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Age differences in free will and control perceptions across the lifespan and around the world

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ABSTRACT

Variation in free will and control perceptions has been examined across the development of young children, adults, and in several different countries. In two studies (three samples; total $N = 492{,}134$), older adults believed less in free will, fatalistic determinism, and perceived less control over their lives than younger adults. In Study 2 (Samples 1 [48 countries] and 2 [99 countries]), control perceptions were highest among individuals who lived in countries that were more indulgent (versus restricted). Country-level characteristics often moderated the link between age and control perceptions, although variation in age differences was relatively small. The current studies are the largest and most comprehensive investigations of demographic and cultural differences in free will and control perceptions. The findings are discussed in the context of the mechanisms that drive changes in free will and control perceptions across the lifespan and across cultures.

How much control do we think we have over our lives? Can we choose to do anything we want and set our minds to? At a young age, many Westerners are assured of this popular sentiment. However, over time, how do these perceptions change? A major component in these judgments is whether people think they have the freedom to choose what they want to do, the decisions they make, and how their lives turn out (Monroe and Reeder, 2011; Monroe et al., 2015; Nichols, 2011; Nowicki and Strickland, 1973; Stroessner and Green, 1990; Waldman et al., 1983). As we age, these intuitions likely shift due to circumstance and an accumulation of wide-ranging personal experiences.

But how does this intuition develop among younger and older adults? And how much does it depend on one's specific cultural context? To date, very few studies have examined how these perceptions depend on the specific cultural context. The developmental research that has been conducted has primarily focused on young children (Kushnir et al., 2015) or focused more broadly on dispositional characteristics, like perceived control (people's belief about their abilities to bring about desired outcomes; see Robinson and Lachman, 2017). This research coincides with other research demonstrating considerable changes that people experience in related characteristics across the adult lifespan, such as the ability to impose self-restraint and take responsibility for their actions (Chopik, 2016; Jackson et al., 2009; Soto et al., 2010; Soto and Tackett, 2015). There is also relatively little information about how perceptions of control vary across cultures, although the topic has received some recent attention in the psychological research (Baumeister, 2008; Clark et al., 2014). Further, no studies have examined how cultural factors (e.g., individualism/collectivism) might moderate age differences in perceptions of control and free will (e.g., do younger and older adults differ more dramatically in individualistic or collectivistic cultures?). In the current studies, we examined age differences in perceptions of free will and control in three combined samples of nearly half a million participants ($N = 492{,}134$). Further, we examined the moderating roles of personal and cultural characteristics on how perceptions of free will and control will differ by age.

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Operationalizing free will and control

In the current study, we operationalized "perceptions of free will and control" in two ways: a standard assessment of free will beliefs and the feeling that people have freedom and control over how their lives turn out (i.e., that their actions matter).

At least in Western cultures, most adults believe that they and others possess control over their mental states and actions and that these actions have an intended outcome (Cusimano and Goodwin, 2019; Monroe and Malle, 2010). This ability is partially inferred by observing constraints (e.g., a person was "forced to do something"), or lack thereof, on others' behavior. This broadly captures an intuitive understanding of why people often judge whether they have full control over their capacities and, by extension, whether these actions matter for their lives (Nichols, 2004, 2011). Although we may generally view people as in control of their lives and that their free choices impact their outcomes, we know we and others are nonetheless limited by many forces (Confer and Chopik, 2019). These limiting forces include physical, biological, social (i.e., norms), and cultural factors, such as the force of gravity, unconscious neural activation, experiencing racial exclusion, or living in an autocratic state. Each of these factors can limit the paths we wish to pursue otherwise and can take decisions out of our hands.

In the psychological literature, perceptions of control and free will are conceptualized and measured in many ways (e.g., Rakos et al., 2008; Stroessner and Green, 1990). We review two ways researchers have traditionally operationalized these constructs in the past: free will beliefs and perceptions of control over their lives.

One of the most popular conceptualizations of free will is the FAD-Plus model proposed by Paulhus and colleagues (Carey and Paulhus, 2013; Paulhus and Carey, 2011; Paulhus and Margesson, 1994). The FAD-Plus model makes distinctions about the structure of free will beliefs, including people's beliefs in determinism; that people think they have free will and control over their thoughts and actions; that people might think the universe is a predictable (or a random place); and that people might think there are quantifiable ways of uncovering why people act the way they do. More formally, in this model, the authors distinguish between these four facets of free will as fatalistic determinism (i.e., "Fate already has a plan for each of us."), free will (i.e., "People can overcome obstacles if they want to."), unpredictability (i.e., "Life is hard to predict because it is almost totally random."), and scientific determinism (i.e., "People's biological makeup influences their talents and personality" and "Science has shown how your past environment created your current intelligence and personality."). Each of these facets was derived from experimental and theoretical work suggesting that variation in free will beliefs can be primarily attributable to these factors (e.g., Ebert and Wegner, 2011; Shariff et al., 2014).

Many constructs have been proposed to capture the general sense that people have control over their lives and that they can achieve important outcomes of their own volition. For example, researchers have studied concepts like autonomy (Sheeran et al., 2021), locus of control (Cheng et al., 2013), perceived control (Drewelies et al., 2017), and self-efficacy (Sheeran et al., 2016). Variation in these perceptions is linked with several important outcomes for individuals, although their exact measurement varies greatly between studies. Researchers often assess perceived control, which assesses people's beliefs about whether they can bring about "desired outcomes," not just whether they have control over their lives or actions. Other times, researchers assess domain-specific types of control (e.g., control over the food they eat and how it affects health; Houts and Warland, 1989). In line with more straightforward measures of control perceptions, we operationalized perceptions of control in a relatively simple way—we used existing data that had asked a face valid item of control perceptions: "Please…indicate how much freedom of choice and control you feel you have over the way your life turns out." Thus, variation in control beliefs, in the current studies, captures the degree to which people feel they have free choice and control over how their lives turn out.

We acknowledge that, despite our outcomes (free will beliefs and control perceptions) being present in each other's nomological network, they are not the same thing. Worth noting, control perceptions and free will beliefs are only moderately correlated (*r*s ranged from 0.35 to 0.59 with established measures of free will beliefs; see Supplementary Table 1 for a full description of their interrelations). There has been some concept creep in which the free will literature has slowly expanded to subsume some elements of these constructs (and has led to additional conceptual and empirical confusion). We ultimately stuck with these two indicators as broad reflections of the degree to which people think they control their lives and actions. More thorough discussions and reviews of free will beliefs in psychology and their associations with affective and behavioral outcomes, including their history and measurement, can be found elsewhere (Baumeister, 2008; Baumeister and Brewer, 2012; Baumeister and Monroe, 2014; Berniūnas et al., 2021; Clark et al., 2014, 2021; Monroe and Ysidron, 2021; Vonasch and Baumeister, 2013).

Free will and control perceptions across the lifespan

The ontogeny of free will and control perceptions has been explored in early development (Buttelmann et al., 2009; Chernyak et al., 2013; Gergely et al., 2002; Kushnir et al., 2015; Messer, 2016). A separate literature has also examined changes in perceived control and constraints across the adult lifespan (Robinson and Lachman, 2017). Overall, the recognition of constraints on one's actions necessarily takes time and personal experiences to develop. As children transition into adulthood and adults transition into old age, one might expect further alterations in how they imagine their control over their mental states, actions, and life outcomes (Vargas Lascano et al., 2015). Indeed, existing models of motivation and personality development propose that, when people pursue goals across the lifespan, they form representations about their experiences, including what they are and are not able to do and achieve (Dweck, 2017). In this way, age can be considered a proxy—however imperfect—for experience and knowledge about the world. Note, this does not necessarily entail that an individual must experience everything life has to offer by a certain age. However, it is relatively uncontroversial that people, with age, witness events and experiences of their own, their close others, and the broader world. Living life provides exposure to experiences that might affect thoughts and perceptions about free will and control. But why specifically would our perceptions of free will and control change during different developmental stages?

As one example, one of the main perspectives of adult development is that constraints and rewards provided by social institutions compel individuals to change themselves in important ways to adjust to these constraints (i.e., the social investment principle; Roberts et al., 2005). In other words, social institutions (e.g., legal systems, workplace expectations, norms) constrain our behavior, and we attempt to modulate our actions accordingly. Adults who successfully respond to constraints imposed on them may be engendered with the belief that they can control their actions and behaviors to meet desired goals and be successful (e.g., Bandura, 1979). Some support for this line of thinking is found in the literature—higher perceptions of free will and control associated with greater occupational success (Stillman et al., 2010) and occasionally health and well-being (Hofmann et al., 2014; Kunzmann et al., 2002; Li et al., 2016). On the other hand, people not being able to overcome certain constraints may be met with a sense that they cannot fully control their lives and what they want to do (Marek et al., 2017).

The literature on perceived control provides less controversial expectations about how free will and control perceptions might differ by age. Across cross-sectional and longitudinal studies, perceived control tends to increase throughout early adulthood and into middle adulthood (Houts and Warland, 1989; Vargas Lascano et al., 2015), although some studies find little or no change throughout this section of life (Cobb-Clark and Schurer, 2013). Age differences and developmental changes beyond middle adulthood are less ambiguous—most studies find late-life declines in perceived control (Drewelies et al., 2017;

Gatz and Karel, 1993; Hale and Cochran, 1986; Specht et al., 2013). There is evidence that the oldest old might experience some increases in perceived control (Specht et al., 2013), but this might be partially due to a methodological effect. Specifically, because people with higher levels of perceived control (and those who increase in perceived control) have greater longevity (Infurna et al., 2013; Turiano et al., 2014), the eldest participants in the study might be those particularly high in perceived control.

Nevertheless, based on our current assessment of the literature, only the diversity of control-related constructs, several predictions could be made. For example, with age and evidence that they can successfully adjust their behavior in light of constraints, people may be less likely to endorse fatalistic interpretations of the world (e.g., older adults may report having more control or perceiving greater free will over their lives). Alternatively, even though people might be able to overcome some barriers, they may feel their actions and behavior are increasingly constrained by many other outside forces as they age. This ultimately may lead to judgments that they have less control over their lives (e.g., older adults may report lower perceptions of control and free will). This hypothesis is supported by work suggesting that lower perceptions of free will are associated with higher conformity—not challenging the norms of their environment (Alquist et al., 2013). Likewise, self-control and traditionalism—both facets of the personality trait of conscientiousness—are positively associated with each other, and traditionalism is higher among older adults (Chopik, 2016; Roberts et al., 2005). With more life experience, people might also come to acknowledge inherent randomness in the universe as they age (e.g., older adults may report higher perceptions of randomness in their lives). Altogether, perceptions of free will and control might track along with similar psychological characteristics, like perceived control, which might be highest in middle age but lower in younger and older adults.

The effects of personal and cultural influences on free will and control perceptions

Aside from age, other characteristics, including demographic (e.g., religiosity, education) and cultural (e.g., individualism/collectivism) factors, may shape how adults perceive how much control and free will they have over their lives. Along with mean-level differences in control perceptions across these characteristics, there is also an open question about how these variables affect control perceptions *across the lifespan*. The effects of these characteristics on perceptions likely vary between younger and older adults. Just as the acknowledgement of constraints develops over time and age, so does the accumulation of other influences (e.g., being religious, living in a certain culture). In the next two sections, we brief summarize how demographic and cultural factors examined in our studies might affect perceptions of free will and control. In the current studies, we examined mean differences in perceptions across these factors and how these factors moderate age differences in control perceptions. Because of the study's exploratory nature and that no studies have examined moderation of age differences in control and free will perceptions (particularly based on demographic and cultural factors), we treated these tests as exploratory.

Personal characteristics

Perceptions of free will and control likely depend on the specific attitudes and experiences of the individual in question and therefore vary according to political orientation, religious attendance, gender, and education level. While some of these characteristics have been examined in prior research, many have not. Below, we briefly detail how these factors might influence perceptions of control and free will.

For political orientation, Everett et al., 2021 demonstrate that conservatives perceive more control over life relative to liberals. They suggest this is due to conservatives' tendency to moralize and hold others more morally responsible compared to liberals (see also Carey and Paulhus, 2013). Interestingly, liberals are often stereotyped as being more likely and able to change (in various ways), despite thinking they have less control over their everyday life (Lassetter and Neel, 2019). Regardless, conservatives may view people as less constrained, and therefore more responsible for their decisions and in control over their lives (Clarkson et al., 2015).

Similarly, individuals with higher religious attendance may think they have greater control over their lives. Indeed, Baumeister et al. (2010) suggest that free will is a cornerstone of religion, as religions encourage people to exhibit self-control in line with particular standards and resist impulses (e.g., not committing vices) to benefit both individuals and the cohesion of the religious group (McCullough and Willoughby, 2009). For example, Buddhists in Nepal report that through engaging in Buddhist practices of meditation and loving kindness, they feel an increased sense of control over their lives (Cassaniti, 2015). Likewise, perceptions of control are often proposed as the link between engaging in religious practices and higher levels of well-being (i.e., that engaging in religious rituals enhances perceptions of control; Jackson and Bergeman, 2011). That being said, it is also conceivable that religiosity might *reduce* perceptions of control and free will, as customs and rules provide many constraints and regulations on behavior (e.g., not to lie).

Regarding gender, men may have stronger beliefs in free will and think they have greater control relative to women. This may follow from the fact that men are higher in agentic-related traits, and there are some contexts in which men are also perceived to possess higher levels of agency (Block et al., 2019). Men also tend to favor retribution relative to women (which is associated with belief in free will; Helgeson and Fritz, 1999; Hurwitz and Smithey, 1998; Kutateladze and Crossman, 2009; Whitehead and Blankenship, 2000). Few gender differences have emerged when examining free will beliefs specifically. However, men do report higher levels of scientific determinism compared to women (Paulhus and Carey, 2011). The literature on broader perceptions of control is a little clearer—men report thinking they have greater control over their lives, and this gender difference might partially explain differences between men's and women's professional outcomes (Specht et al., 2013; Stevens et al., 1993).

Lastly, regarding education, there are conflicting findings of its association with control perceptions and believing in free will—further suggesting that the two constructs do not fall perfectly under one umbrella. On the one hand, adults with higher levels of education might have lower control perceptions and free will beliefs relative to adults with lower levels of education. This is because highly educated adults tend to be more scientifically literate and adopt a more scientific worldview (which might undermine beliefs in free will and control; Libet, 1999). Experimentally, Shariff et al. (2014) found that describing deterministic and scientific elements of the universe lowered free will beliefs. On the other hand, literature also shows that highly educated people report higher perceived mastery and control (i.e., the belief in your abilities to bring about a given outcome; Ross and Mirowski, 2013). This finding could stem from the fact that highly educated individuals might have more material resources and thus feel fewer constraints on their lives and behaviors. Thus, highly educated adults may alternatively believe they have *greater* control over their lives.

Cultural characteristics

The constraints people face, and the possibility of overcoming them, vary widely across cultural contexts. Because of this, beliefs regarding people's ability to impose their will is also expected to be culturally sensitive. In adults, Sarkissian et al. (2010) have found that belief in free will is present across several cultures. Likewise, many cultures at least partially prescribe that individuals are autonomous and have varying degrees of control perceptions (Cheng et al., 2013). However, despite people in these cultures thinking that they have free will and control over their lives, there is likely social and cross-cultural variation in these perceptions. Some evidence from early childhood supports this idea (Chernyak et al., 2013). Illustrations of this variation come

from related literature examining variation in fate control and negotiable fate (Au et al., 2012; Chaturvedi et al., 2009). Fate control is akin to beliefs about fatalism and control over personal outcomes (see Leung et al., 2002, for work on social axioms, one of which is fate control). In this work, Chinese adults are more likely to perceive external constraints on their goal pursuits (Chen et al., 2009). However, the concept of negotiable fate might have more implications for how people navigate these perceptions of constraints. Specifically, negotiable fate concerns people's ability to be efficacious or navigate their lives given the constraints imposed by fate (Au et al., 2012). The implication is that, even in the context of cross-cultural variation in control and free will perceptions, there might also be variation across people within a culture and across the lifespan. Negotiable fate (navigating life in the context of constraints) tends to be higher in Southeast Asia, East Asia, and Eastern Europe compared to North American countries and Western Europe (Leung and Bond, 2004). Negotiable fate is thought to enhance coping and positive self-views in contexts that constrain people's goal pursuits (Au et al., 2012). In this way, multiple predictions could be made—people in countries that may otherwise constrain their individual actions may try to navigate those environments by imposing a sense of autonomy despite these constraints. On the other hand, people in countries with relatively fewer constraints may feel their control and free will more readily translate to life outcomes and feel a greater sense of autonomy.

In the current studies, we focused on a few specific factors associated with variation in the aforementioned control and free will perceptions. Specifically, we examined the roles of GDP, income inequality, homicide rates, and Hofstede's six cultural dimensions. Based on previous research (i.e., Clark et al., 2014), we expected higher GDP, inequality, and homicide rates would be associated with greater perceptions of control. Clark et al. (2014) suggest these metrics, especially homicide rates, could cause a punitive motivation that increases perceptions of free will and control. The links between control perceptions, inequality, and GDP are a little more perplexing. Although Clark et al. found that higher GDP and higher inequality were both associated with greater control perceptions, it also makes sense that restricting opportunities for individuals (e.g., through a low GDP or high inequality) may translate to lower perceptions of control (for which there is some support found at both the individual- and country-level; Clark and Senik, 2011; Ross and Mirowski, 2013). Nevertheless, we have included these indicators, and more, to re-examine their links with control perceptions.

Making firm predictions about how control perceptions vary according to Hofstede's cultural dimensions is difficult, given the lack of empirical research linking cultural factors to free will and control. Hofstede's dimensions are a broad model of cultural values separated into six dimensions: individualism/collectivism, power distance, uncertainty avoidance, long-term/short-term orientation, indulgence/restraint, and masculinity/femininity. These dimensions have been discussed extensively elsewhere and have long been the subject of cross-cultural research (and debate) (e.g., Tung and Quaddus, 2002). We ultimately chose to examine these cultural characteristics because they represented one of the most recognizable and comprehensive taxonomies to describe how cultures vary.

Individualistic and collectivist cultures vary in their views on autonomy and responsibility (Kashima et al., 1995; Miller and Turnbull, 1986; Miller and Bersoff, 1992). People from individualistic cultures tend to believe more in an inherent, discrete quality that differentiates (and emphasizes separation between) individuals. This worldview contrasts the more contingent and relational nature that collectivist cultures tend to hold. In support of this idea, Cheng and colleagues (2013) found that believing one has control over their life did not translate as strongly to outcomes in collectivistic cultures, presumably because of the reduced emphasis on agentic goals. Because of this, one might expect individualistic cultures to believe more in autonomous individuals' control over their lives compared to collectivist cultures.

Power/distance is the level at which a country accepts inequality among individuals. How that inequality is perceived to be created may guide individuals' intuitions about control. One prediction is that, overall, people may view inequality as being created through individual differences in hard work or motivation (or through their own willpower), and therefore tend to accept the influence of control (i.e., that people's places are earned; Jost et al., 2004). Indeed, perceptions of free will specifically seem to increase support for economic inequality (Mercier et al., 2020). However, an opposing prediction is that overall, people from unequal countries may view inequality as being created by unequal societal distributions, *not* others' autonomous control and free will. If inequality is perceived to not stem from people's hard work or willpower, there may be a tendency to deny the existence and influence of one's control over life.

The uncertainty/avoidance dimension reflects the degree to which people feel stressed or threatened in uncertain situations. People living in more uncertain cultures may think they have less control over their lives, as individuals partly avoid uncertainty because they do not think they have control over it (Hovenkamp-Hermelink et al., 2019), which is a common tenet of many of the associated constructs we have discussed so far (Ebert and Wegner, 2011; Feldman and Chandrashekar, 2018).

Long-term orientation refers to cultivating and focusing on long-term outcomes through the adaptation of eschewing (or delaying the fulfillment of) immediate desires. Overcoming short-term gratifications, and progressing past one's current cultural climate, may lead people to believe they can overcome obstacles and barriers through their own control and actions. As a result, this might lead to the prediction that people from countries higher in long-term orientation might report more control over their life outcomes.

For indulgence/constraint, Baumeister et al. (2010, p. 67) posit that free will explicitly involves the ability to override impulses, habits, and behavior to meet the standards of one's society. Likewise, many operationalizations of control are partially defined by their ability to avoid temptation and overindulgence (Roberts et al., 2005). Thus, one prediction is that people from more restrained countries believe more in their ability to control their actions. However, constrictive norms of a culture could highlight restrictions on people's behavior (i.e., that they have less control over their lives). People's lack of opportunities to indulge may also be made salient and, as a result, people from highly restrictive countries may have lower perceptions of control.

Lastly, for masculinity/femininity, as previously discussed, more masculine cultures may perceive more control relative to feminine cultures based on the masculine tendency to be punitive (Helgeson and Fritz, 1999; Hurwitz and Smithey, 1998; Kutateladze and Crossman, 2009; Whitehead and Blankenship, 2000). However, men report high levels of scientific determinism, which is associated with lower perceptions of free will and control (Paulhus and Carey, 2011), so the associations between masculinity/femininity and control perceptions at a cultural level are unclear.

In examining these demographic and cultural factors as moderators of the link between age and free will and control perceptions, we were also able to examine the cumulative exposure of these factors across the lifespan. For example, by comparing younger and older adults' standing on these perceptions across cultures, we can make some inferences about the effects of living in a particular country over a long developmental window. Living in a collectivistic culture might make a person more attentive to the contingent nature of behavior, so older adults from collectivistic cultures might feel they have little control over their lives. Likewise, living in a culture that is so often focused on long-term orientations might eliminate age differences because citizens (of all ages) are so often focused on crafting their futures through their own actions. Alternatively, individuals might be adept at thinking they can successfully navigate and be autonomous in their environments despite environmental constraints (Au et al., 2012). These are just some speculatory ways that culture might affect younger and older people differently. We

formally tested cultural moderation of age differences in control perceptions to see if culture exerted similar influences across the adult lifespan.

The current studies

The current studies hope to provide important descriptive data on free will and control perceptions, including how they differ across the adult lifespan and how demographic and cultural factors affect perceptions of free will and control. We examined these questions in two studies containing three large cross-sectional samples totaling nearly half a million people (N = 492,134). We examined age and demographic differences in free will beliefs in Study 1. We also examined age, demographic, and cultural differences in control perceptions in forty-eight and ninety-nine countries in Study 2 (i.e., Samples 1 and 2). A major contribution of the current studies is expanding the number of demographic and cultural predictors of variation in free will and control perceptions and also how these indicators might moderate the association between age and perceptions.

Open science and ethical disclosures

The current studies were not pre-registered. Study files are available at https://osf.io/6geyp/. The data and full materials from Study 2 (https://europeanvaluesstudy.eu/; https://www.worldvaluessurvey.org/wvs.jsp) are publicly available to researchers following registration with the data curators but cannot be hosted on our OSF site for the project. Nevertheless, the syntax files are available for the three samples. Bivariate associations and study descriptives are available in Supplementary Tables 3–5. Data from Study 1 (from YourMorals.org) and some additional data on the overlap between our outcomes are available on our OSF site. Exact item wording of the YourMorals free will questions can be found in the .qsf file on the OSF page.

Many publications have been generated from these data sets and are too numerous to list here. A complete list of publications for each data set is available at the aforementioned links for the European Values Survey and the World Values Survey. Currently, there is no website summarizing all of the publications originating from YourMorals.org; however, many landmark publications on Moral Foundations Theory have used these data (Graham et al., 2009, 2011). To our knowledge, free will data from Study 1 have not been the focus of any prior investigations. Control perceptions have been the subject of many papers that have used the EVS and WVS in disciplines such as political science, economics, sociology, and psychology (although it has been called many different things, like locus of control and freedom; Clark et al., 2014; Hanson and Tuch, 2019; Inglehart et al., 2008; Jensen et al., 1990; Nikolaev and Bennett, 2016; Verme, 2009; Welzel et al., 2003). No previous work has examined age differences in these variables or moderation of age effects of these variables by personal or cultural characteristics.

The current studies were analyses of existing data sources and were thus exempt from regulatory oversight. The data collected in our measurement validation study was approved by the institutional review board at Michigan State University.

Study 1

Study 1 examined age differences in free will beliefs—a subset of our free will and control perceptions operationalization. We also examined how demographic factors predict and moderate these beliefs for individuals from the United States. These factors included gender, education, political orientation, and religious attendance. Although our analyses were largely exploratory, particularly how free will beliefs differed by age, we did make a few predictions about the role of demographic factors. Specifically, we hypothesized that individuals who were male, conservative, and had high religious attendance would believe more in free will.

Method

Participants and procedure

Participants were 10,811 respondents (63.7% Female; 83.9% White/Caucasian) who completed the free will measure from 2009 to 2018 from YourMorals.org, a website that hosts several online surveys. Participants ranged in age from 18 to 88 (M_{age} = 36.71, SD = 15.61). Sample sizes within each age range were relatively large (e.g., 18–29 years: 3072 participants, 30–39 years: 2865, 40–49 years: 1650, 50–59 years: 1323, 60+: 1901). The sample size was chosen by using all available data on free will beliefs at the time of study conception. Thus, no stopping or a priori sample size was implemented. The sample size for the current study enabled us to detect an effect as low as f^2 = 0.0009 at 80% power and α = 0.05. Due to missing data on some of the demographic characteristics, our sample size was approximately 5000 for some analyses, which still enabled us to detect relatively small effects (f^2 = 0.002 at 80% power and α = 0.05).

An additional 9,085 participants were excluded because they were either younger than 18 or older than 100 (n = 64) or from outside the United States (n = 9,021). Non-U.S. participants were excluded because the survey was administered entirely in English, and we did not have information on the English fluency of non-U.S. participants.

Measures

Free will beliefs

Free will beliefs were assessed via the Free-will and Determinism (FAD) Scale (Paulhus and Margesson, 1994). The FAD scale is a 28-item measure that is comprised of four subscales, each of which are comprised of seven items: fatalistic determinism (α = 0.80; e.g., "I believe my future has been pre-determined by fate."), scientific causation (α = 0.66; e.g., "As with other animals, human behavior always follows the laws of nature."), randomness/chance (α = 0.66; e.g., "Life is hard to predict because it is almost totally random."), and free will (α = 0.78; e.g., "People have complete control over the decisions they make."). Participants indicated their agreement with each statement on a scale ranging from 1(*totally disagree*) to 5(*totally agree*). Responses were averaged to create composites of each subscale. Scale properties are consistent with previous research using the FAD scale (Paulhus and Carey, 2011; Paulhus and Margesson, 1994).

Personal characteristics

Gender, education, political orientation, and religious attendance were entertained as possible moderators of the effects of age on each free will scale. Education was assessed on a 9-point scale ranging from 1(*some high school*) to 9(*completed a graduate or professional degree*). Political orientation was measured on a 7-point scale ranging from 1(*very liberal*) to 7(*very conservative*). Religious attendance was measured with a single item, "Thinking about your life these days, how often do you attend religious services, apart from social obligations such as weddings or funerals?" to which participants responded on a scale ranging from 1(*never*) to 7(*every week or more than once a week*).[1,2]

[1] In the current study, we operationalized religiosity based on active participation/attendance in religious services, although there are many alternative ways of doing so. We chose this operationalization because it was consistently measured in all three data sets. Unfortunately, Study 1 did not reliably measure religious affiliation over the course of data collection. However, Study 2 did; a summary of how people identifying with the major religious traditions differ in their control perceptions can be found in Supplementary Table 2. In short, Muslim participants reported the lowest perceptions of control; Christians and "Other" participants (Sikh, African religious, Jewish) reported higher perceptions of control. However, these differences were small (η^2 < .01).

[2] A reviewer pondered whether parents and non-parents differed in their perceptions of control and free will (whether it might affect their insights into ge-

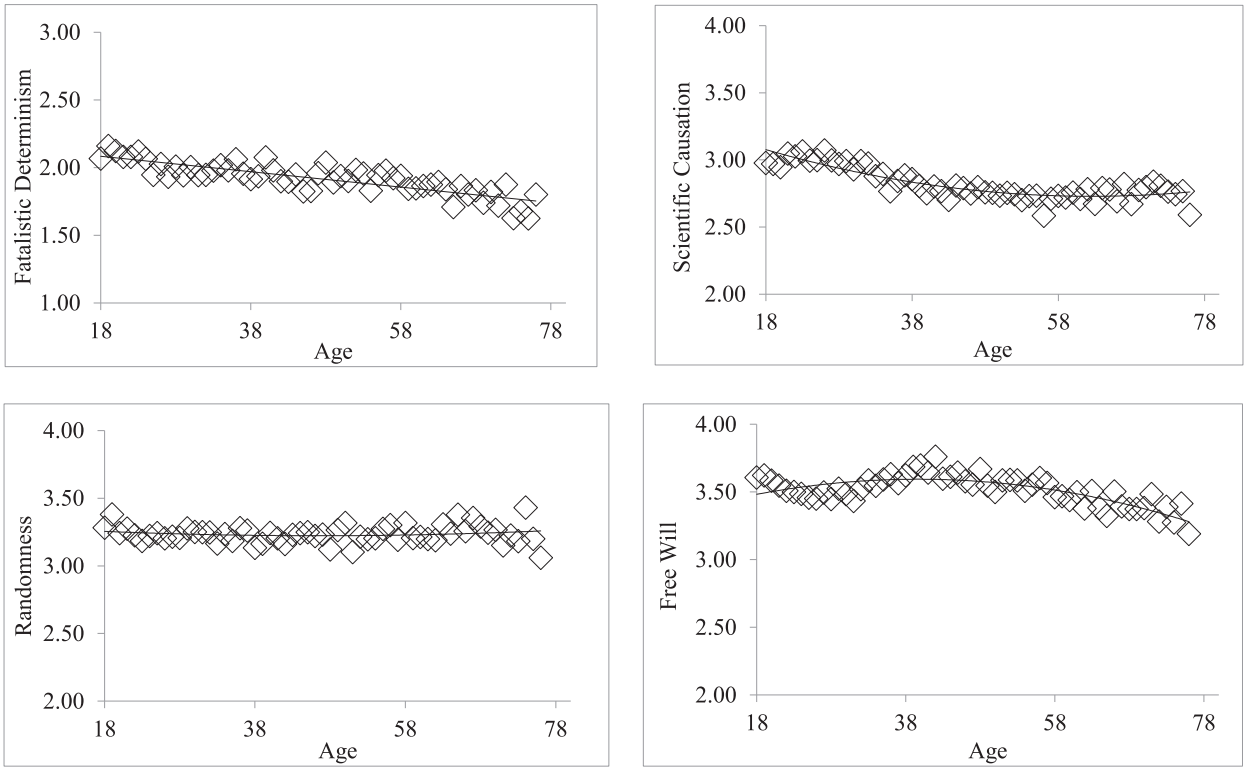

Fig. 1. Age differences in fatalistic determinism (a), scientific causation (b), randomness (c), and free will (d) for Study 1.

Results and discussion

Age differences in free will beliefs

To formally examine age differences in each FAD subscale, we tested the linear and quadratic effects of age on each subscale. We limited our investigation to quadratic effects and did not test more complex models, as developmental models are rarely precise enough to make hypotheses about cubic effects of lifespan differences in nearly any psychological construct (Chopik et al., 2019). We entered age and age^2 as predictors of each subscale. Age was mean-centered before computing age^2. We retained the most sophisticated model (i.e., age term) that was significant and plotted and interpreted age differences according to the linear or quadratic effect. The age results in Figs. 1a-d are plotted from ages 18 to 78 because sample sizes for ages beyond this fell below $n = 20$.

For the fatalistic determinism subscale, the best fitting model was the linear effect of age, $b = -0.01$, $SE < 0.001$, $\beta = -0.11$, $t = -11.75$, $p < .001$, $F(1, 10{,}807) = 138.02$, $R^2 = 0.01$. The inclusion of the quadratic term was not significant ($p = .12$). As seen in Fig. 1a, fatalistic determinism was highest among younger adults and lower among middle-aged and older adults.

For the scientific causation subscale, the best fitting model was the quadratic effect of age, $b < 0.001$, $SE < 0.001$, $\beta = 0.06$, $t = 5.12$, $p < .001$, $F(2, 10{,}804) = 156.80$, $R^2 = 0.03$. The linear effect of age was also significant ($\beta = -0.20$, $p < .001$). As seen in Fig. 1b, scientific causation was highest among younger adults and lower among middle-aged and older adults. These age differences were most dramatic among younger adults and flatter among middle-aged and older adults.

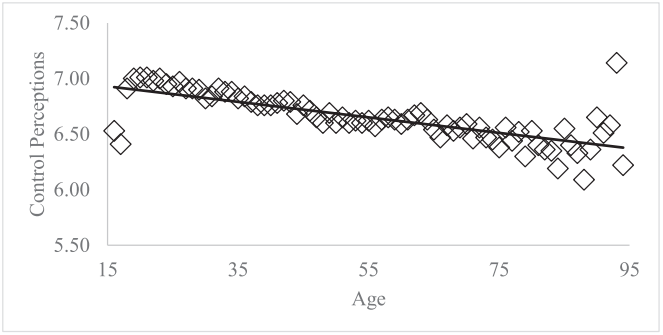

Fig. 2. Age differences in free will (Study 2: Sample 1).

For the randomness subscale, the best fitting model was the quadratic effect of age, $b < 0.001$, $SE < 0.001$, $\beta = 0.05$, $t = 3.98$, $p < .001$, $F(2, 10{,}805) = 8.39$, $R^2 = 0.002$. The linear effect of age was also significant ($\beta = -0.04$, $p = .001$). As seen in Fig. 1c, age differences were very small. Randomness was slightly higher among younger and older adults and lower among middle-aged adults.

For the free will subscale, the best fitting model was the quadratic effect of age, $b < 0.001$, $SE < 0.001$, $\beta = -0.07$, $t = -6.00$, $p < .001$, $F(2, 10{,}805) = 25.61$, $R^2 = 0.01$. The linear effect of age was not significant ($\beta = 0.01$, $p = .56$). As seen in Fig. 1d, free will beliefs were highest among younger and middle-aged adults and lowest among older adults.

Are age differences in free will moderated by personal characteristics?

Our next question examined possible moderators of age differences in each free will subscale. Specifically, we focused on the moderating roles of gender, education, political orientation, and religious at-

netic/scientific causation or that, alternatively, the responsibility might reduce perceptions of control. Although this information was not available to us in Study 1, it was available to us in both samples for Study 2. We found that parents perceive less control over their lives than non-parents in Study 2's Sample 1 ($d = .12$) and Sample 2 ($d = .07$). Integrating this information is a bit beyond the scope of the current project but these comparisons are reported here for the sake of transparency.

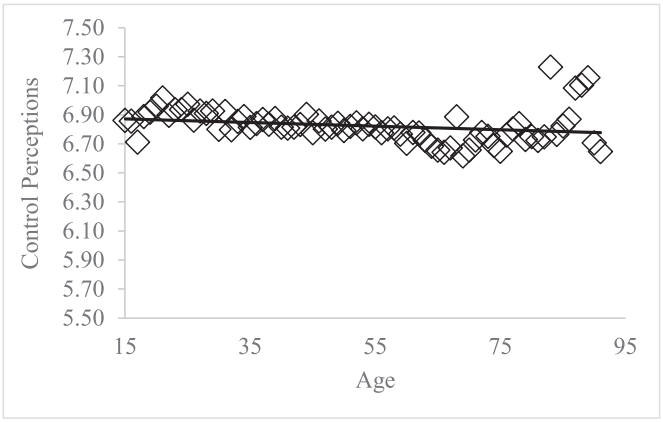

Fig. 3. Age differences in control perceptions (Study 2: Sample 2).

tendance. We mean-centered all continuous variables, and gender was contrast coded (−1: men, 1: women). Main effects of each variable and each two-way interaction between a variable and an age term were entered as predictors of each free will subscale separately. We tested moderating effects in two steps. The first step contained the linear effects (age, gender, education, political orientation, religious attendance, age × gender, age × education, age × political orientation, and age × religious attendance). The second step added the additional quadratic effects (age^2, age^2 × gender, age^2 × education, age^2 × political orientation, and age^2 × religious attendance). This was done because, although there might not be a significant quadratic effect of age seen on average in our previous analyses, such a trend could be present among one group of participants (e.g., liberals) but not others (e.g., conservatives). If the inclusion of the second step did not explain significantly more variance, the simpler, first step was ultimately retained (Chopik et al., 2013). Significant interactions were decomposed by estimating the effect of age at +/- 1 SD at the mean of each moderator. We also controlled for the year of data collection in each model.

For the fatalistic determinism subscale, the best fitting model was the linear effect model, $F(10, 4929) = 71.78$, $p < .001$, $R^2 = 0.13$. The inclusion of the quadratic moderation effects did not significantly add to the model ($p = .056$). As seen in Table 1, younger adults, women, people with lower levels of education, conservatives, and those who attend religious services more often endorsed fatalistic determinism. Three interactions were significant: age × education, age × political orientation, and age × religious attendance. Adults with higher levels of education showed more dramatic differences in fatalistic determinism with age ($b = −0.01$, $\beta = −0.13$, $p < .001$) compared to adults with lower levels of education ($b = −0.002$, $\beta = −0.06$, $p = .006$). Conservatives showed more dramatic differences in fatalistic determinism with age ($b = −0.01$, $\beta = −0.12$, $p < .001$) compared to liberals ($b = −0.003$, $\beta = −0.06$, $p = .003$). Participants who attended religious services more frequently ($b = −0.01$, $\beta = −0.15$, $p < .001$) showed sharper differences in fatalistic determinism; those who attended religious services less frequently did not differ by age ($b = −0.001$, $\beta = −0.03$, $p = .19$).

For the scientific causation subscale, the best fitting model was the quadratic model, $F(15, 4922) = 70.29$, $p < .001$, $R^2 = 0.18$. As seen in Table 1, younger adults, men, people with higher levels of education, liberals, and those who rarely attended religious services were more likely to endorse scientific causation. Participants who took the survey more recently were more likely to endorse scientific causation. There were two significant interactions: age × religious attendance and age^2 × gender. Those who attended religious services less often showed greater age differences in scientific causation ($b = −0.01$, $\beta = −0.24$, $p < .001$) compared to those who attended religious services more often ($b = −0.006$, $\beta = −0.16$, $p < .001$). Among women, the effect of age^2 on scientific causation was significant ($b < 0.001$, $\beta = 0.12$, $p = .002$); among men, the effect of age^2 was not significant ($b < 0.001$, $\beta = 0.04$, $p = .15$). Plotting these quadratic effects revealed that women experienced the greatest (negative) age differences in scientific causation after middle age whereas men had a negative linear association between age and scientific causation.

For the randomness subscale, the best fitting model was the linear effect model, $F(10, 4928) = 20.62$, $p < .001$, $R^2 = 0.04$. The inclusion of the quadratic moderation effects did not significantly add to the model ($p = .68$). As seen in Table 1, people with lower levels of education, liberals, and those who rarely attended religious services were more likely to endorse randomness. Participants who took the survey more recently were less likely to endorse randomness. There were two significant interactions: age × gender and age × education. Men experienced higher levels of randomness with age ($b = 0.002$, $\beta = 0.05$, $p = .02$), whereas women did not report significant age differences ($b = −0.001$, $\beta = −0.02$, $p = .34$). Individuals with higher levels of education reported higher levels of randomness with age ($b = 0.002$, $\beta = 0.06$, $p = .004$); individuals with lower levels of education did not report significant age differences in randomness ($b = −0.002$, $\beta = −0.04$, $p = .04$).

For the free will subscale, the best fitting model was the quadratic model, $F(15, 4925) = 85.94$, $p < .001$, $R^2 = 0.21$. The quadratic model was likely the best fitting model because of the significant age^2 effect, as all the moderating effects in this step were not significant ($ps > 0.10$). As seen in Table 1, older adults, women, people with lower levels of education, and conservatives were more likely to endorse free will beliefs. People who took the survey more recently were less likely to endorse free will beliefs. There were no significant moderating effects on age in this quadratic model predicting free will beliefs.

Summary of results

Overall, older adults were lower in fatalistic determinism, provided fewer scientific causes for behavior, and were less likely to endorse believing in free will compared to younger adults.

Men were higher in fatalistic determinism, feelings of randomness/chance, and were less likely to believe in free will. Educated individuals were lower in fatalistic determinism, feelings of randomness/chance, belief in free will, and provided more scientific causes for behavior. Conservatives were higher in fatalistic determinism and belief in free will, and less likely to perceive life as random and provide scientific causes for behavior. People who attended religious services were higher in fatalistic determinism and less likely to provide scientific causes for behavior or perceive life as random. Finally, people who took the survey more frequently were more likely to endorse scientific causation and less likely to endorse randomness and free will.

These personal characteristics rarely moderated the effects of age on each of the free will belief subscales. In the cases in which moderation was present, the interaction effects were generally small, not consistent across subscales, and often distinguished between groups moving in a similar direction across age, albeit one group might have had more dramatic age differences. One common effect found across models is that highly educated participants tended to endorse fatalistic determinism less and embrace randomness more across life. Other effects across the lifespan were less straightforward. To summarize these effects, (negative) age differences in fatalistic determinism were most dramatic for highly educated participants, conservatives, and people who often attended religious services. Age differences in scientific determinism were most dramatic for people who rarely attended religious services and women. Finally, feelings of randomness/chance were higher among older adults who were men and highly educated.

Study 2

Study 2 examined how control perceptions varied across the adult lifespan in two cross-cultural samples. In addition to examining cross-cultural variation (in forty-eight European countries in Sample 1 and

Table 1
Age differences in free will beliefs in Sample 1.

Fatalistic determinism							
						95% CI (b)	
	b	SE	β	t	p	LB	UB
Intercept	1.97	.01		168.31	< 0.001	1.95	2.00
Age	−0.004	.001	−0.09	−6.14	< 0.001	−0.01	−0.003
Gender	.07	.01	.09	6.65	< 0.001	.05	.09
Education	−0.02	.01	−0.05	−3.27	.001	−0.02	−0.01
Political orientation	.06	.01	.14	8.59	< 0.001	.05	.07
Religious attendance	.09	.01	.27	16.63	< 0.001	.08	.10
Year	.01	.01	.02	1.16	.25	−0.004	.02
Age × Gender	.001	.001	.02	1.40	.16	< 0.001	.002
Age × Education	−0.001	< 0.001	−0.04	−26.67	.01	−0.001	< 0.001
Age × Political orientation	−0.001	< 0.001	−0.03	−2.11	.04	−0.002	< 0.001
Age × Religious attendance	−0.001	< 0.001	−0.07	−4.51	< 0.001	−0.002	−0.001
Scientific causation							
						95% CI (b)	
	b	SE	β	t	p	LB	UB
Intercept	2.88	.01		239.22	< 0.001	2.87	2.90
Age	−0.01	.001	−0.20	−8.63	< 0.001	−0.01	−0.01
Gender	−0.08	.01	−0.13	−7.55	< 0.001	−0.09	−0.06
Education	.01	.01	.04	2.03	.04	.002	.02
Political orientation	−0.10	.01	−0.28	−14.72	< 0.001	−0.11	−0.09
Religious attendance	−0.06	.01	−0.20	−10.52	< 0.001	−0.07	−0.05
Year	.02	.01	.05	3.91	< 0.001	.01	.03
Age × Gender	< 0.001	.001	.01	.62	.54	−0.001	.002
Age × Education	−0.001	< 0.001	−0.04	−1.87	.06	−0.001	< 0.001
Age × Political orientation	.001	< 0.001	.03	1.54	.12	< 0.001	.002
Age × Religious attendance	.001	< 0.001	.05	1.97	.05	< 0.001	.002
Age^2	< 0.001	< 0.001	.09	3.71	< 0.001	< 0.001	< 0.001
Age^2 × Gender	< 0.001	< 0.001	.06	2.26	.02	< 0.001	< 0.001
Age^2 × Education	< 0.001	< 0.001	.03	1.30	.20	< 0.001	< 0.001
Age^2 × Political orientation	< 0.001	< 0.001	.01	.51	.61	< 0.001	< 0.001
Age^2 × Religious attendance	< 0.001	< 0.001	−0.001	−0.05	.96	< 0.001	< 0.001
Randomness							
						95% CI (b)	
	b	SE	β	t	p	LB	UB
Intercept	3.23	.01		289.98	< 0.001	3.21	3.25
Age	< 0.001	.001	.01	.53	.60	−0.001	.002
Gender	−0.02	.01	−0.03	−1.92	.06	−0.04	< 0.001
Education	−0.02	.004	−0.07	−4.48	< 0.001	−0.03	−0.01
Political orientation	−0.04	.01	−0.10	−5.98	< 0.001	−0.05	−0.03
Religious attendance	−0.03	.01	−0.10	−6.17	< 0.001	−0.04	−0.02
Year	−0.02	.01	−0.04	−3.17	.002	−0.03	−0.01
Age × Gender	−0.001	.001	−0.04	−2.47	.01	−0.003	< 0.001
Age × Education	.001	< 0.001	.05	3.65	< 0.001	< 0.001	.001
Age × Political orientation	−0.001	< 0.001	−0.03	−1.69	.09	−0.001	< 0.001
Age × Religious attendance	< 0.001	< 0.001	.01	.83	.41	< 0.001	.001
Free will							
						95% CI (b)	
	b	SE	B	t	p	LB	UB
Intercept	3.50	.01		258.22	< 0.001	3.50	3.55
Age	.003	.001	.07	3.02	.003	.001	.01
Gender	.07	.01	.10	5.63	< 0.001	.05	.10
Education	−0.04	.01	−0.11	−5.78	< 0.001	−0.05	−0.02
Political orientation	.20	.01	.46	24.81	< 0.001	.18	.21
Religious attendance	−0.01	.01	−0.02	−0.90	.37	−0.02	.01
Year	−0.03	.01	−0.07	−5.35	< 0.001	−0.04	−0.02
Age × Gender	< 0.001	.001	−0.01	−0.27	.79	−0.002	.001
Age × Education	.001	< 0.001	.03	1.59	.11	< 0.001	.001
Age × Political orientation	−0.001	.001	−0.03	−1.34	.18	−0.002	< 0.001
Age × Religious attendance	< 0.001	< 0.001	−0.02	−1.05	.29	−0.001	< 0.001
Age^2	< 0.001	< 0.001	−0.11	−4.85	< 0.001	< 0.001	< 0.001
Age^2 × Gender	< 0.001	< 0.001	−0.02	−0.86	.39	< 0.001	< 0.001
Age^2 × Education	< 0.001	< 0.001	−0.04	−1.65	.10	< 0.001	< 0.001
Age^2 × Political orientation	< 0.001	< 0.001	−0.04	−1.57	.12	< 0.001	< 0.001
Age^2 × Religious attendance	< 0.001	< 0.001	.04	1.55	.12	< 0.001	< 0.001

99 countries all over the world in Sample 2), we also added country-level moderators of control perceptions. In this study, we looked at how control perceptions varied depending on factors such as GDP, homicide rate, and Hofstede's six dimensions of cultural variation. Given the little research on cultural determinants of control beliefs, we took a largely exploratory approach to these tests. Because of this exploratory approach, we limited our discussion to the effects that replicated across the two samples. However, our supplementary materials contain the full models including country-level predictors.

Method

Participants and procedure

Sample 1

Participants were 160,382 individuals (53.9% Female) from the European Values Survey collected from 1981 to 2010 (EVS; Gedeshi et al., 2019). Since 1981, the EVS has interviewed representative national samples of several European countries. Information on publications, findings, methodology, and free data access is available at https://europeanvaluesstudy.eu/. For the current study, data from waves 1–4 of the EVS were aggregated, and forty-eight different countries are represented in the current report. Sample sizes ranged from 483 (Northern Cyprus) to 8698 (Germany), with an average sample size of 3341 (SD = 1746). The overall sample ranged in age from 15 to 108 (M = 44.81 years, SD = 17.43 years); the median level of education was some secondary education. Each decade of life was well represented (e.g., 15–19 years: 6331; 20–29 years: 32,298; 30–39 years: 30,130; 40–49 years: 28,995; 50–59 years: 24,882; 60–69 years: 21,076; 70+ years: 16,670). The sample size was chosen using all available data from the EVS, and no participants were excluded. Thus, no stopping or a priori sample size was implemented. The sample size for the current study enabled us to detect an effect as low as f^2 = 0.00006 at 80% power and α = 0.05.

Sample 2

Participants were 320,941 individuals (51.8% Female) from the World Values Survey collected from 1981 to 2014 (WVS; see Inglehart et al., 2008). Since 1981, the WVS has interviewed representative national samples of several different countries worldwide. Information on publications, findings, methodology, and free data access is available at http://www.worldvaluessurvey.org. For the current study, data from waves 1–5 of the WVS were aggregated, and ninety-nine different countries are represented in the current report. Sample sizes ranged from 405 (Dominican Republic) to 16,423 (South Africa), with an average sample size of 3242 (SD = 2545). The overall sample ranged in age from 13 to 99 (M = 40.74 years, SD = 16.12 years); the median level of education was some secondary education. Each decade of life was well represented (e.g., 13–19 years: 18,194; 20–29 years: 83,890; 30–39 years: 74,900; 40–49 years: 62,231; 50–59 years: 46,101; 60–69 years: 32,221; 70+ years: 23,734). The sample size was chosen using all available data from the WVS and no participants were excluded. Thus, there was no stopping rule or a priori sample size. The sample size for the current study enabled us to detect an effect as small as f^2 = 0.00003 at 80% power and α = 0.05.

Measures

In Study 2, the measures were identical for Samples 1 and 2.

Control perceptions

Control perceptions was assessed with a single item created for the EVS and World Values Survey (Clark et al., 2014; EVS/WVS variable name A173). Specifically, the item read, "Some people feel they have completely free choice and control over their lives, while other people feel that what they do has no real effect on what happens to them. Please use this scale where 1 means "none at all" and 10 means "a great deal" to indicate how much freedom of choice and control you feel you have over the way your life turns out."

Personal characteristics

Gender, education, political orientation, and religious attendance were entertained as possible moderators of the effects of age on control perceptions. Education was assessed on an 8-point scale ranging from 1(*inadequately complete elementary education*) to 8(*university with degree/higher education*). Unfortunately, political orientation was only measured in the fourth wave of the EVS, leaving considerable missingness (~76%) on this variable (it is also problematically related to the wave variable that was integrated into the analyses [i.e., present in the fourth wave and absent in the other three]). Thus, for Sample 1 only, political orientation was not considered. Religious attendance was measured with a single item, "How often do you attend religious services?" to which participants responded on a scale ranging from 1(*never or practically never*) to 8(*more than once a week*).

Country-level characteristics[3]

Because they were significant cross-cultural predictors of control perceptions in previous research (Clark et al., 2014), country-level gross-domestic product (GDP) per capita (n = 48 countries had available data for S1, 94 countries for S2; Central Intelligence Agency, 2011), Gini index of income inequality (n = 46 countries had available data for S1, 89 countries for S2; Central Intelligence Agency, 2011), and homicide rates (n = 47 countries had available data for S1, 97 countries for S2; United Nations Office on Drugs and Crime, 2011) were gathered as country-level predictors of control perceptions.

Hofstede's dimensions of cultural variation were also included in the analysis. Hofstede and colleagues (2010) suggest that country-level differences in societal values can be characterized by six dimensions (see Hofstede's website for full details of data collection and a copy of the questionnaire instrument: https://geerthofstede.com/research-and-vsm/vsm-2013/). These dimensions are derived from cross-national surveys of workers and citizens, featuring updated replication samples of the original 1960s-70s IBM survey respondents, respondents of the Chinese Value Survey, and respondents from the World Values Survey. The most up-to-date scores published came from surveys conducted in 2008 and provided to researchers in 2010 (Hofstede et al., 2010). Amalgamations of these surveys were averaged at the country level and then standardized on a scale from 0 to 100.

Power Distance measures the degree to which a culture is accepting of inequality. *Individualism/collectivism* refers to the degree to which people prefer loosely knit social networks and individuality (higher values) versus tightly knit social networks and interdependence with others (lower

[3] Because the data from Samples 1 (1981-2008) and 2 (1981-2014) were collected over many years, we considered modeling the country-level variables as time-varying. Ignoring how these variables change over time introduces inferential problems in which future values on some characteristic would predict past scores on control perceptions.In both samples, including GDP and Gini values from the first year control perceptions were collected (rather than 2011) did not affect the results. We think this is likely attributable to the high degree of stability in GDP (r = .97) and Gini (r = .89) over the study window. In terms of Hofstede-related indices, very few countries had available scores in 1981 (and some of the more recent indicators, like indulgence/restraint, had not been conceptualized yet). This made it impossible to use older values to model as predictors of control perceptions (because survey data on these cultural dimensions did not exist back then). In the past, researchers who have encountered similar issues (and Hofstede's website) have both acknowledged that countries change very slowly in these characteristics. As a result of their high degree of stability, using the scores at any given point can serve as a rough approximation of that country's standing (see Footnote #6 from North & Fiske, 2015). Hofstede's website even goes as far as to suggest that the scores published at any point can be considered "up-to-date" (as they use a blend of older and newer data) and can thus be used without concern (https://hi.hofstede-insights.com/faq).

values). *Masculinity/Femininity* assesses the degree to which a culture can be characterized by assertiveness and competitiveness (masculinity; higher values) or nurturance and cooperation (femininity; lower scores). *Uncertainty Avoidance* measures the degree to which a country's citizens are uncomfortable with uncertainty and ambiguity. *Long-term Orientation* assesses the outlook of a culture; countries with a long-term orientation place more importance on the future. *Indulgence/restraint* refers to the degree to which a society allows free gratification of basic and natural human drives related to the enjoyment of life (relative to suppression of gratification of needs by strict social norms). Scores on each of these dimensions were gathered from Hofstede's latest reporting on cultural dimensions (Hofstede et al., 2010). Country-level scores on each of the dimensions were available for 36 countries (for Sample 1) and 58 countries (for Sample 2) in the current analyses (and for a total of 84 and 85 countries for long-term orientation and indulgence v. restraint, respectively, for Sample 2).[4]

Results and discussion

Multi-level modeling

Because respondents were nested within countries, a multi-level random-coefficient model for control perceptions was created, using the SPSS MIXED procedure (Peugh and Enders, 2005). Participant age, gender, political orientation, religious attendance, country-level variables (e.g., GDP, Gini, homicide rate, Hofstede's cultural dimensions), and interactions between these variables and age were entered as predictors of control perceptions. All continuous variables were centered before computing interaction terms. Participant gender (−1 = male, 1 = female) was contrast coded. The age results were plotted from ages 16 to 94 (for S1) or from ages 15 to 91 (for S2) because sample sizes for ages before/beyond this fell below $n = 20$. We controlled for wave of data collection in all analyses. To enable comparisons with Study 1, we report the model with the personal characteristics first, followed by the cultural predictors. Worth noting, in modeling the random slope of age, we discovered that the variance and covariances were near zero. We then adjusted the model to be a simpler one by modeling random intercepts.

As in Study 1, we examined the best-fitting age effect for control perceptions by entering the effects of age and age^2 as predictors of control perceptions in a multi-level model for Samples 1 and 2. In both samples, we found that the linear effect of age was the best fitting model (Sample 1: $b = -0.009$, $SE = 0.0003$, $df = 159{,}794.80$, $t = -29.30$, $p < .001$ 95% CI[−0.010, −0.009], $r = -0.07$; Sample 2: $b = -0.005$, $SE = 0.0003$, $df = 316{,}941.86$, $t = -13.56$, $p < .001$ 95% CI[−0.005, −0.003], $r = -0.02$). Age^2 did not significantly predict control perceptions ($ps > 0.09$). As seen in Figures 5 (S1) and 6 (S2), younger adults reported higher levels of control perceptions compared to middle-aged and older adults.

The results from the multi-level models with personal characteristics (and their interactions with age) are presented in Tables 2 (for Sample 1) and 3 (for Sample 2); we report on the consistent results across the two samples. In both samples, men and people with higher levels of education reported higher control perceptions. People who took the survey in more recent years also had higher control perceptions. In Sample 2, conservative participants reported more control over their lives. Interestingly, greater religious attendance was associated with perceiving less control in Sample 1 but more control in Sample 2, although both are relatively small effects compared to larger predictors in the model (e.g., education). Two-way interactions between age and education and age and religious attendance were the only consistent moderation effects across the samples. The effect of age was stronger among those with higher levels of education (S1: $r = -0.05$, $p < .001$; S2: $r = -0.02$, $p < .001$) compared to lower levels of education (S1: $r = -0.04$, $p < .001$; S2: $r = -0.001$, $p = .59$). The effect of age was stronger among those with higher levels of religious attendance in Sample 1 (higher attendance: $r = -0.06$, $p < .001$; lower attendance: $r = -0.04$, $p < .001$) but weaker among those with higher levels of religious attendance in Sample 2 (higher attendance: $r = 0.002$, $p = .44$; lower attendance: $r = -0.02$, $p < .001$).

Do country-level characteristics predict variation in control perceptions and how they differ by age?

We next added the country-level predictors to the aforementioned model and their two-way interactions with age (see Supplementary Tables 6 and 7). Across both samples, the lone cultural level predictor was indulgence v. restraint; individuals from more restrained countries felt like they had less control over their lives ($rs > 0.46$). Additional predictors of control perceptions in Sample 2 were inequality (negatively), individualism (negatively), and long-term orientation (negatively); however, these effects were not found in Sample 1.

A few variables moderated the association between age and control perceptions—inequality, individualism, masculinity, and indulgence/restraint. However, these moderating effects were relatively small in magnitude, picking up minor differences between individuals and countries. Further, some of the interactions with age were in the opposite directions across the two samples. To summarize the effects of the consistent interactions, among people from countries lower in inequality, higher in individualism, and lower in masculinity, there was a negative correlation between age and control perceptions (i.e., the correlation between age and control perceptions for the other end of each dimension was not significant). Among people from countries lower in indulgence, the correlation between age and control perceptions was particularly negative (the correlation between age and control perceptions for the other end of each dimension was also negative, albeit not as strong). The interactions were small and near-zero (with the simple slopes often only differing at the hundredth or thousandth decimal place), so the results from these moderation tests should not be overinterpreted given their practical size.

Altogether, there was not strong evidence for moderation by country-level characteristics (in terms of the magnitude of variation of age differences or their consistent direction).

Summary of results

To summarize, as in Study 1, control perceptions were highest among younger adults and lower among middle-aged and older adults. Control perceptions were higher among men, those with more education, and those who took the survey more recently (and conservatives in Sample 2). Control perceptions were also highest among individuals from more indulgent countries (and less restrained). There were several significant moderating effects, but they were small in size and rarely consistent in interpretation. There was a (particularly) negative association between age and control perceptions among individuals from countries that were more equal, were more individualistic, less masculine, and lower in indulgence.

General discussion

Although most people believe in free will and perceive that they have control over their lives, these perceptions likely vary across several dimensions. Across three samples ($N = 492{,}134$), we found that free will and control perceptions were higher among young adults and lower

[4] Although Hofstede's cultural dimensions are widely used, they are often the subject of some controversy, particularly the degree to which they assess individualism/collectivism (Schwartz, 1990; Talhelm, 2019; Triandis et al., 1988). To supplement our analysis of individualism/collectivism, we ran a supplementary analysis using the GLOBE taxonomy's individualism/collectivism measure (House et al., 2004). Like the Hofstede version of individualism/collectivism, the GLOBE measure of individualism/collectivism was not a significant predictor of control perceptions.

Table 2
Age differences in perceptions of control in Study 2, Sample 1.

					95% CI (b)		
	b	*SE*	*T*	*p*	*LB*	*UB*	*r*
Intercept	6.45	.11	57.74	< 0.001	6.23	6.67	
Age	−0.01	.00	−19.23	< 0.001	−0.01	−0.01	−0.07
Gender	−0.07	.01	−8.48	< 0.001	−0.08	−0.05	−0.03
Education	.12	.00	29.04	< 0.001	.11	.13	.10
Religious attendance	−0.02	.00	−4.20	< 0.001	−0.02	−0.01	−0.01
Wave	.09	.02	5.58	< 0.001	.06	.12	.02
Age × Gender	−0.002	< 0.001	−3.62	< 0.001	−0.002	−0.001	−0.01
Age × Education	−0.001	< 0.001	−4.06	< 0.001	−0.001	< 0.001	−0.01
Age × Religious attendance	−0.001	< 0.001	−3.75	< 0.001	−0.001	< 0.001	−0.01

Note. The effect size *r* is a standardized effect size calculated by using the t-values and degrees of freedom from the multi-level model.

Table 3
Age differences in perceptions of control in Study 2, Sample 2.

					95% CI (b)		
	b	*SE*	*t*	*p*	*LB*	*UB*	*r*
Intercept	6.21	.07	87.26	< 0.001	6.07	6.35	
Age	−0.002	< 0.001	−5.98	< 0.001	−0.003	−0.001	−0.01
Gender	−0.06	.005	−11.45	< 0.001	−0.07	−0.05	−0.03
Education	.10	.002	39.75	< 0.001	.09	.10	.09
Political orientation	.07	.002	30.83	< 0.001	.06	.07	.07
Religious attendance	.01	.002	5.71	< 0.001	.01	.02	.01
Wave	.14	.005	30.32	< 0.001	.13	.15	.07
Age × Gender	< 0.001	< 0.001	.86	.39	< 0.001	.001	.002
Age × Education	−0.001	< 0.001	−5.59	< 0.001	−0.001	−0.001	−0.01
Age × Political orientation	< 0.001	< 0.001	1.52	.13	< 0.001	< 0.001	.003
Age × Religious attendance	.001	< 0.001	7.45	< 0.001	.001	.001	.02

Note. The effect size *r* is a standardized effect size calculated by using the t-values and degrees of freedom from the multi-level model.

among older adults. Men, conservatives, educated individuals, and those with higher religious attendance tended to report having more control over their lives. In Study 2, people from countries higher in indulgence reported higher control perceptions. Country-level characteristics often moderated the link between age and free will beliefs, but these associations were often very small. These studies represent the largest and most comprehensive examinations of lifespan and cultural differences in free will and control perceptions conducted to date.

Demographic differences in free will and control perceptions

Across the three samples, older adults perceived less free will and control over their lives. This finding could be attributable to the fact that as people age, they begin to learn and acknowledge the wide-ranging constraints on their minds and behavior (see Chernyak et al., 2013; Gergely et al., 2002). There is a continuation of learning about constraints placed on one's behavior, such as those imposed by social institutions (i.e., workplace rules and norms), and that these, in turn, drive individual and social development (Roberts et al., 2005). However, it was an open question about whether perceptions of control and free will also mapped on to age differences in these perceived constraints across life.

We also investigated how demographic characteristics were associated with variation in free will and control perceptions. Many findings from our studies support the connection between control perceptions and the tendency to moralize and hold people responsible for their actions. For example, we find that conservatives around the world perceived they had more control over their lives relative to liberals. This is likely connected to conservatives' emphasis on personal responsibility and downplaying the role of external constraints on one's behavior (Eidelman et al., 2012; Skitka and Tetlock, 1992, 1993). Indeed, Everett et al., 2021's recent research demonstrates how conservatives' moralizing attitudes heighten their free will perceptions relative to liberals. In line with this idea, we also found that, compared to women, men also reported higher control perceptions on average. This may likewise be attributed to the tendency of men to moralize and support retribution (Helgeson and Fritz, 1999), which is associated with a higher perception of moral responsibility (Caspar et al., 2017; Krueger et al., 2014; Shariff et al., 2014). Lastly, higher religious attendance was associated with greater perceptions of control/free will in Study 1 and Sample 2 of Study 2. This supports the idea that many religions promote free will and control by encouraging choice and taking responsibility for decisions (and their outcomes) (see Baumeister et al., 2010; McCullough and Willoughby, 2009).

As for education, our results were not as clear. Study 1 suggested that educated adults believe less in free will, while Study 2's samples showed that highly educated people perceive more control over their lives. In this specific case, it is worth noting that there are likely plenty of people who can hold disbelief in free will but nevertheless think they have control over the outcomes of their lives (the two are only modestly positively correlated). In Study 1, although older adults believed less in free will, they were also less likely to endorse beliefs about fatalistic determinism and that the universe is a random place. Although highly educated adults may be more likely to endorse a deterministic-scientific worldview (and therefore believe less in free will), they may also be in a position to overcome various constraints (i.e., financial) and therefore have a higher perception of how much freedom and control they have over their lives. However, the current studies cannot answer these questions definitively.

Cultural differences in control perceptions

The analysis of cross-cultural variation in control perceptions in Study 2 provided several surprising findings. The most counterintuitive was that individualism/collectivism was not a consistent predictor of control perceptions (although it showed the opposite pattern than would be expected—people living in individualistic societies reported lower perceptions of control over their lives). This was a puzzling result as we expected individualistic cultures, which are thought to emphasize individual autonomy, would stress individual autonomy and engender

people with perceptions that they have control over their lives. Indeed, these results seem to contrast with Chernyak et al. (2013)'s finding that older children from the United States (an 'individualistic' culture) believe more in their freedom of choice relative to their counterparts in Nepal (a 'collectivist' culture). It appears it is still debatable whether focusing more on one's autonomy and choices translates into feeling a freer will. Over time, individuals may realize that they possess (or lack) conscious influence on their decisions due to overcoming (or submitting to) constraints. This violation of expectations may lead to particularly low levels of free will among people from individualistic cultures. Nonetheless, because this is only speculation (and the effect was not present in Sample 1), we encourage future researchers to examine this finding further.

Importantly, the individualistic/collectivist dichotomy is often an oversimplification (or, according to some, a misrepresentation) of cultures (Talhelm, 2019). For example, regions around the world generally contain areas that have both individualistic/collectivistic influences (Vignoles et al., 2016). Some values serve both the individual and the collective (Schwartz, 1990), and collectivist cultures display a vigilance of in-group members that is indicative of attributing individual responsibility to people's actions (Liu et al., 2019). Given these critiques of individualism/collectivism, we also encourage researchers to examine different conceptualizations and taxonomies of cultural differences (e.g., Schwartz taxonomies, the other GLOBE characteristics) and how they might be associated with free will and control perceptions.

In Study 2, people from more restrained countries possessed lower perceptions of control. This finding seems to contrast with Baumeister et al. (2010)'s suggestion that beliefs in free will and control represent the ability to avoid behaviors and temptations that unacceptable in society. One might expect that more restrained countries think they have more control over their actions and the consequences of those actions. However, our results suggest the opposite. This may be interpreted through how citizens perceive these societies to be constraining their individual freedom. More restrained countries likely have many customs, norms, and laws that condemn or commend various desires, impulses, and behaviors. Perhaps individuals from restrained countries feel the weight of these regulations or are more often reminded of the impulses pulling on their decisions. An individual living in a more indulgent society may not feel compelled by any of these forces, and hence, may feel freer to do as they please.

In addition to cultural differences in control perceptions, several cultural variables moderated associations between age and control perceptions in Study 2. The sharper age differences could result from people in these cultures reflecting more on constraints (e.g., countries high in restraint and femininity) or being confronted with constraints that violate their perceptions of agency over time (e.g., countries high in individualism). It should be noted that these variables rarely and inconsistently moderated age differences. Because the link between age and control perceptions was largely consistent across cultural contexts in adulthood, this may suggest that cultures engender specific beliefs in control earlier in life. Moreover, as people from different cultures age, they may universally experience the force of constraints placed upon their lives, and their control perceptions could decline in a largely homogenous way. Although people around the world may face different constraints, the result appears to be that any constraints—irrespective of their cultural specificity—likely lower perceptions of control as people grow into adulthood and old age.

Limitations and future directions

The studies had many strengths. For example, we analyzed three large data sets from relatively diverse participants and countries using multiple measures of our umbrella construct—free will and control perceptions. We also integrated data from multiple sources, including information on how countries varied economically and socially.

Nevertheless, there are some limitations worth acknowledging. First, the data from the three samples were cross-sectional. This limitation leaves open the possibility that we captured differences in free will and control perceptions between members of different birth cohorts rather than lifespan differences. In other words, it would be the difference between (a) concluding that people born more recently in history have higher free will or control perceptions and (b) concluding that these beliefs and perceptions decline across the lifespan. The danger in this ambiguity is that different birth cohorts are exposed to different sociocultural norms that might influence their perceptions or other psychological characteristics (Roberts et al., 2010; Stewart and Healy, 1989). Worth noting, because the age differences were so consistent across data sets, cultures, and cultural variables, our data are more likely to lend themsleves to the developmental interpretation—that free will and control perceptions decline across age and that they are relatively resilient to the modeling of cultural factors (Bleidorn et al., 2013; McCrae et al., 2000, 1999). Formally modeling year of data collection in the analyses yielded conflicting results—free will beliefs tended to be lower in more recent years in Study 1, but control perceptions tended to higher in more recent years in Study 2 (a replication and extension of Inglehart et al., 2008).

The pattern seen in Study 2 more squarely aligns with studies examining birth cohort differences in perceived control. For example, in cohort sequential studies, more recent cohorts in the U.S. and Germany tend to perceive fewer constraints, and this is particularly true for people's perceptions of the degree to which luck and fate govern their lives (Drewelies et al., 2018; Gerstorf et al., 2019). However, some evidence suggests that more recent cohorts of U.S. college students might be shifting toward more external evaluations of control (i.e., less internal perceptions of control; Twenge et al., 2004). The exact pattern of cohort differences might also be moderated by age, such that more recent cohorts of older adults perceive fewer constraints, but more recent cohorts of younger adults perceive less control over their lives, some of which might be attributable to economic differences between the cohorts and across the lifespan (Drewelies et al., 2018).[5] Ultimately, formal tests of these questions in the current data was not possible and beyond the current scope of the paper. Future research should follow different cohorts of individuals over time to appropriately separate cohort and developmental effects on free will and control perceptions. A more direct test might be to experimentally manipulate many of the proposed processes to see if they affect free will and control perceptions, whether they implicate culture (Oyserman and Lee, 2008) or lifespan development (Fung et al., 1999).

Second, cultures are not static in their characteristics and can change considerably over time. Relevant to the current studies, this means that cultures are influencing people differently as they—both cultures and individuals—age. This makes it unclear if differences in free will and control perceptions can be just attributed to individuals aging across time, or our cultures becoming more similar/different across time (Chopik, 2020; Grossmann and Varnum, 2015; Santos et al., 2017; Varnum and Grossmann, 2017). Again, we were only able to superficially model this possibility by including the year of data collection in our analyses, but cultures likely change at much slower rates than captured in these samples. Future research can model broader, macro-level changes in cultures to see how temporal variation at a regional level might affect individual decision-making and perceptions.

Finally, the age-related differences in free will and control perceptions varied dramatically across samples, ranging from moderate in size to relatively small. This can also be said of the moderating role of individual and cultural characteristics. It was generally the case that, despite

[5] Following the suggestion of a reviewer, we tested whether age and wave moderated each other in predicting control/free will perceptions. These interactions were not significant in either Studies 1 (*ps* > .233) or 2 (Sample 1: $p = .083$; Sample 2: $p = .066$).

significant moderation being present, decomposing the interactions revealed relatively similar effects across different levels of the moderating variables. Although the effects were relatively small, it was important to provide some reasonable expectations about effect sizes for future research. It is also worth noting that we chose age as a relatively imperfect measure of a process we thought unfolds across life (e.g., that people witness events or have experiences that challenge their existing thoughts about control and free will). Examining these questions using more proximal measures or even under experimental conditions might more carefully test the processes we outlined or establish a clearer causal chain. Whether or not manipulating free will and control perceptions on their own translates into judgments of others and pro(anti)-social behavior is another question entirely—a possibility that researchers have been critical of recently (Crone and Levy, 2019; Monroe et al., 2017; Nadelhoffer et al., 2020). In the meantime, evaluating whether personally witnessing or experiencing exogenous forces put upon one's will and control affects perceptions is an important issue to examine. For example, does experiencing a life event not directly under one's control affect how people think about control and free will? Some evidence suggests that it may be possible (Luhmann et al., 2021), but it has largely been untested so far.

Conclusion

The current studies provided a comprehensive examination of how free will and control perceptions differed across the lifespan and across different cultures. We found, consistently, that belief in free will and control perceptions were highest among younger adults and lower among middle-aged and older adults. Men, conservatives, educated individuals, and those with higher religious attendance reported higher free will beliefs and control over their lives. People from countries higher in indulgence reported higher free will beliefs. The moderating effects of demographic and cultural characteristics on age differences were relatively small but provided some exciting new research directions. Despite their limitations, the current samples help situate the study of free will and control perceptions within a cross-cultural lifespan developmental framework. Future research can more carefully examine the sources of variation in free will and control perceptions across the lifespan and investigate how much of this variation is attributable to socialization influences from an individual's cultural setting.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Study 1 and supplemental data provided; Study 2 data is available via application process (Syntax for all studies provided)

Ethical

The data (for the measurement validation study) were collected in a matter consistent with ethical standards for the treatment of human subjects. Documentation of informed consent for this study was waived. The data from Studies 1–2 were analyses of existing data and were exempt from human subjects oversight (and thus do not have informed consent documentation).

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.cresp.2023.100093.

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