Journal of Experimental Child Psychology 221 (2022) 105432

Contents lists available at ScienceDirect

Journal of Experimental Child Psychology

journal homepage: www.elsevier.com/locate/jecp

The evolutionary novelty of childcare by and with strangers

Satoshi Kanazawa

Department of Management, London School of Economics and Political Science, London WC2A 2AE, UK

ARTICLE INFO

Article history:
Received 1 February 2022
Revised 14 March 2022

Keywords:
Day care
Child care
Israeli kibbutzim
Taiwanese *sim pua* marriages
Incest avoidance
Westermarck effect

ABSTRACT

Alloparenting by and with genetically unrelated individuals is evolutionarily novel; thus, the Savanna–IQ Interaction Hypothesis predicts that more intelligent parents are more likely to resort to paid childcare by strangers. Analyses of individual data (National Child Development Study) in the United Kingdom (Study 1) and macrolevel data from the United States (Study 2) and economically developed Organization for Economic Cooperation and Development (OECD) nations (Study 3) confirmed the hypothesis. Net of education, earnings, sex, current marital status, and number of children, more intelligent British parents were more likely to resort to paid childcare at ages 33 and 42; net of female labor force participation rate, median household income, median cost of childcare, and mean education, U.S. states with higher average intelligence had higher proportions of children (ages 0–4) in paid childcare; and net of maternal employment, gross domestic product (GDP) per capita, cost of childcare, and female educational attainment, OECD nations with higher average intelligence had higher proportions of infants (ages 0–2) in paid childcare. The results were remarkably consistent; both across the 50 U.S. states and 45 economically developed OECD nations, a one IQ point increase in the average intelligence of the population was associated with a 1.8% increase in the proportion of children in paid childcare. Contrary to earlier findings, there was some suggestive evidence that the experience of paid daycare might harm the cognitive development of children. The studies point to the importance of evolutionary perspective in developmental psychology and child development.

E-mail address: S.Kanazawa@lse.ac.uk

https://doi.org/10.1016/j.jecp.2022.105432
0022-0965/

Introduction

Whereas the evolutionary perspective has influenced many subfields of psychology, developmental psychology, with a very few notable exceptions (Belsky, Steinberg, & Draper, 1991; Bjorklund & Pellegrini, 2000, 2002; Ellis & Del Giudice, 2019; Ellis, 2004; Figueredo et al., 2006), has remained largely immune to evolutionary thinking. What does the evolutionary perspective have to offer developmental psychology and child development?

For example, the National Institute of Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development (SECCYD), the largest and most comprehensive study of childcare and early child development to date (Belsky, Caspi, Moffitt, & Poulton, 2020, pp. 153–177; U.S. Department of Health and Human Services, 2006), largely focused on the *consequences* of exposure to childcare. Whereas one study (NICHD Early Child Care Research Network [ECCRN], 1997) explicitly examined the familial characteristics of children in different types and onset of nonmaternal care, and other NICHD SECCYD studies always statistically controlled for maternal and familial characteristics as covariates in their analyses, the study nevertheless mostly compared children in different types of childcare settings (for example, childcare centers vs. childcare homes) and the effects of quantity and quality of childcare on cognitive and social development. (Admittedly, that was the explicitly stated purpose of the study.) It did not systematically and extensively compare children in *any* type of childcare with those who were in exclusive maternal care (except in NICHD ECCRN, 2000) or explore *why* some parents chose to put their children in childcare in the first place, whereas others cared for their children themselves. What do we know about the *antecedents* of exposure to childcare? Which parents are more likely to put their children in paid childcare by strangers? Can evolutionary psychology explain such individual differences? It is important for developmental scientists to study the antecedents of exposure to paid childcare because they cannot accurately interpret its consequences unless they know who are recruited into it in the first place.

In this paper, I draw from the recent theoretical developments in evolutionary psychology to predict that, because alloparenting by genetically unrelated strangers is entirely evolutionarily novel, more intelligent parents are more likely to put their children in paid childcare than less intelligent parents are. The analysis of individual data from the United Kingdom (Study 1) and aggregate data from the United States (Study 2) and Organization for Economic Cooperation and Development (OECD) nations (Study 3) confirmed the prediction.

The Savanna–IQ Interaction Hypothesis

It is one of the fundamental assumptions of evolutionary psychology that the human brain is evolutionarily designed for and adapted to the conditions that prevailed during human evolutionary history, which may differ from the current conditions in which human actors find themselves today (Tooby & Cosmides, 1990). Known variously as the Savanna Principle (Kanazawa, 2004b), the evolutionary legacy hypothesis (Burnham & Johnson, 2005), or the mismatch hypothesis (Hagen & Hammerstein, 2006; Li, van Vugt, & Colarelli, 2018), evolutionary psychologists assume that the human brain is biased to respond to the current environment as if it were still the ancestral environment even if the adaptive consequences have completely changed.

These observations raise a wide range of questions about why certain traits were selected in the ancestral environment and whether they still remain adaptive today. Here I focus on general intelligence, contending, as I have done before, that it originally evolved as a domain-specific psychological adaptation to solve evolutionarily novel adaptive problems that did not routinely present themselves to our ancestors during human evolutionary history (Kanazawa, 2004a). The logical conjunction of these observations suggests that the evolutionary constraints on the human brain may be stronger among less intelligent individuals than among more intelligent individuals. Such evolutionary logic suggests that individuals with lower levels of general intelligence may have correspondingly greater difficulty with evolutionarily novel entities and situations than individuals with higher levels of general intelligence do. At the same time, general intelligence might not make any difference in the

human brain's ability to comprehend and deal with evolutionarily familiar entities and situations that existed throughout human evolutionary history. Thus, the Savanna–IQ Interaction Hypothesis (Kanazawa, 2010a, 2010b) avers that more intelligent individuals are better able to comprehend entities and situations that did not exist in the ancestral environment. Because it is very difficult for humans to prefer what they do not truly comprehend, the Hypothesis also suggests that more intelligent individuals may be more likely to acquire and espouse evolutionarily novel preferences and values that our ancestors did not possess than less intelligent individuals are (Kanazawa, 2012).

Recent studies have shown that more intelligent individuals are indeed more likely to hold a wide range of evolutionarily novel preferences and values. For example, they are more likely to be politically liberal in the United States, because our ancestors genuinely cared about the welfare of only their genetic kin and allies, as American conservatives would, not about a large number of anonymous others whom they had never encountered or would never encounter, as American liberals would (Kanazawa, 2010b). They are more likely to be atheistic (Kanazawa, 2010b), because humans are evolutionarily designed to believe in higher powers, either as an evolutionary byproduct of "animistic bias" (Guthrie, 1993) or "agency detection mechanism" (Atran, 2002) or as an evolved, higher-order adaptation (Kanazawa, 2015). They are more likely to be nocturnal (Kanazawa & Perina, 2009; Roberts & Kyllonen, 1999) because our ancestors did not have any artificial means of illumination until the domestication of fire, and thus their days were limited to diurnal activities from sunrise to sunset (Chagnon, 1997; Cronk, 2004; Hill & Hurtado, 1996; Lee, 1979; Levinson, 1991, 1995; Whitten, 1976). They prefer to listen to purely instrumental music such as classical or elevator music (Kanazawa & Perina, 2012; Račevska & Tadinac, 2019), because, as Mithen (2005) suggested, music might have originally evolved as a vocal means to communicate emotions. They prefer to drink alcohol and use psychoactive drugs (Kanazawa & Hellberg, 2010; White & Batty, 2012), because high-concentration alcoholic beverages and psychoactive drugs emerged during the past 10,000 years. More intelligent individuals are more likely to engage in binge drinking and get drunk (Kanazawa, 2012, pp. 163–167). At the same time, less intelligent individuals are more likely to be nationalist (Kanazawa, 2021), because nationalism—the tendency to identify with the ingroup against the outgroup—is evolutionarily familiar.

For any one of these findings, it would be possible to propose an alternative, perhaps non-evolutionary, explanation. However, the Savanna–IQ Interaction Hypothesis provides a unified evolutionary account that explains *why* general intelligence might affect preferences and values as varied as nocturnal activities, nationalism, alcohol consumption, and musical taste. It would be very difficult to propose an alternative *unified* account that covers the entire range of explananda covered by the Savanna–IQ Interaction Hypothesis. All the empirical evidence in its support suggests that, in general and in all domains, more intelligent individuals are more likely to hold "unnatural" preferences and values that our ancestors likely did not have and that evolution did not design humans to possess. In contrast, once again, in general and in all domains, less intelligent individuals are more likely to possess "natural" preferences and values that our ancestors likely had and that evolution designed humans to possess (Kanazawa, 2012).

The evolutionary novelty of alloparenting by and with strangers

Another "unnatural" value that our ancestors likely never possessed is reliance on genetically unrelated strangers to care for their children. Alloparenting—direct childcare provided by someone other than the biological mother—and cooperative breeding are universal in human societies (Burkart, Hrdy, & van Schaik, 2009; Hrdy, 2009). However, such extramaternal care in traditional societies is provided by the biological father and other genetic kin of the child—very seldom, if ever, by genetically unrelated strangers.

Molecular genetic evidence suggests that humans practiced female exogamy throughout evolutionary history (Seielstad, Minch, & Cavalli-Sforza, 1998). When girls reached puberty, they left their natal groups to marry into neighboring groups in order to avoid inbreeding, whereas boys stayed in their natal groups all their lives. It means that all males in a hunter–gatherer band were genetically related to each other, whereas no adult females were. Given that childcare, including alloparental care, is predominantly provided by women (Quinn, 1977; Trivers, 1972), children in alloparental care

throughout human evolutionary history were often not genetically related to their alloparents (except for their biological father and his kin, including prepubescent female kin still in their natal group). However, they were never "strangers" in the same sense that modern daycare workers and childcare providers are; women in hunter–gatherer bands throughout human evolutionary history were integral and long-term members of the tribe who spent their entire adult lives there except in the event of divorce (Betzig, 1989).

Equally important, children in alloparental care throughout human evolutionary history were always genetically related *to each other* because their fathers were genetic kin; children in hunter–gatherer bands were never raised with other children who were not genetically related to them. This has left an evolutionary imprint on human cognitive architecture. Compared with other species, the human ability for kin detection by visual and olfactory modalities is weak (Mateo, 2015). Humans instead recognize kin via prior association and familiarity (Lieberman, Tooby, & Cosmides, 2007); humans are evolutionarily designed to assume that others with whom they spent a lot of time together as infants and of whom their own caretakers also take care are siblings or other close genetic kin. This is the basis of the Westermarck effect of incest avoidance (Westermarck, 1891). Humans appear to be evolutionarily designed not to be sexually attracted to others with whom they spent much time when they were children and of whom their own mother also takes care, as evidenced by the observations that genetically unrelated children communally raised together on Israeli kibbutzim feel sexual aversion toward each other (Lieberman & Lobel, 2012; Shepher, 1971) and Taiwanese *sim pua* marriages, where adoptive siblings raised together later get married, often remain childless (Lieberman, 2009; Wolf, 1970). The empirical evidence for the Westermarck effect suggests that children who were raised together in modern daycare centers and homes might implicitly and unconsciously regard each other as siblings and may later develop sexual aversion toward them. The evolved human nature simply could not have anticipated the modern childcare settings, where children spend significant portions of their days with genetically unrelated strangers (other children and their carers).

It is evident that childcare by and with genetically unrelated strangers—as is common in modern daycare centers and homes—is entirely evolutionarily novel. Therefore, the Savanna–IQ Interaction Hypothesis would predict that more intelligent parents are more likely to resort to paid childcare than less intelligent parents are. I tested this hypothesis in three studies with individual data from the United Kingdom (Study 1) and aggregate data from the United States (Study 2) and economically developed OECD nations (Study 3).

Study 1: Individual data from the United Kingdom

Data

The National Child Development Study (NCDS) is a large, ongoing, and prospectively longitudinal study that has followed a *population* (not a sample) of British respondents since birth for more than 60 years. The study included *all* babies (N = 17,419) born in Great Britain (England, Wales, and Scotland) during one week (03–09 March 1958). The respondents were subsequently reinterviewed in 1965 (Sweep 1 at age 7; n = 15,496), 1969 (Sweep 2 at age 11; n = 18,285), 1974 (Sweep 3 at age 16; n = 14,469), 1981 (Sweep 4 at age 23; n = 12,537), 1991 (Sweep 5 at age 33; n = 11,469), 1999–2000 (Sweep 6 at age 41–42; n = 11,419), 2004–2005 (Sweep 7 at age 46–47; n = 9534), 2008–2009 (Sweep 8 at age 50–51; n = 9790), and 2013 (Sweep 9 at age 55; n = 9137). There were more respondents in Sweep 2 than in the original sample (Sweep 0) because the Sweep 2 sample included eligible children who were in the country in 1969 but not in 1958. In each sweep, personal interviews and questionnaires were administered to the respondents; to their mothers, teachers, and doctors during childhood; and to their partners and children during adulthood. Virtually all (97.8%) of the NCDS respondents were Caucasian. The Centre for Longitudinal Studies (CLS) of University College London now conducts NCDS, and the data are publicly and freely available to registered users of the UK Data Service (https://ukdataservice.ac.uk).

Dependent variable: Use of paid childcare

At (and only at) ages 33 and 42, NCDS asked all respondents who had children under 14 whether they usually paid for childcare (0 = no, 1 = yes). NCDS did not explore what type of paid childcare the respondents used. I analyzed this variable with binary logistic regression. While it is not impossible to pay genetic relatives to provide childcare, most parents do not. In one study in Washington State, only 7% of parents paid grandparents and 22% paid other relatives (Brandon, Maher, Joesch, & Doyle, 2002). In addition, entering into formal economic exchange with a genetic relative for provision of childcare would itself be evolutionarily novel.

Independent variable: General intelligence

NCDS has probably the strongest measure of childhood general intelligence of all large-scale surveys. The respondents took multiple intelligence tests at ages 7, 11, and 16. At 7, the respondents took four cognitive tests: Copying Designs Test, Draw-a-Man Test, Southgate Group Reading Test, and Problem Arithmetic Test. At 11, they took five cognitive tests: Verbal General Ability Test, Nonverbal General Ability Test, Reading Comprehension Test, Mathematical Test, and Copying Designs Test. At 16, they took two cognitive tests: Reading Comprehension Test and Mathematics Comprehension Test. I performed a factor analysis at each age to compute their general intelligence score for each age. All cognitive test scores at each age loaded only on one latent factor, with reasonably high factor loadings (age 7: Copying Designs = .671, Draw-a-Man = .696, Southgate Group Reading = .780, and Problem Arithmetic = .762; age 11: Verbal General Ability = .920, Nonverbal General Ability = .885, Reading Comprehension = .864, Mathematical = .903, and Copying Designs = .486; age 16: Reading Comprehension = .909 and Mathematics Comprehension = .909). The latent general intelligence scores at each age were then converted into the standard IQ metric, with a mean of 100 and a standard deviation of 15. Then, I performed a second-order factor analysis with the IQ scores at three different ages to compute the overall childhood general intelligence score. The three IQ scores loaded only on one latest factor with very high factor loadings (age 7 = .867; age 11 = .947; age 16 = .919). I used the childhood general intelligence score in the standard IQ metric as the main independent variable.

Control variables

In my multiple binary logistic regression, I controlled for respondents' education (0 = no qualification; 1 = CSE 2–5/NVQ 1; 2 = O levels/NVQ 2; 3 = A levels/NVQ 3; 4 = higher qualification/NVQ 4; 5 = degree/NVQ 5–6), earnings (natural log of net annual earnings in 1K GBP + .00001 in order to allow natural log transformation for respondents with no earnings), sex (0 = female, 1 = male), whether currently married (0 = no, 1 = yes), and number of children.

Dependent variable for secondary analysis: Child's general intelligence

At 33, one third of NCDS respondents were randomly selected, and, if they had children, all of their children (up to four) completed the "child" interviews, which included cognitive tests. Because the oldest child had, by definition, the longest exposure to paid childcare or exclusive maternal care, I selected the oldest child of each respondent to be included in the sample of children.

All children who were four years of age or older took a set of cognitive tests. Four-year-olds took the Peabody Picture Vocabulary Test (PPVT) and the verbal memory test. Five- and six-year-olds took PPVT, verbal memory test, Peabody Individual Achievement Test (PIAT) math test, and PIAT reading test. Children who were seven years old and older took PPVT, PIAT math test, PIAT reading test, and forward and backward digit span tests.

I performed a factor analysis within each age group to compute children's general intelligence score. All cognitive test scores loaded only on one latest factor, with reasonably high factor loadings (age 4: PPVT = .806, verbal memory = .806; age 5–6: PPVT = .506, verbal memory = .656, PIAT math = .842, PIAT reading = .821; age 7+: PPVT = .391, PIAT math = .880, PIAT reading = .892, digit span =

.802). The latent general intelligence scores were converted into the standard IQ metric with a mean of 100 and a standard deviation of 15.

Results

Table 1 presents the results of the multiple binary logistic regression. Columns (1) and (3) show that, when entered alone, childhood general intelligence was significantly positively associated with the use of paid childcare at both age 33 (b = .035, p < .001) and 42 (b = .046, p < .001). The standardized effects show that a one standard deviation increase in childhood general intelligence (15 IQ points) was associated with a 69% increase in the odds of paid childcare use at 33 and a 99% increase at 42.

Columns (2) and (4) show that controlling for education, earnings, sex, whether currently married, and number of children did not much attenuate the effect of childhood intelligence on the use of paid childcare. Even net of the control variables, childhood general intelligence was significantly associated with paid childcare use at 33 (b = .025, p < .001) and 42 (b = .016, p < .001). The standardized effects show that a one standard deviation increase in childhood general intelligence was associated with the increased odds of paid childcare use by 46% at 33 and 27% at 42.

Quite predictably, both education and earnings were positively associated with paid childcare use, and sex was negatively associated, likely because there were far more single mothers in need of paid childcare than single fathers. Surprisingly, neither current marital status nor the number of children was significantly associated with paid childcare use.

In Table 1, Columns (2) and (4), the earnings variable measures the respondent's own earnings; it is therefore the child's mother's earnings for female respondents, and the child's father's earnings for male respondents. Arguably, what matters most for the parents' decision whether or not to place their

Table 1
Association of childhood IQ with adult use of paid childcare at 33 and 42 years of age: National Child Development Study

	Age 33		Age 42	
	(1)	(2)	(3)	(4)
Childhood IQ	.035***	.025***	.046***	.016***
	(.004)	(.006)	(.003)	(.005)
	1.690	*1.455*	*1.994*	*1.271*
Education		.296***		.427***
		(.056)		(.044)
		1.564		*1.907*
Earnings		.352***		.280***
		(.036)		(.039)
		8.044		*4.366*
Sex		−4.551*		−.538***
		(.305)		(.105)
		.103		*.764*
Currently married		−.085		−.027
		(.184)		(.130)
		.962		*.988*
Number of children		−.149		−.066
		(.088)		(.055)
		.836		*.920*
Constant	−5.787	−4.338	−6.669	−5.022
	(.403)	(.628)	(.373)	(.468)
Nagelkerke R^2	.040	.451	.074	.190
N	4711	3762	4828	4430

Note. Main entries are unstandardized regression coefficients.
(Entries in parentheses are standard errors).
Italicized entries are standardized effects on odds associated with 1 SD change.
* p < .05.
*** p < .001.

children in paid childcare is the mother's (potential) earnings, not the father's. If I divide the sample by the respondent's sex, and use the respondent's own earnings for female respondents and the spouse's earnings for male respondents, the results are substantively identical.

General intelligence is significantly associated with the Big Five personality factors, in particular Openness for experience (Dunkel, 2013). However, controlling for the Big Five personality factors in Equations (2) and (4) in Table 1 did not at all alter the substantive conclusions about the significant association between childhood general intelligence and use of paid childcare during adulthood. None of the Big Five personality factors were significantly associated with paid childcare use, except for Neuroticism; more Neurotic parents were more likely to use paid childcare both at 33 and 42.

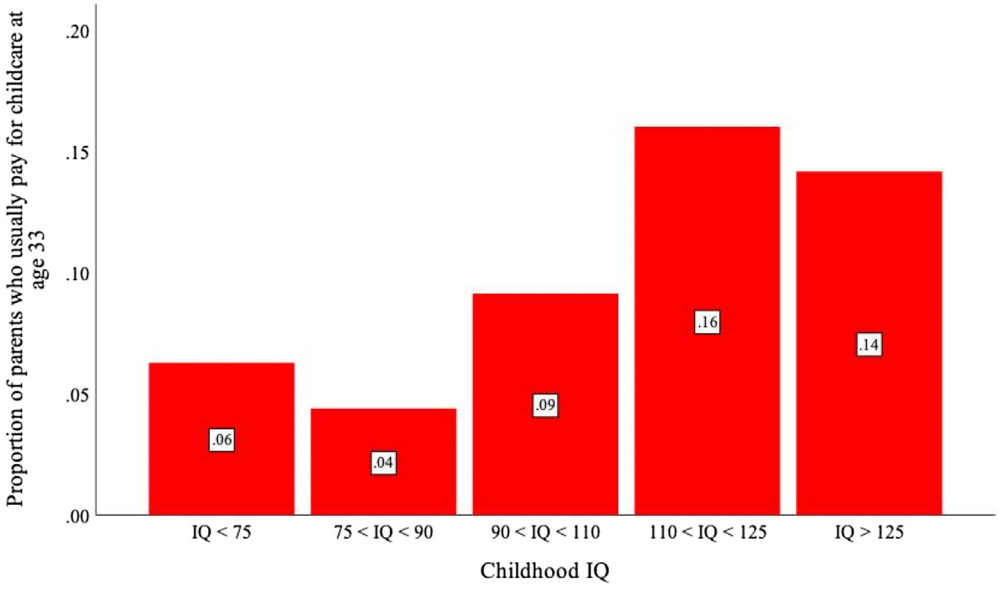
Fig. 1 presents the bivariate association between childhood general intelligence (grouped into five "cognitive classes" only for the purpose of graphic presentation here) and whether or not respondents used paid childcare. Fig. 1A shows that the association at age 33 was not quite monotonically positive. Nevertheless, respondents who were below average in childhood general intelligence were less likely to use paid childcare than those who were about average, and those who were above average in childhood general intelligence were more likely to use it than those who were about average. In other words, the association would have been monotonically positive if I had created three cognitive classes instead of five. Fig. 1B shows that the same association at age 42 was perfectly monotonically positive with the five cognitive classes; the higher the childhood general intelligence, the more likely respondents were to use paid childcare. Those in the highest cognitive class were nearly nine times as likely to use paid childcare than those in the lowest cognitive class (.35 vs. .04), although, as column (4) in Table 1 shows, education and earnings accounted for some of this differential.

Fig. 2 presents the mean IQs of NCDS respondents who were randomly selected for the child interview and their oldest child (1147 parent–child pairs) by whether or not the child was in paid childcare. Consistent with the multiple binary regression analyses presented in Table 1, NCDS respondents who put their children in paid childcare had significantly higher childhood general intelligence by 6 IQ points than those who did not (105.02 vs. 99.04, $t(1145) = -4.346$, $p < .001$). In sharp contrast, however, their oldest children were no more intelligent than the children who were in exclusive maternal care (104.49 vs. 103.81, $t(1145) = -0.535$, $p = .593$). However, net of parental IQ, being in paid childcare was not significantly associated with the child's IQ ($b = .350$, $p = .783$).

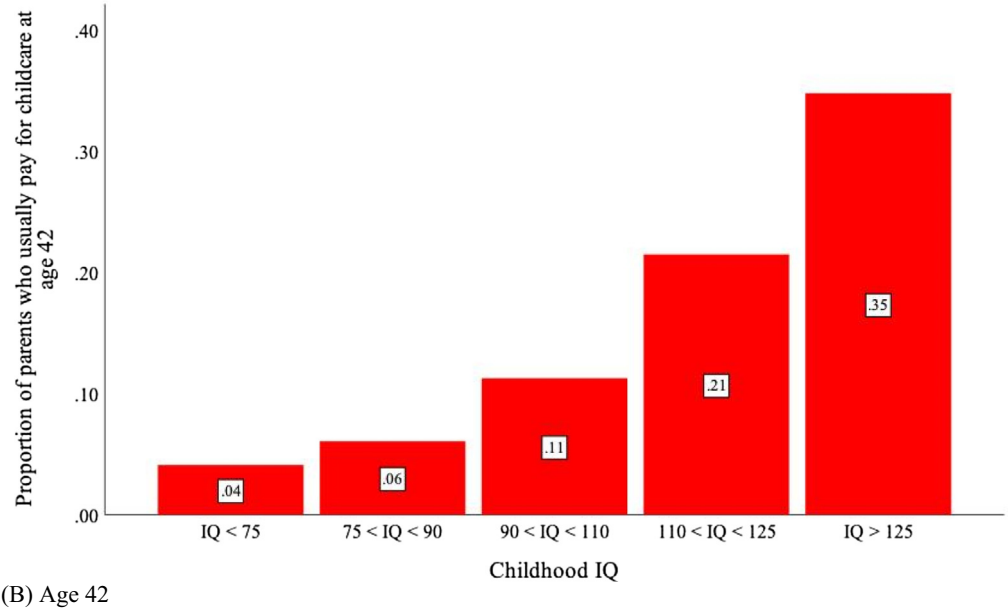
Discussion

The analysis of the NCDS data supports the prediction derived from the Savanna–IQ Interaction Hypothesis at the individual level. British respondents who had higher childhood general intelligence, measured at ages 7, 11, and 16, were significantly more likely to use paid childcare at ages 33 and 42 for their children under 14. The significant effect of childhood general intelligence on paid childcare use remained even after controlling for education, earnings, sex, current marital status, and number of children.

The additional analysis of NCDS respondents' oldest children provides suggestive evidence that exposure to paid childcare may be harmful to children's cognitive development. Given high heritability of general intelligence, children are on average expected to have IQs comparable to those of their parents (Rindermann & Ceci, 2018). The regression to the mean is expected to be minimal here, both because neither the mean IQ of 99.04 among parents who did not put their children in paid childcare nor that of 105.02 among parents who did were far enough away from the mean IQ of 100, and because there is minimal measurement error in the measurement of IQs with multiple cognitive tests (Barnett, van der Pols, & Dobson, 2004). Thus, the fact that parents who put their children in paid childcare were significantly more intelligent by six IQ points than parents who did not, yet their oldest children were no more intelligent than children in exclusive maternal care, provided suggestive (but not conclusive) evidence that the exposure to paid childcare by and with strangers might have hampered cognitive development among children who were in paid childcare compared with those who were in exclusive maternal care or, conversely, exclusive maternal care might have facilitated cognitive development. The latter interpretation might be more accurate given that the mean IQ of children in exclusive maternal care increased by a greater amount from their parents than that of children in paid childcare decreased. However, because the multiple regression analysis did not show a negative



(A) Age 33



(B) Age 42

Fig. 1. Association between childhood intelligence and use of paid childcare: (A) age 33; (B) age 42.

association between children's IQ and being in paid childcare, net of parental IQ, this analysis is merely suggestive of the potentially beneficial effect of exclusive maternal care or the potentially harmful effect of paid childcare on children's cognitive development. In fact, the null finding from the multiple regression analysis was consistent with earlier findings from NICHD SECCYD showing that high-

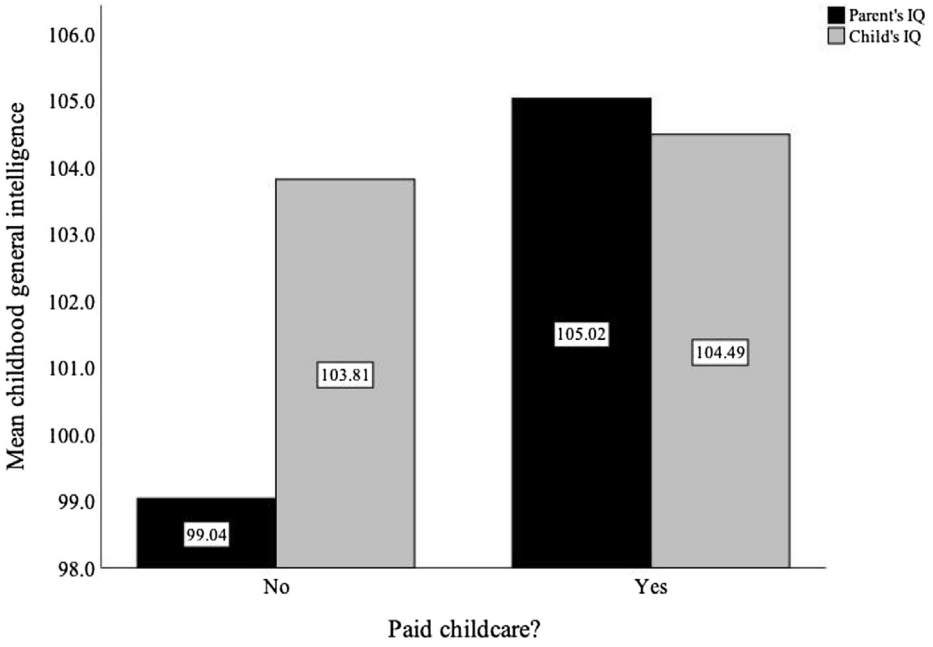


Fig. 2. Mean IQs of National Child Development Study respondents and their oldest children by use of childcare at age 33.

quality childcare facilitated cognitive development, whereas low-quality childcare hindered it, so if one lumped all children in childcare together without regard to quality (as NCDS data did), then there was null association between being in childcare and cognitive development (NICHD ECCRN, 2002).

Study 2: Aggregate data from the United States

Study 2 explored the macrolevel implications of the Savanna–IQ Interaction Hypothesis and tested the prediction that average intelligence of a population is significantly positively associated with the proportion of children in paid childcare. I tested this macrolevel prediction with data across 50 U.S. states.

Dependent variable: Proportion of children in paid childcare

RegionTrack (2019) *Child Care in State Economies* provides data on the proportion of children in nonparental paid childcare for more than 10 hours per week in each state in 2015–2017 for three age groups: 0–4, 5–14, and 0–14. The figures for the three age groups were all very highly correlated ($r_{0-4,5-14}$ = .907; $r_{0-4,0-14}$ = .971, $r_{5-14,0-14}$ = .979), so I use only the figure for the 0–4 age group as the dependent variable. The results were substantively identical if I used the other two figures. The proportion for the 0–4 age group varied from 18.0% in Hawaii to 54.4% in Minnesota. I analyzed this variable with OLS regression.

Independent variable: State IQ

McDaniel (2006) estimated the mean IQ of the population in each state from the National Assessment of Educational Progress standardized tests for reading and math that were administered to a sample of public school children in each state. The state IQ varied from 94.2 in Mississippi to 104.3 in Massachusetts. It is important to note that the state IQ measures the average intelligence of all state

residents, not just parents. Average intelligence of parents in a state (or a nation; see Study 3 below) is not available.

Control variables

In my multiple regression analyses, I controlled for women's labor force participation rate in percentage in 2016; median household income in dollars in 2017; median cost of childcare centers for four-year-olds in dollars in 2017; and mean years of schooling in 2016. Data on all control variables are available in RegionTrack (2019).

Results

Table 2 presents the results of the OLS regression. Column (1) shows that, when entered alone, state IQ was significantly positively associated with the proportion of children in paid childcare (b = 1.813, p < .001). The association between state IQ and proportion of children in paid childcare was strong; the unstandardized regression coefficient shows that a one-point increase in state IQ was associated with a 1.8% increase in the proportion of children in paid childcare, and the standardized regression coefficient shows that an increase of one standard deviation in state IQ was associated with a 0.62 standard deviation increase in the proportion of children in paid childcare. State IQ alone explained 39% of the variance in the proportion of children in paid childcare.

Column (2) shows that, even net of female labor force participation rate, median household income, median cost of childcare, and mean education, state IQ was still significantly positively associated with the proportion of children in paid childcare. The inclusion of the control variables nearly halved the effect of state IQ, but it was still statistically significant (b = .972, p = .030).

Quite unsurprisingly, of all the variables included in the multiple regression analysis, the proportion of women in the paid labor force had the strongest association with the proportion of children in

Table 2
Association between state IQ and proportions of children aged 0 to 4 years in paid childcare: U.S. states

	(1)	(2)
State IQ	1.813***	.972*
	(.331)	(.434)
	.620	*.333*
Female labor force participation		1.754***
		(.444)
		.827
Median household income		-4.68^{-4}
		(2.72^{-4})
		−.359
Median cost of childcare		1.48^{-4}
		(.001)
		.040
Mean education		−4.164
		(6.315)
		−.145
Constant	−148.025	−84.009
	(33.206)	(68.029)
R^2	.385	.558
N	50	50

Note. Main entries are unstandardized regression coefficients.
(Entries in parentheses are standard errors).
Italicized entries are standardized regression coefficients.
* p < .05.
*** p < .001.

paid childcare. A one percentage point increase in the female labor force participation rate was associated with a 1.8% increase in the proportion of children in paid childcare. Neither median household income nor mean education was significantly associated with the proportion of children in paid childcare. (Median household income was significantly *negatively* associated with it for the age groups 0–14 and 5–14 years in results not shown.) This was in stark contrast to the results from the individual data in Study 1, where both earnings and education were significantly (all *p*s < .001) positively associated with the use of paid childcare. Equally surprisingly, the cost of childcare was not significantly associated with the proportion of children in paid childcare. It is important to note that, while state IQ and mean education were significantly positively associated (r = .664, N = 50, p < .001), it was state IQ, not mean education, that predicted the proportion of children in paid childcare, consistent with the prediction derived from the Savanna–IQ Interaction Hypothesis.

Fig. 3 presents a scatterplot depicting the bivariate association between state IQ and the proportion of children in paid childcare. The data show a strong positive association between state IQ and the proportion of children in paid childcare.

Discussion

The analysis of the macrolevel data across the U.S. states was consistent with the results from the analysis of the individual data from the United Kingdom (*but only when it came to the effect of intelligence*) and equally supported the prediction from the Savanna–IQ Interaction Hypothesis. State IQ alone explained 39% of the variance in the proportion of children in paid childcare. Even net of female labor force participation rate, median household income, median cost of childcare, and mean education, state IQ was still significantly positively associated with the proportion of children in paid childcare.

It is notable that intelligence was the only variable that had a consistent effect in Studies 1 and 2. Earnings and education were both significantly positively associated with paid childcare use in Study 1, yet neither median household income nor mean education was significantly associated with the proportion of children in paid childcare in Study 2. (Median household income was even significantly *negatively* associated with the proportion of children in paid childcare for the 0–14 and 5–14 age groups.) Whereas general intelligence and education, net of each other, were independently significantly positively associated with the decision to use paid childcare at the individual level in

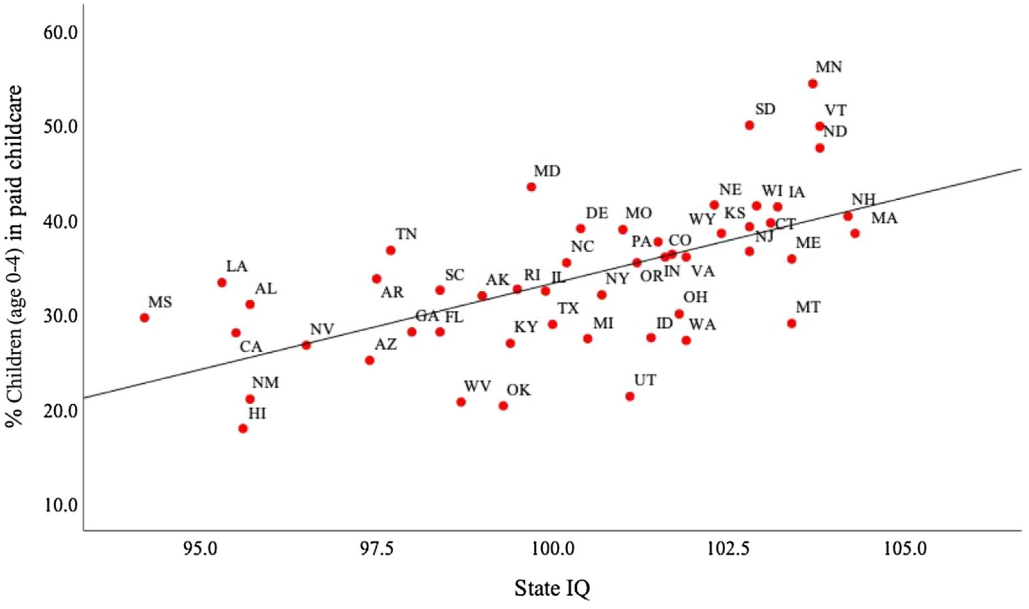


Fig. 3. Association between state IQ and share of children ages 0–4 in paid childcare.

Study 1, mean education, net of state IQ, was not at all associated with the dependent measures in Study 2. Because the Savanna–IQ Interaction Hypothesis avers that it is general intelligence, not education, that promotes evolutionarily novel preferences, such as the preference for paid childcare by and with genetically unrelated strangers, the results from Study 2 strongly supported the theoretical prediction.

Study 3: Aggregate data from OECD nations

Study 3 explored the same aggregate association between average intelligence and proportion of children in paid childcare at a higher level of aggregation, among the economically developed nations of the Organization of Economic Cooperation and Development (OECD).

Dependent variable: Proportion of infants in paid childcare

The OECD measured the proportion of children ages 0–2 who were enrolled in early childhood education and care services, mostly in 2018 or 2019. The data are available at the OECD website (https://data.oecd.org). While, as of 2021, there were 38 member states, the OECD collected data on this variable (although not on any of the control variables included in the multiple regression analysis below) from eight additional nations (Argentina, Bulgaria, Brazil, Croatia, Cyprus, Indonesia, Romania, Russia). At the same time, data from one member state (Canada) were not available, making the final sample size 45 nations. The proportion of infants in paid childcare varied from 0.2% in Turkey to 65.5% in the Netherlands.

Independent variable: National IQ

Lynn and Vanhanen (2012) compiled a comprehensive list of national IQs (the mean IQ of a national population) of 192 nations in the world (all the nations with a population of at least 40,000), either by calculating the mean score from a large number of primary data or by carefully estimating them from available sources. Numerous studies have demonstrated that the national IQ data have extremely high reliability and validity (Hunt & Wittmann, 2008; Kanazawa, 2009, pp. 546–547; Kulivets & Ushakov, 2016; Lim et al., 2018; Rindermann & Ceci, 2009; Rindermann, 2007, 2018).

Control variables

In my multiple regression analysis, I controlled for maternal employment rate (percentage of women ages 15–64 with at least one child ages 0–14 in full- or part-time employment), GDP per capita (in U.S. dollars), net cost of childcare (cost of full-time, center-based childcare for two children, ages 2 and 3, after any subsidies, for a couple earning 67% of the average wage, as a percentage of their wages), and female educational attainment (percentage of women ages 25–64 who have attained at least upper secondary education). Data on all control variables are available from the OECD website and come from 2020 or the latest year available.

Results

Column (1) in Table 3 shows that, when entered alone, national IQ of 45 OECD and other economically developed nations was significantly positively associated with the proportion of infants in paid childcare ($b = 1.844$, $p < .001$, standardized coefficient = .620). The unstandardized coefficient of 1.844 was eerily similar to that from the same regression equation from Study 2 (1.813). They suggest that, both across 50 U.S. states and across 45 economically developed nations, a one IQ point increase in average intelligence of the population increased the proportion of small children in paid childcare by 1.8%. Given that the 50 U.S. states are very different from the economically developed nations in Study 3, which include such culturally diverse nations as Indonesia, South Korea, and Russia, this was a remarkably convergent result.

Table 3
Association between national IQ and proportions of children aged 0 to 2 years in paid childcare: Organization for Economic Cooperation and Development nations

	(1)	(2)
National IQ	1.844***	1.836*
	(.508)	(.852)
	.484	*.352*
Maternal employment		.746**
		(.261)
		.467
Gross domestic product per capita		3.45^{-4}
		(1.88^{-4})
		.294
Net cost of childcare		−.037
		(.256)
		−.022
Female educational attainment		−.553*
		(.257)
		−.385
Constant	−143.751	−166.391
	(48.662)	(73.932)
R^2	.235	.482
N	45	35

Note. Main entries are unstandardized regression coefficients.
(Entries in parentheses are standard errors).
Italicized entries are standardized regression coefficients.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

Column (2) in Table 3 shows that, unlike a similar regression equation from Study 2, where the introduction of control variables halved the association between state IQ and the proportion of children in paid childcare, controlling for maternal employment, GDP per capita, net cost of childcare, and female educational attainment did not at all attenuate the association between national IQ and proportion of infants in paid childcare ($b = 1.836$, $p = .040$, standardized coefficient = .352). As in Study 2, maternal employment was positively associated with the proportion of infants in paid childcare ($b = .746$, $p = .008$, standardized coefficient = .467). Unlike in Study 2, female educational attainment was significantly negatively associated with the dependent measure ($b = -.553$, $p = .040$, standardized coefficient = −.385). It is interesting to note that the two purely economic predictors (GDP per capita and net cost of childcare) were not at all associated with the proportion of infants in paid childcare.

Fig. 4 presents a scatterplot of the bivariate association between national IQ and the percentage of infants in paid childcare. Once again, Fig. 4 looks eerily similar to Fig. 3, plotting the bivariate association between state IQ and the proportion of small children in paid childcare among the 50 U.S. states, although the bivariate association was slightly stronger in Fig. 3 than in Fig. 4 ($r = .620$ vs. $r = .484$). Neither scatterplot evinces the existence of an outlier or an influential observation.

Discussion

Results from Study 3, with data from the OECD and other economically developed nations of the world, very closely replicated the results from Study 2, with data from the 50 U.S. states, down to the absolute value of the coefficient. In both the 50 U.S. states and the 45 economically developed nations, a one IQ point increase in the average intelligence of the population increased the proportion of young children in paid childcare by 1.8%. Once again, given the vast social, cultural, economic, legal, and religious differences between the 50 U.S. states and the 45 economically developed nations in the world, the convergence of the results was truly remarkable.

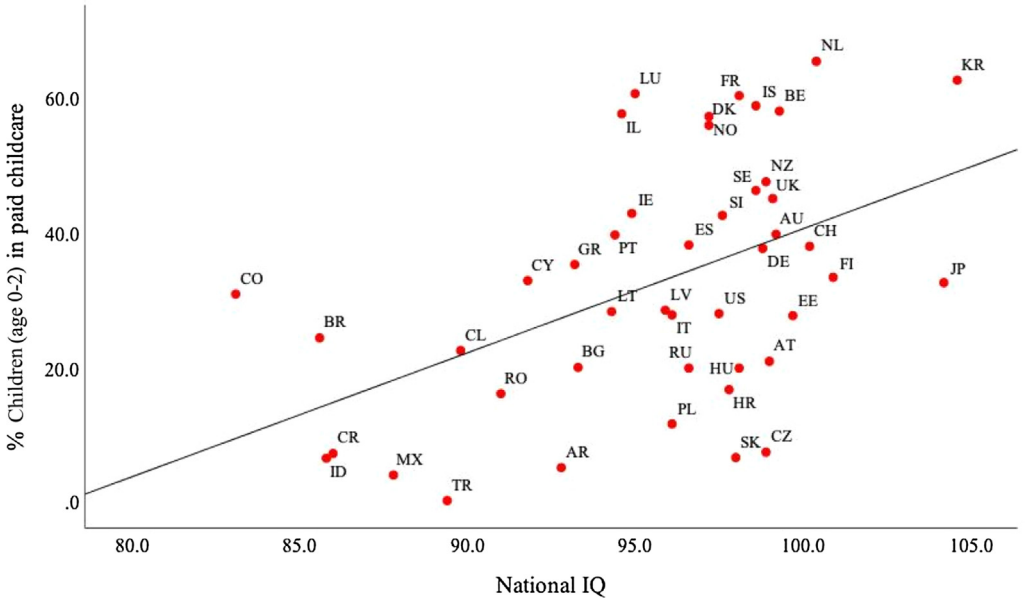


Fig. 4. Association between national IQ and share of children ages 0–2 in paid childcare.

There were other similarities between Studies 2 and 3. Maternal employment had a significantly positive association with the dependent measure in both; quite unsurprisingly, the proportionately more women and mothers were in paid employment, the proportionately more young children were in paid childcare. In both studies, purely economic predictors were not associated with the proportion of young children in paid childcare; neither the means/wealth (the median household income in Study 2 and GDP per capita in Study 3) nor the cost (the cost of paid childcare) was significantly associated with the actual proportion of young children in paid childcare. The latter finding in Study 3 was particularly noteworthy given that, with heavy government subsidies, the actual net cost of childcare in some nations (such as Chile and Italy) was zero. Yet some parents chose not to place their children in "paid" childcare; the proportion of infants in paid childcare was comparatively very low in both Chile (22.5%) and Italy (27.8%). Vast majorities of Chilean and Italian parents chose not to place their children in childcare by and with strangers even when doing so cost them nothing and freed up their time, perhaps because such a practice was entirely evolutionarily novel and therefore unthinkable to some parents.

General discussion

Because childcare by and with genetically unrelated strangers is evolutionarily novel, the Savanna–IQ Interaction Hypothesis in evolutionary psychology predicts that more intelligent parents are more likely to resort to paid childcare than less intelligent parents are. The analyses of individual data from the United Kingdom (Study 1) and aggregate data from the United States (Study 2) and OECD nations (Study 3) confirmed the prediction. Even net of education, earnings, sex, whether currently married, and number of children, childhood general intelligence, measured at ages 7–16, had a very strong positive association with the use of paid childcare as parents at ages 33 and 42. Even net of female labor force participation rate, median household income, median cost of childcare, and mean education, state IQ was strongly positively associated with the proportion of children in paid childcare. Even net of maternal employment rate, GDP per capita, net cost of childcare, and female educational attainment, national IQ was strongly positively associated with the proportion of infants in paid childcare. Across both the 50 U.S. states and 45 economically developed nations, a one IQ point increase in the average intelligence of the population was associated with a 1.8% increase in the proportion of young

children in paid childcare. The results from the three studies supported the prediction derived from the Savanna–IQ Interaction Hypothesis.

There was some suggestive evidence that, contrary to some earlier findings (NICHD ECCRN, 2000) but consistent with others (Fort, Ichino, & Zanella, 2019), exposure to paid childcare may be detrimental to children's cognitive development or, alternatively and more consistent with the data, exclusive maternal care may be conducive to it. Despite the fact that parents who placed their children in paid childcare were more intelligent than parents who did not by six IQ points, their children were no more intelligent than those who were in exclusive maternal care. However, because the multiple regression did not show a significant negative association between being in paid childcare and child IQ, net of parental IQ, this finding was only tentative and suggestive, not definitive or conclusive. NICHD SECCYD produced studies that examined the effect of exposure to paid childcare on child cognitive development (NICHD ECCRN, 2000, 2002). However, their findings are now dated, and there have not been comparably large-scale and systematic longitudinal studies since the conclusion of NICHD SECCYD in 2007. Future research is necessary to continue to explore the effect of exposure to paid childcare or the experience of exclusive maternal care on early cognitive development.

Alternative explanations

Because two frequent confounds with general intelligence—education and earnings—were both statistically controlled in all three studies, the effect of intelligence on paid childcare use was unlikely to be statistically confounded with a third factor. There may, however, be other potential explanations for the findings reported above. For example, NCDS used in Study 1 is survey data and, like all survey data, is not immune from respondent misrepresentation. It is therefore possible that more intelligent parents are not more likely to place their children in paid childcare but simply more likely to state that they do. Alternatively, since more intelligent respondents are in general more likely to be honest in their survey responses (Kanazawa, 2014, p. 324n), less intelligent parents may be more likely to state that they do not place their children in paid childcare when they actually do. However, there are a couple of reasons to believe that this was not likely. First, respondents normally lie on surveys in order to conceal their illegal, embarrassing, or otherwise counternormative behavior. For example, in one study of voting in the United States, numerous respondents lied and said they voted when they did not, but virtually no respondents lied and said they did not vote when they did (Belli, Traugott, & Beckmann, 2001, p. 483, Table 1). Because placing children in paid childcare in the United Kingdom during the 1990s was in no way illegal, embarrassing, or otherwise counternormative at all, it is not likely that many NCDS respondents would have been compelled to lie about it. Second, Studies 2 and 3 do not rely on respondent self-report and instead are based on official government and international statistics, yet findings from Studies 2 and 3 converge with those from Study 1. Therefore, there is greater confidence that intelligence may have a positive effect on paid childcare use.

Limitations

There are some limitations to the studies. First, because NCDS (unlike the NICHD SECCYD) is a general survey of child development and was not specifically designed to study childcare, the measurement of paid childcare use was crude and limited to one binary measure of whether respondents usually paid for childcare at two sweeps only. In particular, it did not measure what type of paid childcare the respondents used or how many hours their children spent in paid childcare. However, this crude binary measure was sufficient to uncover the very strong effect of childhood general intelligence on the use of paid childcare decades later as parents. Second, as with any macrolevel data, the aggregate data across 50 U.S. states in Study 2 and across 45 economically developed nations in Study 3 can depict only aggregate associations such as the strong positive association between the mean IQ and the proportion of children in paid childcare, depicted in Figs. 3 and 4, which I presume (but cannot demonstrate) to reflect individual behavior at the micro level. In particular, I cannot be certain that it is the more intelligent parents in each state or nation who place their children in paid childcare. However, given the strong aggregate pattern, one would need to contrive an extremely contorted explanation to suggest that it is the less intelligent parents who place their children in paid childcare

in greater numbers in states and nations with higher mean intelligence or that there is no association between intelligence and paid childcare use at the individual level despite the strong association at the aggregate level. No such explanation readily comes to mind. Ecological fallacy (Robinson, 1950) is a potential problem only when there is no comparable microlevel data or when the available microlevel data are inconsistent with the aggregate pattern (Idrovo, 2011). This is not the case here; the available microlevel data (Study 1) are completely consistent with the available macrolevel data (Studies 2 and 3).

The present paper demonstrates one potential contribution that an evolutionary perspective can make to the study of child development in developmental psychology. Among other things, it can point to one of the potential antecedents of exposure to paid childcare by explaining why some parents are more likely to resort to paid childcare by and with strangers than other parents. Neither parents nor children are blank slates molded and shaped only by their current environment and past life experiences. To the contrary, they are evolved animals with distinctive and species-typical evolutionary history and innate cognitive biases and tendencies borne of such history that nevertheless influence their current choices and behavior. I encourage all developmental psychologists and child development researchers to follow the lead of the field's pioneers (Belsky et al., 1991; Bjorklund & Pellegrini, 2000, 2002; Ellis & Del Giudice, 2019; Ellis, 2004; Figueredo et al., 2006) and explicitly incorporate evolutionary thinking into their work by recognizing the evolved cognitive and behavioral tendencies and biases in children and parents.

Acknowledgments

I thank Jay Belsky, Paula England, three anonymous reviewers, and Editor David F. Bjorklund for their comments on earlier drafts. I dedicate this paper to Jay Belsky, for not only directly inspiring this paper with his book *The Origins of You* and providing constructive comments on an earlier draft, but also for being a pioneering developmental psychologist for the last four decades, a model scientist, the wisest academic that I know, and a true friend.

References

Atran, S. (2002). *In god we trust: The evolutionary landscape of religion*. Oxford, UK: Oxford University Press.
Barnett, A. G., van der Pols, J., & Dobson, A. J. (2004). Regression to the mean: What it is and how to deal with it. *International Journal of Epidemiology, 34*, 215–220.
Belli, R. F., Traugott, M. W., & Beckmann, M. N. (2001). What leads to voting overreports? Contrasts of overreporters to validated voters and admitted nonvoters in the American National Election Studies. *Journal of Official Statistics, 17*, 479–498.
Belsky, J., Caspi, A., Moffitt, T. E., & Poulton, R. (2020). *The origins of you: How childhood shapes later life*. Cambridge, MA: Harvard University Press.
Belsky, J., Steinberg, L., & Draper, P. (1991). Childhood experiences, interpersonal development, and reproductive strategy: An evolutionary theory of socialization. *Child Development, 62*, 647–670.
Betzig, L. (1989). Causes of conjugal dissolution: A cross-cultural study. *Current Anthropology, 30*, 654–676.
Bjorklund, D. F., & Pellegrini, A. D. (2000). Child development and evolutionary psychology. *Child Development, 71*, 1687–1708.
Bjorklund, D. F., & Pellegrini, A. D. (2002). *The origins of human nature: Evolutionary developmental psychology*. Washington DC: American Psychological Association.
Brandon, R. N., Maher, E. J., Joesch, J. M., & Doyle, S. (2002). *Understanding family, friend, and neighbor care in Washington State: Developing appropriate training and support* (Report to the Washington Department of Social and Health Services, Division of Child Care and Early Learning). Seattle, WA: Human Services Policy Center.
Burkart, J. M., Hrdy, S. B., & van Schaik, C. P. (2009). Cooperative breeding and human cognitive evolution. *Evolutionary Anthropology, 18*, 175–186.
Burnham, T. C., & Johnson, D. D. P. (2005). The biological and evolutionary logic of human cooperation. *Analyse & Kritik, 27*, 113–135.
Chagnon, N. A. (1997). *Yanomamö*. Fort Worth, TX: Harcourt Brace.
Cronk, L. (2004). *From Mukogodo to Maasai: Ethnicity and cultural change in Kenya*. Boulder, CO: Westview.
Dunkel, C. S. (2013). The general factor of personality and general intelligence: Evidence for substantial association. *Intelligence, 41*, 423–427.
Ellis, B. J. (2004). Timing of pubertal maturation in girls: An integrated life history approach. *Psychological Bulletin, 130*, 920–958.
Ellis, B. J., & Del Giudice, M. (2019). Developmental adaptation to stress: An evolutionary perspective. *Annual Review of Psychology, 70*, 111–139.
Figueredo, A. J., Vásquez, G., Brumbach, B. H., Schneider, S. M. R., Sefcek, J. A., Tal, I. R., et al (2006). Consilience and life history theory: From genes to brain to reproductive strategy. *Developmental Review, 26*, 243–275.
Fort, M., Ichino, A., & Zanella, G. (2019). Cognitive and noncognitive costs of day care at age 0–2 for children in advantaged families. *Journal of Political Economy, 128*, 158–205.

Guthrie, S. E. (1993). *Faces in the crowds: A new theory of religion*. New York: Oxford University Press.
Hagen, E. H., & Hammerstein, P. (2006). Game theory and human evolution: A critique of some recent interpretations of experimental games. *Theoretical Population Biology, 69*, 339–348.
Hill, K., & Hurtado, A. M. (1996). *Ache life history: The ecology and demography of a foraging people*. New York: Aldine.
Hrdy, S. B. (2009). *Mothers and others: The evolutionary origins of mutual understanding*. Cambridge, MA: Harvard University Press.
Hunt, E., & Wittmann, W. (2008). National intelligence and national prosperity. *Intelligence, 36*, 1–9.
Idrovo, A. J. (2011). Three criteria for ecological fallacy. *Environmental Health Perspectives, 119* a332.
Kanazawa, S. (2004a). General intelligence as a domain-specific adaptation. *Psychological Review, 111*, 512–523.
Kanazawa, S. (2004b). The Savanna Principle. *Managerial and Decision Economics, 25*, 41–54.
Kanazawa, S. (2009). IQ and the values of nations. *Journal of Biosocial Science, 41*, 537–556.
Kanazawa, S. (2010a). Evolutionary psychology and intelligence research. *American Psychologist, 65*, 279–289.
Kanazawa, S. (2010b). Why liberals and atheists are more intelligent. *Social Psychology Quarterly, 73*, 35–57.
Kanazawa, S. (2012). *The intelligence paradox: Why the intelligent choice isn't always the smart one*. New York: John Wiley.
Kanazawa, S. (2014). Why is intelligence associated with stability of happiness? *British Journal of Psychology, 105*, 316–337.
Kanazawa, S. (2015). Where do gods come from? *Psychology of Religion and Spirituality, 7*, 306–313.
Kanazawa, S. (2021). Possible evolutionary origins of nationalism. *Political Behavior, 43*, 1685–1705.
Kanazawa, S., & Hellberg, J. E. U. (2010). Intelligence and substance use. *Review of General Psychology, 14*, 382–396.
Kanazawa, S., & Perina, K. (2009). Why night owls are more intelligent. *Personality and Individual Differences, 47*, 685–690.
Kanazawa, S., & Perina, K. (2012). Why more intelligent individuals like classical music. *Journal of Behavioral Decision Making, 25*, 264–275.
Kulivets, S. G., & Ushakov, D. V. (2016). Modeling relationship between cognitive abilities and economic achievements. *Psychology: Journal of the Higher School of Economics, 13*, 636–648.
Lee, R. B. (1979). *The !Kung San: Men, women and work in a foraging society*. Cambridge, UK: Cambridge University Press.
Levinson, D. (Ed.-in-Chief) (1991–1995). *Encyclopedia of world cultures* (10 Vols.). Boston: G. K. Hall.
Li, N. P., van Vugt, M., & Colarelli, S. M. (2018). The evolutionary mismatch hypothesis: Implications for psychological science. *Current Directions in Psychological Science, 27*, 38–44.
Lieberman, D. (2009). Rethinking the Taiwanese minor marriage data: Evidence the mind uses multiple kinship cues to regulate inbreeding avoidance. *Evolution and Human Behavior, 30*, 153–160.
Lieberman, D., & Lobel, T. (2012). Kinship on the kibbutz: Coresidence duration predicts altruism, personal sexual aversions and moral attitudes among communally reared peers. *Evolution and Human Behavior, 33*, 26–34.
Lieberman, D., Tooby, J., & Cosmides, L. (2007). The architecture of human kin detection. *Nature, 445*, 727–731.
Lim, S. A., Updike, R. L., Kaldjian, A. S., Barber, R. M., Cowling, K., York, H., ... Murray, C. J. L. (2018). Measuring human capital: A systematic analysis of 195 countries and territories, 1990–2016. *Lancet, 392*, 1217–2018.
Lynn, R., & Vanhanen, T. (2012). *Intelligence: A unifying construct for the social sciences*. London: Ulster Institute for Social Research.
Mateo, J. M. (2015). Hamilton's legacy: Mechanisms of kin recognition in humans. *Ethology, 121*, 419–427.
McDaniel, M. A. (2006). Estimating state IQ: Measurement challenges and preliminary correlates. *Intelligence, 34*, 607–619.
Mithen, S. (2005). *The singing Neanderthals: The origins of music, language, mind and body*. London: Weidenfeld & Nicholson.
National Institute of Child Health and Human Development Early Child Care Research Network (1997). Familial factors associated with the characteristics of nonmaternal care for infants. *Journal of Marriage and the Family, 59*, 389–408.
National Institute of Child Health and Human Development Early Child Care Research Network (2000). The relation of child care to cognitive and language development. *Child Development, 71*, 960–980.
National Institute of Child Health and Human Development Early Child Care Research Network (2002). Early child care and children's development prior to school entry: Results from the NICHD study of early child care. *American Educational Research Journal, 39*, 133–164.
Quinn, N. (1977). Anthropological studies on women's status. *Annual Review of Anthropology, 6*, 181–225.
Račevska, E., & Tadinac, M. (2019). Intelligence, music preferences, and uses of music from the perspective of evolutionary psychology. *Evolutionary Behavioral Sciences, 13*, 101–110.
RegionTrack (2019). *Child care in state economies: 2019 update*. Arlington, VA: Committee for Economic Development.
Rindermann, H. (2007). The *g*-factor of international cognitive ability comparisons: The homogeneity of results in PISA, TIMSS, PIRLS and IQ-tests across nations. *European Journal of Personality, 21*, 667–706.
Rindermann, H. (2018). *Cognitive capitalism: Human capital and the well-being of nations*. Cambridge, UK: Cambridge University Press.
Rindermann, H., & Ceci, S. J. (2009). Educational policy and country outcomes in international cognitive competence studies. *Perspectives on Psychological Science, 4*, 551–557.
Rindermann, H., & Ceci, S. J. (2018). Parents' education is more important than their wealth in shaping their children's intelligence: Results of 19 samples in seven countries at different developmental levels. *Journal for the Education of the Gifted, 41*, 298–326.
Roberts, R. D., & Kyllonen, P. C. (1999). Morningness–eveningness and intelligence: Early to bed, early to rise will likely make you anything but wise! *Personality and Individual Differences, 27*, 1123–1133.
Robinson, W. S. (1950). Ecological correlations and the behavior of individuals. *American Sociological Review, 15*, 351–357.
Seielstad, M. T., Minch, E., & Cavalli-Sforza, L. L. (1998). Genetic evidence for a higher female migration rate in humans. *Nature Genetics, 20*, 278–280.
Shepher, J. (1971). Mate selection among second generation kibbutz adolescents and adults: Incest avoidance and negative imprinting. *Archives of Sexual Behavior, 1*, 293–307.
Tooby, J., & Cosmides, L. (1990). The past explains the present: Emotional adaptations and the structure of ancestral environments. *Ethology and Sociobiology, 11*, 375–424.
Trivers, R. L. (1972). Parental investment and sexual selection. In B. Campbell (Ed.), *Sexual selection and the descent of man 1871–1971* (pp. 136–179). Chicago: Aldine.

U.S. Department of Health and Human Services (2006). *The NICHD Study of Early Child Care and Youth Development: Findings for Children Up to Age 4 1/2 Years*. Washington, DC: National Institutes of Health.
Westermarck, E. (1891). *History of human marriages*. New York: Macmillan.
White, J., & Batty, G. D. (2012). Intelligence across childhood in relation to illegal drug use in adulthood: 1970 British Cohort Study. *Journal of Epidemiology and Community Health, 66*, 767–774.
Whitten, N. E. Jr., (1976). *Sacha Runa: Ethnicity and adaptation of Ecuadorian jungle Quichua*. Urbana: University of Illinois Press.
Wolf, A. P. (1970). Childhood association and sexual attraction: A further test of the Westermarck hypothesis. *American Anthropologist, 72*, 503–515.