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Cohort Effects in Children's Delay of Gratification

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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 United States ($N = 354$; *Mdn* age = 34 years). To test the validity of this prediction, Study 2 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 in the late 1960s, 1980s, and 2000s, matched on age (3 to 5 years) at the time of testing. In contrast to popular belief, results revealed a linear *increase* in delay over time ($p < .0001$, $\eta_p^2 = .047$), 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, preschool education, and public attention to executive function skills 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 causal factors.

Keywords: delay of gratification, marshmallow test, executive function, self-regulation, cohort effect

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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

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the underlying self-control processes have roots in early childhood. In their classic laboratory paradigm, the "marshmallow test," Mischel and colleagues (1989) 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). The developmental significance of this paradigm is underscored by the finding 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 scholastic aptitude test 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, 2013; 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 self-control using a variety of cognitive strategies (Mischel et al., 2011; Mischel, 2014). But the task also catalyzed the broader field of self-regulation and executive function in developmental psychology. Executive function 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). These skills are needed when one intentionally tries to regulate or control the self, as opposed to many automatic and unconscious forms of self-regulation (e.g., breathing), although there is some debate in the field about terminology (e.g., Hofmann, Schmeichel, & Baddeley, 2012; Nigg, 2017). Executive function depends largely on prefrontal cortex and has a protracted development extending beyond adolescence, but the most striking improvements take place in early childhood (Carlson, Zelazo, & Faja, 2013). Research output on executive function in childhood has more than tripled in the past two decades (Carlson, 2011), yielding new knowledge about its correlates and consequences (especially for academic achievement), biobehavioral roots, environmental influences on its development, and effective ways to train it (Blair & Raver, 2014; Carlson et al., 2013; Diamond & Lee, 2011).

The focus of this explosion of research has been on executive function in the course of individual development, but to fully comprehend and account for developmental phenomena, we must take the long view by situating it in a historical context (Bronfenbrenner, 1977). We would want to know, for example, if base rates of executive function in young children have changed over time. Fortunately, the Marshmallow Test has been used and virtually unchanged for several decades, enabling us to investigate this question: Are there cohort effects on children's delay of gratification over the decades since Mischel and colleagues initiated those studies half a century ago?

Our predictions were equivocal. We reasoned that, on the one hand, we hear parents, grandparents, and teachers complain that "kids today" have deficiencies in self-control. 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) which serves to immediately relieve boredom, and thus they 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). Several scholars have lamented the decline of nonscreen play time for young children and its potential psychological effects (Bodrova, Germeroth, & Leong, (2013); Louv & Charles, (2011)). But on the other hand, if one considers the increasing requirements for abstract thought that have occurred with the technology revolution, 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-control skills actually have improved over this time period. Increasing opportunities for high-quality preschool education (Karch, 2013) as well as more enlightened parenting practices that foster intrinsic self-control versus authoritarian control by caregivers, also might contribute to historical changes in children's performance (Trifan, Stattin, & Tilton-Weaver, 2014).

To investigate these issues, in Study 1 we first queried the general public in 2015 about their predictions as to whether children today would wait as long as children 50 years ago in the Marshmallow Test. Then in Study 2, we carried out an analysis of cohort effects on actual delay times in children ages 3–5 whom we tested in the 1960s, 1980s, and the first decade of the 2000s. The findings would have implications for our understanding of potential societal influences on a vital construct in human development.

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

We first wanted to know what a fairly broad sample of American adults would believe about potential changes in children's delay of gratification and self-control, rather than rely on impressions and anecdotal evidence from our own admittedly limited experience as psychologists.

Method

Participants

Participants were 358 adults recruited from Amazon's Mechanical Turk (MTurk) program for one month in 2015 (mid-March to mid-April). MTurk is widely used in behavioral research and the data obtained through MTurk tend to be at least as reliable as those obtained via traditional methods (Buhrmester, Kwang, & Gosling, 2011). 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 the online supplemental material 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 (response order reversed from the other question). 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. We then asked a series of questions to help contextualize these main responses, regarding participants' perceptions of their own delay-of-gratification skills and those of their children if they were parents (presented more fully in the online supplemental material). This research was carried out in accordance with ethical standards at the University of Minnesota Institutional Review Board (3 0911S74574), "The Development of Persistence and Self-Control."

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 Figure 1, 257 of 358 (72%) participants believed that children today would wait less long, $\chi^2(2) = 33.99$, $p < .0001$, and 267 of 358 (75%) believed that children today would have less self-control, $\chi^2(2) = 44.25$, $p < .0001$, than children 50 years ago.

Next, we looked to see if any of the demographic variables moderated participant responses to the above questions. Responses did not differ significantly by age, sex, race, income, or region of the U.S. However, those identifying as Hispanic ($n = 20$) were even more likely than non-Hispanics to endorse that children today would not wait as long as children in the past, $\chi^2(2) = 13.17$, $p = .001$, and that children's self-control has decreased, $\chi^2(2) = 7.68$, $p = .022$.

Finally, 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* ($SD = 1.50$), $t(352) = 12.83$, $p < .0001$ (see Figure S1 in the online supplemental material). However, those who claimed they would not have delayed very long as a child (less than 5 min) were more likely to endorse "same/no change" regarding today's children, $\chi^2(20) = 70.14$, $p < .0001$. 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 ($M_{\text{parent}} = 7.3$, $SD = 3.19$; $M_{\text{child}} = 6.06$, $SD = 2.89$), $t(138) = 5.08$, $p < .0001$ (see Figure S2 in the online supplemental material). 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 (see Figure S2 in the online supplemental material), the responses were highly correlated, $r(121) = .64$, $p < .0001$, and not significantly different from each other ($M_{\text{first}} = 5.93$, $SD = 2.89$; $M_{\text{last}} = 6.03$, $SD = 3.04$), $t(120) = -.433$, $p = .67$.

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. These findings held true across demographic variables, with one exception: They were even more amplified among Hispanic adults, which might reflect more authoritarian values about child rearing on average (e.g., Calzada, Huang, Anicama, Fernandez, & Brotman, 2012). A limitation of this study is that in an effort to keep the survey brief to increase participation, we did not ask the respondents to explain the basis for their

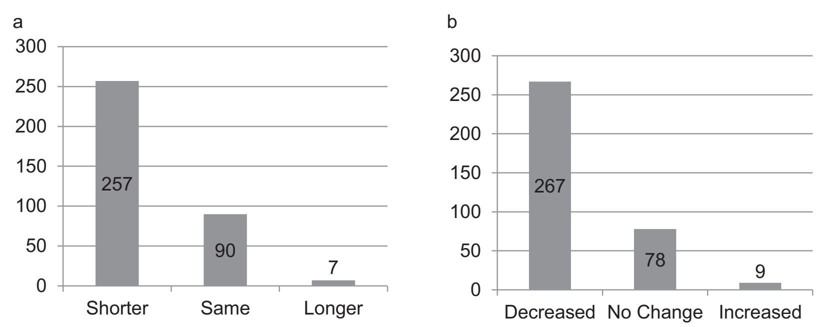

Figure 1. Responses (*N*) to the question about the delay-of-gratification paradigm, "Compared to 50 years ago, children today would wait . . ." (Panel a) and, "Compared to 50 years ago, children's ability to control themselves has . . ." (Panel b).

judgments. They might have been drawing on observations of children's apparent fixation with technology that offers immediate gratification, and/or knowledge of purported increases in attention and behavior problems in youth. But were they accurate in their predictions?

Study 2: How Long They Waited

In Study 2, we tested the intuition that was clearly revealed in Study 1 by analyzing delay-of-gratification data collected in the 1960s, 1980s, and 2000s by our labs. 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 by Stephanie Carlson and colleagues collected at the University of Washington and the University of Minnesota in the first decade of the 2000s, all using the same paradigm.

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 (1989). 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 ages 3 to 5 years were tested in this control condition (see Table 1). The sample consisted of primarily Caucasian children of Stanford University faculty or Stanford graduate students.

1980s cohort. Participants included 135 typically developing children ages 4 to 5 years 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 (see Table 1). As with the Bing sample, they were primarily Caucasian children of parents affiliated with the university.

2000s cohort. Participants included 540 typically developing children ages 3 to 5 years (see Table 1). Families were recruited from participant pools at two urban universities, University of Washington ($n = 296$) tested between 2002 and 2007 and University of Minnesota ($n = 244$) tested between 2008 and 2012. The sample was predominantly Caucasian (88.2%) with a median annual household income of $100,000 and a college education level. Given the rise in prescriptions for stimulant medication in children (LeFever et al., 2003), it is important to note that no participants were prescribed 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., one Oreo cookie) and the other with a visibly larger amount (e.g., two 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 immediately, 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

Table 1
Characteristics of the Samples

Dates of data collection	1960s	1980s	2000s
	1965–1969	1985–1989	2002–2012
N	165	135	540
Age months *M* (*SD*)	51.45 (6.76)	57.68 (4.41)	50.27 (9.28)
Range months	35–70	48–66	36–71
Sex	51% female	52% female	47% female
Location	San Francisco Bay	New York City	Seattle, WA, Minneapolis, MN
Race	Mostly Caucasian	Mostly Caucasian	Mostly Caucasian
SES	Middle upper	Middle upper	Middle upper
N samples	6	1	7
Publications	Mischel and Ebbesen (1970) Mischel, Ebbesen, and Zeiss (1972) Mischel and Baker (1975) + unpublished	Sethi, Mischel, Aber, Shoda, and Rodriguez (2000) + unpublished	Beck, Schaefer, Pang, and Carlson (2011) + unpublished

Note. SES = socioeconomic status.

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 the online supplemental material.)

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 control condition (described in the preceding text) 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 amid 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 2, delay time increased significantly over the decades: 1960s (M = 298.45 s, 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 repeated 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 ($R = .21$, $R^2 = .043$), $F(1, 839) = 38.11$, $p < .0001$.

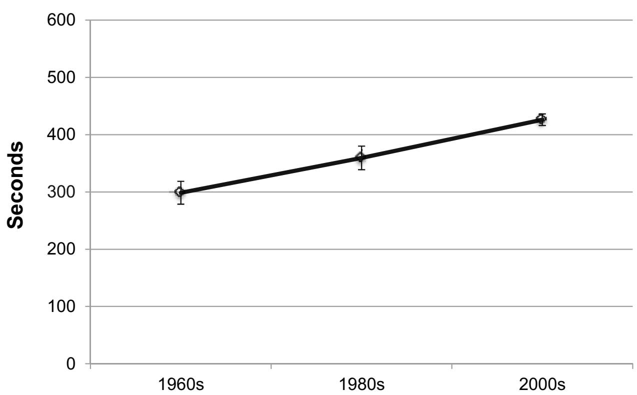

Figure 2. Delay time (sec) as a function of cohort. Bars represent standard error.

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 more difficult 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 analysis of variance (ANOVA) controlling for age in months. Age was marginally significant, $F(1, 839) = 3.449$, $p = .064$, $\eta_p^2 = .004$. Nevertheless, birth cohort remained a significant predictor of delay time, $F(2, 839) = 20.365$, $p < .0001$, $\eta_p^2 = .046$. Planned repeated 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) × Age Group (2) ANOVA using the median split on age (younger = 35 to 52 months; older = 53 to 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 (see Figure 3).

Sex. We next tested whether the cohort effect differed by sex. A Cohort (3) × 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, $t(163) = -1.791$, $p = .075$), the main effect of sex did not reach statistical significance ($p = .104$), and neither did the interaction term ($p = .133$; see Figure 4).

Geography. All children in the 1960s cohort were located in the San Francisco Bay area 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 repeated 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 reran the ANOVA examining delay time across cohorts. The cohort effect was significant in the

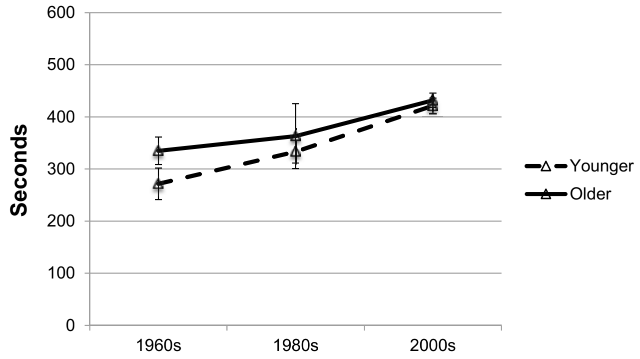

Figure 3. Delay time (sec) as a function of cohort and age group. Bars represent standard error.

first sample, $F(2, 414) = 9.326$, $p < .0001$, $\eta_p^2 = .043$, with planned repeated 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 College, 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 (see Figure 5). 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, $F(12, 692) = 5.33$, $p < .0001$, $\eta_p^2 = .085$.

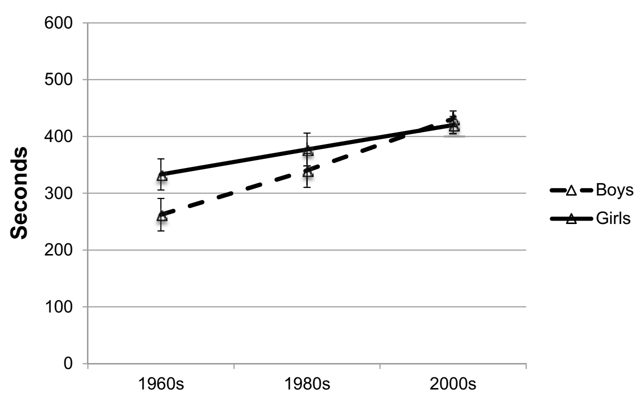

Figure 4. Delay time (sec) as a function of cohort and sex. Bars represent standard error.

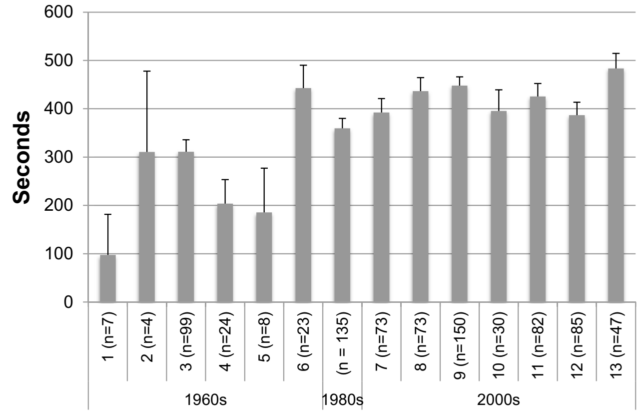

Figure 5. Delay time (sec) as a function of study samples within the 1960s, 1980s, and 2000s cohorts. Studies within cohorts are not shown in chronological order, as some were overlapping. Bars represent standard error.

Nonparametric tests. We noted that delay times were not normally distributed, but rather were bimodal (almost no delay vs. full delay) in the 1960s, and became more negatively skewed over time (skewness = .066, −.32, and −.837, respectively). Hence, to compare the distributions, we divided delay times into 30-s intervals and found that the proportion of children who delayed less than 30s decreased while those who delayed the full 600s increased over time, $\chi^2(40) = 103.584$, $p < .0001$, with a robust effect, $\eta = .293$ (see Figure 6). Furthermore, the proportion of children who delayed the full 10 min (vs. not waiting the entire time) 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*, $p < .0001$). On the other end of the distribution, the proportion of children who delayed less than 30 s before eating the treat or ringing the bell also was significantly different across cohorts, Kruskal-Wallis statistic $< .0001$. It decreased from the 1960s to 1980s (Mann–Whitney *U*, $p < .01$) but the 1980s and 2000s proportions were not significantly different ($p = .246$).

Age-equivalents. In the main analysis, children in the 1960s waited on average 127.51 s less than children in the 2000s. Children in the 1980s were in between, waiting on average 66.61 s less than those in the 2000s. Carlson's data from the 2000s are illustrated as a function of age in Figure 7. 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 (see Figure 7). In other words, children in the earlier cohorts performed at the same level as children who were as much as a full year younger in the later cohort.

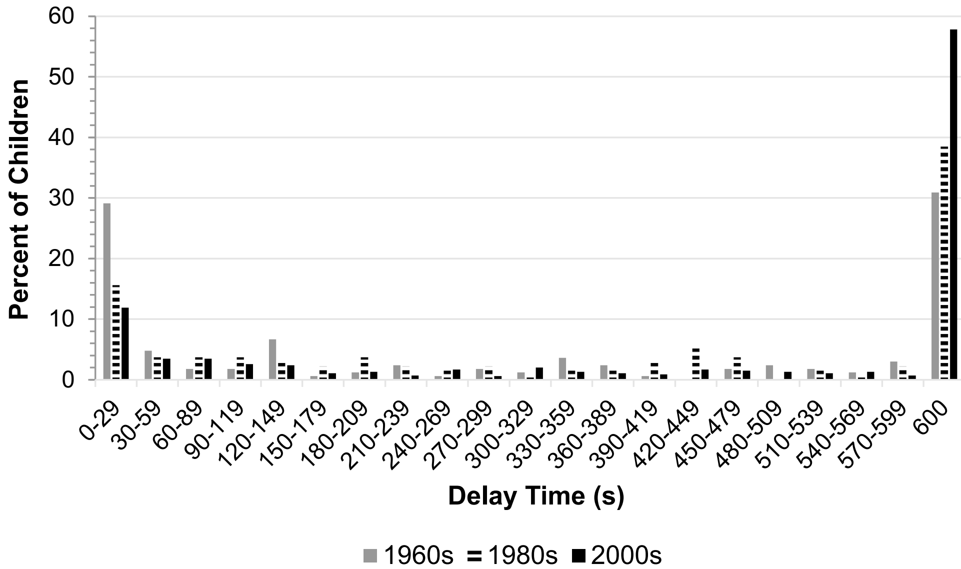

Figure 6. Percentage of children who delayed in each 30-s interval as a function of cohort.

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 change in the shape of the distributions at both the lower and upper ends and an increase in the proportion of children who delayed a full 10 min. These analyses suggest that children were becoming more successful at delaying gratification rather than simply becoming more variable over time. The main 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). Hence, 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" have worse self-control and are less able to delay gratification. Instead, the results showed a clear increase in delay of gratification among typically developing 3- to 5-year-old children in the United States 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 attention-deficit/hyperactivity disorder (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 rarer ADHD diagnosis and treatment was in the earlier cohorts (and the effects of such medication would have only dampened our results).

Socioeconomic status (SES) is a potential factor, as it is known to be related to executive function. Children growing up in poverty tend to have lower executive function 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 executive function performance at age 4 in a linear fashion (Raver, McCoy, Lowenstein, & Pess, 2013). We have incomplete information on SES of the families who participated, particularly in the earlier cohorts. Nonetheless, 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 likely 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 argued that the root of it lies in changes in what is needed for

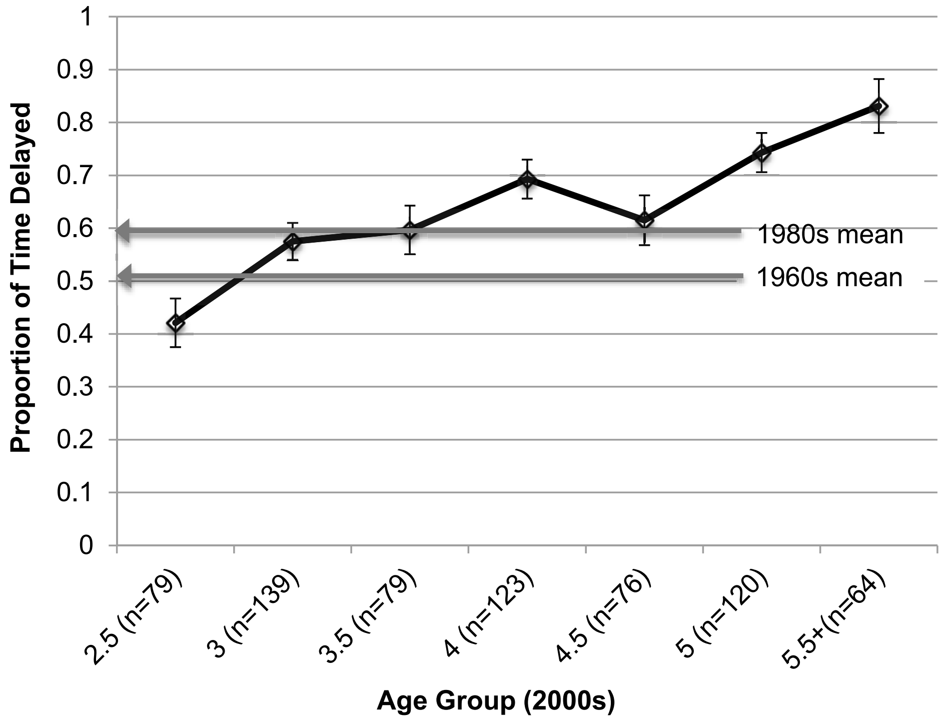

Figure 7. Proportion of time delayed as a function of age group in the 2000s, overlaid with average performance of children in the 1960s and 1980s. Delay times increased significantly with age, $F(6, 680) = 8.46$, $p < .001$. Data shown here include more children from the 2000s than the subset analyzed in the present study, because they represent a broader age range than the other cohorts. Proportion is used because the delay time varied across studies. Bars represent standard error. 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. See the online article for the color version of this figure.

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, represents a form of mediated cognition (abstraction of thought through cultural artifacts), which is more generally associated with enhanced intelligence (Flynn & Blair, 2013; Vygotsky, 1978).

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 know from a host of experiments 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 reconstrue 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, 2017). 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. It should be noted, however, that there have been reports of a reverse Flynn effect for IQ attributed to changing demographics (Dutton, van der Linden, & Lynn, 2016), and it remains to be seen if this will be reflected in executive function, too.

In addition to general changes in higher order cognition, to reconcile the discrepancy between the expectation that "kids today" lack self-control with the present finding of greater ability to delay gratification in the experimental paradigm we examined, we suggest the following distinction may be helpful: (1) how *able* children are to delay gratification when they are motivated to do so with a clear contingency and no other distractions, which is the condition created in the classic Marshmallow Test, versus (2) whether they will *choose* to delay gratification when left to their own digital devices and other available choices. Children's spontaneous decisions to delay in real-world settings could depend on numerous factors, including age, subjective value of the immediate and delayed rewards, and how well they can imagine their future selves (Garon, 2016). Interestingly, performance on a repeated choice task (e.g., "Do you choose 1 (candy, sticker) now or 2 (or 3 or 4) for later?") was only modestly related to measures involving an actual, sustained delay (Duckworth & Kern, 2011). In our own 2000s cohort, a subset of the children participated in both the delay-of-gratification task and the repeated delay choice task, and they were uncorrelated, $r(262) = .075$, $p = .223$, thus underscoring the important distinction between ability and choice. Unfortunately, we do not have comparable delay choice data from the earlier cohorts, to assess whether that too has changed over time.

The availability of digital apps might be a double-edged sword in this regard: Apps might make it harder for some children to remain focused on less immediately rewarding tasks like homework, yet, ironically, the abstract thought and attention-control skills those devices are exercising could make it easier for them to delay gratification (e.g., by self-distraction and psychological distancing from the immediate temptation), when they are motivated to do so, as in the Marshmallow Test. To shed some empirical light on this hypothesis, within our 2000s cohort, we compared the Washington sample, tested between 2002 and 2007 and the Minnesota sample, tested between 2008 and 2012, because the latter subcohort experienced the birth of the Smartphone in 2007, which introduced children to their parents' digital screens earlier than ever before. Although it is confounded with study location, it is important to note there was not a significant difference between these samples in delay of gratification. Thus, 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-control and executive function. The fields of cognitive development and educational psychology have come to incorporate more research on nonacademic 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 et al., 1988; Rothbart & Derryberry, 1981; Zelazo, Carter, Reznick, & Frye, 1997). At the same time, publications for educators and children's TV programs have increased coverage on executive function (e.g., *EdWeek*; *Zero to Three*; *Sesame Street*), and influential books have touted the importance of children's self-control for healthy development (e.g., Galinsky, 2010; Leach, 1977; Medina, 2010; Tough, 2012). School networks and curricula have even made executive function skills the bedrock of their approach to student learning (e.g., Knowledge is Power Program (KIPP); Tools of the Mind). Policymakers, too, have taken note, including the addition of state standards for socioemotional skills (including self-control) in all 50 U.S. states (CASEL, 2015; Department of Health and Human Services, 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 for 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 United States 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, Meyers, Tanaka, & Waldfogel, 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 (see Figure 8). 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 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-control as a foundation for school success. Experience in these caregiving environments would be likely to provide children with a lot of practice at delaying gratification (e.g., waiting turns) and the strategies for doing so, such as abstract thought and psychological distance.

Parenting, too, likely has changed in ways that are conducive to increasing delay of gratification in children. Several studies have shown that high-quality parenting that supports the child's growing autonomy in the preschool period is associated with the healthy development of executive function skills, as opposed to a more controlling style that denies the opportunity for choice and self-management. This holds true in both mothers and fathers as well as relatively wealthy and poor parents (Bernier, Carlson, et al., 2010; Distefano, Galinsky, McClelland, Zelazo, & Carlson, in press; Fay-Stammbach, Hawes, & Meredith, 2014; Karreman, van Tuijl, Aken, & Deković, 2006; Meuwissen & Carlson, 2015). Thus changes in parenting over time could be consistent with our results. In fact, Trifan et al. (2014) reported that parents in Sweden became more egalitarian and less controlling over the past 50 years, and another study found that parental child-care time, which is associated with a host of positive child outcomes, increased significantly (particularly among well-educated parents) across 11 Western countries from 1965 to 2012, precisely the dates of our study (Dotti Sani, & Treas, 2016).

Limitations

It should be noted that the current study examined only a small and specific subpopulation of people, cultures, and social contexts. Thus below we explicitly state the Constraints on Generality (Simons, Shoda, & Lindsay, 2017), and refrain from assuming that the results generalize beyond those that are represented in the study. First, the survey study drew upon the MTurk population in March of 2015, which was three years after the last data point included in our 2000s cohort, and these adults were more socioeconomically diverse than the families of the children tested. Nonetheless, there is no evidence to support a reversal of the trend in those three years.

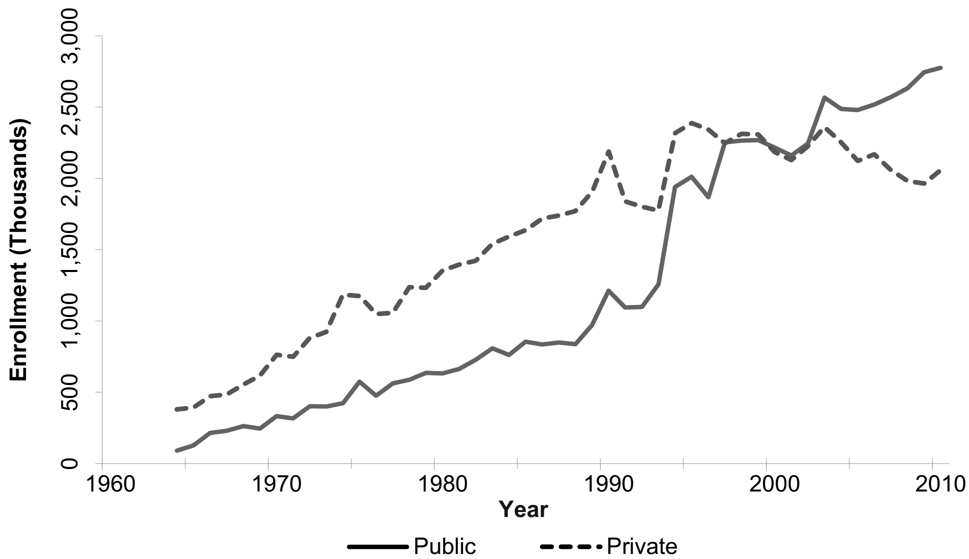

Figure 8. Preschool enrollment in the United States, 1964-2010. Reprinted with permission from *Early start: Preschool politics in the United States*, by A. Karch, p. 5. Copyright, 2013 by University of Michigan Press. See the online article for the color version of this figure.

Second, most of our participants came from socioeconomically advantaged populations of preschool children in metropolitan California, New York, Washington, and Minnesota, hence we do not know what the trend is for lower SES children, or in other areas of the U.S., not to mention in other countries. As noted earlier, children from low-income families are at a distinct risk of having low executive function performance, and in turn low academic achievement, independent of IQ (e.g., Raver et al., 2013). Unfortunately, we did not have complete demographic data across samples and were unable to test the cohort effect for different levels of income or parent education. 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).

Third, it should be noted that delay of gratification is just one of many measures of executive function 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 executive function tend to be correlated, they form separate factors in a confirmatory factor analysis (Carlson, White, & Davis-Unger, 2014, Figure 1). There are also important developments in executive function beyond the preschool period (e.g., Huizinga, Dolan, & van der Molen, 2006; Zelazo & Carlson, 2012). Hence, although we believe the delay-of-gratification task was the best starting point 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 studies in more socioeconomically diverse samples, using additional measures of executive function in a broader age range.

Finally, although it has often been assumed that delaying gratification is adaptive, it should be noted that it is context dependent. For example, Mahrer (1956), Mischel and Staub (1965), 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 and unpredictable 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; Sturge-Apple, Davies, Cicchetti, Hentges, & Coe, 2017). However, as discussed above, the choice to delay gratification and the ability to delay gratification when one chooses to do so are psychologically distinct processes. We must not lose sight of the important work ahead to ensure that all children are given the opportunity to develop executive function skills, so that they can more effectively engage in behaviors that are, in their particular culture and social environment, most conducive to 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 executive function skills in the preschool period remains critically important, we speculate that increases in abstract thought and social awareness of executive function, along with rising preschool enrollment, changes in parenting, and, somewhat paradoxically, cognitive skills associated with screen technologies, may have contributed to generational improvements in the delay-of-gratification task. However, knowing when to employ self-control skills is likely to be as important as knowing how to employ them in a rapidly changing environment. Just as a wide-angle lens enables us to see the subject in context, viewing developmental phenomena through the chronosystem enables us to witness transformations we might otherwise overlook (Bronfenbrenner, 1977).

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