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Abstract

In the 1960s at Stanford University's Bing Preschool, children were given the option of taking an immediate, smaller reward or receiving a delayed, larger reward by waiting until the experimenter returned. Since then, the "Marshmallow Test" has been used in numerous studies to assess delay-of-gratification. Yet, no prior study has compared the performance of children across the decades. Common wisdom suggests children today would wait less long, preferring immediate gratification. Study 1 confirmed this intuition in a survey of adults in the U.S. (N = 354; Median age = 34 years). To test the validity of this intuition, in Study 2 we analyzed the original data for average delay-of-gratification times (out of 10 min) of 840 typically developing U.S. children in three birth cohorts from similar middle-high socioeconomic backgrounds, tested 20 years apart (1960s, 1980s, and 2000s), matched on age (3-5 years) at the time of testing. In contrast to popular belief, results revealed a linear *increase* in delay over time (p < .0001, η_p^2 = .047), such that children in the 2000s waited on average 2 min longer than children in the 1960s, and 1 min longer than children in the 1980s. This pattern was robust with respect to age, sex, geography and sampling effects. We posit that increases in symbolic thought, technology, and public attention to self-regulation have contributed to this finding, but caution that more research in diverse populations is needed to examine the generality of the findings and to identify the causal factors underlying them.

Word count: 249

Keywords: Delay-of-gratification, Marshmallow Test, Executive Function, Cohort Effect, Preschool

Cohort Effects in Children's Delay-of-gratification

The ability to resist temptation and forgo immediate pleasure in pursuit of long-term goals is relevant for many domains of functioning, including health (e.g., addiction, nutrition, exercise), finances (e.g., spending, saving, investing), relationships (e.g., marriage, parenting) and educational and career achievement (e.g., studying, working). Delay-of-gratification can be defined as the postponing of immediate gratification to attain a delayed more valuable reward (e.g., Mischel, Shoda, & Rodriguez, 1989), and the underlying self-control processes have roots in early childhood. In their classic laboratory paradigm, Mischel and colleagues measured how long preschool children would wait when given the choice of having one small treat now or waiting for a larger treat later (e.g., Mischel, 1974; Mischel et al., 1989). They discovered that individual differences in wait times and delay behavior during early childhood predicted a range of developmental outcomes into adolescence and adulthood, including academic competence and SAT scores, self-regulation, healthy weight, effective coping with stress and frustration, social responsibility, and positive peer relations (e.g., Ayduk et al., 2000; Mischel, Shoda & Peake, 1988; Mischel et al., 1989; Seeyave et al., 2009; Schlam, Wilson, Shoda, Mischel, & Ayduk, 2012; Shoda, Mischel, Peake, 1990; Stumphauzer, 1972). Remarkably, consistently high versus low delayers had greater cognitive control in their 40s (Casey et al., 2011), suggesting long-term stable individual differences in delay-of-gratification (see Mischel, 2014 for review).

The "Marshmallow Test" is now considered an exemplar measure of control of the self by the self via a variety of cognitive strategies (Mischel et al., 2011; Mischel, 2014). But the legacy of the task has expanded beyond these studies to catalyze the broader field of self-regulation and executive function in developmental psychology. Executive function (EF) refers to the goal-directed conscious control of thoughts, actions, and emotions and includes processes of working memory, inhibition, and mental flexibility (Miyake & Friedman, 2012). EF has a protracted development extending beyond adolescence, but the most striking improvements take place in early childhood (Carlson, Zelazo, & Faja, 2013). Research output on EF in childhood has more than tripled in the past two decades (Carlson, 2011), yielding new knowledge about its correlates and consequences, biobehavioral roots, environmental influences on its development, and effective ways to train it (Blair & Raver, 2014; Carlson et al., 2013; Diamond & Lee, 2011).

Despite this explosion of research, a widely asked question remains unanswered: Are there cohort effects on children's self-control over the decades since Mischel and colleagues initiated those studies half a century ago? The present research was motivated by this question. We reasoned that, on the one hand, compared to growing up in the 1960s, young children raised in the 2000s have much greater exposure to technology in the form of "screen time" (American Academy of Pediatrics, 2016), and thus might be more likely to expect immediate gratification of rewards. In fact, screen time is correlated with poor attention and difficulties in school (Huffer & Lee, 2016). From 1960-2000, there was a more than 100-fold increase in the annual rate of ADHD drug treatment among U.S. children (LeFever, Arcona, & Antonuccio, 2003). But on the other hand, if one considers the increasing requirements for abstract thought, which track with gains in IQ scores across generations (Flynn, 1987), as well as reports of improved attention skills associated with some screen technology (e.g., Green & Bavelier, 2003), then it is possible that children's self-regulation skills actually have improved over this time period.

To investigate these issues, in Study 1 we first queried the general public in a survey study about their predictions as to whether children today would wait as long as children 50 years ago in the Delay-of-Gratification test. Then in Study 2 we carried out an analysis of cohort effects on actual delay times in children ages 3-5 tested in the 1960s, 1980s, and the first decade of the 2000s.

Study 1: Perceptions About Children's Delay-of-gratification,1960s to 2000s

Method

Participants

Participants were 358 adults recruited from Amazon's Mechanical Turk program for one month in 2015 (mid-March to mid-April). Each of these unique participants completed the questionnaire in full, and was compensated between $0.45 and $1.00 in MTurk credit depending on date of completion. Ages ranged from 20 to 69 years, with a median age of 34 (M = 36.79 years; SD = 10.87). The majority of participants identified as Caucasian (82.8%), with African American (6.8%) and Asian (6.8%) being the next two most represented racial groups. Additionally, 5.6% of the sample identified as Hispanic. Recruitment was limited to the United States, and responses were obtained from 41 different states. Household income ranged from less than $25,000 to over $200,000 per year, with the median between $25,000 and $49,999. Gender representation was approximately equal with 49.2% of the sample identifying as female. About half the sample (54%) identified themselves as parents.

Procedure

Participants were asked to complete a brief demographic questionnaire and then to respond to four questions, and two additional optional questions if they had children. The main question included a brief description of the classic Delay-of-gratification test, and asked whether they thought children today would wait a shorter amount of time (scored as 1), a longer amount of time (scored as 3), or no change (scored as 2), when compared with children tested 50 years ago (see Supplemental Information for verbatim questions).

To verify that participants were actively attending to the questionnaire, the main question of interest was rephrased as to whether children today have more self-control, less self-control, or no change compared to 50 years ago (the response order reversed). The two questions were asked back to back and counterbalanced with regard to presentation order. Responses were then recoded so that high and low numbers had the same meaning on both questions.

Results

Four participants gave diametrically opposing answers to the two primary questions, suggesting they were not attending closely to the survey, and were thus removed from further analyses. The remaining cases were highly consistent in their responses to the two question formats, *ICC*(354) = .91. As shown in Figures 1 and 2, 257 of 358 (72%) participants believed that children today would wait less long (X^2 = 33.99, p < .0001) and 90 of 358 (25%) believed that children today would have less self-control (X^2 = 44.25, p < .0001) than children 50 years ago.

Next we analyzed responses to the probes about the participants' own delay-of-gratification and self-control and that of their children (if applicable). On the whole, participants believed they themselves were above average on delay-of-gratification as adults, $M = 5.02$ on a scale where 4 was labeled "average", $SD = 1.50$, $t(352) = 12.83$, $p < .0001$ (Figure 3). The adults who had at least one child ($N = 139$) believed they themselves would have waited significantly longer as a 4-year-old child than their own first-born child, $M_{parent} = 7.3$, $SD = 3.19$, $M_{child} = 6.06$, $SD = 2.89$, $t(138) = 5.08$, $p < .0001$ (Figures 4 and 5). Responses for self and child were significantly correlated, $r(139) = .55$, $p < .0001$. Among the participants with two or more children who speculated how long their first-born and last-born children would delay (Figure 6), the responses were highly correlated, $r(121) = .64$, $p < .0001$, but not significantly different from each other, $M_{first} = 5.93$, $SD = 2.89$, $M_{last} = 6.03$, $SD = 3.04$, $t(120) = -.433$, $p = .67$.

Discussion

The survey study affirmed that adults in the U.S. generally intuit that children today are less tolerant of delayed gratification and less self-controlled than children were 50 years ago. Furthermore, those who were parents suspected their children would not delay as long as they themselves would have as 4-year-olds, just one generation earlier. In Study 2, we tested this intuition by analyzing delay-of-gratification data collected in the 1960s, 1980s, and 2000s.

Study 2: How Long They Waited

Our approach was to gather de-identified data from the original delay-of-gratification studies conducted by Walter Mischel and colleagues at Stanford University in the 1960s, and by Lawrence Aber and colleagues at Barnard College of Columbia University in the 1980s, and finally to combine the data sets with de-identified data using the same paradigm by Stephanie Carlson and colleagues collected at the University of Washington and the University of Minnesota in the first decade of the 2000s.

Method

Participants

1960s cohort. Participants were enrolled in the Bing Preschool at Stanford University in Palo Alto, CA, and participated in a delay-of-gratification experiment conducted by Mischel and colleagues. The purpose of these experiments was to examine the effects of various strategies and situations on waiting time. However, most of these experiments also included a control condition in which children waited in a bare room (devoid of distracting objects) with both of the rewards left uncovered (i.e., visible) on the table at which they sat, and were not provided with any strategies. A total of 165 typically-developing children were tested in this "spontaneous delay" condition (*M* age = 51.45, *SD* = 6.76, range = 35 to 70 months, 81 boys and 84 girls). The sample consisted of primarily Caucasian children of Stanford University faculty or Stanford graduate students.

1980s cohort. Participants included 135 typically developing children (*M* age = 57.68, *SD* = 4.41, range = 48 to 66 months, 65 boys and 70 girls), who were enrolled in the Toddler Center at Barnard College of Columbia University in New York City, and were tested in a condition designed to be similar to the control condition at Bing described above. As with the Bing sample, they were primarily Caucasian children of parents affiliated with the university.

2000s cohort. Participants included 540 typically-developing children (*M* age = 50.27 months, *SD* = 9.28, range = 36 to 71 months, 285 boys and 255 girls). Families were recruited from participant pools at two urban universities, University of Washington (*n* = 296) and University of Minnesota (*n* = 244) regions of the U.S. The sample was predominantly Caucasian (88.2%) with 48.6% of the participants claiming an annual household income of $100,000 or more. Given the rise in prescriptions for stimulant medication in children cited earlier (LeFever et al., 2003), it is important to note that participants were pre-screened for developmental disorders and none were on stimulant medication at the time of the study.

Procedure

Children were tested individually in a quiet room of the Bing Preschool at Stanford University (1960s) designated for research studies, or in a university developmental psychology laboratory (1980s and 2000s). The same procedure was used across sites.

Delay-of-gratification (Mischel & Ebbesen, 1970; Mischel et al.,1989). Children selected a favorite treat from a variety of options. Then treats were placed on two identical plates, one with a smaller amount (e.g., 1 Oreo cookie) and the other with a visibly larger amount (e.g., 2 Oreo cookies). Children were told that the experimenter needed to leave the room "to do some work." They were given a bell to ring and told that this bell would bring the experimenter back into the room immediately. This was followed by a demonstration of the "bring-me-back" bell until it was clear that children understood, and experienced, that the bell would reliably bring the experimenter back. Next, children were instructed that if they chose to wait until the experimenter returned to the room on his or her own, they would receive the larger amount of treats. However, if they did not want to wait they could ring the bell and the experimenter would return, but in that case they would only receive the smaller amount of treats. Children were told there is no right or wrong way to play the game and then asked to repeat the rules to the experimenter as a check for their understanding of the contingencies. Once it was clear they understood the rules, the experimenter left the room and watched children through a one-way mirror or on a video monitor. The experimenter returned to the room when one of the following occurred: 1) children rang the bell; 2) children licked or put the treat(s) in their mouth; 3) children left the room; or 4) a predetermined maximum waiting time (at least 10 min) had passed. The total time children waited (in seconds) was recorded. Upon returning, the experimenter uniformly praised children for waiting as long as they had, and allowed them to consume the treats or take them home at the end of the session. (See verbatim instructions in Supplemental Information.)

Task Variations. At each research site across cohorts, there were task variations designed to test hypotheses about factors that made it more or less difficult to delay gratification. However, for the present comparison, *only the standard condition (described above) was included*. None of the children were told how long the experimenter would be gone. The maximum delay time was either 10 or 15 min, but it was truncated to 10 min (600 sec) across studies and cohorts for comparison in the present analyses. (Note that of the 103 children who delayed longer than 10 min in the 15-min version, 80 waited the full 15 min, suggesting there was very little variation lost by truncating the data to 10 min.)

The rewards were always food, and always a smaller versus larger amount, presented on two identical plates/trays/shallow bowls, physically present and uncovered throughout the delay. Options varied among sweet or salty bite-size treats (e.g., mini marshmallows, pretzel sticks, Froot Loops, Goldfish crackers, raisins, chocolate chips). The order of the delay task amidst other tasks of interest in the studies varied widely and thus is treated as a random variable.

Results

We began with the main analysis investigating delay-of-gratification time as a function of birth cohort (i.e., 1960s, 1980s, vs. 2000s). This was followed by several follow-up analyses to test the robustness of this result.

Main Analysis

We first conducted an analysis of variance with cohort predicting delay time. As shown in Figure 7, delay increased significantly over the 50-year span: 1960s M = 298.45, SD = 256.06; 1980s M = 359.36, SD = 240.35; 2000s M = 425.96, SD = 236.08; $F(2, 839) = 19.04$, $p < .0001$, $\eta_p^2 = .044$. Planned contrasts indicated a significant increase from 1960s to 1980s, $p = .03$, and again from 1980s to 2000s, $p = .004$. Curve estimates revealed a significant linear trend ($R = .21$, $R^2 = .043$), $F(1, 839) = 38.11$, $p < .0001$.

Follow-up Analyses

Age. We next examined whether this linear increase in delay time held true across age. Children in the 1980s cohort were 6 months older, on average, than both the 1960s and 2000s cohorts, $F(2, 839) = 44.069$, p < .0001, $\eta_p^2 = .095$. This age difference would work in favor of longer delay times compared to the 1960s cohort, but is harder to reconcile with the further increase in delay times among younger children in the 2000s cohort. To examine the cohort effect independent of age, we ran the above ANOVA controlling for age in months. Age was marginally significant, $F(1, 839) = 3.449$, $p = .064$, $\eta_p^2 = .004$. Nevertheless, cohort remained a significant predictor of delay time, $F(2, 839) = 20.365$,

$p < .0001$, $\eta_p^2 = .046$. Planned contrasts showed a marginally significant increase from 1960s to 1980s, $p = .086$, and a significant increase from 1980s to 2000s, $p = .001$, when controlling for age.

To investigate whether the cohort effect on delay was stronger in younger or older children, we next conducted a Cohort (3) x Age Group (2) ANOVA using the median split on age (Younger = 35-52 months, Older = 53-71 months). The cohort effect again was significant, $F(2, 839) = 17.404$, $p < .0001$, $\eta_p^2 = .04$. Age Group was not significant ($p = .173$), nor was the interaction term ($p = .476$). Thus, delay times increased across the three cohorts in younger and older children alike (Figure 8).

Sex. We next tested whether the cohort effect differed by sex. A Cohort (3) x Sex (2) ANOVA again revealed a significant main effect of cohort, $F(2, 839) = 19.169$, $p < .0001$, $\eta_p^2 = .044$. Although girls ($M = 333.27$, $SD = 251.8$) tended to delay longer than boys ($M = 262.35$, $SD = 256.99$) in the 1960s cohort, $t(163) = -1.791$, $p = .075$), this gap closed over time, although it should be noted that the main effect of sex did not reach statistical significance ($p = .104$), nor did the interaction term ($p = .133$) (Figure 9).

Geography. All children in the 1960s cohort were located in California and all in the 1980s cohort were in New York City. Preliminary analyses indicated no difference in wait time between the Washington and Minnesota subsamples of the 2000s cohort when controlling for age in months ($p = .391$). Nonetheless, we carried out the ANOVA separately for these groups to test for possible geographical differences. Using the Washington sample, the effect of cohort was significant, $F(2, 595) = 16.561$, $p < .0001$, $\eta_p^2 = .053$, with planned contrasts indicating a significant increase from 1960s to 1980s ($p = .03$) and from 1980s to 2000s ($p = .004$). Similarly, using the Minnesota sample, cohort was a significant predictor of delay time, $F(2, 543) = 12.14$, $p < .0001$, $\eta_p^2 = .043$, with planned contrasts again significant across both time spans (ps = .033 and .022, respectively).

Random split validation. To further validate the main finding, we divided the total sample into two randomly generated groups, Ns = 415 and 425, and re-ran the ANOVA examining delay time across cohorts. The cohort effect was significant in the first sample, $F(2, 414) = 9.326$, $p < .0001$, $\eta_p^2 =$

.043, with planned contrasts indicating no significant change from 1960s to 1980s (*p* = .248) but a significant increase in delay from 1980s to 2000s (*p* = .018). In the second random sample, cohort was again significant, $F(2, 424) = 10.004$, $p < .0001$, $\eta_p^2 = .045$. Planned contrasts were marginally significant from 1960s to 1980s (*p* = .057) and 1980s to 2000s (*p* = .085). Hence, although paired contrasts were not always significant in the split samples, the main effect of cohort on delay time remained robust.

Study variation within cohorts (1960s and 2000s only). Whereas the 1980s cohort represents a single sample from a study conducted at Barnard, the 1960s cohort was drawn from six studies conducted at Bing Preschool and the 2000s cohort was drawn from seven separate studies. We conducted an ANOVA on study predicting delay time. We controlled for age in this analysis because ages differed across studies (within the 3- to 5-year-old range). The overall effect of study was significant, $F(12, 704) = 5.974$, $p < .0001$, $\eta_p^2 = .094$ (as was age, $p = .003$, $\eta_p^2 = .013$). Although there was variation in delay times in both the early and later cohorts, and caution must be noted about the small *N*s, it is notable that the samples from the 2000s waited longer than all but one of the samples from the 1960s (Figure 10). Moreover, although there were study-to-study variations, even when study was entered as a random effect, we still found a significant main effect of birth cohort on delay time, $F(12, 692) = 5.33$, $p < .0001$, $\eta_p^2 = .085$.

Nonparametric tests. We noted that delay times were not normally distributed, but rather were bimodal (almost no delay versus full delay) in the 1960s, and became more negatively skewed over time (skewness = .066, -.32, and -.837, respectively). Hence, to confirm the pattern of results, we conducted nonparamentric tests of the cohort effect comparing the proportion of children who delayed the full 10 min or not (i.e., Delayers or Non-delayers). As illustrated in Figure 11, the proportion of delayers was significantly different across cohorts, Kruskal-Wallis statistic < .0001. Follow-up tests using this indicator of performance showed no significant difference from 1960s to 1980s (Mann-

Whitney *U*, $p = .168$), but a significant increase in the number of delayers from 1980s to 2000s (Mann-Whitney *U*, $p < .0001$).

Age-equivalents. In the main analysis, children in the 1960s waited on average 127.51 seconds less than children in the 2000s. Children in the 1980s were in between, waiting on average 66.61 sec less than those in the 2000s. Carlson's data from the 2000s are illustrated as a function of age in Figure 12. To put these cohort differences in perspective, we overlaid the average performance of children in the 1960s and 1980s. Participants in the 1960s cohort, having a mean age of 4 years and 3 months at the time of testing, waited the equivalent of a 2.5- to 3-year-old child of the 2000s cohort. Children in the 1980s cohort, with an average age of 4 years and 9 months, waited the equivalent of a 3.5-year-old child in the 2000s (Figure 12). Put another way, children of the 2000s were performing at the same level as children who were as much as a full year older in the earlier cohorts.

Discussion

The purpose of this study was to investigate spontaneous, self-determined wait times on the standard delay-of-gratification task across three birth cohorts including the 1960s, 1980s, and 2000s. Results showed a significant linear increase in delay time across cohorts, as well as a significant increase in the proportion of children who delayed a full 10 min. This finding was robust to age, sex, and geography within the 2000s cohort. It held up in a split-half validation and across samples within the first and last cohorts.

Children in the 2000s waited on average 2 min longer than children in the 1960s, and 1 min longer than children in the 1980s. Put into terms of the age-related data from the 2000s, this is the equivalent of over 1 year (1960s) and 6 months (1980s) of maturation. If we look further at the longitudinal outcomes associated with delay times in early childhood, longer delays predicted a host of salubrious outcomes including academic achievement and social-emotional coping skills (for review see Mischel, 2014). In other words, the average increases in delay times we observed across a 50-year span are of practical as well as statistical significance.

General Discussion

These cohort effects stand in sharp contrast with the commonly received wisdom, as was evident in our survey study, that “kids today” are more impulsive and expect instant gratification, and hence are less attentive, patient, and persistent. Instead, the results showed a clear increase in delay-of-gratification among typically developing 3- to 5-year-old children in the U.S. from the 1960s to the 2000s.

Why the increase in delay-of-gratification?

We first address this question through a process of elimination. It does *not* appear to be due to methodology, setting, geography, sampling variation, age, or sex of the children. We also took steps to ensure no children in the 2000s cohort were on medication to treat ADHD at the time of the study, and we assume participants in the 1960s and 1980s were not likely to be receiving them, given how much more rare ADHD diagnosis and treatment was in the earlier cohorts.

Socioeconomic status (SES) is a potential factor, as it is known to be related to EF. Children growing up in poverty tend to have lower EF performance compared to their higher income peers (e.g., Hackman & Farah, 2009; Noble, McCandliss, & Farah, 2007), with the number of months spent at or below the poverty line in early childhood being associated with lower EF performance at age 4 in a linear fashion (Raver, McCoy, & Lowenstein, 2013). We have incomplete information on SES of the families who participated, particularly in the earlier cohorts. Nonetheless, published reports from each cohort suggest the children in all three cohorts were from primarily White, well educated, middle- to upper-middle class families who were living in or near a metropolitan area and were willing to participate in research at a major university. If anything, the participants from the 1960s, all attending Stanford University’s Bing preschool, were more likely to be from families with higher SES. However, if that were the case, we would have obtained a result opposite from what we found.

If not these demographic factors, then what? First, consider other general cohort effects that have been established over the same time period. Most obvious are rapidly changing technologies, increased globalization, and corresponding changes in the economy. At a more psychological level, there has been a statistically significant increase in IQ scores over the decades since records were first kept 100 years ago. Known as the Flynn Effect (Flynn, 1987), absolute scores on IQ tests for children and adults have increased by an average of 3 points each decade from 1909 to 2013 (Pietschnig & Voracek, 2015). This increase in IQ is correlated with gains in nutrition and gross domestic product, but Flynn argues that the root of it lies in changes in what is needed for human adaptation in society. Successful adaptation has come to rely on the ability to engage in abstract thought and to reason about hidden causes, which in turn raises average IQ on a population level over time (Flynn, 1987). On this analysis, increased reliance on digital technology is not necessarily the forebear of stunted development, but rather, a form of mediated cognition that is more generally associated with enhanced intelligence (Flynn & Blair, 2013).

A similar argument can be made for generational increases in executive function skills, as suggested by our findings. Abstract thought rests on the ability to think symbolically, to represent objects and events beyond the here and now. We now know from a host of studies that encouraging children to think about something more symbolically, with greater "psychological distance" from the situation, helps them exert greater self-control in a variety of executive function tasks. For example, when preschool children are asked to re-construe a tempting treat as something less edible, they have better inhibitory control (Carlson, Davis, & Leach, 2005; Mischel & Baker, 1975; see also Apperly & Carroll, 2009; Werner & Kaplan, 1963). When asked to make a decision for someone else to delay versus themselves, 3-year-olds can make the wiser choice (Prencipe & Zelazo, 2005). And when asked to pretend to be someone more competent, like a superhero, young children perform as if they were a year older on persistence and cognitive flexibility tasks, a phenomenon known as the "Batman Effect" (White & Carlson, 2016; White, Prager, Schaefer, Kross, Duckworth, & Carlson, 2016). The benefits of psychological distance also have been reported in several studies of adolescent and adult emotion regulation (Kross & Ayduk, 2011; Kross, Ayduk, & Mischel, 2005). Therefore, changing societal demands for more abstract and symbolic thought could influence population levels of executive function skills such as delay-of-gratification.

In addition to general changes in higher-order cognition, there could be specific changes in how children have learned to manage their motivation and attention in some contexts but not in others. It is important to distinguish between (1) how *able* children are to delay gratification when they are motivated to do so with a clear contingency (delay = receive the desired outcome), which is the condition created in the classic delay measure, versus (2) how much immediate gratification they seek and receive when left to their own digital devices and other available choices. As we alluded to earlier, some of the cognitive attention-control skills they are developing spontaneously with those devices are like those deliberately taught in computer programs to enhance EF (e.g., Rueda et al., 2005; Thorell et al., 2009). On the other hand, the addictive features of digital apps might also make it harder for some children to remain focused on less immediately rewarding tasks like homework, resulting in poor school performance and concern among parents. Thus, the same devices, and the instant gratification and distractions they so readily provide, may underlie the widespread perception that children today increasingly expect immediate gratification—and get constantly reinforced for it with clicks on their devices. In short, kids now may seek and receive immediate gratification from diverse sources more than their counterparts half a century ago. Yet, ironically, the cognitive attention-control skills those devices are teaching our children may make it easier for them to delay gratification (e.g., by self-distraction and psychological distancing from the immediate temptation), especially *when they are motivated to do so*, as on the “Marshmallow Test.” While these speculations are plausible, they remain speculations and potential hypotheses worth testing, and they are indeed receiving research attention (e.g., Bavelier, Green, Han, Renshaw, Merzenich, & Gentile, 2011).

Another source might be changes in public awareness and attention to self-regulation and executive function. The fields of cognitive development and educational psychology have come to incorporate more research on non-academic skills, such as executive function, temperament, and character strengths that nevertheless predict academic achievement (Blair, 2002; Duckworth & Carlson, 2013; Eisenberg, Valiente, & Eggum, 2010; Kochanska, Murray, & Coy, 1997; Kopp, 1982; Mischel, Shoda, & Peake, 1988; Rothbart & Derryberry, 1981; Zelazo, Carter, Reznick, & Frye, 1997).

At the same time, publications for educators and children's television programs have increased coverage on EF (e.g., *EdWeek*; *Zero to Three*; *Sesame Street*), and influential books have touted the importance of children's self-regulation for healthy development (e.g., Galinsky, 2010; Leach, 1977; Medina, 2010; Tough, 2012). School networks and curricula have even made self-regulation skills the bedrock of their approach to student learning (e.g., Knowledge is Power Program (KIPP); Tools of the Mind). Policy-makers, too, have taken note, including the addition of state standards for self-regulation skills in all 50 U.S. states (CASEL, 2015; DHHS, 2015), and the creation of research and policy centers to help educators navigate these changes (e.g., Collaborative for Academic, Social, and Emotional Learning; Character Lab; Harvard Center on the Developing Child/Frontiers of Innovation; Transforming Education; task forces of the National Governors' Association).

Although these are relatively recent examples, they represent a zeitgeist that was likely decades in the making. In fact, in 1968, only 15.7% of all 3- and 4-year-olds in the U.S. attended preschool; this number climbed to 52.1% by the year 2000. Enrollment expanded nearly fivefold among 3-year-olds and increased from 23% to 65% among 4-year-olds in this timeframe (Bainbridge et al., 2005; Karch, 2013). Government funding for preschool was present in the mid-1960s but enrollment in public programs lagged behind private providers until overtaking private enrollment beginning around 2000 (Figure 13). The primary objective of preschool also changed from largely custodial care to "school readiness" beginning in the 1980s (Karch, 2013). As the science of early brain, cognitive and socioemotional development progressed in parallel with increases in of out-of-home care and education of young children, preschool administration and teacher training became professionalized, and private companies had to compete with public programs and with each other for enrollment by offering evidence-based practices for school readiness. We posit that these conditions converged to set the stage for increased quality of early childhood education, including an emphasis on self-regulation as a foundation for school success, and the signs of public awareness of it cited earlier.

Limitations

A clear limitation of this research is the generalizability of our findings, given our samples were limited to socioeconomically advantaged U.S. preschool children. In fact, our work is far from complete. As noted earlier, children from low-income families are at a distinct risk of having low EF performance, independent of IQ (e.g., Raver et al., 2013). But among so-called "resilient" children living in poverty who nevertheless have well developed EF skills as measured on a variety of tasks, school performance and behavior ratings are on par with their more economically advantaged peers (Masten et al., 2012). In other words, having good EF is a protective factor in the context of poverty. Increased preparation of EF skills is thus considered a promising avenue for reducing the academic achievement gap among low-income students, and there is preliminary evidence that EF-focused curricula can improve academic outcomes (e.g., Blair & Raver, 2014; Diamond & Ling, 2016). Unfortunately, we did not have complete demographic data across samples and were unable to test the cohort effect as a function of income or parent education, even within the suspected limited range represented. This would be especially important to examine in light of the rising achievement gap between lower and upper income students over the past 50 years (Reardon, 2011). With respect to the delay-of-gratification task, in particular, it should be noted that Mahrer (1956) and later Kidd, Palmeri, and Aslin (2013) demonstrated that most children did not delay when they did not trust the experimenter to return with a larger reward. In a low-resource environment, it might be irrational to delay, so it does not necessarily indicate poor self-control ability when children choose not to, and could even be considered adaptive (Carlson & Zelazo, 2011; Lee & Carlson, 2015).

In addition, it should be noted that delay-of-gratification is just one of many measures of EF designed for preschool children, and specifically one of the "hot/delay" variety versus "cool/conflict" tasks, where there is no tangible reward at stake (e.g., Garon, Bryson, & Smith, 2008). Although delay and conflict measures of EF tend to be correlated, they form separate factors in a confirmatory factor analysis (Carlson, White, & Davis-Unger, 2014, Fig. 1). There are also important developments in EF beyond the preschool period (e.g., Huizinga, Dolan, &

van der Molen, 2006; Zelazo & Carlson, 2012). Hence, although the delay-of-gratification task was the best starting place to examine cohort effects in children's self-control given its long history, and the robust effect documented in our research is encouraging, it awaits replication in more socioeconomically diverse samples, using additional measures of EF in a broader age range. We must not lose sight of the important work ahead to ensure that all children are given the opportunity to practice the self-regulatory skills that are foundational for healthy development.

Conclusion

We inquired whether delay-of gratification in children is decreasing over time, and found two very different answers: yes, according to the intuitions of a large online sample of adults in the U.S., and no, according to the actual delay times recorded in experiments conducted in three birth cohorts tested in the 1960s, 1980s, and 2000s. The results were robust to age, sex, geography, and sampling effects. Although the findings cannot be generalized to all groups of children and the cultivation of EF skills in the preschool period remains critically important, we speculate that increases in abstract thought, social awareness of self-regulation along with rising preschool enrollment, and, somewhat ironically, cognitive skills associated with screen technologies, may have contributed to generational improvements in the delay-of-gratification task. Knowing *when* to employ self-control skills is likely a further adaptation beyond knowing *how* to employ them in a rapidly changing environment. Just as a wide-angle lens enables us to see the bigger picture, viewing developmental phenomena through the chronosystem enables us to witness transformations we might otherwise overlook (Bronfenbrenner, 1977).

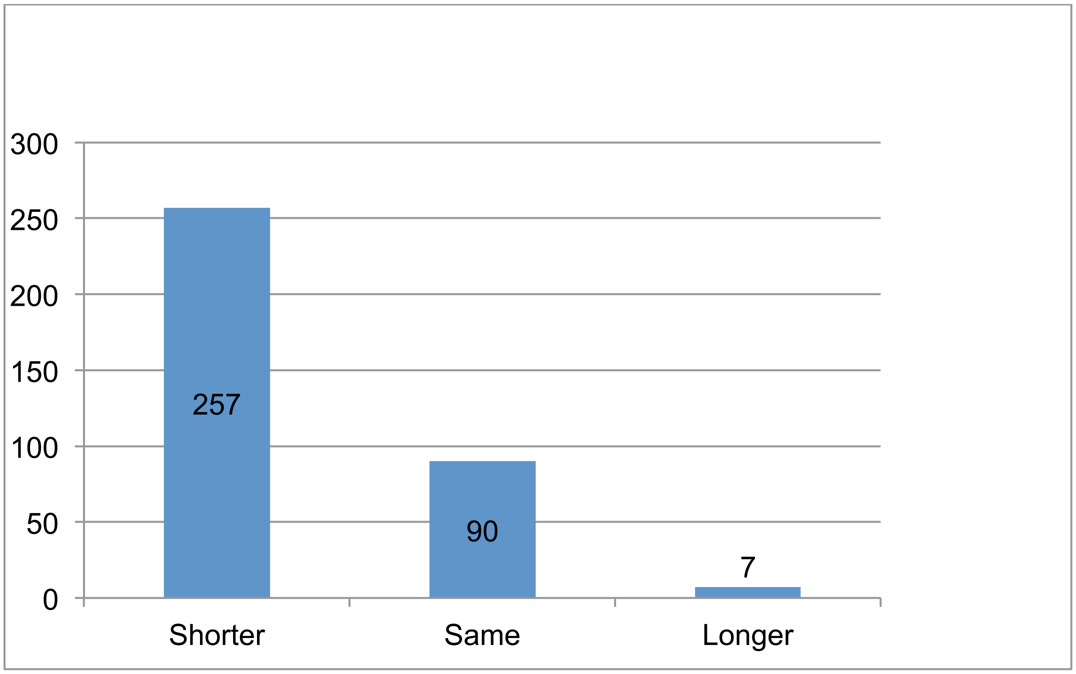

Figure 1. Responses (*N*) to the question about the delay-of-gratification paradigm, “Compared to 50 years ago, children today would wait…”

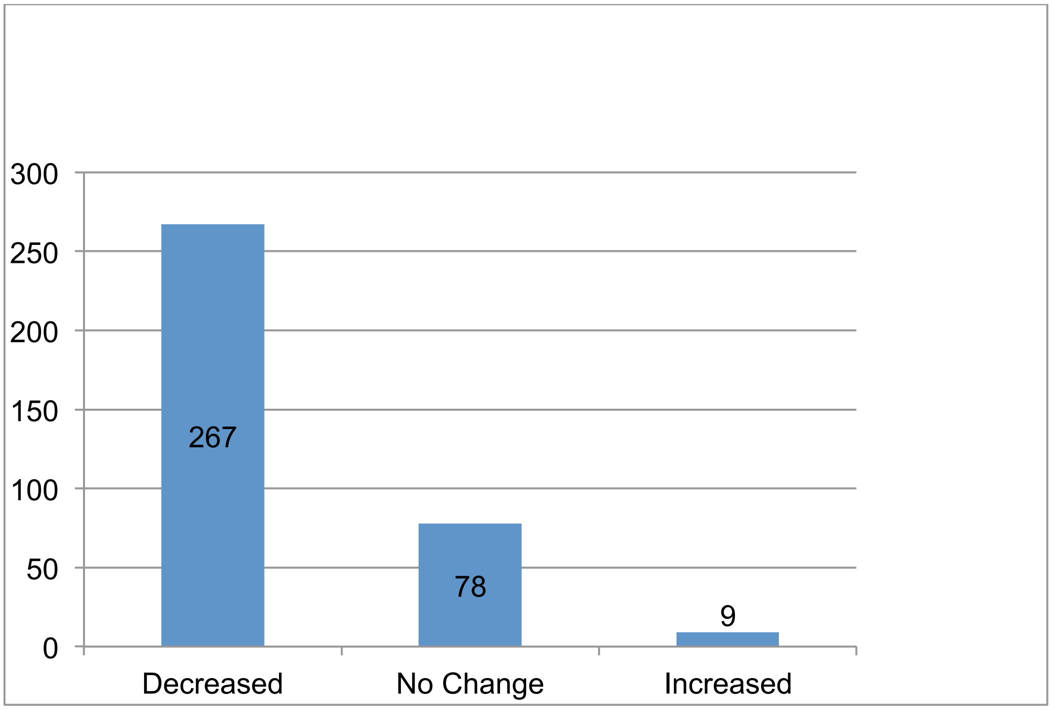

Figure 2. Responses (*N*) to the question, “Compared to 50 years ago, children’s ability to control themselves has…”

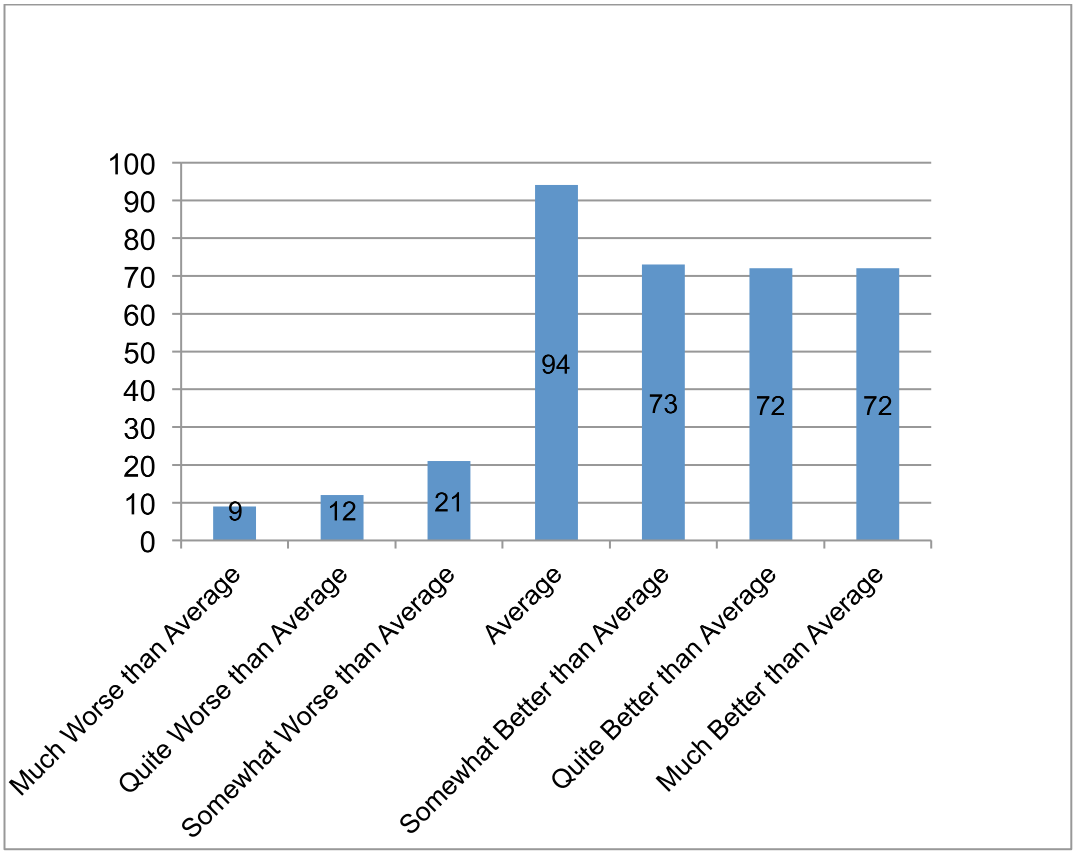

Figure 3. Responses (*N*) to the question, “How good are you at delaying gratification now?” *M* (out of 7) = 5.02, *SD* = 1.50, *N* = 353.

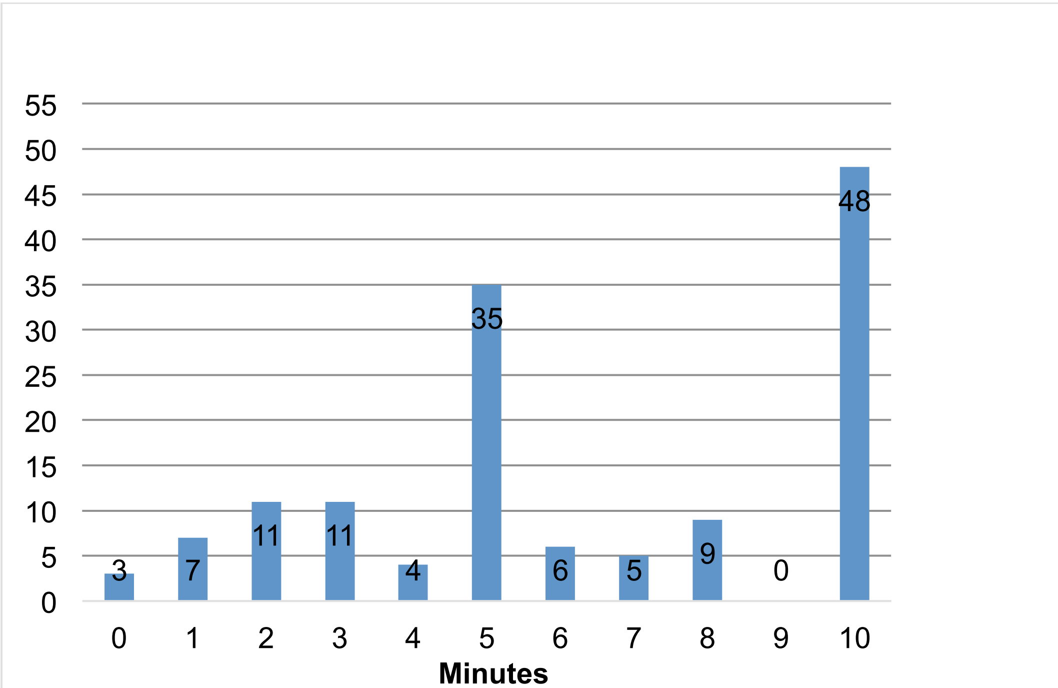

Figure 4. Responses (*N*) to the question, "When you were a child (age 4), how long would you have waited?" *M* = 7.3, *SD* = 3.19, *N* = 139.

Note. Showing subset of participants who were parents. One additional parent participant did not answer this question.

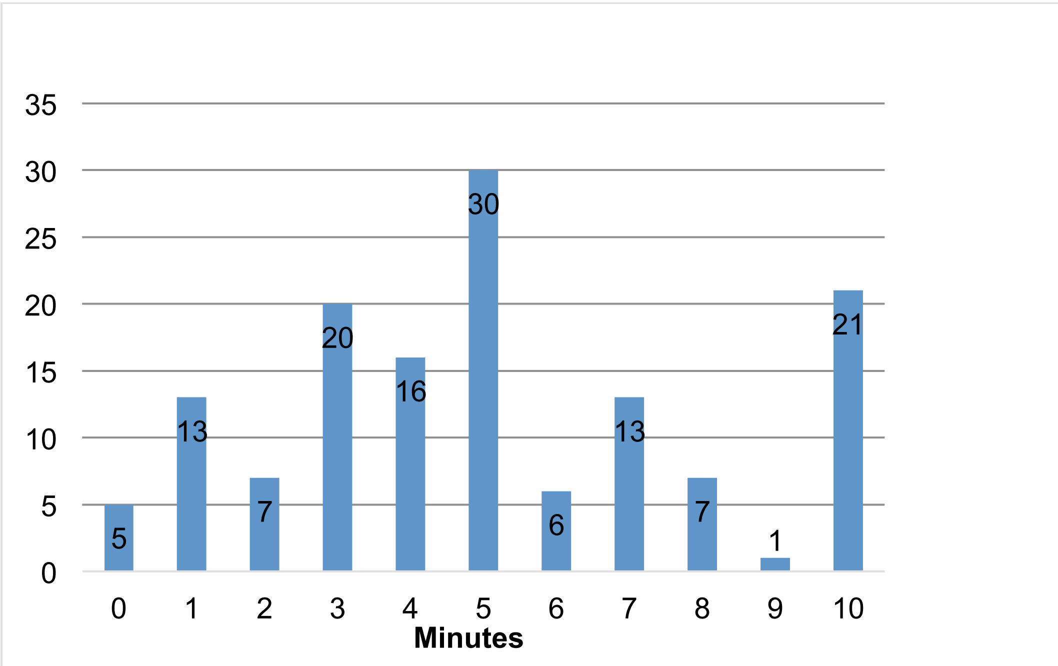

Figure 5. Responses (*N*) to the question, “If you have a child, at age 4, how long would he/she wait?” (first-born). *M* = 6.06, *SD* = 2.89, *N* = 139.

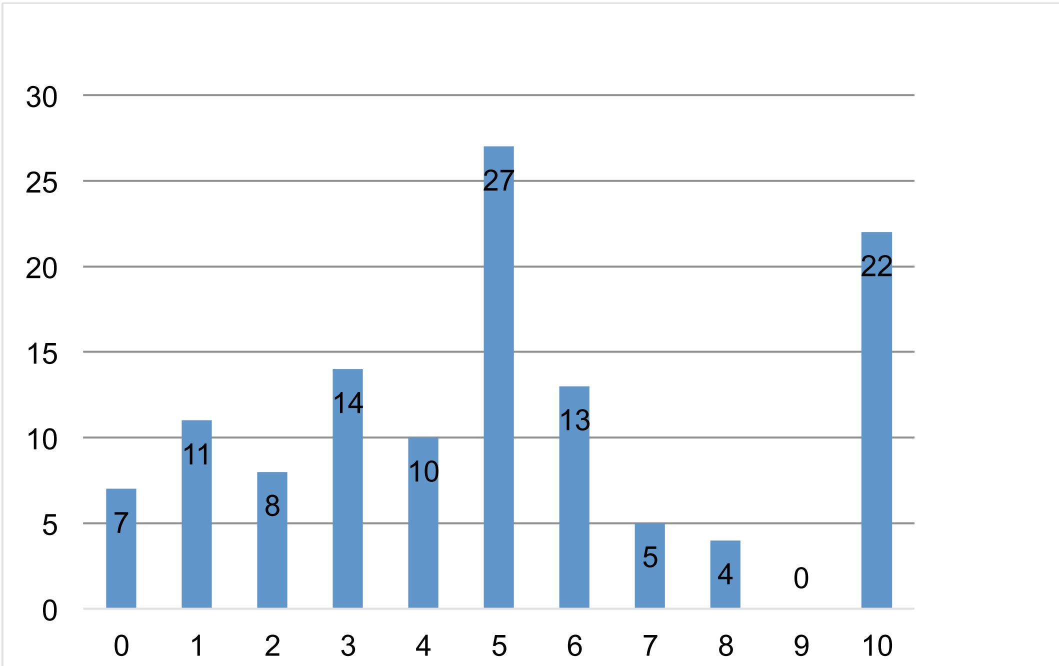

Figure 6. Responses (*N*) to the question, "If you have a child, at age 4, how long would he/she wait?" (last-born). *M* = 6.03, *SD* = 3.04, *N* = 121.

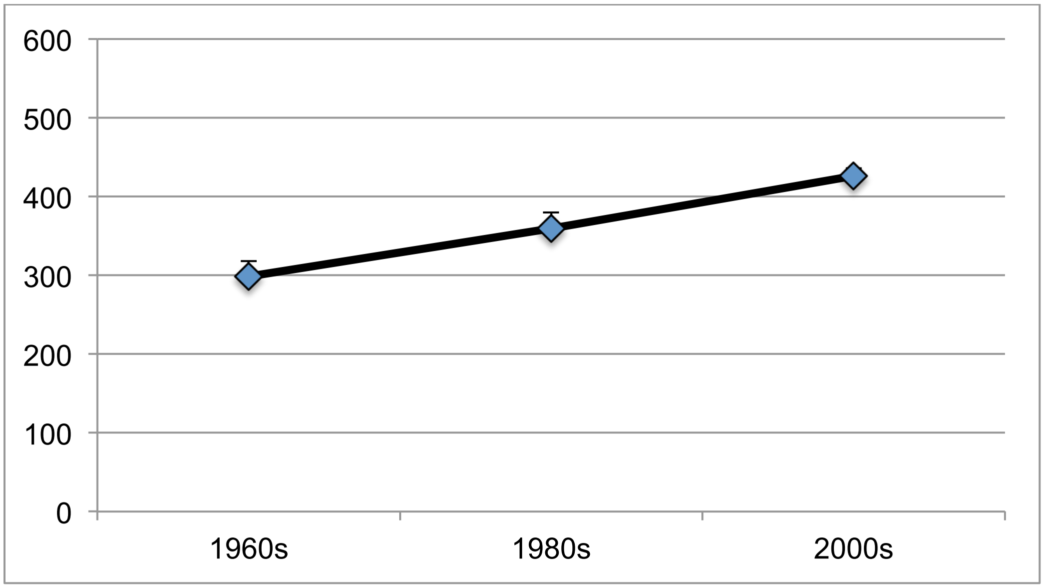

Figure 7. Delay time (sec) as a function of cohort

Note. Bars represent standard error.

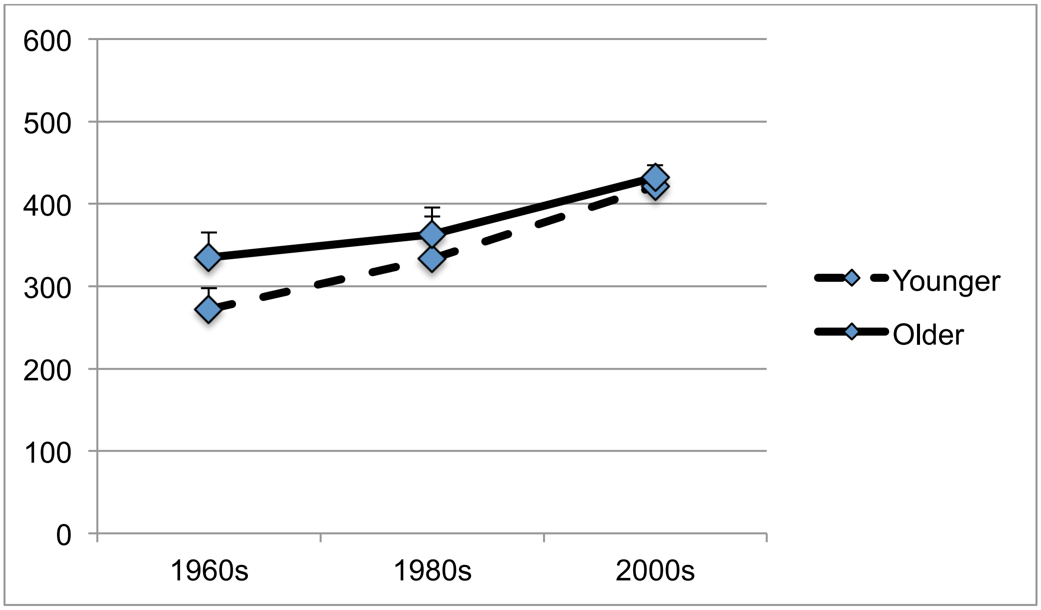

Figure 8. Delay time (sec) as a function of cohort and age group

Note. Bars represent standard error.

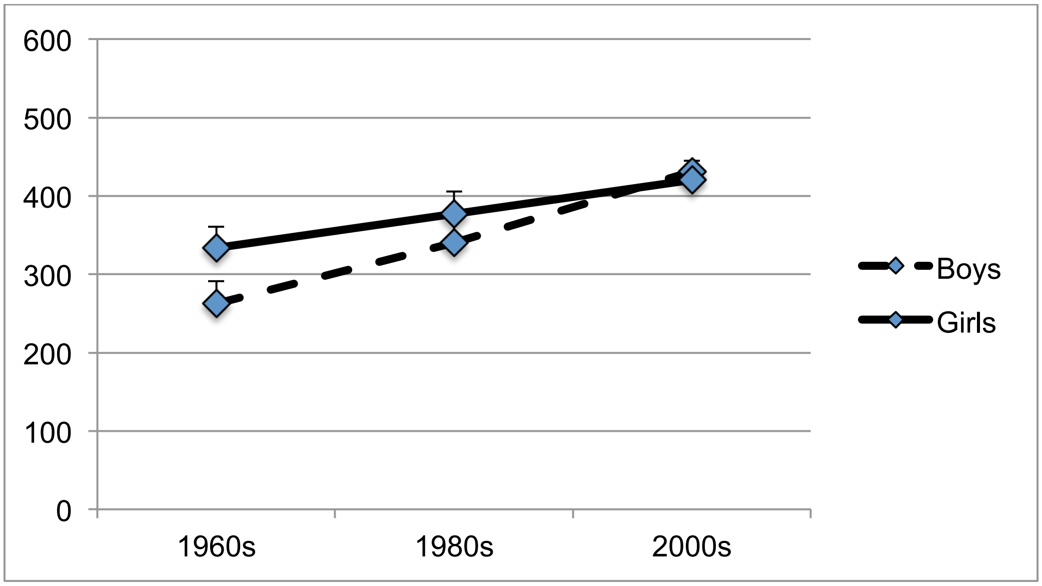

Figure 9. Delay time (sec) as a function of cohort and sex

Note. Bars represent standard error.

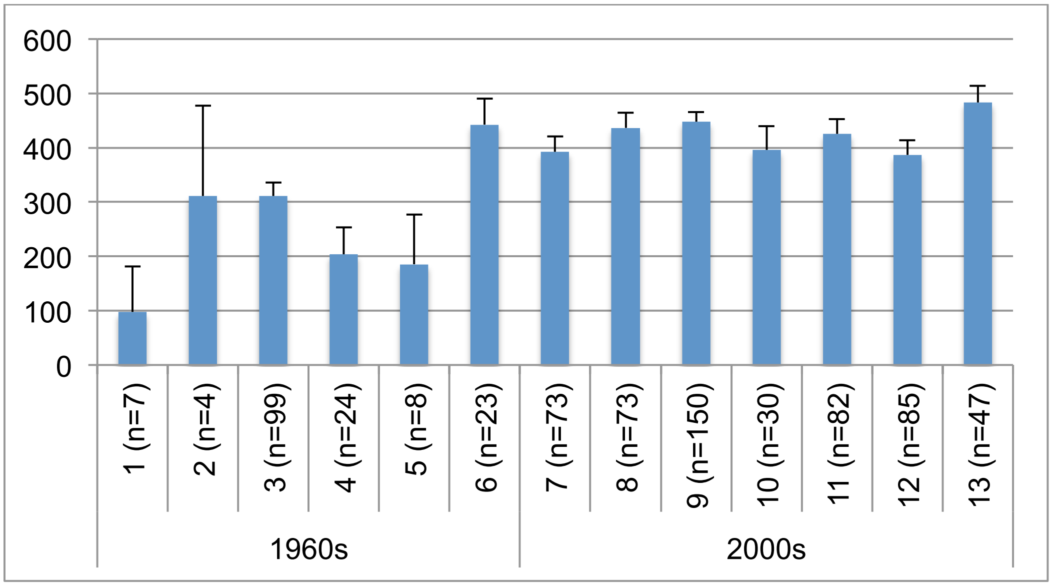

Figure 10. Delay time (sec) as a function of study samples within the 1960s and 2000s cohorts

Note. Studies within cohorts are not shown in chronological order, as some were overlapping. Bars represent standard error.

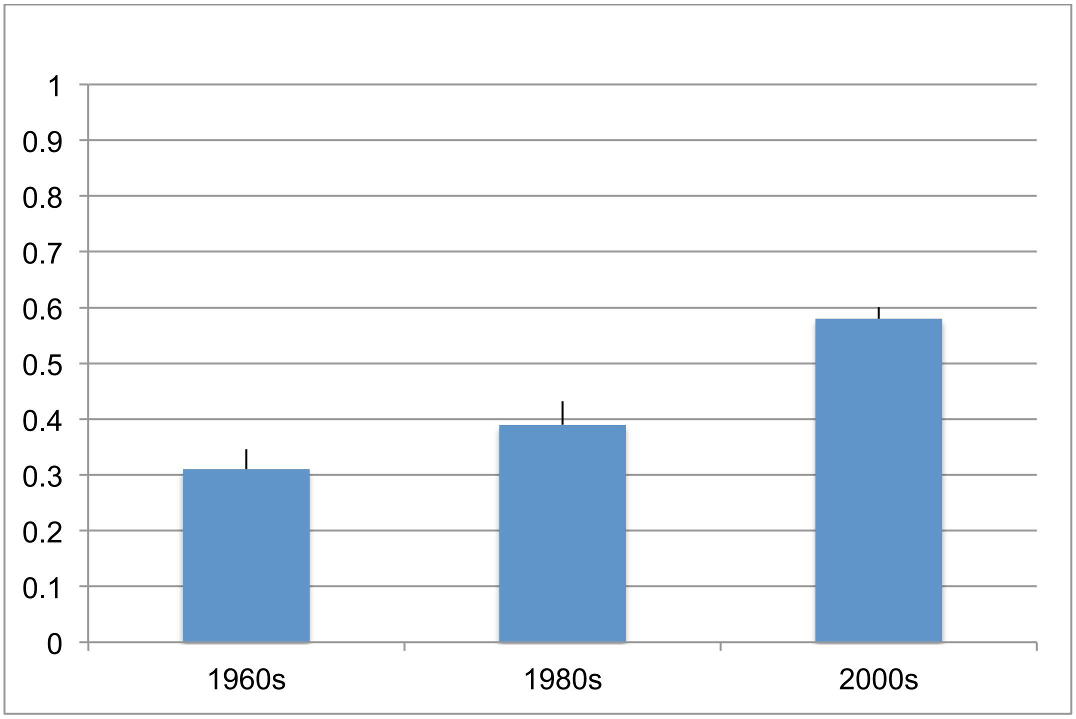

Figure 11. Proportion of children who delayed 10 min as a function of cohort

Note. Bars represent standard error.

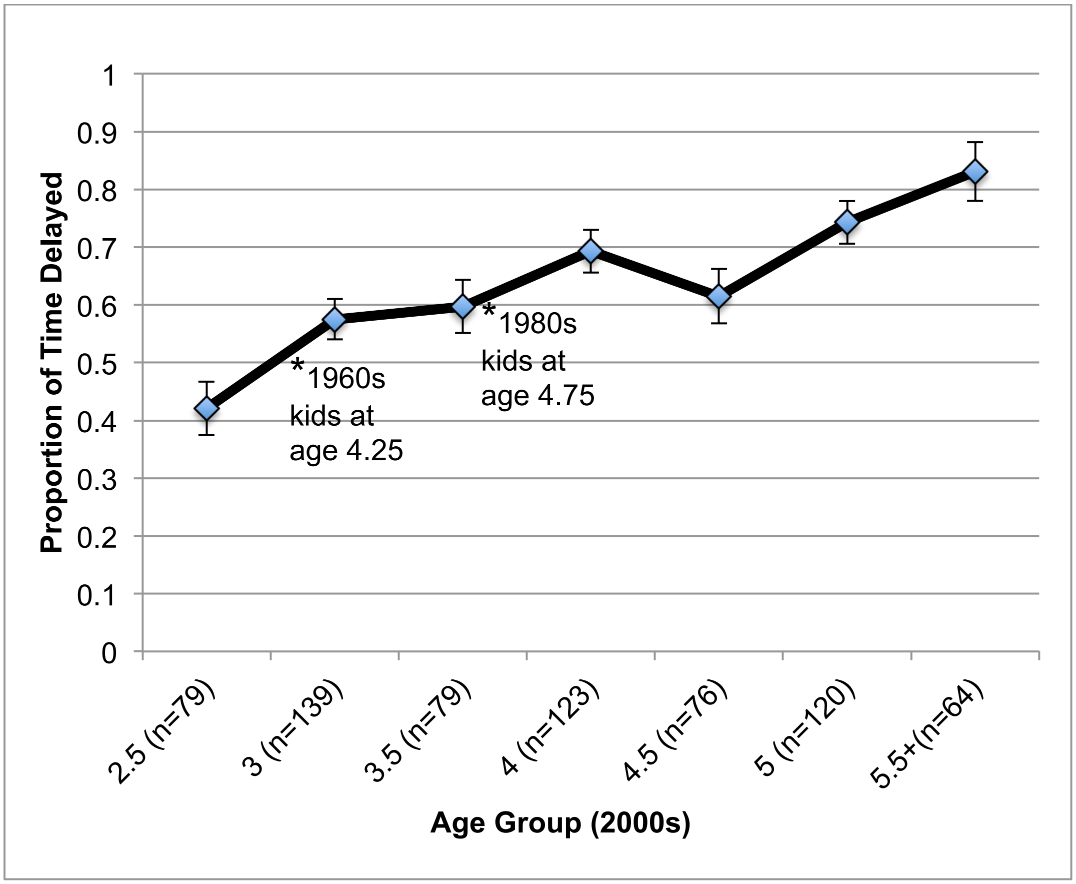

Figure 12. Proportion of time delayed as a function of age group in the 2000s, overlaid with average performance of children in the 1960s and 1980s.

Note. Delay times increase significantly with age, $F(6, 680) = 8.46$, $p < .001$. Data shown here include more children from the 2000s than the subset analyzed in the present study, because they represent a broader age range than the other cohorts. Bars represent standard error.

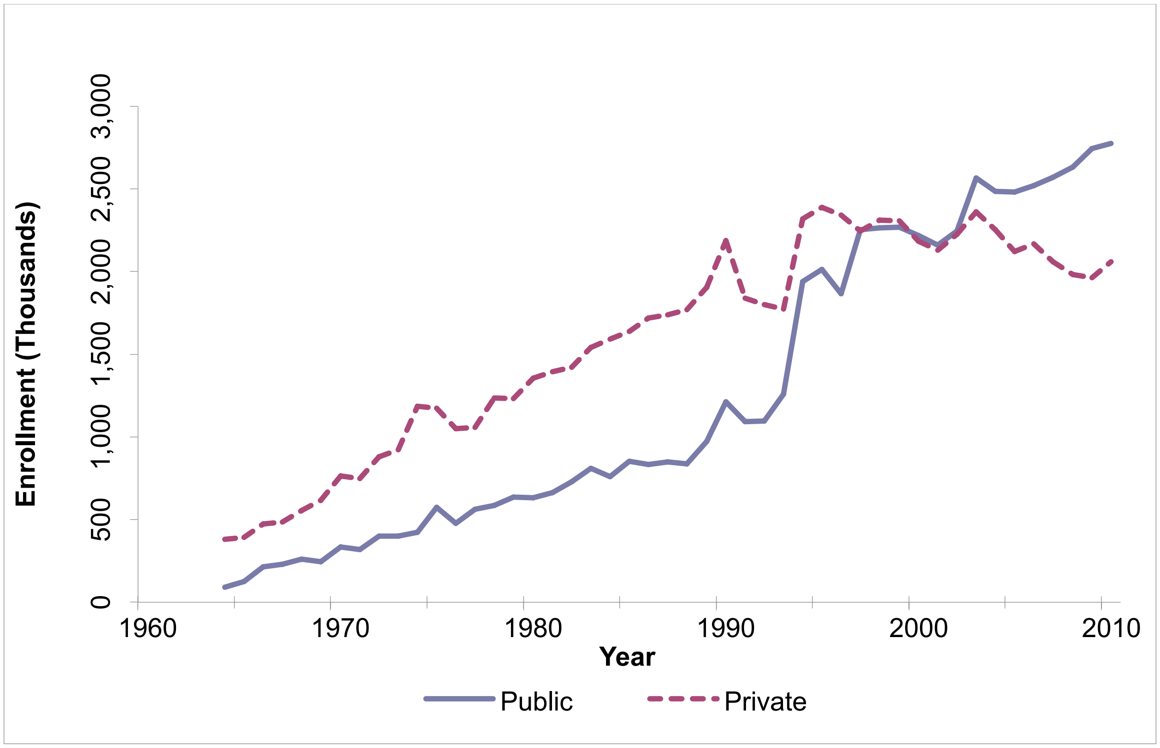

Figure 13. Preschool enrollment in the United States, 1964-2010. Reprinted from Karch (2013).

Supplemental Information

Study 1

Verbatim Instructions on the MTurk Survey

Over the last 50 years, scientists have tested children's ability to delay gratification in the following way: In a pleasant room with a table and a couple of chairs, a child first plays games with an adult (a research assistant) until rapport and a trusting relationship is built. Then the child is asked to choose his or her favorite treat (e.g., marshmallows, cookies, pretzels). The child is seated at a table. On the table are a small amount of the child's chosen reward (e.g., 1 cookie), a larger reward (e.g., 2 cookies) side by side, and a bell placed nearby the rewards. The adult says that she has to leave the room to do some work. She explains that the child can have the smaller reward now, but if the child waits until the adult returns to the room, the child can have the larger reward. She then explains to the child that he/she can bring the adult back at any time by ringing the bell, but in that case, the child can only have the smaller reward. Children are told there is no right or wrong way to play this game. They are not told how long the adult will be out of the room (which could be 10 minutes or more). The treats are left on the table in front of the child and are visible at all times. There are no other toys or distractions present in the room.

Q1
In this situation, when compared with children 50 years ago, do you think children today would wait:

- ○ Shorter amount of time
- ○ No change
- ○ Longer amount of time

Q2
Do you think young children (3-5 years old) nowadays are more, or less, able to control themselves (e.g., wait patiently for a reward) than children of their parents', or their grandparents', generations?

- ○ Children's self-control ability has increased over the last 50 years.
- ○ Children's self-control ability has decreased over the last 50 years.
- ○ No change

Last questions

Q3
When you were a child of about 4 years old, how long would you have waited for a larger reward in the delay-of-gratification test situation?
(respondent chooses from a range of 0-10 minutes)

Q4

How good are you at delaying gratification (waiting for long-term larger rewards) now?
(respondent chooses from a scale ranging from much worse than average to much better than average. Average is labeled)

Q5
If you have a child, if he or she were about 4 years old, how long would he/she wait for a larger reward in the delay-of-gratification test situation? (If you have more than one child, answer for your first-born.)
(respondent chooses from a range of 0 to ten minutes or N/A)

Q6
If you have a child, if he or she were about 4 years old, how long would he/she wait for a larger reward in the delay-of-gratification test situation? (If you have more than one child, answer for your lastborn.)
(respondent chooses from a range of 0 to ten minutes or N/A)

Study 2

Verbatim Instructions in the Delay-of-gratification Task

Bell Practice
(Take out bell) **E:** Look, a bell! See, this is how it works. *(Ring once)* Now you try it. Sometimes I have to go out of the room, but you can always make me come back by ringing this bell. This is called the bring-me-back bell. Every time you ring it you make me come back right away. Let's try it now. I'll go out of the room, and you will make me come back by ringing this bell.

Leave the room and come back immediately at the sound of the bell.
E: See, you made me come back!
Pull back bell from child's reach.

Treat Choice
Take out three ziplock bags of treat choices.
E: Look, I have more treats! Which kind do you like the best? **Treat choice** ____________

Rules
E: Now, listen closely. I have to go out of the room to do some work.
If you wait without eating the________ and without leaving your seat until I come back by myself, then you can have the large pile of ________.
But if you don't want to wait for the large pile of ________, then you can ring this bell at any time you want to, and I'll come back right away. But if you ring the bell, you cannot have the large pile, you can only have the small pile of ________ right away.
There is no right or wrong way to do this. You might want to wait and get a large pile of treats or you might not want to wait so much and get a smaller pile. Either way is OK. It is your choice and you can stop at any time you want to by ringing this bell.

Rule Check
E: So if you stay in your seat…and don't touch the treats…and don't ring the bell until I come back by myself…which pile do you get?

> *If child answers incorrectly, give rule reminder once:* "Remember, if you wait the whole time without ringing the bell you get the large pile, but if you want the small pile right away you can ring the bell to bring me back."
> *Repeat question.*

E: But if you want to you can ring the bell and then which pile do you get?

> *If child answers incorrectly, give rule reminder once:* "Remember, if you wait the whole time without ringing the bell you get the large pile, but if you want the small pile right away you can ring the bell to bring me back."
> *Repeat question.*

Begin Delay Task
Place the plates 12" from child's edge of the table with bell between plates.
Make sure that the child is seated properly: chair tucked in, facing the rewards.

E: See you in a bit!

Exit room and close door behind you.

*Start stopwatch for **10 min**.*

End Delay Task
Return to room after 10 minutes or earlier if child rings bell, eats treats, or leaves seat/room.

If waited full 10 minutes:

> *Give child large pile, "Great job waiting, you get the large pile!" After a little time add the small pile, "You did such a good job on all the games, do you want these too?*

If E returned early:

> *Give child small pile, "You didn't want to wait so long, you get this pile!" After a little time add the large pile, "You did such a good job on all the games, do you want these too?*

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