disabled, the long run effect of being seriously disabled is given by $-0.874+(-0.100-0.063+0.112+0.022+0.005)$ = approximately -0.89, thus suggesting that there is no long-term adaptation in the health domain to serious disability. This is consistent with Schkade and Kahneman's (1998) notion of focusing effect: people with serious disability are more likely to be reminded about their incapacitating state compared to

those with only mild disability each time they are prompted to answer a health satisfaction question, leading to slow and incomplete adaptation in the health domain.

The implied well-being effects after any adaptation to disability in other domains are reported at the bottom of Table 2. For illustrative purposes, the predicted levels of domain satisfactions before and after the onset of a disability, based on Table 2's estimates, are also shown in Figure 2. The Moderately Disabled seem to be able to adapt completely to the initial drop in the income satisfaction after spending six years in disability. Adaptation is only partial for the Seriously Disabled; the estimated order of adaptation in the income domain is approximately 56%, i.e. $-0.433+(-0.024+0.103+0.071-0.011+0.051)$ = -0.24, with a standard error of 0.109.

Adaptation in the social life domain is complete within two years of being moderately disabled; the hypothesis of complete adaptation cannot be rejected at conventional confidence levels, i.e. $-0.193+0.144$ = approximately -0.05, with a standard error of 0.084. There is no adaptation, however, in the social life domain for the Seriously Disabled; the long run effect of disability is $-0.269+(-0.052-0.034+0.014-0.088+0.089)$ = approximately -0.34, with a standard error of 0.101. This result thus implies that serious disability starts out bad – in that it limits either the amount or the quality of social life for the individuals – and then gets a little worse over the years. Satisfaction with the amount of leisure time continues to rise after the initial increase in the first year of becoming disabled for those with severe disability. Adaptation in the use of leisure time appears to be complete within the first two years of being moderately disabled. Finally, it appears that we cannot also reject the hypothesis of complete adaptation in the use of leisure time domain for the Seriously Disabled.

Table 2's findings with respect to the initial effects of becoming either moderately disabled or seriously disabled for the first time and whether there is adaptation in each of the seven domain-specific life satisfactions are summarized in Table 3. It is worth mentioning here that all of the estimated coefficients on the control variables have the expected signs (see van Praag et al. 2003). Table 2's results can also be replicated with ordered estimators (see, e.g., Ferrer-i-Carbonell & Frijters, 2004). But, as in Oswald and Powdthavee (2008), as a pedagogical device and for ease of reading the cardinal methods are preferred here. In addition to this, Table 2's results can also be replicated with a Seemingly Unrelated Regression (SUR) estimator that allows the error terms to be correlated across the seven equations. Both ordered probit and SUR results can be supplied on request.

To be sure that such results are not being driven by individuals who are in the panel only briefly, Table 4 re-do the estimations on a smaller balanced panel. Despite some notable increases in the standard errors, the size of the estimated coefficients remains virtually unchanged. A similar conclusion can also be made with regards to the speed and extent of adaptation to both moderate and severe disability, which suggests that it makes virtually no difference whether a balanced or an unbalanced panel is used in this paper's analysis.

What are the implications of the above findings on the extent and speed of adaptation in the global life satisfaction scale? Table 5 attempts to answer this question by estimating a within regression of life satisfaction with seven domain satisfactions as the explanatory variables (Eq.2). Here, we assume that disability enters the life satisfaction function indirectly via its effects on the seven domain satisfactions.

Consistent with van Praag et al (2003), global life satisfaction is indeed an amalgam of various domain satisfactions. All of the *DS* coefficients are positive, statistically significant at the 1% level, and are in this order: partner satisfaction (0.182), social life satisfaction (0.160), use of leisure time satisfaction (0.148), health satisfaction (0.132), income satisfaction (0.097), amount of leisure time satisfaction (0.068), and housing satisfaction (0.066). Here, an increase of health satisfaction by one point increases the overall life satisfaction by 0.132 point, whereas a one-point increase in housing satisfaction would only increase life satisfaction by 0.068. It may be that there are other determinants of *GS*, such as neighborhood satisfaction and health of children, but information on those aspects are not available in the BHPS. The instrument, *Z*, is negative but statistically insignificant, which suggests that there is no statistically important underlying correlation between *GS*-error term and the *DS* variables.

By using these numbers, we can in principle calculate how disability, once enters into each of the domain-specific life satisfactions, can affect the overall life satisfaction outcome. For instance, the onset of a serious disability, holding other things constant, leads to a decrease in health satisfaction by 0.874 point (see the first column of Table 2), which would then result in a decrease in the global life satisfaction by $0.874 \times 0.132 = 0.115$ point. In the second year of being seriously disabled, however, the effect of disability upon health satisfaction is given by $-0.874 + (-0.100) = -0.974$, which is equivalent to a decrease in the global life satisfaction of $0.974 \times 0.132 = 0.128$ point. The net effect from being seriously disabled for the first time to being seriously disabled for the second consecutive year on GS is therefore -0.015.

The above calculations, along with other calculations obtained for each of the seven domain satisfactions, are plotted in Figure 3 for those individuals who became disabled at T and remained disabled to T+5. The heavy lines represent the predicted life satisfaction obtained from Table 3's *indirect* model of adaptation. The dotted lines, on the other hand, represent the predicted life satisfaction obtained from a *direct* model of adaptation, i.e. by estimating Eq.1 on *GS* directly (see the appendix for the point estimates). In other words, the direct model is estimated in the same spirit as the ones estimated by Oswald and Powdthavee (2008) and Clark et al (2008).

There are some interesting patterns that emerge from this analysis. Firstly, as would be expected, the effect of becoming disabled for the first time is clearly negative in both direct and indirect models. The results are also consistent with Oswald and Powdthavee (2008) in that the initial effect is much more negative for the Seriously Disabled compared to the Moderately Disabled. However, the drop in the life satisfaction is considerably larger in the direct model compared to the indirect model. One reason for this may be because, in the indirect model, we also have the satisfaction with the amount of leisure time, which disability has a positive effect upon, as an argument.

Secondly, there is complete adaptation for the Moderately Disabled in both direct and indirect models. However, the time that it takes for adaptation to complete is different between the two models: adaptation to moderate disability is complete after six years in the direct model and four years in the indirect model.

Finally, whilst there is evidence of partial adaptation to disability in the direct model for the Seriously Disabled (i.e. the estimated adaptation is in the order of 24% after six years), the

indirect model predicts a much lower adaptation rate of only 2% after six years. This can partly be explained by the evidence of no adaptation in both health and social life domains from the onset of a severe disablement. And since both domains are two of the most important determinants of *GS*, it is perhaps not surprising that we find no adaptation in global life satisfaction scale even after spending six years being seriously disabled. Conversely, adaptation is much more difficult to interpret in the direct model as we do not allow for the different effects of disability on domain satisfactions to be incorporated into the estimation process.

4. Conclusion

To imagine what life must be like to be disabled is an extremely difficult thing to do if we have never experienced disability (or known anybody who is disabled) before. One reason for this is because we tend to focus our attention on what it must be like to *become* disabled rather than *being* disabled, and, as a result, we fail to anticipate the shift of attention for a disabled person when the event of disability becomes a state of disability (Schkade & Kahneman, 1998). Are these observations made by outsiders completely wrong? Do we miss a large part of what disabled people are thinking about when they are asked to assess how happy they are with their life? Currently little is known about the impact of disability on different domain satisfactions and, in turn, global judgment of life satisfaction.

The current study used a nationally representative longitudinal sample of British people to study the impact of the onset of a disability and the speed and extent of adaptation after disability in different domains of life. Consistent with what attention theory would predict, the onset of a severe disability was found to have the most detrimental impact on health

satisfaction, followed by less salient aspects which are income, social life, the use of leisure time, housing and partner. Becoming seriously disabled had a positive impact on satisfaction with the amount of leisure time.

The results also provide strong evidence of adaptation in each of the affected domain satisfactions for the Moderately Disabled. Adaptation is much slower and significantly less complete, however, for the Seriously Disabled. There is no adaptation in the health domain for those who are seriously disabled and, to make matters worse, there is also a decline in the quality of their social life over the years. Their only two consolations come in the forms of partial adaptation to the initial shock in the income domain and the rising satisfaction with the amount of leisure time in the years following their first encounter with disability.

Although adaptation is the preferred interpretation of this paper's results, other explanations are possible. One objection in particular is that human beings may alter their reported satisfaction score, artificially, after becoming disabled merely because their reference level alters. A disabled person may, for instance, have changed her reference point and started comparing herself only with other disabled people (Groot, 2000) or that she may have changed her end points on each scale (Lacey et al, 2004). There is probably no way to reject such a claim definitely, but one objection to it is that in our data there was a continuing negative effect from longstanding disability on most self-reported satisfaction scores; this seems inconsistent with the claim that disabled people fundamentally shift to a different scale of reference. Also, as a variant, re-doing this paper's analysis - using a so-called GHQ psychiatric taken from the same data set - also showed a bounce back in mental well-being.

Finally, this paper offers a new way to think about adaptation. By allowing different domain satisfactions to explain global life satisfaction, we have perhaps for the first time an empirical model that can explain *how* hedonic adaptation takes place. Future research should use the same approach to investigate the underlying mechanisms of adaptation in other life events such as marriage and unemployment.

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Table 1: Descriptive Statistics, BHPS 1996-2005

Variables	M	SD	Range
Health satisfaction	4.991	1.541	1-7
Income satisfaction	4.648	1.505	1-7
Housing satisfaction	5.442	1.372	1-7
Partner satisfaction	6.190	1.217	1-7
Social life satisfaction	4.976	1.416	1-7
Leisure time (amount) satisfaction	4.745	1.607	1-7
Leisure time (use of) satisfaction	4.895	1.486	1-7
Life satisfaction	5.302	1.200	1-7
Moderately disabled at t	0.011	0.106	0-1
Moderately disabled at t-1	0.011	0.105	0-1
Moderately disabled at t-2	0.004	0.062	0-1
Moderately disabled at t-3	0.007	0.082	0-1
Moderately disabled at t-4	0.006	0.079	0-1
Moderately disabled at t-5	0.007	0.083	0-1
Seriously disabled at t	0.029	0.169	0-1
Seriously disabled at t-1	0.028	0.166	0-1
Seriously disabled at t-2	0.029	0.168	0-1
Seriously disabled at t-3	0.028	0.165	0-1
Seriously disabled at t-4	0.026	0.158	0-1
Seriously disabled at t-5	0.022	0.146	0-1
N=53,025			

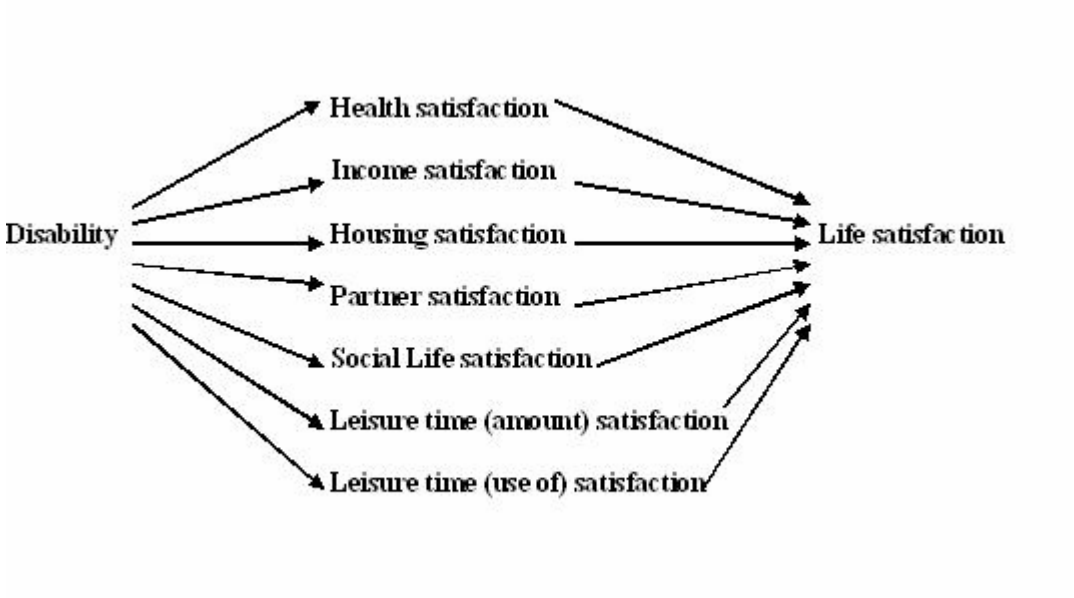

Figure 1: The two-layer model (van Praag et al, 2003).

Table 2: Fixed effects 'within' domain satisfaction regression equations with lagged disability variables up to t-5, BHPS 1996-2005 (unbalanced panel)

Parameters	Health	Income	Housing	Partner	Social life	Leisure (amount)	Leisure (use of)
Moderately disabled at t	-0.180	-0.270	-0.043	-0.085	-0.193	0.064	-0.099
	[0.057]**	[0.057]**	[0.055]	[0.047]+	[0.053]**	[0.059]	[0.056]+
Moderately disabled at t-1	-0.011	-0.078	-0.012	-0.023	0.144	0.155	0.108
	[0.058]	[0.058]	[0.056]	[0.048]	[0.054]**	[0.061]*	[0.058]+
Moderately disabled at t-2	-0.030	-0.209	0.090	0.015	-0.045	-0.150	0.038
	[0.093]	[0.093]*	[0.090]	[0.077]	[0.086]	[0.097]	[0.092]
Moderately disabled at t-3	0.202	0.120	0.065	-0.084	0.104	-0.021	0.151
	[0.070]**	[0.070]+	[0.067]	[0.057]	[0.064]	[0.073]	[0.069]*
Moderately disabled at t-4	0.087	0.219	0.099	0.035	0.077	0.116	0.089
	[0.071]	[0.071]**	[0.068]	[0.058]	[0.066]	[0.074]	[0.070]
Moderately disabled at t-5	0.192	0.160	0.159	0.021	0.074	-0.086	-0.105
	[0.068]**	[0.068]*	[0.065]*	[0.056]	[0.063]	[0.071]	[0.067]
Seriously disabled at t	-0.874	-0.433	-0.029	-0.013	-0.269	0.448	-0.115
	[0.050]**	[0.050]**	[0.049]	[0.041]	[0.047]**	[0.053]**	[0.050]*
Seriously disabled at t-1	-0.100	-0.024	0.043	0.024	-0.052	-0.001	-0.030
	[0.050]*	[0.050]	[0.048]	[0.041]	[0.046]	[0.052]	[0.049]
Seriously disabled at t-2	-0.063	0.103	-0.058	0.016	-0.034	0.114	0.009
	[0.053]	[0.053]*	[0.051]	[0.043]	[0.049]	[0.055]*	[0.052]
Seriously disabled at t-3	0.112	0.071	0.032	-0.028	0.014	-0.061	-0.022
	[0.050]*	[0.051]	[0.049]	[0.041]	[0.047]	[0.053]	[0.050]
Seriously disabled at t-4	0.022	-0.011	0.081	-0.038	-0.088	0.046	-0.030
	[0.051]	[0.051]	[0.050]	[0.042]	[0.048]+	[0.054]	[0.051]
Seriously disabled at t-5	0.005	0.051	-0.024	-0.007	0.089	0.007	0.060
	[0.051]	[0.051]	[0.049]	[0.042]	[0.047]+	[0.053]	[0.050]
The implied well-being effects after any adaptation to disability							
6 years of being mildly disabled	0.259	-0.058	0.357	-0.121	0.160	0.077	0.181
	(0.203)	(0.202)	(0.195)+	(0.166)	(0.187)	(0.211)	(0.200)
6 years of being seriously disabled	-0.898	-0.242	0.044	-0.045	-0.339	0.554	-0.128
	(0.109)**	(0.109)*	(0.105)	(0.089)	(0.101)**	(0.113)**	(0.107)
Age-squared/100	-0.016	0.021	-0.016	0.002	-0.029	-0.034	-0.022
	[0.006]*	[0.006]**	[0.006]**	[0.005]	[0.006]**	[0.007]**	[0.006]**
Log of real household income per capita	-0.007	0.223	0.050	0.014	0.030	-0.036	0.003
	[0.012]	[0.012]**	[0.011]**	[0.010]	[0.011]**	[0.012]**	[0.012]
Living as a couple	-0.005	-0.035	-0.058	0.052	0.078	0.044	0.042
	[0.032]	[0.032]	[0.031]+	[0.026]*	[0.030]**	[0.034]	[0.032]
Widowed	-0.101	-0.226	-0.254	-0.322	0.038	-0.214	0.138
	[0.159]	[0.159]	[0.154]+	[0.131]*	[0.148]	[0.166]	[0.157]
Divorced	-0.016	-0.348	-0.260	-0.149	0.042	0.011	0.033
	[0.069]	[0.069]**	[0.067]**	[0.057]**	[0.064]	[0.072]	[0.068]
Separated	-0.032	-0.495	-0.380	-1.689	-0.034	-0.055	-0.012
	[0.075]	[0.075]**	[0.072]**	[0.061]**	[0.069]	[0.078]	[0.074]
Never married	-0.045	0.034	0.056	-0.319	0.375	0.264	0.284
	[0.046]	[0.046]	[0.044]	[0.038]**	[0.042]**	[0.048]**	[0.045]**
Unemployed	-0.079	-0.849	-0.070	-0.041	-0.193	0.498	-0.039
	[0.040]*	[0.040]**	[0.039]+	[0.033]	[0.037]**	[0.042]**	[0.040]
Self-employed	0.075	0.001	-0.034	-0.002	-0.019	-0.004	-0.058
	[0.031]*	[0.031]	[0.030]	[0.026]	[0.029]	[0.033]	[0.031]+
Retired	-0.003	-0.211	0.087	0.031	0.027	0.780	0.223
	[0.031]	[0.032]**	[0.030]**	[0.026]	[0.029]	[0.033]**	[0.031]**
Not active in the labour market	-0.047	-0.235	0.036	0.052	-0.128	0.262	0.006
	[0.025]+	[0.025]**	[0.025]	[0.021]*	[0.024]**	[0.027]**	[0.025]

Completed first degree	-0.024	0.048	-0.157	0.084	-0.282	-0.151	-0.280
	[0.067]	[0.067]	[0.064]*	[0.055]	[0.062]**	[0.070]*	[0.066]**
Completed higher degree	-0.110	-0.108	-0.238	0.107	-0.292	-0.065	-0.114
	[0.131]	[0.132]	[0.127]+	[0.108]	[0.122]*	[0.137]	[0.130]
Household size	-0.019	-0.001	-0.026	-0.046	-0.032	-0.088	-0.070
	[0.010]+	[0.010]	[0.010]*	[0.009]**	[0.010]**	[0.011]**	[0.010]**
Number of dependent children (age < 16)	0.025	0.011	0.001	-0.007	-0.107	-0.107	-0.068
	[0.014]+	[0.014]	[0.013]	[0.011]	[0.013]**	[0.014]**	[0.014]**
Constant	5.558	2.202	5.344	6.236	5.565	5.863	5.615
	[0.175]**	[0.175]**	[0.169]**	[0.143]**	[0.162]**	[0.183]**	[0.173]**
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Within R-squared	0.027	0.035	0.007	0.024	0.020	0.027	0.013
Observations	53023	53023	53023	53023	53023	53023	53023
Number of person	11121	11121	11121	11121	11121	11121	11121

Note: +<10%, *< 5%, ** < 1%. Standard errors are in parentheses.

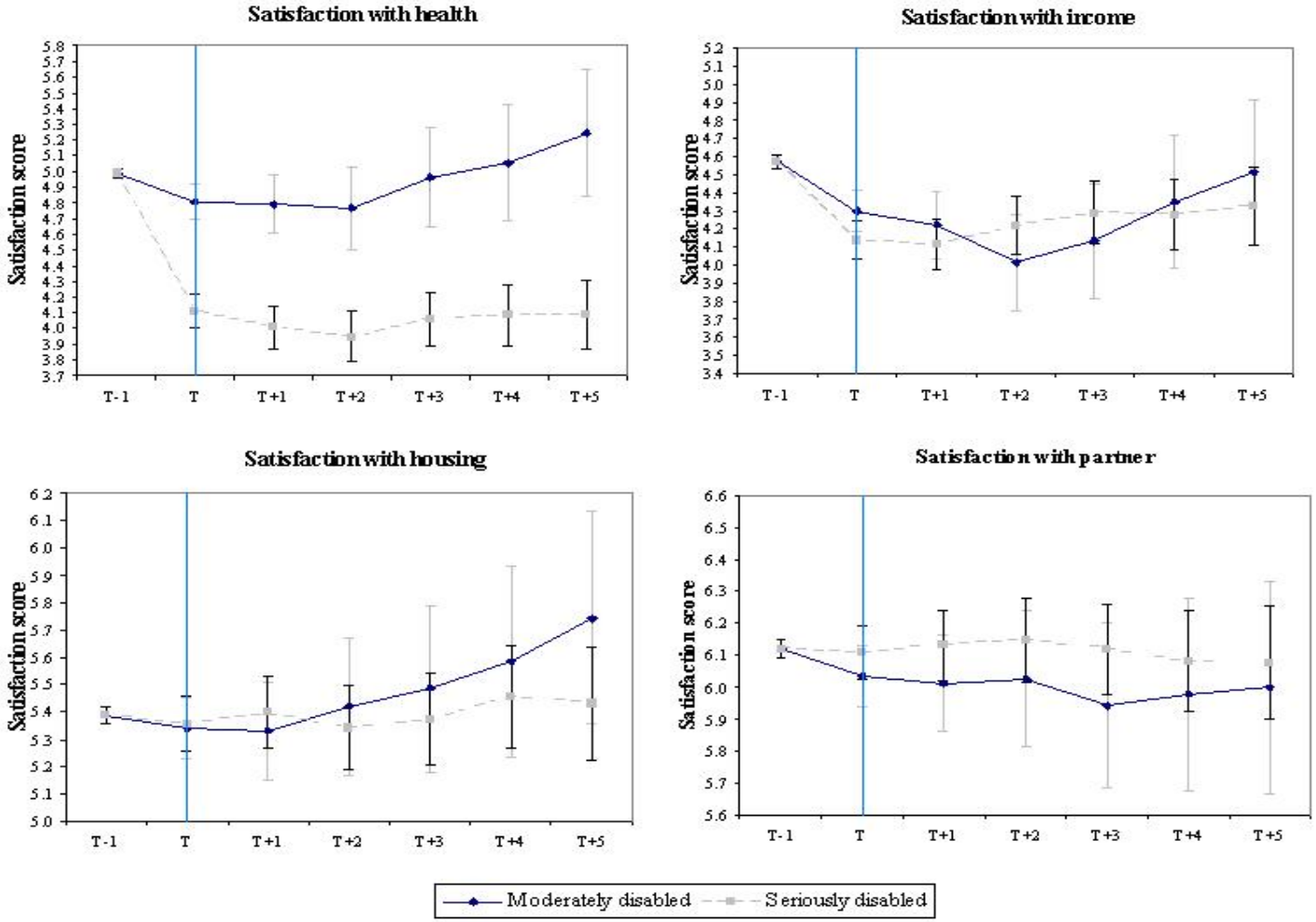

Figure 1: Predicted domain satisfaction after disability. The vertical line (T) indicates the year of disability. 4-standard-error bands (95% C.I.) are reported: two s.e. above and two below.

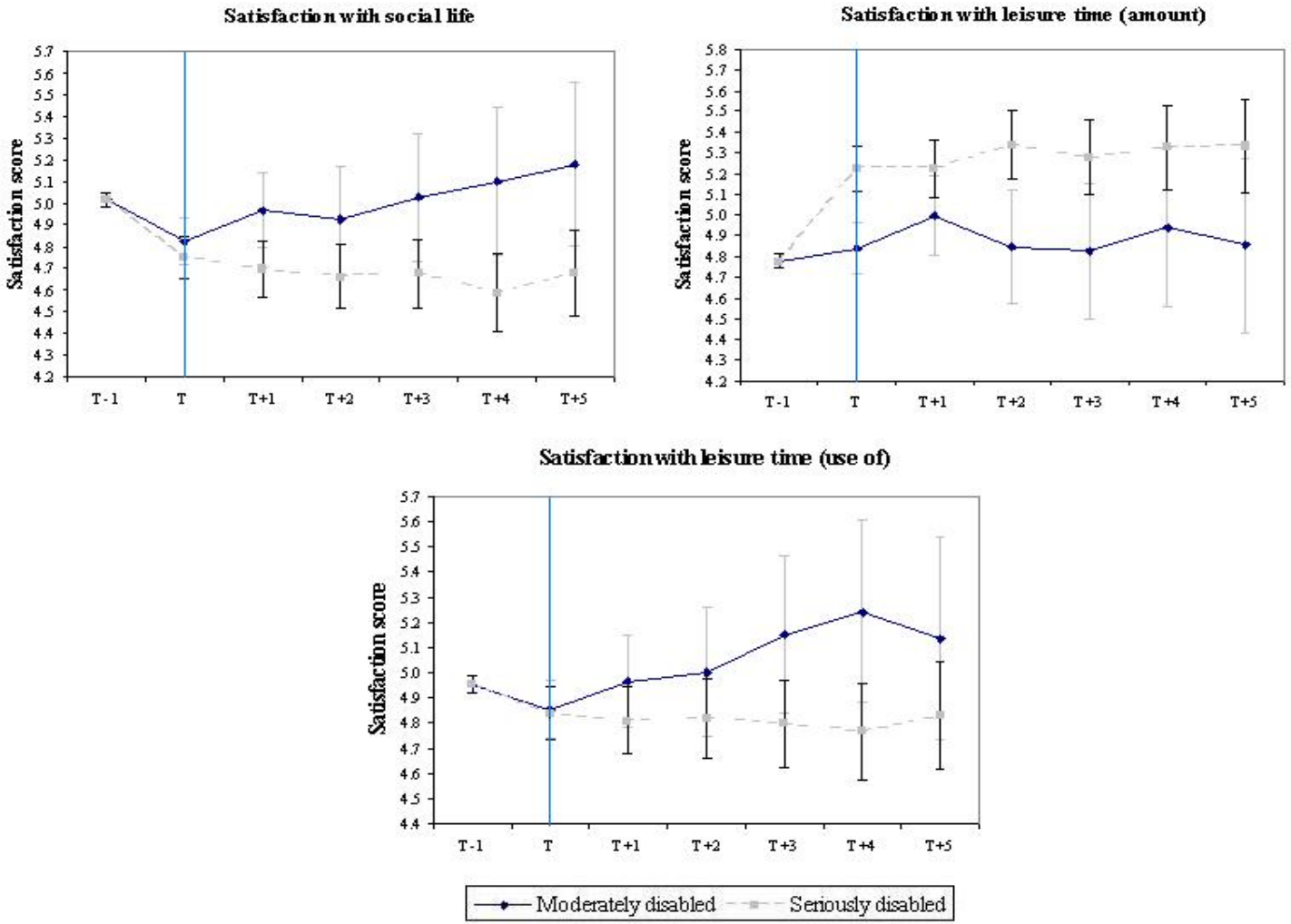

Figure 1 (*continued*).

Table 3: A summary of the initial effect and adaptation in the domain satisfactions

Domain satisfactions	Moderately Disabled		Seriously Disabled	
	Initial effect	Adaptation	Initial effect	Adaptation
Health satisfaction	negative	full	negative	no
Income satisfaction	negative	full	negative	partial
Housing satisfaction	n.s.	-	n.s.	-
Partner satisfaction	negative	full	n.s.	-
Social life satisfaction	negative	full	negative	no
Leisure time (amount) satisfaction	n.s.	-	positive	no
Leisure time (use of) satisfaction	negative	full	negative	full

Note: n.s. = not significant.

Table 4: Fixed effects 'within' domain satisfaction regression equations with lagged disability variables up to t-5, BHPS 1996-2005 (balanced panel)

Parameters	Health	Income	Housing	Partner	Social life	Leisure (amount)	Leisure (use of)
Moderately disabled at t	-0.294	-0.202	-0.075	-0.074	-0.119	0.142	-0.089
	[0.069]**	[0.069]**	[0.066]	[0.056]	[0.063]+	[0.072]*	[0.068]
Moderately disabled at t-1	0.005	-0.031	0.036	0.019	0.223	0.234	0.155
	[0.069]	[0.069]	[0.066]	[0.056]	[0.063]**	[0.072]**	[0.068]*
Moderately disabled at t-2	0.046	-0.099	0.221	-0.124	-0.011	-0.189	0.126
	[0.112]	[0.112]	[0.108]*	[0.091]	[0.103]	[0.117]	[0.111]
Moderately disabled at t-3	0.221	0.080	0.038	-0.144	0.060	-0.030	0.143
	[0.081]**	[0.081]	[0.078]	[0.066]*	[0.074]	[0.084]	[0.080]+
Moderately disabled at t-4	0.190	0.202	0.070	0.067	0.046	0.151	0.119
	[0.080]*	[0.080]*	[0.077]	[0.065]	[0.074]	[0.084]+	[0.079]
Moderately disabled at t-5	0.209	0.186	0.136	0.021	0.068	-0.124	-0.068
	[0.079]**	[0.079]*	[0.076]+	[0.064]	[0.072]	[0.082]	[0.078]
Seriously disabled at t	-0.866	-0.435	0.012	-0.004	-0.258	0.487	-0.120
	[0.062]**	[0.061]**	[0.059]	[0.050]	[0.056]**	[0.064]**	[0.061]*
Seriously disabled at t-1	-0.088	-0.040	0.065	-0.023	0.015	-0.055	-0.048
	[0.061]	[0.061]	[0.058]	[0.049]	[0.056]	[0.063]	[0.060]
Seriously disabled at t-2	0.029	0.084	-0.080	0.025	0.005	0.121	0.037
	[0.063]	[0.063]	[0.061]	[0.052]	[0.058]	[0.066]+	[0.062]
Seriously disabled at t-3	0.097	0.139	0.021	-0.021	0.023	-0.043	0.049
	[0.060]	[0.060]*	[0.058]	[0.049]	[0.055]	[0.063]	[0.059]
Seriously disabled at t-4	0.060	-0.048	0.098	0.057	-0.082	0.106	-0.021
	[0.062]	[0.062]	[0.060]	[0.051]	[0.057]	[0.065]	[0.061]
Seriously disabled at t-5	-0.008	-0.008	0.038	-0.061	0.043	-0.070	-0.013
	[0.061]	[0.061]	[0.059]	[0.050]	[0.056]	[0.064]	[0.060]
The implied well-being effects after any adaptation to disability							
6 years of being mildly disabled	0.376	0.135	0.426	-0.235	0.267	0.183	0.385
	(0.227)+	(0.227)	(0.218)+	(0.185)	(0.208)	(0.237)	(0.223)+
6 years of being seriously disabled	-0.775	-0.307	0.154	-0.026	-0.256	0.546	-0.116
	(0.123)**	(0.123)*	(0.118)	(0.100)	(0.113)*	(0.129)**	(0.121)
Within R-squared	0.028	0.037	0.008	0.025	0.020	0.032	0.013
Observations	36166	36166	36166	36166	36166	36166	36166
Number of person	5146	5146	5146	5146	5146	5146	5146

Note: +<10%, *< 5%, ** < 1%. Standard errors are in parentheses. Control variables as in Table 2.

Table 5: Within life satisfaction regression equation with domain satisfactions as predictors, BHPS 1996-2005 (unbalanced panel)

Parameters	**Life satisfaction**
Health satisfaction	0.132
	[0.005]**
Income satisfaction	0.097
	[0.005]**
Housing satisfaction	0.066
	[0.005]**
Partner satisfaction	0.182
	[0.006]**
Social life satisfaction	0.160
	[0.008]**
Leisure time (amount) satisfaction	0.068
	[0.007]**
Leisure time (use of) satisfaction	0.148
	[0.008]**
Z	-0.015
	[0.013]
Constant	0.866
	[0.184]**
Within R-squared	0.327
Observations	52863
Number of person	11116

Note: The Z variable comes from the principal component of the unexplained satisfactions scores obtained from Table 1's estimates. Standard errors are in parentheses.

** < 1%.

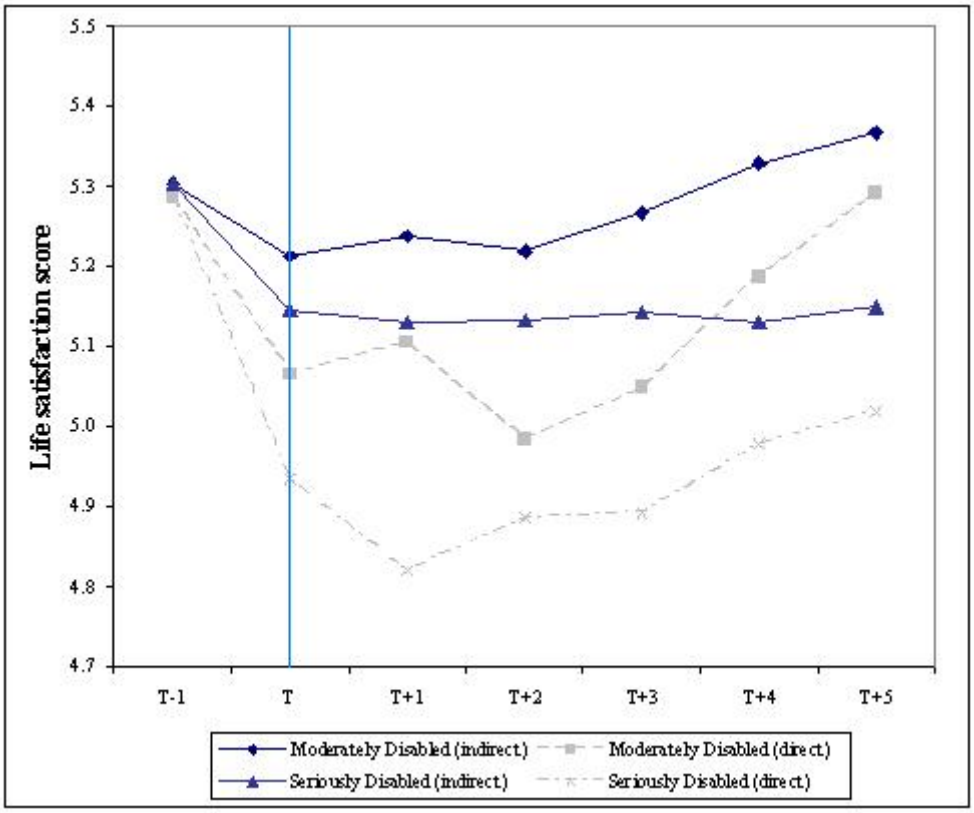

Figure 3: Predicted life satisfaction following disability between indirect (disability affects domain satisfactions before affecting life satisfaction) and direct (disability affects life satisfaction) models. The vertical line (Year T) represents the year of disability.

Appendix: Fixed effects 'within' life satisfaction equationwith lagged disability variables up to t-5, BHPS 1996-2005 (unbalanced panel)

Parameters	Life satisfaction
Moderately disabled	-0.223
	[0.045]**
Moderately disabled at t-1	0.042
	[0.047]
Moderately disabled at t-2	-0.121
	[0.075]
Moderately disabled at t-3	0.063
	[0.056]
Moderately disabled at t-4	0.141
	[0.057]*
Moderately disabled at t-5	0.103
	[0.054]+
Seriously disabled	-0.352
	[0.040]**
Seriously disabled at t-1	-0.114
	[0.040]**
Seriously disabled at t-2	0.066
	[0.042]
Seriously disabled at t-3	0.004
	[0.040]
Seriously disabled at t-4	0.088
	[0.041]*
Seriously disabled at t-5	0.039
	[0.041]
The implied well-being effects after any adaptation to disability	
5 previous years of being mildly disabled	0.004
	(0.162)
5 previous years of being seriously disabled	-0.268
	(0.087)**
Age-squared/100	-0.017
	[0.005]**
Log of real household income per capita	0.019
	[0.009]*
Living as a couple	0.053
	[0.026]*
Widowed	-0.027
	[0.127]
Divorced	-0.034
	[0.055]
Separated	-0.384
	[0.060]**
Never married	0.040
	[0.037]
Unemployed	-0.247
	[0.032]**
Self-employed	-0.005
	[0.025]
Retired	0.069
	[0.025]**
Not active in the labour market	0.022
	[0.020]

Completed first degree	-0.013
	[0.053]
Completed higher degree	-0.100
	[0.105]
Household size	-0.039
	[0.008]**
Number of dependent children (age < 16)	0.022
	[0.011]*
Constant	5.602
	[0.140]**
Year dummies	Yes
Within R-squared	0.327
Observations	52863
Number of person	11116

Note: +<10%, *< 5%, ** < 1%. Standard errors are in parentheses.