Neglecting Decline: Remembered and Predicted Personal Development Diverge from Actual
Longitudinal Change

Sarah Molouki, Daniel M. Bartels and Oleg Urminsky

University of Chicago

Author Note

Sarah Molouki, Daniel M. Bartels, and Oleg Urminsky, Booth School of Business,
University of Chicago. D.M. Bartels and O. Urminsky contributed equally to this work.

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Correspondence should be addressed to Sarah Molouki, Booth School of Business,
University of Chicago, 5807 S. Woodlawn Ave., Chicago, IL 60637.

email: s.molouki@chicagobooth.edu

Abstract

A one-year longitudinal study was conducted to investigate the accuracy of people's assessments of their own personal change over time. We compared people's predicted, actual, and recalled change in their personality, values, and preferences over this time period. On average, participants underestimated the absolute magnitude of their personal change, yet simultaneously overestimated their net improvement, in both prediction and recall. This effect was due to an asymmetry whereby people selectively neglected negative changes, especially prospectively. Although participants in our sample both improved and declined over the year, they were more likely to remember past improvements than declines, and made nearly uniformly positive predictions of future change. We discuss how the current findings reconcile research demonstrating expectations of personal improvement (e.g., Wilson & Ross, 2001; Kanten & Teigen, 2008) with other research that suggests people overpredict their personal stability (Quoidbach, Gilbert, & Wilson, 2013).

Keywords: Self-perception, self, time, future self, past self, personal change, personality

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Imagine yourself ten years in the future. Will you be nearly the same person you are today, just with grayer hair? Or will you be a significantly changed person with different preferences, values, and personality characteristics? If you will have changed, will you have improved, perhaps becoming wiser and kinder, or will you have taken a turn for the worse, ending up lazy and irresponsible? How we view ourselves as changing (or not changing) is important because our self-concept over time not only guides our decisions (Bartels & Rips, 2010; Bartels and Urminsky 2011; Ersner-Hershfield, Garton, Ballard, & Samanez-Larkin, 2009; March, 1978) but also relates to current mental health and well-being (Busseri, Choma, & Sadava, 2009; Fleeson & Baltes, 1998) as well as social behavior (Bartels, Kvaran, & Nichols, 2013; Hershfield, Cohen, & Thompson, 2012).

A large literature on perceptions of personal change has demonstrated biases towards perceiving a trajectory of constant improvement. People mistakenly claim to possess more desirable characteristics in the present than they did in the past (Wilson & Ross, 2001) and think their future selves will be even better (Kanten & Teigen, 2008). In fact, people expect basic personality traits to improve over their lifespan, dropping off only in old age (Krueger & Heckhausen, 1993; Robins, Fraley, Roberts, & Trzesniewski, 2005). However, longitudinal studies tracking the actual development of these personality traits find them to be mostly unchanging (Costa & McCrae, 1989; Herbst, McCrae, Costa, Feaganes, & Siegler, 2000).

However, other research suggests that people view themselves as relatively stable into the future. Work on the projection bias suggests that people underappreciate how much their current

preferences may change over time (Loewenstein & Schkade, 2003; Loewenstein, O'Donoghue, & Rabin, 2003). Similarly, Quoidbach, Gilbert, & Wilson (2013) describe a broad "End of History" illusion, where people underestimate the amount of future change in various aspects of themselves. In this framework, people recognize that they have changed in the past, but view the present as a unique "watershed moment" representing the final culmination of their development.

Taken together, these findings present a puzzle. Do people believe that they have stopped changing, or do they believe the biggest improvements are yet to come? The current study addresses these questions by examining personal change within a single group of participants in a one-year longitudinal study. Whereas most prior studies have either only measured actual personality change over time (Roberts, Walton, & Viechtbauer, 2006; Robins et al., 2005) or focused solely on perceptions of personal change (Quoidbach et al., 2013), we measure and directly compare predicted, actual, and recalled change in a single sample. We use actual change as a baseline to determine whether differences between predicted and remembered change are mainly due to bias in estimating future change, distorted memories of past change, or both.

Our findings reconcile conflicting viewpoints in the literature by suggesting that underestimation of change (e.g., Quoidbach et al., 2013) is moderated by the valence of change (i.e., whether the change is positive or negative). We find that people largely believe that they have improved and will improve, but forget previous decline and underappreciate the potential for future decline. Because people specifically fail to recognize undesirable changes (i.e., declines), they simultaneously underestimate absolute change and overestimate improvement.

Method

College students (N=575) from across the United States who were recruited by a survey research firm to answer questions about their self-perceptions over the course of one year

completed the initial survey in December 2013. Of those, 155 also completed the final survey in December 2014 and were used for analysis (60% female; $M_{\text{age}}=22.1$, $SD=4.5$). Our target sample size for Wave 2 was at least 100, in order to comfortably detect a small anticipated effect size (approximately $\eta_p^2=0.03$) with 80% power (based on data from Quoidbach et al., 2013; see Appendix C for details). We recruited a large sample in Wave 1 because we anticipated substantial attrition over a year, and we collected and analyzed data from all participants who responded to recontact attempts at Time 2.

We measured change in three different personal domains: personality traits, values, and preferences. These constructs are all considered to be important psychological determinants of personal identity (Bartels & Urminsky, 2011; Lewis, 1983; Parfit, 1984; Strohminger & Nichols, 2014) and have been used in previous research on perceptions of personal change (Quoidbach et al., 2013). We examined multiple aspects of personal change in order to ensure that our findings would be representative of general views about personal development rather than being limited to any single domain.

Each participant provided *current* measures of their personality traits, values, and preferences at both Time 1 (Dec 2013) and Time 2 (Dec 2014). At Time 1, they also provided a *prediction* of their personality traits, values, and preferences one year in the future. At Time 2, they provided their *recollection* of their personality traits and values one year ago. Collecting these assessments in a longitudinal design allowed us to compute directly comparable measures of predicted, actual, and remembered change in these constructs for each participant over the same time period.

Survey Measures

Personality. Participants completed a one-item self-assessment for each of five personality dimensions: extraversion, agreeableness, conscientiousness, emotional stability, and openness, after reading a short description of each dimension (see Appendix I for all stimuli). Current, predicted and remembered personality ratings for each of the five dimensions were measured on the same 100 point slider scale. We also measured current personality using a subset of 25 items from the IPIP Big Five factor inventory (Goldberg, 1992; see Appendix E for analyses using these inventory items).

Values. Values were assessed using a 10-item version of the Schwartz Value Inventory (Schwartz, 1992), measuring the personal importance of self-direction, stimulation, hedonism, achievement, power, security, conformity, tradition, benevolence, and universalism. Current, predicted, and remembered importance ratings for each of the ten values were measured on the same 9 point scale.

Preferences. At Time 1, participants reported their favorite food, type of music, hobby, book, and vacation spot, as well as their best friend. They also indicated whether or not they expected each of these to still be their favorite in one year. At Time 2, participants were shown their answers from the first survey, and were asked whether or not each was still their favorite.

Pre-test of Valence

We used an online pre-test with a separate sample (N=100; 41% female, mean age=34.3) to assess which types of changes people generally view as improvements versus declines. To minimize the effects of motivated reasoning (Kunda, 1990), we did not ask about the perceived valence of the changes in the main study. Pretest participants reported how displeased or pleased they would be on a slider scale of 0-100 (with 0 being extremely displeased and 100 being

extremely pleased) if each of the personal attributes used in the longitudinal study were to increase/decrease (personality and values) or change (preferences).

Participants rated increases in all five of the personality dimensions and 9 out of 10 of the values as desirable (i.e., significantly above the scale midpoint of 50; see Appendix B for details). They rated corresponding decreases as undesirable (i.e., significantly below 50). The exception to this pattern was conformity, which was therefore excluded from the main directional analysis (results of main analysis did not differ if conformity was included; see Appendix G). Based on the pre-test results, in the subsequent analyses of personality and values, increases are considered to be improvements and decreases are considered to be declines.

Participants were more open to a future change in preferences for some items than others, $F(5, 495)=29.77, p<.001, \eta_p^2=0.23$. Changes in favorite food, book, and vacation spot were seen as neutral (i.e., not significantly different from 50 on 100-point desirability scale), but participants did not want their favorite hobby, music, or best friend to change (i.e., rated significantly less than 50). Therefore, in the subsequent analyses, changes in hobby, music, and best friend are considered to be declines.

Calculation of Variables

We quantify change in two different ways, looking at both absolute change and directional change. Absolute change is deviation from the present state, ignoring direction. For example, absolute change in actual creativity over one year would be the absolute value of the difference between current ratings of creativity provided at Time 2 and current ratings of creativity provided at Time 1. Thus, all absolute change values are positive. Averaging them across items captures the distinction between variability (high values indicating large changes in

any direction) and stability (low values indicating little change). This approach was taken in some prior work, including Quoidbach et al. (2013).

However, looking only at absolute change neglects the fact (confirmed in the pre-test) that increases and decreases generally differ in desirability. For example, if John increases in creativity, he might consider this an improvement, whereas if he experiences a creativity decrease of equivalent magnitude, he might consider this a decline. Measuring only absolute change obscures this distinction.

We therefore also computed measures of *directional change* as difference scores between answers at Time 2 and answers at Time 1, without taking the absolute value of these changes. Based on the pre-test results, we interpret increases in personality and value items (except for conformity) over the one-year period as improvements and decreases over this period as declines. Averaging across individual items thereby captures the distinction between overall improvement (high positive values indicating net positive change), overall stasis (near-zero values indicating no net change), and overall decline (high negative values indicating net negative change).

In our analyses of personal change, we compare the following: (i) predicted change (difference between future prediction provided at Time 1 and current rating provided at Time 1), (ii) actual change (difference between current rating provided at Time 2 and current rating provided at Time 1), and (iii) remembered change (difference between current rating provided at Time 2 and past recollection provided at Time 2). For each change, we compute both the absolute and directional difference. To illustrate this distinction, two respondents could have the same *absolute* change in creativity (e.g., a value of 10) but differ in their *directional* change, with one person increasing in their creativity (+10), while the other declines (-10). Using both

absolute and directional measures allows us to examine a) whether participants perceive a smaller absolute magnitude of personal change than they actually undergo over the year and b) whether participants overestimate their net improvement over the year, for both prediction and recall.

Results

In the following sections, we separately report the results of parallel analyses of the personality, values and preferences questions.

Change in personality

We found that people largely believed in positive change but underappreciated negative change, in both prediction and recall. This resulted in both an overall underestimation of absolute change and an overestimation of improvement.

Absolute change. We found significant differences in absolute magnitude depending on whether we measured predicted, actual, or recalled change, $F(2, 308)=71.67$, $MSE=70.32$, $\eta_p^2=0.32$, $p<.001$. Participants significantly underpredicted the magnitude of their actual personality change ($M=8.19$ predicted vs. 18.80 actual; $t(154)=11.23$, 95% CI=[8.74, 12.47], $d=0.90$, $p<.001$; see Figure 1a). They also remembered significantly less change than had actually occurred ($M=9.87$ remembered vs. 18.80 actual; $t(154)=8.39$, 95% CI=[6.83, 11.03], $d=0.67$, $p<.001$). Like Quoidbach et al. (2013), we find lower absolute predicted personality change ($M=8.19$, $SD=6.87$) than remembered personality change ($M=9.87$, $SD=9.86$; $t(154)=2.01$, 95% CI=[0.03, 3.33], $d=0.16$, $p=.046$). However, this discrepancy between future prediction and past recall is relatively small compared to the much larger tendency to underestimate both past and future absolute change, relative to actual change.

Fig. 1.

Absolute change in a) personality and b) value importance. Error bars are 95% confidence intervals. Significance of comparisons between predicted, remembered, and actual change indicated as * $p < .05$, *** $p < .001$. Results of this analysis reporting change by individual personality and value items are in Appendix D.

Net directional change. As confirmed by our pretest, people wanted to increase (and did not want to decrease) on the personality measures. This distinction is not reflected in the above absolute change analysis, which conflates increases and decreases. Therefore, we conducted a mean-level analysis of directional personality change that accounts for valence, treating net increases as improvements (positive change) and net decreases as declines (negative change). Overall, we found significant differences in directional change based on whether we measured predicted, actual, or recalled change, $F(2, 308)=10.01$, $MSE=112.00$, $\eta_p^2=0.06$, $p < .001$.

Our analysis revealed a significant tendency to predict net future improvement ($M=+5.66$, $SD=7.50$; $t(154)=9.40$, 95% CI=[4.47, 6.85], $d=0.76$, $p < .001$), as well as a significant tendency to recall net past improvement ($M=+3.61$, $SD=9.69$; $t(154)=4.64$, 95% CI=[2.07, 5.14], $d=0.37$,

$p < .001$). In addition, participants predicted significantly more positive change in the future than they remembered in the past, $t(154)=2.37$, 95% CI=[0.34, 3.77], $d=0.19$, $p=.019$ (see Figure 2a).

In contrast, actual net directional change between Time 1 and Time 2 was near-zero ($M=+0.33$, $SD=17.14$; $t(154)=0.24$, 95% CI=[-2.39, 3.05], $d=0.02$, $p>.250$). So, participants in fact experienced significantly less improvement than they predicted ($t(154)=4.10$, 95% CI=[2.76, 7.90], $d=0.33$, $p<.001$) and less than they remembered ($t(154)=2.38$, 95% CI=[0.56, 5.99], $d=0.19$, $p=0.018$; see Figure 2a). This finding is consistent with existing research documenting self-improvement biases (e.g. Kanten & Teigen, 2008).

Fig. 2.

Directional Change in a) personality and b) value importance. Positive values indicate net improvement and negative values indicate net decline. Error bars are 95% confidence intervals. Significance of comparisons between predicted, remembered, and actual change indicated as *n.s.* = nonsignificant, * $p < .05$, *** $p < .001$. Results of this analysis reporting change by individual personality and value items are listed in the Appendix D.

Individual-level improvements and declines. To better understand how participants on average both underpredicted absolute change and overpredicted improvement, we decomposed the data by valence, and separately examined individual-level net improvements and declines (see Figure 3a). All individual-level analyses exclude participants with zero change on the corresponding measure (indicating that they did not experience either net improvement or decline), but we find similar results when we include all participants (see Appendix D for results accounting for all participants). We found that an equal number of participants actually experienced net improvement versus decline in their personality over the year (49.68% vs. 50.32%, $\chi^2=0.007$, 95% CI=[-0.16, 0.15], $V=0.006$, $p>.250$). The average magnitude of changes observed in participants who improved versus declined was also similar (+13.07 vs. -12.25; $t(153)=0.44$, 95% CI=[-2.84, 4.49], $d=0.07$, $p>.250$), resulting in average directional change near zero in our sample.

In contrast, people were more likely to predict that they would undergo net positive (rather than negative) future changes (83.11% vs. 16.89%; $\chi^2=64.89$, 95% CI=[0.52, 0.77], $V=0.66$, $p<.001$), and the magnitude of predicted improvements was larger than predicted declines (+7.75 vs. -3.01; $t(41)=3.89$, 95% CI=[2.27, 7.20], $d=0.74$, $p<.001$), resulting in overall predicted improvement in our sample. Recalled change exhibited a similar tendency, with more frequent (67.81% vs. 32.19%; $\chi^2=18.52$, 95% CI=[0.20, 0.50], $V=0.36$, $p<.001$) and larger (+8.16 vs. -5.28; $t(130)=2.43$, 95% CI=[0.53, 5.22], $d=0.37$, $p=.017$) remembered improvements than remembered declines.

Fig. 3.

Decomposing directional change into decline and improvement for a) personality and b) values. Column width denotes proportion of participants indicating improvement or decline and column height denotes magnitude of improvement or decline. Error bars are 95% confidence intervals.

The finding that participants both underestimated absolute change and overestimated improvement was largely driven by a disproportionate failure of those who actually experienced decline to predict and remember their decline (see Figure 4, which plots the relationship between actual and predicted or remembered change). Participants who had an actual net decrease in the measured traits over the year had predicted a mean personality *improvement* of +3.62 (SD=6.67), whereas they actually experienced a *decline* of -12.25 (SD=11.65). The difference between these two numbers reflects a *directional* overprediction of improvement by 15.87 scale points, $t(77)=10.87$, 95% CI=[12.96,18.78], $d=1.23$, $p<.001$. Nevertheless, the *magnitude* of their predicted change was still smaller than the magnitude of their actual change (3.62 vs. 12.25; $t(77)=5.47$, 95% CI=[5.48, 11.77], $d=0.62$, $p<.001$), yielding an underestimate of change defined in terms of absolute value (i.e. deviation from zero). In contrast, those who actually experienced an overall increase in the measured traits predicted an improvement of +7.73 (SD=7.76) compared to an actual improvement of +13.07 (SD=11.44), reflecting an underestimation of both

their improvement and their absolute deviation from zero, $t(76) = 4.05$, 95% CI=[2.72, 7.97], $d=0.55$, $p<.001$. Nevertheless, actual decliners' overpredictions of their improvement were more extreme than actual improvers' underpredictions of their improvement (absolute error=15.87 for decliners vs. 5.34 for improvers; $t(152)=5.35$, 95% CI=[6.64, 14.42], $d=0.86$, $p<.001$). That is, participants who experienced net negative change over the year neglected this decline more than those who experienced net positive change underappreciated their improvement, leading to both an underestimation of absolute change and an improvement bias over the sample as a whole.

Participants expressed a similar, though less extreme, pattern in recall. Although improvers underestimated their past positive change ($M=+6.58$ remembered vs. +13.07 actual), decliners on average did not acknowledge their negative change at all ($M=+0.67$ remembered vs. -12.25 actual). This larger neglect of change among decliners (absolute error=12.92 for decliners vs. 6.49 for improvers; $t(153)=2.83$, 95% CI=[1.95, 10.91], $d=0.46$, $p=.005$) again led to an overall bias towards improvement in the sample along with an underestimation of absolute change.

Fig. 4.

Comparison of a) actual (x-axis) versus predicted (y-axis) personality change and b) actual (x-axis) versus remembered (y-axis) personality change. The solid black line is the fitted regression line and the solid gray line is the line which would fit completely accurate estimates (i.e., $y = x$).

Change in the Importance of Values

We again found that participants both underpredicted absolute change and overpredicted improvement in the importance of their values, due to their neglect of decline in prediction and recall.

Absolute change. Overall, there were significant differences in the absolute magnitude of change based on whether predicted, actual, or recalled change was measured, $F(2, 308)=66.93$, $MSE=0.27$, $\eta_p^2=0.30$, $p<.001$. Although absolute predicted change ($M=0.74$, $SD=0.47$) was significantly smaller than remembered change ($M=1.05$, $SD=0.69$; $t(154)=5.56$, 95% $CI=[.20, 0.42]$, $d=0.45$, $p<.001$) both were also significantly smaller than actual change ($M=1.41$, $SD=0.57$; $t_s(154)>5.53$, 95% $CI_{pred}=[0.57, 0.78]$, 95% $CI_{rem}=[0.24, 0.50]$, $d_s>0.44$, $p_s<.001$; Figure 1b).

Net directional change. There were significant differences in net directional change for value importance in predicted, actual, and remembered change, $F(2, 308)=13.47$, $MSE=0.49$, $\eta_p^2=0.08$, $p<.001$. We recall that as confirmed by the pre-test, people prefer increases to decreases in the importance ratings of the values tested, such that increases reflect improvements and decreases reflect declines. We found that participants both predicted ($M=+0.15$, $SD=0.53$, $t(154)=3.41$, 95% $CI=[0.06, 0.23]$, $d=0.27$, $p<.001$) and remembered ($M=+0.20$, $SD=0.73$, $t(154)=3.40$, 95% $CI=[0.08, 0.32]$, $d=0.27$, $p<.001$) significant improvement in the importance of overall values to a similar degree, $t(154)=0.74$, 95% $CI=[-0.20, 0.09]$, $d=0.06$, $p>.250$ (see Figure 2b). However, actual net directional change reflected a decline in the importance of these values ($M=-0.18$, $SD=0.923$; $t(154)=-2.44$, 95% $CI=[-0.33, -0.035]$, $d=0.20$, $p=.016$) which was significantly lower than both predicted ($t(154)=4.02$, 95% $CI=[0.17, 0.49]$, $d=0.32$, $p<.001$) and remembered change ($t(154)=4.51$, 95% $CI=[0.21, 0.55]$, $d=0.36$, $p<.001$).

Individual-level improvements and declines. Decomposing directional change revealed that over the course of the year, a similar number of people actually experienced net improvement vs. decline in the importance of values (45.58% vs. 54.42%, $\chi^2=1.15$, 95% CI=[-0.24, 0.07], $V=0.09$, $p>.250$). Furthermore, the average magnitude of actual declines was larger than the average magnitude of actual improvements (+.65 vs. -.90, $t(143)=2.75$, 95% CI=[0.07, 0.65], $d=0.44$, $p=.007$, Figure 3b). In contrast, more people predicted net improvement rather than decline in value importance (67.18% vs. 32.82%, $\chi^2=15.46$, 95% CI=[0.17, 0.49], $V=0.34$, $p<.001$) and the average magnitude of predicted improvement was similar to that of predicted decline (+.48 vs. -.46, $t(87)=0.35$, 95% CI=[-0.11, 0.16], $d=0.06$, $p>.250$). Similarly, more participants remembered undergoing improvement rather than decline in value importance (60.00% vs. 40.00%, $\chi^2=5.40$, 95% CI=[0.03, 0.36], $V=0.20$, $p=.020$), and in this case the average magnitude of recalled improvements was larger than that of declines (+.68 vs. -.45, $t(123)=2.73$, 95% CI=[0.06, 0.40], $d=0.42$, $p=.007$).

As observed for personality, the tendency to underestimate absolute change and overestimate improvement in values stemmed largely from those who experienced declines in value importance (see Figure 5). Participants whose average value importance had declined over the course of the year ($M=-0.90$, $SD=0.63$) instead predicted ($M=0.09$, $SD=0.61$) and recalled ($M=0.11$, $SD=0.72$) a smaller increase. Although improvers again underestimated their actual improvement ($M_{\text{predicted}} = 0.22$ vs. $M_{\text{actual}} = 0.65$), decliners made larger errors than improvers in both their predictions (absolute error=0.99 vs. 0.43, $t(142)=4.53$, 95% CI=[0.31, 0.80], $d=0.73$, $p<.001$) and their recall (absolute error=1.01 vs. 0.32, $t(145)=5.05$, 95% CI=[0.42, 0.95], $d=0.82$, $p<.001$), leading to an overall underestimation of absolute change but an overestimation of improvement.

Fig. 5.

Comparison of actual value changes (x-axis) with a) predicted and b) remembered (y-axis) value changes. The solid black line is the fitted regression line and the solid gray line is the line which would fit completely accurate estimates (i.e., $y = x$).

Change in preferences

Misprediction of preference change was measured by comparing the number of favorite items at Time 1 that participants expected would change over the coming year to the number that had actually changed at Time 2. The average predicted change in people's favorite items across all six categories was significantly lower ($M=1.04$ out of 6 favorites predicted to change) than actually occurred ($M= 1.32$ out of 6 favorites changed; $t(150)=2.71$, 95% CI=[0.08, 0.49], $p=.008$, $d=0.25$).¹ This underestimation of absolute change in preferences is broadly consistent with the findings of Quoidbach et al. (2013), although their measure of underprediction is based on a comparison to remembered, rather than actual, changes.

However, the accuracy of estimated absolute change differed significantly across the six categories of items, $F(5, 750)=3.54$, $MSE=0.21$, $\eta_p^2=0.02$, $p=.004$. To understand this difference,

¹ Excludes four incomplete responses, and is based on individual-level averages across items.

we incorporated valence into our preference analysis. Because participants only indicated a binary change vs. no change response for the preference items, we could not directly examine direction of change as we did for personality and values. Instead, we compared average change in categories where people in the pretest said they did not want a change in their favorite (hobby, music, and best friend), to average change in categories where changing one's favorite was viewed as neutral (food, vacation, and book).

Change was significantly underpredicted for the items that people did not want to change (predicted change $M=0.37$ out of 3 vs. actual change $M=0.60$ out of 3; $t(150)=3.35$, 95% CI=0.03, 0.12], $d=0.27$, $p=.001$). In particular, people most strongly underpredicted the likelihood of having a different best friend in a year (predicted $M=0.11$ vs. actual $M=0.24$; McNemar's $\chi^2=9.82$, 95% CI_{odds ratio}=[1.61, 8.56], $p=.002$), which was the most undesirable change based on the pretest. In contrast, average predictions for items that people did not mind changing were not significantly biased (predicted $M=0.67$ out of 3 vs. actual $M=0.73$ out of 3; $t(150)=.88$, 95% CI=[-0.06, 0.02], $d=0.07$, $p>.250$). The interaction between change measurement (predicted vs. actual) and valence of change (negative vs. neutral attitudes to change) was marginally significant, Wald $\chi^2=3.72$, $p=.054$. This suggests that the underappreciation of change in preferences is somewhat more pronounced for those changes generally viewed as negative.

Discussion

The results of our longitudinal study reveal that people consistently neglect negative change in both the future and the past. As a result, they simultaneously underestimate absolute change and overestimate improvement.

By measuring actual change in addition to estimates of past and future change, we were able to directly quantify both misprediction and misrecollection of absolute change. We find that people predict only half as much absolute change in personality and values as they in fact experience. We also find that people remember less absolute change than actually occurred in the past, in contrast with previous research that characterized recollections as accurate (Quoidbach et al., 2013). Nevertheless, recall was significantly less subject to distortion than prediction, perhaps because the past is more constrained by reality than the future (Kane, McGraw, & Van Boven, 2009). However, under-recall of prior change may in fact contribute to poor predictions, making it difficult for people to accurately extrapolate from prior change to future change.

We also find that misestimation depends on the desirability of personal change. People incorrectly predict net improvement in the future and recall somewhat smaller net improvement in the past. This pattern arises from a systematic underestimation of negative change compared to positive change. We find this pattern not only in our data, but also in a valence-sensitive re-analysis of the Quoidbach et al. (2013) data (see Appendix A). People largely believe in improvement, but neglect decline.

This specific belief in limited negative change drives the process by which people both underestimate the absolute magnitude of change (e.g., Quoidbach et al., 2013) and overestimate improvement (e.g., Kantén & Teigen, 2008). People who experience declines over time predict modest improvement instead, resulting in underprediction of their absolute change as well as a larger overestimation of improvement. In contrast, people who do in fact experience improvement are more accurate, only somewhat underestimating the magnitude of their positive change. Taken together, these tendencies result in both an overall net improvement bias and underestimation of absolute change.

Our findings reveal an interaction between predictions and valence that significantly alters the interpretation of the “End of History” illusion (Quoidbach et al., 2013). We find little evidence that people believe that they have had substantial positive development in the past, but are now fully developed and will be unchanging in the future. Although people acknowledge some past variability, they misremember past declines and even more strongly underappreciate the possibility of losing ground in their rosy, improving futures. Rather than representing the end of a developmental trajectory, the present moment represents a watershed of a different sort for people: the moment when their somewhat rocky past resolves into a consistent upward climb.

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SUPPLEMENTARY MATERIALS

Table of Contents

Appendix A: Re-analysis of Quoidbach et al. (2013) Data	25
Appendix B: Results of Valence Pretest	30
Appendix C: Additional Methodological Notes	32
Appendix D: Additional Results for Personality and Value Change	34
Changes in Individual Personality and Value Items	34
Proportions of Individual-Level Improvement, Decline, and No Change	38
Appendix E: Analysis of Alternate Personality Measures	39
Appendix F: Additional Accuracy Analyses	41
Appendix G: Reanalysis of Value Change Including Conformity	43
Appendix H: Global Measures of Similarity and Change	45
Appendix I: Listing of Stimuli	49
Personality Measures	49
Value Measures	55
Preference Measures	57
Measures of Global Similarity and Change	59
Appendix References	62

Appendix A: Re-analysis of Quoidbach et al. (2013) Data

The results of our study suggest that people underpredict personal change, largely by ignoring negative change, and this contributes to a self-improvement bias. The measures in Quoidbach et al. (2013) do not include measures of actual change (due to the cross-sectional study design). But, we can re-analyze their data to determine whether a self-improvement bias in predicted (versus remembered) change becomes apparent when examining net directional change rather than absolute change.

The original finding of Quoidbach et al.'s (2013) study was that the absolute value of remembered change was larger than absolute value of predicted change, representing a prospective underestimation of the magnitude of absolute change. However, we expect that analyzing the direction of change for each participant (with positive numbers representing improvements and negative numbers representing declines) will yield different results, consistent with the findings in our study. Here, we expect to see either no difference in predicted and recalled net improvement or a larger net improvement in predicted versus recalled change.

Method

We replicated our comparison of absolute and directional change using Quoidbach et al.'s original dataset (publicly available online via the Inter-university Consortium for Political and Social Research).² Their data is based on a survey of a large cross-sectional online sample and covers a wider age range than our data. Note that because this dataset is cross-sectional, it only allows us to compare predicted change and remembered change at a single point in time, between-subjects, and does not include measures of actual change.

² www.icpsr.umich.edu, deposit no. 32668

Results

Personality. The Quoidbach et al. (2013) personality data revealed that people predicted less absolute change ($M=1.23$, $SD=0.95$) than they remembered ($M=1.54$, $SD=1.03$, $t(7064)=13.60$, 95% $CI=[0.27, 0.36]$, $d=0.32$, $p<.001$). A regression analysis with age and condition as predictors revealed no significant interaction, $B= -0.0004$, 95% $CI=[-0.003, 0.002]$, $p>.250$ (see Figure 1a), suggesting that the bias in beliefs about change does not vary with age.

Fig. 1. Predicted vs. remembered a) absolute change in personality and b) directional change in personality plotted by age.

However, similar to the findings from our longitudinal study, additional analyses using directional (rather than absolute) change found that predicted change ($M=.76$, $SD=.92$) was significantly more positive than remembered change ($M=.30$, $SD=1.25$, $t(6165)=17.76$, 95%

CI=[0.41, 0.51], $d=0.42$, $p<.001$; see Figure 1b). Also, a regression analysis revealed an age X condition interaction ($B=-0.007$, 95% CI=[-0.009, -0.004], $p<.001$), such that predictions were less skewed toward optimism for older adults, consistent with previous research on optimistic biases over the lifespan (Lachman, Röcke, Rosnick, & Ryff 2008; Fleeson & Heckhausen, 1997). In particular, recalled change was relatively constant over age, whereas predicted change was less strongly positive for older participants.

Values. As reported in Quoidbach et al. (2013), people predicted less absolute change in values ($M=0.54$, $SD=0.51$) than they remembered ($M=1.38$, $SD=0.92$, $t(1786)=28.72$, $p<.001$, $d=1.17$; see Figure 2a).

Fig. 2. Predicted vs. remembered a) absolute change in values and b) directional change in values plotted by age.

In our longitudinal study, we found no difference in directional change between predictions and recollections. In contrast, in the Quoidbach et al. (2013) data, people predicted a smaller net improvement ($M=0.08$, $SD=.50$) in values than they remembered ($M=.26$, $SD=0.80$, $t(1941)=6.77$, $p<.001$, $d=0.27$; see Figure 2b).

However, the difference between predicted and remembered improvement in values was significantly smaller than the corresponding difference between predicted and remembered absolute change, $F(1, 2715)=439.50$, $MSE=0.34$, $\eta_p^2=0.14$, $p<.001$. This suggests that the underestimation of future decline likely plays a significant part in the absolute difference observed in this data, though it does not completely determine it. There was no significant interaction when age was included in a regression model ($\beta=0.057$, $p>.250$), suggesting that the findings for values do not vary with age.

Preferences. Participants predicted that an average of 1.62 preferences (out of a possible total of 6) would change over the following year, whereas participants remembered a mean of 2.01 preference changes (Wald $\chi^2=139.92$, $p<.001$, marginal $R^2=0.025$). However, the difference between predicted and remembered change also varied by whether change in that preference tends to be considered neutral or negative (based on our pretest). On average, participants predicted change in fewer items (0.61 out of 3) than they remembered (1.05 out of 3) for items where change was viewed as negative (Wald $\chi^2=406.61$, $p<.001$, marginal $R^2=0.081$). In contrast, participants actually predicted slightly more average change (1.01 out of 3 items) than they remembered (0.95 out of 3 items) for preferences where change is largely viewed as neutral (Wald $\chi^2=5.51$, $p=.019$, marginal $R^2=0.001$). The interaction between condition (predicted versus remembered) and desirability of change (positive or neutral) was significant (Wald $\chi^2=386.39$,

$p < .001$). This suggests that the underprediction of change seems to be largely driven by items where preference change would be viewed as negative.

Appendix B: Results of Valence Pretest

Table B1: Pretest results regarding desirability of changes used in study.

Note: Significance tests refer to difference from scale midpoint of 50.

Personality	How do you feel about increase ? (0 = extremely displeased, 100 = extremely pleased)	How do you feel about decrease ? (0 = extremely displeased, 100 = extremely pleased)
Extraversion	M = 68.37, SD = 19.93 $t(99) = 9.22, p < .001, d = 0.92$	M = 29.41, SD = 19.61 $t(99) = -10.50, p < .001, d = 1.05$
Agreeableness	M = 73.67, SD = 21.10 $t(99) = 11.22, p < .001, d = 1.12$	M = 26.26, SD = 23.68 $t(99) = -10.03, p < .001, d = 1.00$
Conscientiousness	M = 81.77, SD = 17.71 $t(99) = 17.94, p < .001, d = 1.79$	M = 20.89, SD = 22.35 $t(99) = -9.22, p < .001, d = 1.30$
Emotional Stability	M = 85.60, SD = 16.95 $t(99) = 21.00, p < .001, d = 2.10$	M = 13.72, SD = 19.58 $t(99) = -18.53, p < .001, d = 1.85$
Openness	M = 72.64, SD = 21.20 $t(99) = 10.68, p < .001, d = 1.07$	M = 26.45, SD = 21.97 $t(99) = -10.72, p < .001, d = 1.07$
Values	How do you feel about increase ? (0 = extremely displeased, 100 = extremely pleased)	How do you feel about decrease ? (0 = extremely displeased, 100 = extremely pleased)
Self-direction	M = 81.32, SD = 18.03 $t(99) = 17.37, p < .001, d = 1.74$	M = 19.30, SD = 20.40 $t(99) = -15.05, p < .001, d = 1.51$
Stimulation	M = 66.76, SD = 19.01 $t(99) = 8.82, p < .001, d = 0.88$	M = 31.81, SD = 21.21 $t(99) = -8.58, p < .001, d = 0.86$
Hedonism	M = 58.85, SD = 29.36 $t(99) = 3.01, p = .003, d = 0.30$	M = 42.58, SD = 28.54 $t(99) = -2.60, p = .011, d = 0.26$
Achievement	M = 78.12, SD = 21.43 $t(99) = 13.12, p < .001, d = 1.31$	M = 24.09, SD = 23.23 $t(99) = -11.16, p < .001, d = 1.12$
Power	M = 58.31, SD = 29.00 $t(99) = 2.87, p = .005, d = 0.29$	M = 40.75, SD = 26.16 $t(99) = -3.54, p < .001, d = 0.35$
Security	M = 78.04, SD = 21.24 $t(99) = 13.20, p < .001, d = 1.32$	M = 20.44, SD = 21.41 $t(99) = -13.80, p < .001, d = 1.38$
Conformity	M = 46.78, SD = 26.92 $t(99) = -1.20, p = .235, d = 0.12$	M = 51.78, SD = 23.47 $t(99) = 0.76, p > .250, d = 0.08$
Tradition	M = 58.97, SD = 22.53 $t(99) = 3.98, p < .001, d = 0.40$	M = 41.15, SD = 22.26 $t(99) = -3.98, p < .001, d = 0.40$
Benevolence	M = 74.85, SD = 18.85 $t(99) = 13.18, p < .001, d = 1.31$	M = 26.07, SD = 20.74 $t(99) = -11.54, p < .001, d = 1.15$
Universalism	M = 73.52, SD = 22.61 $t(99) = 10.40, p < .001, d = 1.04$	M = 26.73, SD = 25.09 $t(99) = -9.28, p < .001, d = 0.93$
Preferences	How do you feel about change ? (0 = extremely displeased, 100 = extremely pleased)	
Favorite food	M = 53.33, SD = 20.97; $t(99) = 1.59, p = .12, d = 0.16$	
Favorite book [†]	M = 53.1, SD = 25.41; $t(99) = 1.22, p = .22, d = 0.12$	
Favorite vacation	M = 49.63, SD = 25.57; $t(99) = -0.14, p > .250, d = 0.01$	
Favorite movie [†]	M = 54.39, SD = 24.39; $t(99) = 1.80, p = .07, d = 0.18$	
Favorite hobby	M = 41.59, SD = 25.06; $t(99) = -3.36, p = .001, d = 0.34$	
Favorite type of music	M = 40.31, SD = 22.81; $t(99) = -4.25, p = .001, d = 0.42$	
Best friend	M = 24.67, SD = 24.72; $t(99) = -10.25, p < .001, d = 1.02$	

[†]Note: Item only used in Quoidbach et al. (2013); our study used favorite book instead.

General Global Change	How do you feel about staying the same? (0 = <i>extremely displeased</i> , 100 = <i>extremely pleased</i>)	How do you feel about being different? (0 = <i>extremely displeased</i> , 100 = <i>extremely pleased</i>)
	M = 65.44, SD = 24.23 $t(99) = 6.37, p < .001, d = 0.64$	M = 42.44, SD = 25.89 $t(99) = -2.92, p = .004, d = 0.29$

Appendix C: Additional Methodological Notes

Participant Attrition

Out of 575 participants who completed the first survey, 155 also completed the final survey and were used in the final analysis. Participants who only completed the first survey did not differ from those who completed both surveys in their predictions of personal change (see Table C1).

Table C1. Analysis of Time 1 Responses by Attrition Status

Time 1 Measure	Completed Time 1 Only (N=420)	Completed Time 1 and 2 (N=155)	Comparison
Predicted Personality Change (absolute)	M=7.89, SD=6.55	M=8.19, SD=6.87	$t(264)=0.47, p>.250$
Predicted Personality Change (directional)	M=5.47, SD=6.61	M=5.66, SD=7.50	$t(247)=0.29, p>.250$
Predicted Values Change (absolute)	M=0.23, SD=0.52	M=0.79, SD=0.50	$t(251)=0.88, p>.250$
Predicted Values Change (directional)	M=6.48, SD=1.04	M=0.15, SD=0.53	$t(268)=1.61, p=.108$
Predicted Preference Change (number of preferences)	M=1.04, SD=1.05	M=1.07, SD=1.08	$t(273)=0.27, p>.250$
General Similarity to Future Self (see Appendix G)	M=65.97, SD=18.14	M=68.55, SD=15.67	$t(316)=1.68, p=.093$

Sample Size Calculation

In order to calculate an approximate expected effect size for the type of change measured (predicted, actual, or remembered), we used the original data from the within-subjects study reported in Quoidbach, Gilbert, & Wilson (2013).³ We performed a mixed ANOVA on this data, with condition (predicted vs. remembered) as the within-subjects variable and participant age as the between-subjects variable. This test yielded a partial eta-squared of 0.025 and the correlation

³ Original data set publicly available online at www.icpsr.umich.edu, deposit no. 32668, Study 1_1

among repeated measures was 0.375. With this information, G Power software (Faul, Erdfeder, Lang, & Buchner, 2007) was used to calculate that a sample size of 100 was required to detect the effect with 80% power. Performing a paired t-test on this data (without controlling for participant age) yields an effect size of $d=0.32$ which requires a sample size of 78 participants. We targeted a large sample for our first survey because we anticipated that approximately 25-30% of these participants would return to complete the next survey one year later. In line with this estimate, 27% of our initial participants (155 out of 575) ultimately completed both surveys.

Additional Surveys Completed by Participants

In addition to the Time 1 (December 2013) and Time 2 (December 2014) surveys discussed in this paper, participants also completed additional personality measures in April 2014 and August 2014, to be used in an unrelated study. Participants were not asked to make predictions or recollections related to any of the measures collected during April and August. Further details about questionnaires administered in April and August are available upon request.

Appendix D: Additional Results for Personality and Value Change

Figure D1. Comparison of Predicted, Remembered, and Actual Absolute Personality Change Grouped by Big Five Factor

Note: Error bars represent 95% confidence intervals.

Table D1. Results of Paired t-tests for Differences Between Predicted, Remembered, and Actual Absolute Personality Change Grouped by Big Five Factor.

	AGREEABLENESS	EMOTIONAL STABILITY	OPENNESS
<i>Actual vs. Predicted</i>	$t(154) = 9.00 ; p < .001$	$t(154) = 4.59 ; p < .001$	$t(154) = 8.60 ; p < .001$
<i>Actual vs. Remembered</i>	$t(154) = 4.72 ; p < .001$	$t(154) = 4.13 ; p < .001$	$t(154) = 6.83 ; p < .001$
<i>Remembered vs. Predicted</i>	$t(154) = 4.03 ; p < .001$	$t(154) = 0.39 ; p > .250$	$t(154) = 1.85 ; p = .067$
	CONSCIENTIOUSNESS	EXTRAVERSION	
<i>Actual vs. Predicted</i>	$t(154) = 8.54 ; p < .001$	$t(154) = 4.06 ; p < .001$	
<i>Actual vs. Remembered</i>	$t(154) = 7.08 ; p < .001$	$t(154) = 3.66 ; p < .001$	
<i>Remembered vs. Predicted</i>	$t(154) = 0.79 ; p > .250$	$t(154) = 0.58 ; p > .250$	

Figure D2. Comparison of Predicted, Remembered, and Actual Net Directional Personality Change Grouped by Big Five Factor

Note: Error bars represent 95% confidence intervals.

Table D2. Results of Paired t-tests for Differences Between Predicted, Remembered, and Actual Directional Personality Change Grouped by Big Five Factor.

	AGREEABLENESS	EMOTIONAL STABILITY	OPENNESS
<i>Actual vs. Predicted</i>	$t(154) = -2.90 ; p = .004$	$t(154) = -2.52 ; p = .013$	$t(154) = -1.90 ; p = .059$
<i>Actual vs. Remembered</i>	$t(154) = -2.75 ; p = .007$	$t(154) = -1.06 ; p > .250$	$t(154) = -1.28 ; p = .201$
<i>Remembered vs. Predicted</i>	$t(154) = 0.33 ; p > .250$	$t(154) = -1.52 ; p = .128$	$t(154) = -0.96 ; p > .250$
	CONSCIENTIOUSNESS	EXTRAVERSION	
<i>Actual vs. Predicted</i>	$t(154) = -2.12 ; p = .036$	$t(154) = -4.17 ; p < .001$	
<i>Actual vs. Remembered</i>	$t(154) = -0.86 ; p > .250$	$t(154) = -2.09 ; p = .038$	
<i>Remembered vs. Predicted</i>	$t(154) = -1.80 ; p = .074$	$t(154) = -2.69 ; p = .008$	

Figure D3. Comparison of Predicted, Remembered, and Actual Absolute Change Grouped by Schwartz Values

Note: Error bars represent 95% confidence intervals.

Table D3. Results of Paired t-tests for Differences Between Predicted, Remembered, and Actual Absolute Value Change Grouped by Individual Values.

	ACHIEVEMENT	HEDONISM	SELF-DIRECTION
<i>Actual vs. Predicted</i>	$t(154) = 4.62 ; p < .001$	$t(154) = 6.13 ; p < .001$	$t(154) = 4.35 ; p < .001$
<i>Actual vs. Remembered</i>	$t(154) = 1.88 ; p = .062$	$t(154) = 3.17 ; p = .002$	$t(154) = 1.97 ; p = .051$
<i>Remembered vs. Predicted</i>	$t(154) = 2.91 ; p = .004$	$t(154) = 3.79 ; p < .001$	$t(154) = 2.33 ; p = .021$
	BENEVOLENCE	POWER	STIMULATION
<i>Actual vs. Predicted</i>	$t(154) = 8.85 ; p < .001$	$t(154) = 4.25 ; p < .001$	$t(154) = 4.17 ; p < .001$
<i>Actual vs. Remembered</i>	$t(154) = 1.59 ; p = .114$	$t(154) = 3.24 ; p = .001$	$t(154) = 1.81 ; p = .072$
<i>Remembered vs. Predicted</i>	$t(154) = 6.63 ; p < .001$	$t(154) = 1.52 ; p = .130$	$t(154) = 3.05 ; p = .003$
	CONFORMITY	SECURITY	TRADITION
<i>Actual vs. Predicted</i>	$t(154) = 5.63 ; p < .001$	$t(154) = 4.98 ; p < .001$	$t(154) = 3.98 ; p < .001$
<i>Actual vs. Remembered</i>	$t(154) = 3.16 ; p = .002$	$t(154) = 2.42 ; p = .017$	$t(154) = 4.12 ; p < .001$
<i>Remembered vs. Predicted</i>	$t(154) = 1.99 ; p = .048$	$t(154) = 1.95 ; p = .053$	$t(154) = 0.31 ; p > .250$
	UNIVERSALISM		
<i>Actual vs. Predicted</i>	$t(154) = 5.49 ; p < .001$		
<i>Actual vs. Remembered</i>	$t(154) = 3.43 ; p < .001$		
<i>Remembered vs. Predicted</i>	$t(154) = 2.02 ; p = .045$		

Figure D4. Comparison of Predicted, Remembered, and Actual Net Directional Change Grouped by Schwartz Values

Note: Error bars represent 95% confidence intervals.

Table D4. Results of Paired t-tests for Differences Between Predicted, Remembered, and Actual Directional Value Change Grouped by Individual Values.

	ACHIEVEMENT	HEDONISM	SELF-DIRECTION
<i>Actual vs. Predicted</i>	$t(154) = -2.75 ; p = .007$	$t(154) = -0.80 ; p > .250$	$t(154) = -3.99 ; p < .001$
<i>Actual vs. Remembered</i>	$t(154) = -3.43 ; p < .001$	$t(154) = -1.20 ; p = .230$	$t(154) = -3.62 ; p < .001$
<i>Remembered vs. Predicted</i>	$t(154) = 0.79 ; p > .250$	$t(154) = 0.42 ; p > .250$	$t(154) = 0.14 ; p > .250$
	BENEVOLENCE	POWER	STIMULATION
<i>Actual vs. Predicted</i>	$t(154) = -3.50 ; p < .001$	$t(154) = -1.49 ; p = .139$	$t(154) = -2.46 ; p = .015$
<i>Actual vs. Remembered</i>	$t(154) = -3.52 ; p < .001$	$t(154) = 0.92 ; p > .250$	$t(154) = -1.67 ; p = .097$
<i>Remembered vs. Predicted</i>	$t(154) = 0.07 ; p > .250$	$t(154) = -2.81 ; p = .006$	$t(154) = -0.57 ; p > .250$
	CONFORMITY	SECURITY	TRADITION
<i>Actual vs. Predicted</i>	$t(154) = -1.39 ; p = .168$	$t(154) = -1.48 ; p = .140$	$t(154) = -1.13 ; p > .250$
<i>Actual vs. Remembered</i>	$t(154) = 1.84 ; p = .068$	$t(154) = -4.24 ; p < .001$	$t(154) = -1.46 ; p = .145$
<i>Remembered vs. Predicted</i>	$t(154) = -3.52 ; p < .001$	$t(154) = 2.92 ; p = .004$	$t(154) = 0.34 ; p > .250$
	UNIVERSALISM		
<i>Actual vs. Predicted</i>	$t(154) = -1.27 ; p = .207$		
<i>Actual vs. Remembered</i>	$t(154) = -3.34 ; p = .001$		
<i>Remembered vs. Predicted</i>	$t(154) = 1.96 ; p = .051$		

Table D5. Proportions of Participants Experiencing Overall Improvement, Decline, or No Change in Personality.

	Count	%	% Among Participants Reporting Change
Improvement	77	49.68%	49.68%
Decline	78	50.32%	50.32%
No Change	0	0	-

Table D6. Proportions of Participants Predicting Overall Improvement, Decline, or No Change in Personality.

	Count	%	% Among Participants Reporting Change
Improvement	123	79.35%	83.11%
Decline	25	16.13%	16.89%
No Change	7	4.52%	-

Table D7. Proportions of Participants Remembering Overall Improvement, Decline, or No Change in Personality.

	Count	%	% Among Participants Reporting Change
Improvement	99	63.87%	67.81%
Decline	47	30.32%	32.19%
No Change	9	5.81%	-

Table D8. Proportions of Participants Experiencing Overall Improvement, Decline, or No Change in Values.

	Count	%	% Among Participants Reporting Change
Improvement	67	43.23%	45.58
Decline	80	51.61%	54.42
No Change	8	5.16%	-

Table D9. Proportions of Participants Predicting Overall Improvement, Decline, or No Change in Values.

	Count	%	% Among Participants Reporting Change
Improvement	88	56.77	67.18
Decline	43	27.74	32.82
No Change	24	15.48	-

Table D10. Proportions of Participants Remembering Overall Improvement, Decline, or No Change in Values.

	Count	%	% Among Participants Reporting Change
Improvement	81	52.26%	60%
Decline	54	34.84%	40%
No Change	20	12.90%	-

Appendix E: Results from Alternate Personality Measures

Table E1. Correlations Between Single Item and Scale Measures of Each Personality Dimension at Time 1 (Dec 2013) and Time 2 (Dec 2014). (See Appendix I for Measures).

	at Time 1	at Time 2
Extraversion	$r = 0.638$	$r = 0.465$
Agreeableness	$r = 0.352$	$r = 0.543$
Conscientiousness	$r = 0.441$	$r = 0.371$
Emotional stability	$r = 0.549$	$r = 0.519$
Openness	$r = 0.241$	$r = 0.254$

Note: All correlations in table are significant at $p = 0.003$ or less.

Figure E1. Reanalysis of Absolute Directional Personality Change Using Scale Measures of Current Personality at Time 1 and Time 2.

Note: To compensate for differences in question format between predicted/remembered assessments (0-100 rating) and current personality inventory (1-5 rating), all scores were converted to a 0-1 scale for this analysis. Error bars represent 95% confidence intervals.

* $p < .05$, ** $p < .01$.

Figure E2. Reanalysis of Absolute Directional Personality Change Using Scale Measures of Current Personality at Time 1 and Time 2.

Note: To compensate for differences in question format between predicted/remembered assessments (0-100 rating) and current personality inventory (1-5 rating), all scores were converted to a 0-1 scale for this analysis. Error bars represent 95% confidence intervals.

* $p < .05$, *** $p < .001$.

Appendix F: Additional Accuracy Analyses

Although we found systematic biases in mean-level perceptions of personal change, this does not tell us whether participants are nevertheless generally well-calibrated about the direction and relative magnitude of their change. That is, despite the fact that people are biased, do those who, for example, predict and report a larger positive change in fact experience more improvement than those who anticipate less change? Or, are people completely uncalibrated when it comes to describing their own personal change? (See Epley & Dunning, 2006 for a more thorough treatment of the distinction between bias and discrimination accuracy; see also Yaniv, Yates, & Smith, 1991; Corwin, 1994). We examined these questions by looking at the correlations between participants' predicted and recollected net directional change and their actual net directional change in personality and values.

Despite the mean-level biases in both predictions and recollections of change in personality/values, these are positively correlated with actual change, suggesting that people do demonstrate some knowledge about the direction and relative size of their changes (see Tables F1 and F2). That is, despite being systematically more likely to overpredict improvement over time in retrospect and especially in prospect, people's assessments of their own change still provided discriminating information about how they would change relative to others. So, for example, even though people who decline over time still tend to show an improvement bias (e.g., reporting an improvement rather than a decline), their reported improvements are nevertheless more tempered than those who truly undergo large positive change.

Table F1. Correlations Between Predicted/Remembered Directional Personality Change and Actual Directional Personality Change.

Personality Correlations	Predicted with Actual	Remembered with Actual
Agreeableness	0.36***	0.22**
Extraversion	0.17*	0.36**
Conscientiousness	0.46***	0.07
Emotional Stability	0.46***	0.45***
Openness	0.20*	0.31***

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Table F2. Correlations between Predicted/remembered Directional Value changes and Actual Directional Value Changes.

Value correlations	Predicted with Actual	Remembered with Actual
Hedonism	0.23**	0.41***
Achievement	0.22**	0.29***
Power	0.18*	0.22**
Benevolence	0.18*	0.36***
Universalism	0.22**	0.27***
Security	0.33***	0.32***
Conformity	0.37***	0.27***
Tradition	0.22**	0.19*
Self-direction	0.19*	0.26**
Stimulation	0.30***	0.21**

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

Appendix G: Reanalysis of Value Change Including Conformity

Conformity was excluded in the original directional analysis of net improvement/decline in values because of the fact that both increases and decreases in the importance of this value were rated as neutral on average in the pretest (that is, increases did not reflect improvements and decreases did not reflect declines as they did for the other 9 values). Nevertheless, as a test of robustness, the following results repeat the original analyses while retaining conformity in the value measure. We again find that participants over-predicted their improvement, even when including conformity in the composite value measures.

Net Directional Change

There were significant differences in net directional change for value importance by type of change (predicted, actual, recalled; $F(2, 308)=9.62, p<.001, \eta_p^2=0.06$). Participants predicted ($M=+0.12, SD=0.49$) and remembered improvement in the importance of overall values ($M=+0.11, SD=0.72$) to a similar degree ($t(154)=0.16, 95\% CI=[-0.13, 0.15], d=0.01, p>.250$). However, actual net directional change reflected a decline in the importance of the values ($M=-0.18, SD=0.92; t(154)=-2.43, 95\% CI=[-0.32, -0.03], d=0.20, p=0.016$) that was significantly less positive than either predicted ($t(154)=4.02, 95\% CI=[0.15, 0.44], d=0.32, p<.001$) or remembered change ($t(154)=3.39, 95\% CI=[0.12, 0.45], d=0.27, p<.001$).

Individual-level improvements and declines

Decomposing directional change revealed that over the course of the year, a similar number of people actually experienced an improvement vs. a decline in the importance of values (45.45% vs. 54.55%, $\chi^2=1.18, 95\% CI=[-0.25, 0.07], V=0.09, p>.250$). Furthermore, the average magnitude of actual declines was larger than the average magnitude of improvements (+.68 vs. -.92, $t(138)=2.87, 95\% CI = [0.07, 0.41], d=0.48, p=.005$). In contrast, more people predicted

improvements rather than declines in value importance (61.97% vs. 38.02%, $\chi^2=8.14$, 95% CI=[0.07, 0.40], $V=0.23$, $p<.004$) and the absolute magnitude of predicted improvements was similar to that of predicted declines (+.45 vs. -.40, $t(126)=1.06$, 95% CI=[-0.05, 0.15], $d=0.18$, $p>.250$). A similar number of participants recalled overall improvements and declines (54.35% vs. 45.65%, $\chi^2=1.04$, 95% CI=[-0.08, 0.25], $V=0.09$, $p>.250$), with recalled improvements slightly, though not significantly, larger than declines (+.61 vs. -.47, $t(128)=1.62$, 95% CI=[-0.03, 0.32], $d=0.27$, $p=0.107$).

The tendency to underestimate absolute change and overestimate improvement in values stemmed largely from those who experienced declines in value importance. Participants whose average value importance had increased ($M = +0.67$, $SD = 0.42$) indeed predicted ($M = +0.28$, $SD = 0.41$) and recalled ($M = +0.23$, $SD = 0.70$) an increase. However, participants whose average value importance had declined over the course of the year ($M = -0.92$, $SD = 0.58$) instead predicted ($M = -0.01$, $SD = 0.54$) and recalled ($M = 0.02$, $SD = 0.72$) relative stability. As a result, decliners were less accurate than the improvers in both their predictions (absolute error=.91 vs. 0.40, $t(139)=4.53$, 95% CI=[.29, .73], $d=0.74$, $p<.001$) and their recall (absolute error=.94 vs. 0.44, $t(141)=3.72$, 95% CI=[0.23, 0.76], $d=0.62$, $p<.001$).

Appendix H: Global Measures of Similarity and Change

Measures

In addition to specific measures of personality, values, and preferences, participants also completed measures to assess their global perceptions of similarity and change (see Appendix I for measures). At Time 1, participants completed a three-item measure of psychological connectedness to the future self (Bartels & Urminsky, 2011). These items asked them to report similarity to, overlap with, and expected change in the future self over the next year, using 100-point scales. At Time 2, participants completed a similar measure assessing perceived similarity to, overlap with, and amount of change from the person they were one year ago.

Results

Participants in the first survey (at Time 1), predicted that they would be more similar to their future self in a year ($M=68.55$, $SD=15.67$), than those in the second survey a year later (at Time 2), remembered being to their past self a year ago ($M=62.97$, $SD=20.59$, $t(154)=3.13$, 95% $CI=[2.06, 9.11]$, $d=0.25$, $p=0.002$). These scores were obtained by averaging the items from the three-item global psychological connectedness measure that assessed general similarity, overlap, and (reverse-scored) change. This is consistent with Quoidbach et al. (2013)'s finding that people predicted they would undergo less general "change as a person" in the future than they remembered in the past.

Additional Analysis of Relationships Between Global Change and Positive/Negative Change in Specific Domains

Because global change was rated as generally negative in the pretest, we performed a series of regressions to determine whether overall perceptions of global change in our sample were in fact more strongly associated with negative (versus positive) predicted and remembered

changes in personality, preferences, and values. In order to do so, we calculated the proportion of positive versus negative personality and value changes reported by each participant. That is, if a participant reported improvements in 3 personality dimensions and declines in 2 dimensions, their positive personality change was 3/5 and their negative personality change was 2/5.

Similarly, a participant who predicted positive change in 8 out of 10 values was assigned a value of 8/10 for positive value change and 2/10 for negative value change. These values were then regressed on participants' total global change scores in order to determine whether positive or negative change had a greater influence on global perceptions of change. We also examined the relationship between the absolute magnitude of change in each domain and global change.

Results

Regression 1: Relationship between absolute value of predicted personality change and global change.

	B	β	SE	<i>t</i>	<i>P</i>
Constant	72.93		1.91	38.10	<.001
Predicted Absolute Personality Change	0.535	0.235	0.179	2.98	0.003

Regression 2: Relationship between predicted positive and negative personality change and global change.

	B	β	SE	<i>t</i>	<i>P</i>
Constant	72.95		1.92	37.98	<.001
Predicted Positive Personality Change	0.518	0.216	0.190	2.72	0.007
Predicted Negative Personality Change	0.637	0.121	0.417	1.53	0.128

Regression 3: Relationship between value of remembered personality change and global change.

	B	β	SE	<i>t</i>	<i>P</i>
Constant	71.94		2.12	33.97	<.001
Remembered Absolute Personality Change	0.909	0.435	0.152	5.98	<.001

Regression 4: Relationship between remembered positive and negative personality change and global change.

	B	β	SE	<i>t</i>	<i>P</i>
Constant	71.85		2.12	33.81	<.001
Remembered Positive Personality Change	1.01	0.403	0.182	5.54	<.001
Negative Remembered Personality Change	0.67	0.171	0.287	2.34	0.021

Regression 5: Relationship between absolute value of predicted value change and global change.

	B	β	SE	<i>t</i>	<i>p</i>
Constant	72.53		2.32	31.26	<.001
Predicted Absolute Value Change	5.39	0.162	2.655	2.03	0.044

Regression 6: Relationship between predicted positive and negative value change and global change.

	B	β	SE	<i>t</i>	<i>p</i>
Constant	72.58		2.36	30.80	<.001
Predicted Positive Value Change	3.68	0.085	3.456	1.07	0.288
Predicted Negative Value Change	7.18	0.157	3.659	1.96	0.052

Regression 7: Relationship between absolute value of remembered value change and global change.

	B	β	SE	<i>t</i>	<i>p</i>
Constant	70.46		2.92	24.09	<.001
Absolute Remembered Value Change	7.14	0.241	2.33	3.07	0.003

Regression 8: Relationship between remembered positive and negative value change and global change.

	B	β	SE	<i>t</i>	<i>p</i>
Constant	70.43		2.99	23.58	<.001
Remembered positive value change	7.23	0.201	2.832	2.55	0.012
Remembered negative value change	6.96	0.137	4.013	1.74	0.085

Regression 9: Total predicted preference change and global change.

	B	β	SE	<i>t</i>	<i>p</i>
Constant	70.46		1.81	39.01	<.001
Total number of predicted changes	1.91	0.127	1.224	1.56	0.12

Regression 10: Neutral and negative predicted preference change and global change.

	B	β	SE	<i>t</i>	<i>p</i>
Constant	70.36		1.78	39.63	<.001
Predicted neutral preference changes	1.42	0.072	1.616	0.88	0.382
Predicted negative preference changes	2.30	0.085	2.192	1.05	0.296

Regression 11: Total remembered preference change and global change.

	B	β	SE	<i>t</i>	<i>p</i>
Constant	71.43		2.302	31.03	<.001
Total number of remembered changes	6.37	0.372	1.287	4.95	<.001

Regression 12: Neutral and negative remembered preference change and global change.

	B	β	SE	<i>t</i>	<i>p</i>
Constant	71.40		2.30	30.99	<.001
Predicted neutral preference changes	7.68	0.305	1.951	3.94	< .001
Predicted negative preference changes	4.72	0.162	2.249	2.10	0.038

The absolute magnitude of change in each of the domains measured (personality, values, preference) is generally a good predictor of global change. Overall, positive and negative changes both seem to contribute to perceptions of global change. Although pretest results indicated that people tend to view global change as undesirable, we find no evidence that people seem to be disproportionately relying on specific negative (vs. positive) changes in making their assessments of personal global change.

Appendix I: Listing of Stimuli

Personality Measures

Single-Item Measures

Current personality (assessed at Time 1 and Time 2).

Extroversion: People who possess this characteristic show an energetic approach towards the social and material world. They are generally social, active, assertive, enthusiastic, and tend to have positive emotions. They may commonly be leaders in social groups and have a large number of friends.

At this moment in time, how extroverted are you?

Agreeableness: People who possess this characteristic have a prosocial and altruistic orientation towards others. They are modest, trusting, and empathetic. They will generally tend to work well in groups, help others, and emphasize the good qualities in other people.

At this moment in time, how agreeable are you?

Conscientiousness: People who possess this characteristic have good impulse control. They exhibit constraint, stay on task, and are good at following rules, organizing, and planning. They tend to do well in school and at other goal-oriented behaviors.

At this moment in time, how conscientious are you?

Emotional stability: People who possess this characteristic are calm and stable. They tend to be relaxed and have control over their emotions. In general, they are able to handle stressful life events and situations without losing their composure.

At this moment in time, how emotionally stable are you?

Openness: People who possess this characteristic tend to sample from and enjoy a wide variety experiences. They tend to be creative, original, and have a complex mental and experiential experience. They like learning for its own sake and come up with new ideas for interesting and stimulating activities.

At this moment in time, how open are you?

Predicted personality (assessed at Time 1).

Note: Participants were presented with descriptions of each personality trait (see current personality section) when making all assessments.

In exactly one year from now, how extroverted will you be?

Remembered personality (assessed at Time 2).

Note: Participants were presented with descriptions of each personality trait (see current personality section) when making all assessments.

Exactly one year ago, how extroverted were you?

Exactly one year ago, how agreeable were you?

Exactly one year ago, how conscientious were you?

Exactly one year ago, how emotionally stable were you?

Exactly one year ago, how open were you?

Alternate measure of current personality only: 25-item sets of IPIP Big-Five Factor Markers (Goldberg, 1992; administered at Time 1 and Time 2).

Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age. So that you can describe yourself in an honest manner, your responses will be kept in absolute confidence. Indicate for each statement whether it is

1. Very Inaccurate, 2. Moderately Inaccurate, 3. Neither Accurate Nor Inaccurate, 4. Moderately Accurate, or 5. Very Accurate as a description of you.

Items 1-25 administered at Time 1 (Dec 2013)

Note: 5 items per personality dimension; (R) indicates reverse-scored item

	Item	Factor
1.	Am the life of the party.	[Extraversion]
2.	Insult people.	[Agreeableness (R)]
3.	Am always prepared.	[Conscientiousness]
4.	Get stressed out easily.	[Emotional Stability (R)]
5.	Have a rich vocabulary.	[Openness]
6.	Often feel uncomfortable around others.	[Extraversion (R)]
7.	Am interested in people.	[Agreeableness]
8.	Leave my belongings around.	[Conscientiousness (R)]
9.	Am relaxed most of the time.	[Emotional Stability]
10.	Have difficulty understanding abstract ideas.	[Openness (R)]
11.	Feel comfortable around people.	[Extraversion]
12.	Am not interested in other people's problems.	[Agreeableness (R)]
13.	Pay attention to details.	[Conscientiousness]
14.	Worry about things.	[Emotional Stability (R)]
15.	Have a vivid imagination.	[Openness]
16.	Keep in the background.	[Extraversion (R)]
17.	Sympathize with others' feelings.	[Agreeableness]
18.	Make a mess of things.	[Conscientiousness (R)]
19.	Seldom feel blue.	[Emotional Stability]
20.	Am not interested in abstract ideas.	[Openness (R)]
21.	Start conversations.	[Extraversion]
22.	Feel little concern for others.	[Agreeableness (R)]
23.	Get chores done right away.	[Conscientiousness]
24.	Am easily disturbed.	[Emotional Stability (R)]
25.	Have excellent ideas.	[Openness]

Items 26-50 administered at Time 2 (Dec 2014)

Note: 5 items per personality dimension; (R) indicates reverse-scored item

26.	Bottle up my feelings.	[Extraversion (R)]
27.	Am on good terms with nearly everyone.	[Agreeableness]
28.	Find it difficult to get down to work.	[Conscientiousness(R)]
29.	Feel threatened easily.	[Emotional Stability (R)]
30.	Catch on to things quickly.	[Openness]
31.	Feel at ease with people.	[Extraversion]
32.	Have a good word for everyone.	[Agreeableness]
33.	Make plans and stick to them.	[Conscientiousness]
34.	Get overwhelmed by emotions.	[Emotional Stability (R)]
35.	Can handle a lot of information.	[Openness]
36.	Am a very private person.	[Extraversion (R)]
37.	Show my gratitude.	[Agreeableness]
38.	Leave a mess in my room.	[Conscientiousness (R)]
39.	Take offense easily.	[Emotional Stability (R)]
40.	Am good at many things.	[Openness]
41.	Wait for others to lead the way.	[Extraversion (R)]
42.	Think of others first.	[Agreeableness]
43.	Love order and regularity.	[Conscientiousness]
44.	Get caught up in my problems.	[Emotional Stability(R)]
45.	Love to read challenging material.	[Openness]
46.	Am skilled in handling social situations.	[Extraversion]
47.	Love to help others.	[Agreeableness]
48.	Like to tidy up.	[Conscientiousness]
49.	Grumble about things.	[Emotional Stability (R)]
50.	Love to think up new ways of doing things.	[Openness]

Value Measures

Please rate how important each of these values is as a **guiding principle** to you *[right now/one year from now/one year ago]*.

Use the rating instructions below:

0--means the value is [will be/was] not at all important, it is not [will not be/was not] relevant as a guiding principle for you.

3--means the value is [will be/was] important.

6--means the value is [will be/was] very important.

7--means that the value is [will be/was] of supreme importance as a guiding principle in your life

-1 is for rating any values that are [will be/were] ***opposed*** to the principles that guide you.

The higher the number (0, 1, 2, 3, 4, 5, 6), the more important the value is [will be/was] as a guiding principle in your life ***right now[one year from now/one year ago]***.

RIGHT NOW[ONE YEAR FROM NOW/ONE YEAR AGO]...

Preference Measures

Note: Preference measures adapted from Quoidbach, Gilbert, & Wilson (2013)

Time 1: Current and Predicted Preferences

1. What is your favorite food? [participant types in answer]

Do you think your favorite food IN ONE YEAR will be the same as your favorite food TODAY? [Yes/No]

2. What is your favorite type of music? [participant types in answer]

Do you think your favorite type of music IN ONE YEAR will be the same as your favorite type of music TODAY? [Yes/No]

3. What is your favorite hobby? [participant types in answer]

Do you think your favorite hobby IN ONE YEAR will be the same as your favorite hobby TODAY? [Yes/No]

4. What is your favorite book? [participant types in answer]

Do you think your favorite book IN ONE YEAR will be the same as your favorite book TODAY? [Yes/No]

5. What is your favorite vacation spot? [participant types in answer]

Do you think your vacation spot IN ONE YEAR will be the same as your favorite vacation spot TODAY? [Yes/No]

6. Who is your best friend? [participant types in answer]

Do you think your best friend IN ONE YEAR will be the same person as your best friend TODAY? [Yes/No]

Time 2: Assessment of Actual Preference Change

1. One year ago, you told us your favorite food was [displays participant's answer from Time 1].

Is your favorite food TODAY the same as your favorite food ONE YEAR AGO? [Yes/No]

2. One year ago, you told us your favorite type of music was [displays participant's answer from Time 1].

Is your favorite type of music TODAY the same as your favorite type of music ONE YEAR AGO? [Yes/No]

3. One year ago, you told us your favorite hobby was [displays participant's answer from Time 1].

Is your favorite hobby TODAY the same as your favorite hobby ONE YEAR AGO? [Yes/No]

4. One year ago, you told us your favorite book was [displays participant's answer from Time 1].

Is your favorite book TODAY the same as your favorite book ONE YEAR AGO? [Yes/No]

5. One year ago, you told us your favorite vacation spot was [displays participant's answer from Time 1].

Is your favorite vacation spot TODAY the same as your favorite vacation spot ONE YEAR AGO? [Yes/No]

6. One year ago, you told us your best friend was [displays participant's answer from Time 1].

Is your best friend TODAY the same person as your best friend ONE YEAR AGO? [Yes/No]

Global Measures of Similarity and Change

(Results related to these measures reported in Appendix H only)

Time 1: Global similarity/change predictions

Similarity

Please think about the important characteristics that make **you** the person you are now—your personality, temperament, major likes and dislikes, beliefs, values, ambitions, life goals, and ideals—and please rate the degree of connectedness between the person you expect to be in **a year** compared to the person you are now.

Please enter a value on the line below, where:

0 means "I will be completely different in the future" and

100 means "I will be exactly the same in the future".

Overlap

Now, please think again about the important characteristics that make **you** the person you are now—your personality, temperament, major likes and dislikes, beliefs, values, ambitions, life goals, and ideals—and indicate your opinion about the degree of connectedness or overlap held between the person you are now and the person you will be in a year by using the slider bar to mark it on the line below.

The **right side** of the line means means there is COMPLETE OVERLAP between you now and you in the future, as shown in this diagram:

The **left side** of the line means means there is NO OVERLAP between you now and you in the future, as shown in this diagram:

Change

How much is who you are going to change in the coming year?

Time 2: Global similarity/change recall

Similarity

Please think about the important characteristics that make **you** the person **you are now**—your personality, temperament, major likes and dislikes, beliefs, values, ambitions, life goals, and ideals—and please rate the degree of connectedness between **the person you were a year ago** compared to the person you are now.

Please enter a value on the line below, where:

0 means "I was completely different in the past" and

100 means "I was exactly the same in the past".

Overlap

Now, please think again about the important characteristics that make **you** the person you are now—your personality, temperament, major likes and dislikes, beliefs, values, ambitions, life goals, and ideals—and indicate your opinion about the degree of connectedness or overlap held between the person you are now and the person you were **one year ago** by using the slider bar to mark it on the line below.

The **left side** of the line means means there is NO OVERLAP between you now and you in the past, as shown in this diagram:

The **right side** of the line means means there is COMPLETE OVERLAP between you now and you in the past, as shown in this diagram:

Change

Overall, how much has who you are changed in the past year?

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