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Science Aspirations, Capital, and Family Habitus: How Families Shape Children's Engagement and Identification With Science

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Low participation rates in the study of science, technology, engineering, and mathematics (STEM) post-16 are a matter of international concern. Existing evidence suggests children's science aspirations are largely formed within the critical 10 to 14 age period. This article reports on survey data from over

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9,000 elementary school children in England (age 10/11) and qualitative data from 160 semi-structured interviews (92 children aged 10/11 and 78 parents), collected as part of an ongoing 5-year longitudinal study in the United Kingdom tracking children from 10 to 14. Drawing on the conceptual framework of Bourdieu, the article explores how the interplay of family habitus and capital can make science aspirations more "thinkable" for some (notably middle-class) children than others. It is argued that while family habitus is not deterministic (there is no straightforward alignment between family habitus, capital, and a child's science aspirations), social inequalities in the distribution of capital and differentially classed family habitus combine to produce uneven (classed, racialized) patterns in children's science aspirations and potential future participation.

Keywords: aspirations, Bourdieu, family, inequality, science

Introduction

A considerable body of evidence now exists that compared to other school subjects, science is failing to engage young people (Jenkins & Nelson, 2005; Lyons, 2006; Osborne & Collins, 2001; Sjøberg & Schreiner, 2005). Yet, student interest in science at age 10 has been shown to be high and with little gender difference (Murphy & Beggs, 2005)—although stark gender differences emerge as children get older. In the United Kingdom, research has shown that the point of decline begins in the final year of elementary school when students are aged 10/11 (Murphy & Beggs, 2005). Indeed, an overwhelming body of accumulated evidence points to interests in science being formed by age 14 (Lindahl, 2007; Ormerod & Duckworth, 1975; The Royal Society, 2006; Tai, Qi Liu, Maltese, & Fan, 2006). For instance, an analysis conducted by Tai et al. (2006) of data collected for the 1988 U.S. National Educational Longitudinal Study showed that by age 14 students *with* expectations of science-related careers were 3.4 times more likely to earn a physical science and engineering degree than students *without* similar expectations. This effect was even more pronounced for those who demonstrated high ability in mathematics, with 51% being likely to undertake a science, technology, engineering, and mathematics (STEM) related degree. Such data demonstrate the importance of the formation of career aspirations of young people long before the point at which many make the choice about which subject to pursue at high school and then college. This article draws on data from the first phase of an ongoing, longitudinal study that explores the development of children's science attitudes and aspirations from the age of 10 up to 14, in an attempt to understand the processes and factors at work during this critical period. In particular, as discussed next, this article explores how families can shape children's propensity to develop science-related aspirations—an area in which comparatively less work has been undertaken

How Does the Family Shape Children's Science Identities?

Evidence indicates that the family plays an important role in helping to shape students' engagement, aspirations, and achievement/attainment in science (e.g., Aschbacher, Li, & Roth, 2010; Ferry, Fouad, & Smith, 2000; Gilmartin, Li, & Aschbacher, 2006; Stake, 2006). For instance, Gilmartin et al.'s (2006) survey of 1,126 10th-grade students in Southern California "attests to the powerful role of family context when exploring early stages of the science and engineering pipeline specifically and students' career aspirations generally" (p. 196).

Yet it is also recognized that while families are highly influential on science attitudes and participation, this relationship is complex (Atherton et al., 2009) and worthy of further investigation. Different patterns of participation and engagement with science have been noted in relation to different ethnic groups (e.g., Huang, Taddese, & Walter, 2000). Moreover, Gilmartin et al. (2006) suggest that family influence may work in different ways for different ethnic groups (see also Springate, Harland, Lord, & Wilkin, 2008), being stronger and with clearer messages in Latino and Asian families as compared to White and African American families. As Aschbacher et al. (2010) report, Asian American parents "stand out" as providing particularly "strong expectations and support" for STEM careers.

Family factors have also been linked to the gender gap in science and engineering participation (e.g., Dick & Rallis, 1991; Eccles, 1993; Frome & Eccles, 1998; Manis, 1989; Tenenbaum & Leaper, 2003) and social class differences in STEM participation (Royal Society, 2006; Aschbacher et al., 2010). For instance, Tenenbaum and Leaper (2003) found that parents were more likely to think that science is difficult for their daughters than for their sons, and Aschbacher et al. (2010) found that higher science achievers tend to come from more affluent families possessing strong scientific social capital and a range of economic, social, and cultural resources to support achievement.

The present study seeks to build on this work by undertaking a detailed unpacking of how and why families "matter" to the development (or not) of children's science aspirations. In particular, the article looks at the interplay of "family habitus" and family capital to analyze how the family and its everyday practices, resources (both generic and science related), values, and sense of identity ("who we are") influences the extent to which children come to see science as an (im)possible and/or (un)desirable future career path. In other words, the article asks how and why is science a more "thinkable" aspiration in some families and not others?

Theoretical Lens

This article represents an attempt to work productively across two fields of educational research and theory, namely, the *sociology of education* and *science education*, and has two main aims. First, we seek to identify what insights the application of a Bourdieuian lens might bring to science education and understanding of the reasons for persistent low participation rates in science. Second, we attempt to advance work within Bourdieuian-inspired sociology of education through an exploration of the purchase of the concept of "family habitus" as a theoretical tool for making sense of the ways in which families (and their values, resources, sense of "self"/identity, and practices) may relate to children's (science) aspirations.

We begin by setting out the rationale for employing "family habitus" as a potentially tenable concept for making sense of the role played by families in the production of children's science aspirations.

Within the sociology of education, the writings of Pierre Bourdieu (e.g., 1977, 1984, 2001) have been highly influential, notably his theory of practice, which seeks to understand the reproduction of social inequalities in society. In short, Bourdieu proposes that relations of privilege and domination are produced through the interaction of *habitus* with *capital* (resources—which can be economic, cultural, social, and symbolic) and *field* (social contexts). His approach is centrally concerned with the interplay between agency and structure and has been used productively by others to highlight, for instance, "the largely invisible but powerful ways that parents' social class impacts children's life experiences" (Lareau, 2007, p. 117). For instance, drawing on Bourdieuian theory, Lareau (2003) develops a conceptualization of how distinct patterns of parenting can emerge between differently classed families: She details how patterns of "concerted cultivation" (in which the child is at the center of a family project for the reproduction of privilege) tend to be more prevalent within middle-class families, which deploy considerable resources (emotionally, financially, and in terms of time and energy) to facilitate their children's social and educational advancement (e.g., by building up children's "CVs" through substantial extracurricular activities; by intervening in schooling). In contrast, a parenting pattern that tends to be more common among working-class families advocates the "accomplishment of natural growth," in which parents do not seek to "hot-house" children but view development as occurring more "naturally" in line with the child's interests and aptitudes. As Lareau shows, these patterns of parenting can powerfully contribute to the reproduction of social inequalities, with middle-class families being far more effective at ensuring that their children "succeed" socially and educationally (see also Vincent and Ball, 2005, for examples of how middle-class parents' strategizing can advantage them within educational markets). Yet, to date, Bourdieuian theory has not been extensively used within the field of science education.

Habitus has been proposed as a tool for understanding how the individual is socially constituted. As Reay (2004) usefully discusses, it provides a sophisticated means for examining the individual as a social actor who is culturally and temporally located (as our ways of understanding the world are shaped by collective and individual histories). Although people exercise agency, this agency is circumscribed, as they are a product of their social location. As Reay explains, habitus can be conceptualized as an inner matrix of dispositions that shapes how the individual understands and makes sense of the social world:

> a complex internalized core from which everyday experiences emanate . . . a deep interior, epicentre containing many matrices. These matrices demarcate the extent of choices available to any one individual. Choices are bounded by the framework of opportunities and constraints the person finds him/herself in. (p. 435)

Habitus, as shaped by individual and collective histories, provides a framework of dispositions that guide (and set the limits of) future actions. Thus, social axes of "race"/ethnicity, social class, and gender all contribute to shaping what an individual perceives to be possible and desirable. Habitus provides a practical "feel" for the world, framing ways of thinking, feeling, and being, such as taken-for-granted notions of "who we are," and "what we do," and what is "usual" for "us." For instance, various studies have shown how habitus can shape the extent to which higher education is seen as an expected, "automatic" post-16 route or as "not for the likes of us" (Archer, Hutchings, & Ross, 2003; Reay, David, & Ball, 2005).

Habitus is generally used in relation to the individual, but the concept is extended here to explore the family environment (or "micro-climate;" Aschbacher et al., 2010) within which young children are growing up and starting to develop their ideas about science and their relationships (and dis/identification) with science. While Bourdieu did not articulate a specific notion of family habitus, he does propose habitus as encompassing both individual and collective formations, such as gendered habitus (Bourdieu, 2001) and classed habitus (Bourdieu, 1984; Bourdieu & Passeron, 1979). Various writers have worked productively with collective notions of habitus, such as institutional habitus (e.g., Reay et al., 2001), collective class habitus (e.g., Charlesworth, 2000), and collective rural habitus (Atkins, as cited in Reay, 2004). Indeed, Diane Reay argues that a "collective understanding of habitus is necessary, according to Bourdieu, in order to recognize that individuals contain within themselves their past and present position in the social structure" (Reay, 2004, p. 434).

The term *family habitus* has appeared sporadically within academic work conducted from a Bourdieuian framework (e.g., Robb, Dunkley, Boynton, & Greenhalgh, 2007; Thomas, 2002; Tomanovic, 2004)—yet it remains undertheorized, and where it has been cited, its specificity and distinctiveness tend not to have been remarked upon. It is most often used to suggest that student views (e.g., of whether or not to go to university or which schools/universities are considered "for me" or "not for me") are in some way shaped by their family context ("family habitus"), but what family habitus actually "is" is rarely defined. Indeed, the term tends to be used as if its meaning is obvious and "common sense." Consequently, we will expand briefly here upon the conceptual rationale for employing *family habitus*, although we use the term tentatively, in an exploratory fashion (as "open concepts designed to guide empirical work;" Bourdieu, 1990b, p. 107).

We use *family habitus* to refer to the ways and settings in which families operate—as such the concept seeks to go beyond simplistic, conscious forms of identification with science (e.g., attitudes to/liking of science) to also encompass values and everyday practices. In this respect, our conceptualization seeks to contribute an additional complexity to some areas of science education research that has tended to operate with a more one-dimensional approach to "attitudes to science" (see Osborne, Simon, & Collins, 2003). Rather, family habitus is used to explore the extent to which families construct a collective relationship with science and the extent to which this is shaped by their possession of particular sorts of economic, social, and cultural capital. In particular, we examine participants' accounts of how science is "woven" into un/conscious family life (or not).

We see the potential value of a concept of *family habitus* (as opposed, say, to alternatives such as "family identity" or "family context") as grounded in its capacity to better encompass a broad spectrum of family resources, practices, values, cultural discourses, and "identifications" ("who we are"). It provides a lens for attempting to situate and contextualize individual child and parent identities (and orientations to science) within the family environment—for examining the extent to which the everyday family "landscape" shapes, constrains, or facilitates aspirations and engagement in science through the combination of attitudes, values, practices, and ways of being that they engage in.

In some ways, this conceptualization of family habitus echoes the notion of institutional habitus that has been deployed in relation to contexts such as schools and universities (Reay et al., 2005), yet it also obviously differs. Reay (2004) writes that Bourdieu conceptualizes habitus as a "multi-layered concept, with more general notions of habitus at the level of society and more complex, differentiated notions at the level of the individual" (p. 434). In this respect, family habitus is proposed as a means for capturing the family as a unique site within which complex "ways of being" in the world are developed.

The Study

The ASPIRES project is funded by the United Kingdom's Economic and Social Research Council as part of its Targeted Initiative on Science and Mathematics Education. It is a 5-year, longitudinal survey exploring science aspirations and engagement among 10 to 14 year olds. It comprises a quantitative online survey that has been administered to a sample of over 9,000 10-year-old English students (who will be tracked and surveyed again at ages 12 and 14) and in-depth qualitative interviews with pupils (age 10/

11) and their parents (who will also be tracked and reinterviewed when their children are ages 12 and 14). This article is based on analysis of the Phase 1 qualitative data set, which comprises 160 interviews with 78 parents and 92 children age 10 (Year 6), drawn from 11 schools in England. At points throughout the article, contextual information is provided from the survey as a means for framing the qualitative data analysis, although full details of the survey and its methods, analyses, and findings are discussed in separate publications (DeWitt et al., 2011, in press).

The students and parents who were interviewed were recruited from 11 elementary schools in England, representing a range of social/economic contexts, including multiethnic urban, suburban, and rural schools. In terms of geographic location of the schools, there was: 1 in the Midlands, 2 in the Eastern region, 2 in the South East, 4 in London, and 1 in the South. Of the schools, 9 were state primaries and 2 were private/independent schools. Students came from a broad range of socioeconomic classes and ethnic backgrounds.

Potential schools were sampled from the list of 279 schools who responded to the Phase 1 survey as part of the wider study[1] (see also DeWitt et al., in press). A sampling frame was constructed to represent six target categories of school (e.g., "multiethnic urban/inner city schools;" "working-class suburban;" "predominantly White, middle-class, suburban schools;" "independent single sex") to ensure a range of school contexts and populations, and prospective schools were purposively sampled from within these target categories. Schools that agreed to participate were then sent parental consent letters for distribution to all children in Year 6 (age 10).

Two topic guides (for use with children and parents) were developed and piloted, covering areas such as: aspirations for the future (and sources of these aspirations), interests in school and out, what they like/dislike about school, attitudes toward and engagement in school science, and broader perceptions of science. Parental interviews focused on: family context, perceptions and experience of the child's schooling, involvement in education, child's personality and interests, their child's aspirations, and their own perceptions of and relationship with science and engineering, including their thoughts about why so few children pursue science post-16.

Interviews were conducted by four of the article authors, with the majority of the interviews being conducted by the second author. Of the interviewers, three [LA, JDW, BWl] are White middle-class women (with English, American, and French national backgrounds) and one BWg [initials] is a British-Chinese male PhD student. Interviewees were invited to choose their own pseudonyms, hence the pseudonyms cited in this article reflect the personal choices of interviewees.

All interviews were digitally audio-recorded and transcribed. In line with the study's conceptual approach outlined earlier, data were analyzed using a Bourdieuian conceptual lens. The analytic process was undertaken by the lead author who, after initial sorting and coding of the data (e.g., by key topic areas), then searched the data iteratively to develop a typology of family capital/habitus and child aspirations/relationships with science, which was then tested and refined through successive phases of coding and analysis, iteratively testing out emergent themes across the data set to establish "strength" and prevalence (Miles & Huberman, 1994). These coded themes were then subjected to a more theoretically informed analysis (to identify interplays of habitus, capital, and children's identifications with science). Within this, attention was given to aspects of habitus identified by Reay (2004), notably, agency, collective/individual identifications, and interactions of past/present. Where possible, we also sought to identify practices of power and gendered, classed, and racialized discourses, relating these to family practices and resources (to identify constructive elements and wider cultural discourses evoked within respondents' talk).

Parental Attitudes to Science and Children's Science Aspirations/Identifications

Analysis of the survey data suggests that parental attitudes to science play an important role in shaping children's science aspirations. Indeed, parental attitudes to science, experiences of school science, and student self-concept in science were the variables that had the strongest relationship with students' aspirations in science (explaining 50.5% of the variance in student aspirations), with positive parental attitudes associated with stronger aspirations in science (see DeWitt et al., in press). It was also notable that parental attitudes to science were quite strongly positively skewed. That is, most students reported that their parents had positive attitudes toward science.

Moreover, parental attitudes to science were found to be more closely related to children's science aspirations than general parental involvement in child's schooling or general parental aspirations. The survey data suggest that while a family's social structural location (e.g., their ethnicity) is important, family attitudes to science and their encouragement and fostering (or not) of science in their everyday family life (as constituted for instance through pastimes, activities, leisure consumption, TV, books, topics of conversation, social networks) seem likely to be *more* important influences on student science aspirations (DeWitt et al., in press).

In the survey, we found that just under a quarter (23.4%) of children said that they "never" do any science-related activities outside of school, whereas just under a fifth (18.8%) were regularly engaged in science-related activities (at least once a week). Over a third never read a book or magazine about science (36.6%) and never looked at science-related websites (33.8%) (compared to 18.1% who read a book/magazine and 15.4% who look at science-related websites at least once a week). Almost a fifth reported that they never visit a museum or zoo (18.9%) and never watch a science-related TV program (18.8%) (compared to 35.5% who do so once a week—TV being the most widely cited "frequent" science-related activity). Multilevel modeling analyses revealed a range of variables that accounted for a significant amount of the variance in students' participation in science-related activities (outside of school), which included aspirations in science, attitudes to school science, gender, ethnicity, and cultural capital.

Multilevel modeling analyses (see DeWitt et al., in press) also revealed that aspirations in science were more closely related to parental attitudes to science (as well as to student experience of school science) than they were to social structural variables, suggesting that the relationship between gender, ethnicity, and social class and aspirations is quite nuanced and complex.

Initial analysis of the qualitative data identified eight broad "types" of family/child relationship to science (reflecting differences in family habitus, capital, and child science identification/aspiration). These are summarized in the mapping in Table 1.

The following discussion attempts to now "make sense" of the range of family orientations to science that we identified, using the lens of Bourdieuian theory. It is argued that social class plays a key role in promoting, facilitating, or hindering children's science aspirations and identifications, notably through the activation and deployment of capital within middle-class families (and the absence of such resources within working-class families). However, we also show how (family) habitus is not deterministic—there is no straightforward relationship between family habitus and an individual child's identification with science. For instance, families that strongly promote science and deploy ample science-related capital do not necessarily produce children with strong science identifications (and vice versa). Hence, a child may still form science aspirations in the absence of familial science capital—although we suggest that the likelihood of such aspirations being "grown" and sustained may be curtailed by the absence of familial science capital/habitus. We highlight how children exercise agency in relation to the articulation of their interests and aspirations (e.g., "going against the grain" of family expectations), although we maintain that the classed, racialized (and gendered) contexts within which individual children and families are located provide important constraints on the realization of this agency. We begin by discussing how science aspirations, interest, and identification are strongly facilitated within middle-class families and how class privilege can compensate for a lack of science-specific capital. We then move on to discuss the implications of a comparative "lack" of (generic and science-related) capital within the family habitus for children's science identifications and aspirations.

Science Is "For Us": Using Class Privilege to Make Science Thinkable and Realistic

Families with the strongest science interests and orientations were most likely to be middle class (and White/South Asian). These families enjoyed

Table 1
Mapping of Interview Sample Family Relationships to Science

- "Pro-science" family relationships to science:
- "Science Families": families in which science is strongly embedded with pro-science child (*N* = 14, all White and/or South Asian families, predominantly upper-middle/middle class)
- "Doing It for the Kids": families with no preexisting science interest but who have taken up science and embedded it in the family to support strong child interest (*N* = 6, mostly White/English and middle class)
- "Pushing Science" Families: strong family science interest/capital, lesser child interest (*N* = 7) (predominantly White middle-class, minority ethnic (ME) working class/middle class)
- "Pragmatic Persisters": child has no particular interest in science but a plan to continue with it in order to actualize a particular aspiration (*N* = 2, minority ethnic families)

Ambivalent and "weaker" family relationships to science

- "Raw"/"Unrefined" Interest: an enthusiastic child with a high personal interest in science but whose family has low science capital and/or interest (*N* = 12, mostly White, working-class families)
- "Doing not being"/"Interested but . . . ": families in which there is some interest and capitals in support of science and the child has strong interest in science and engages for pleasure in own time but does not want to be a scientist/does not aspire to continue with science in the future (*N* = 25, range of ethnicity, class, and gender)
- "Science as Peripheral": families and children with some interest in science but it is weakly embedded and weakly supported by capitals (*N* = 23, mostly White and Black working class)
- "Science as Irrelevant": families and children with little or no interest or engagement in science (*N* = 3, all White working-class girls)

Note: The above are merely illustrative, representing flexible, shifting, and porous groupings, not homogenous, discrete, or fixed categorizations. Table 1 is intended as a means for capturing and conveying the range (and salient characteristics) of participating families' resources, identifications, and relationships to science.

not only access to high-quality science-related resources/capital but also engaged in family practices that could support and "grow" their children's potential interest/aspirations. As we shall discuss, this is not to say that all children in these families aspired to science careers (some resisted) and/or strongly identified with science (e.g., some held a science-related aspiration in line with family expectation but without any strong intrinsic interest). However, we suggest that their combination of family habitus and capital provides a "fertile ground" that renders science more thinkable/desirable for their children. Moreover, these families' resources and practices enable them to capitalize upon any nascent interest among their children, helping render science a realistic and potentially more robust aspiration.

Middle-class families' economic, social, and cultural capital enabled children to participate in a greater volume and variety of science-related extracurricular activities. For instance, analysis of the survey data indicates that overall, students with high or very high cultural capital were more likely to participate in science-related activities out of school (and students with low or very low cultural capital were less likely to participate in science-related activities outside of school). This relationship was stronger for students with very high or very low cultural capital than those with intermediate levels of cultural capital. This pattern was also replicated in the qualitative data, science being "strongly embedded" exclusively among middle- and upper-middle-class families (of White and/or South Asian heritage). The survey also found that students from more affluent backgrounds (attending private schools, parents in professional occupations, high levels of cultural capital) reported more positive parental attitudes to science—again, this finding was also borne out in our qualitative sample.

Where middle-class families possessed science-specific capital and deployed this within a family habitus that is both strongly "pro-science" and engaging in child-rearing patterns of "concerted cultivation" (Lareau, 2003), the result was extremely powerful. As epitomized by the "science families" within our mapping (Table 1), this interaction of habitus and capital (a) made science highly "visible" and familiar within everyday life; (b) provided specific opportunities, resources, and support for children to develop a practical "feel" and sense of mastery of science; and (c) enabled the cultivation of a perception of science as desirable. This desire for science was often embedded within narratives of family identity that fused the past and present. For instance, these families often described how an interest (and/or careers) in science permeated the nuclear and extended family, often tracing back over generations. Notably, many of these parents themselves held science degrees and/or were working within science-related fields.

The interplay of family habitus and (often substantial) science-specific cultural and social capital produced a sense of science being "what we do" and "who we are."

> As the product of history, habitus produces individual and collective practices. . . . It ensures the active presence of past experiences which, deposited in each organism in the form of schemata of thought and action, tend, more surely than all the formal rules and all explicit norms, to guarantee the conformity of practices and their constancy across time. (Bourdieu 1990a, p. 91)

Consequently, science was not "just another subject," it suffused all aspects of family life, such as daily topics of conversation, leisure time, and family activities and joint interests. This was particularly evident among families whose daughters attended the independent girls school (Austen School), where most parents described choosing the school at least partially on the basis that it strongly promoted science. Fathers were particularly driving and influential figures in fostering and sustaining the science focus within these families, although mothers also frequently expressed interests of their own and/or held science-related qualifications.

For example, Hannah is a middle-class, White British girl who attends Austen School. Her father (Maddison) is an IT professional who holds an engineering degree. Her mother is a dietician with an IT background. Maddison describes both himself and his wife as "quite sciencey." He portrays their everyday family life as embedding science-related interests and forms of capital ("There's always lots of *Scientific American* magazines and dietician magazines and . . . Natural History Museum magazines around."). Hannah's parents' interest in science is exemplified by the "magazines we get, the programmes we watch . . . the bits of newspaper we go to. . . . And what we talk about it in the house—you know we do talk about it." The family regularly discusses and debates media coverage of science-related issues, and Maddison explains that as parents they regulate their children's TV viewing, pushing the Discovery Channel in particular. This commitment to science has also shaped their educational decision making. Maddison explains that they chose Austen School on the basis that it is "strong at science" with excellent facilities and teachers.

The strong embedding of science within the family "habitus" appears to be fostering durable dispositions within Hannah too, who is developing a strong "science identity" and aspires to be a chemist. She "hero worships" (in Maddison's words) her older brother, who is studying for a higher degree in nuclear physics. Hannah says that the person she most looks up to/wants to be like is Einstein, and at school, Hannah is friends with "the sciencey crowd" (as noted by both herself and her father). At home she watches "all" the science programs on children's TV and the Discovery Channel.

In such families, the alignment between family habitus, capital, and the child's personal interests and identifications produces a strong, mutually reinforcing consensus, which is also embodied and realized through emotional bonds and practices. For instance, Isobel (mother of Georgia, a White British middle-class girl, South Coast School) described how Georgia and her father are really "into" science and spend a lot of time together doing "sciencey things" (e.g., astronomy, going to science museums, exploring marine biology, watching science-related TV). Georgia also has a subscription to a children's science magazine that she reads avidly. Isobel describes the time the two spend together in this way as deeply meaningful—it is "their special time together." In line with the family's engagement in "concerted cultivation" child-rearing practices, Georgia and her father's engagement in science-related activities is also educationally oriented (e.g., they describe following up areas of interest in reference books) and appears to often translate into educational capital. As

Isobel explains, "Because he [husband]'s into all that, that's their little time, you know? And so she knows if she talks to daddy about 'wow, daddy what pattern's that?,' or whatever, he'll be 'oh well let's go and get the book out and we'll have a look.'"

While all the strongly embedded families in our typology were middle class, this tendency was not limited to families that sent their children to private schools or to White British families, but was also noted among a number of South Asian families (and those comprising a White British and a South Asian heritage parent). In these families, an interplay between family habitus, capital, and a South Asian cultural discourse (which identifies science as a "respectable" and desirable career aspiration for "us") appears to operate to produce strong science interest and aspirations among children. For instance (like a number of children in the sample), Yogi (a British Indian pupil from Midlands School) has a passion for space. He prefers the "more advanced" TV programs about space (which he watches with his father) and describes popular children's science TV a bit "simplistic." He likes to read about chemistry and has lots of science books at home. Yogi's father also loves science ("He talks about it loads") and actively promotes this interest to Yogi. His mother is interested "but not as much as my dad." Science is a regular topic of interest and discussion within the nuclear and extended family (who "talk a lot about science"), which also provides scientific social capital (e.g., an uncle who works at a space center).

Some parents, like Jack (father of Kaka, a British Muslim Pakistani boy, Metropolitan School), clearly articulated an explicit agenda to actively foster and increase his son's science interest and aspiration through the toys and activities that they present to their children. Jack describes his "love" of physics and chemistry and how he hopes that buying Kaka science and electronics sets and providing enthusiasm for science in the home will contribute to Kaka choosing to pursue a science-related career in the future ("I mean definitely we'll give him a bit more of a push I think to actually get into the stuff . . . so hopefully yeah, we'll actually push him into that."). This strategy seemed to be working, with Kaka agreeing, "I really, really love like science but I want to get better at science, so that's why I want to become a scientist."

The Interaction of Middle-Class Capital and Family Habitus in the Absence of Science Capital

Of course, not all middle-class families in our sample possessed substantial science-related capital. As illustrated in Table 1, we also identified six White/English middle-class families who did not necessarily have a strong preexisting identification with science but who, through the practice of "concerted cultivation," had woven a child's interest in science into family life, with the family subsequently becoming collectively more engaged with science as a result. For instance, Luna (White lower-middle-class girl, Clover School) has a real passion for space and has a longstanding dream of becoming an astronaut. She describes herself as "really into science," saying, "I just like everything about science, I'm really interested in it." Luna is in her school's Science & Engineering club and does space-related projects in her spare time. She talks enthusiastically about looking up space-related websites, reading books about space, playing with science kits, and visiting science and natural history museums. Her fascination with science and space in particular seemed to have been sparked by a pivotal school trip a couple of years previously in which she met a "lady scientist" who made a big impression on her. Since then, her interest has continued to grow and cement into a defining aspects of her personal identity. Luna's parents are bohemian and "artistic," with no preexisting science qualifications or particular interest. However, as Luna's mum Stella explained, they had very much taken up and run with Luna's science interest and support and foster it in numerous ways, using available capital (e.g., purchasing science-related toys, books, and activities), but also by weaving this interest into the family habitus, embedding science in everyday family conversations and practices (e.g., through collective family TV viewing of science-related programs).

Of course it is perhaps unsurprising that all the families in the "strongly embedded" category are from middle-class backgrounds. As PISA (2006) figures suggest, students from more advantaged socioeconomic backgrounds are more likely to express an interest in science and are more likely to have a parent in a science-related career. But as Stella and Luna illustrate, even in the absence of science capital, the middle classes are more likely to enjoy the material (economic) resources and possess the cultural knowledge and artifacts to facilitate and encourage a range of science-related activities. Moreover, they are most likely to espouse a set of values that advocates actively nurturing children in this way (see Lareau, 2007). Thus, even where middle-class families may lack specific cultural or social capital relating to science, they are still likely to have a family habitus that values the "concerted cultivation" (Lareau, 2003) of children (deliberate and active attempts "to stimulate their children's development and foster their cognitive and social skills;" Lareau, 2007, p. 118) through the deployment of capital, which can be drawn on, in cases such as Luna's, to maximize the child's nascent interest.

It is beyond the scope of our data to speculate on the direction of the relationship, between family habitus, capital, and child's identity (i.e., how they combine to produce, encourage, or simply reinforce each other), but we suggest that this relationship will necessarily be complex and most probably impossible to disentangle. Our underlying assertion, however, is that this relationship can be very powerful and can play a key role in making science known, thinkable, desirable, and achievable for a number of middle-class children.

The holistic embedding of science within family life, identity, and as a source of collective interests and practices creates a strong, "pro-science" microclimate that unsurprisingly helps children's identification with science to thrive. As Aschbacher et al. (2010, p. 15) argue from their own study:

> Students who participated in and found solid support for science in multiple communities were more likely to consolidate their science identities and persist in their SEM aspirations . . . than students with less breadth and depth of support. They were buoyed by perceived strong and aligned support for their science identities at home, at school, and in extracurricular activities.

This is also suggested in the analysis of our survey data, which highlights that students who engage in science-related activities outside of school were more likely to express positive attitudes about school science and stronger aspirations in science relative to other students.

The combination of generic middle-class privilege with science-specific resources and a family habitus disposed to the active promotion of science means that these families are well resourced and well positioned to promote, foster, and support their children's science aspirations and to operate strategically within the field of education to help children maximize their choices and build capital that will help them to pursue scientific careers in the future. Indeed, we hypothesize that these children will be the most likely of our sample to still hold science aspirations when we reinterview them at ages 12 and 14.

Agency and Resistance: Instances of Disalignment Between Family Habitus, Capital, and Children's Identities/Aspirations

So far we have discussed the powerful result of alignment between family habitus, capital, and children's own science-related interests, aspirations, and identifications. However, this is not to imply a deterministic model, in which all middle-class children are inevitably socialized into science identifications and aspirations. Indeed, our mapping highlighted seven families in which, despite a strong "push" toward science from their parent/s, children did not seem to express a correspondingly high personal identification with (or aspirations toward) science.

For instance, Vanessa (a Black African girl, Metropolitan School) is pushed strongly toward science by her father (Robbie), who has a degree in pharmaceutical science and is a science technician in a local secondary school. Vanessa describes herself as "okay with science" but sometimes finds it boring. She aspires to become a doctor, which she recognizes is related to science, but her aspiration is not driven from a personal love of science ("because my dad's a scientist he would like me to get a bit interested in science"). Robbie purchases science-related toys/activities for Vanessa and explains how he tries to encourage educationally oriented science-related play and activities at home ("I have tried in my little bit, tried to buy her things like microscopes. . . . We do loads of things [at home] [like] what are the changing phases of water—solid and all that."). Familial scientific habitus is further supported within the extended family (e.g., Vanessa explores "chemicals and materials" with her auntie) and through the family's identification with a cultural discourse of "African valuing of science" ("African people like science a bit more, because science in Africa seems to be what's more money getting."). Whereas Robbie describes himself as "fascinated by science" and would love Vanessa to be a doctor or a pharmacist, he also acknowledges that Vanessa is not as engaged as he is (she is not "intense" in her interest), only "sometimes" looking at books or websites for her own enjoyment.

Poppy is a White, middle-class girl at Austen School. In the interview she said that she enjoys science and would be happy to do "something linked with science" in the future, but her real passion was for an "adventurous" career, and she describes herself as "not really into science." Poppy admires the popular British TV presenter Kate Humble[2] and says it is her dream to "follow in her footsteps." She engages in some science-related activities outside of school (kits, TV programs, family visits to museums), but the science-related aspect of her aspirations seems to be driven by her parents, who regularly encourage Poppy to consider becoming a scientist (especially medicine or veterinary science) and emphasize her aptitude for this. As mum, Lulu, explained, "I just think that her brain works that way really . . . I think she is interested and I keep telling her she's got a scientific brain. So that might make her think that way." Lulu had a personal interest in science ("I think biology really is my thing" and "I'm fascinated by space as well") and indicated that her steering of Poppy is shaped by an unfulfilled desire to have gone into science herself. Indeed, Lulu felt she had been prevented from so doing by "bad advice" in her youth and being "steered" by her school down another route.

In both examples, the nondeterministic nature of habitus is highlighted—both Poppy and Vanessa are shaped by their family habitus (which is produced through an interplay of past and present and through which parents are actively seeking to cultivate certain dispositions towards science), yet simultaneously exercise individual agency in developing and asserting alternative choices.

The complexity of the relationship between social class, familial support, and "pushing" of science and child agency is further underlined by our identification of a small number of exclusively minority ethnic families in which children and their families expressed a more "pragmatic" relationship with science, in which parents and children both espouse a cultural discourse advocating science as a respectable and desirable career aspiration, *but* this is not accompanied by any intrinsic valuing and embedding of science either within the family habitus or the child's personal interest/identity. This is exemplified by what we have termed *pragmatic persistence* (Table 1). In these families, children and their parents expressed what might be termed an ambivalent relationship to science, but this is outweighed by a pragmatic (or extrinsic) valuing of aspirations for the child to pursue a science-related (often medical) career. There was no particular home scientific capital or embedding of science within these families, but there was a strong family and cultural discourse that advocated science-related jobs as aspirational career routes. This was found only among minority ethnic pupils, such as Preeti (South Asian girl, Woodstock School), who described herself as "in the middle" in terms of how into science she is. While she found some aspects interesting, she did not really undertake any science activity at home. She continued, "I haven't got much books about science, except for revision guides." However, she felt that she would continue with science in the future because of her aspiration to become a doctor. She said that her family thinks that science is "OK" but "they don't really talk about it."

This is a theme that is taken up by Wong (in press) in his study of science aspirations and engagement of minority ethnic students aged 11 to 14 in London, which he terms *engagement without interest*. Wong found that those minority ethnic students in his sample who aspired to study the highest level of U.K. compulsory school science qualifications seemed to be driven more by a desire to perform a "clever" pupil identity (with science being popularly recognized as a "difficult" and high-status subject) rather than an intrinsic interest in science per se. He found that for these pupils, achievement in school science was constructed in instrumental terms, as both a marker of academic competence and as a necessary prerequisite for entry into particular career routes (notably in medical-related fields), which were viewed as being of high status and as culturally appropriate and desirable occupations.

Making Science "Unthinkable": Interactions of Family Habitus and a Lack of Science-Related Capital

So far we have discussed how (middle-class) resources and cultural discourses and practices can be mobilized to make science more "thinkable" and potentially more sustainable and achievable aspiration for middle-class children. We now outline the converse side of our argument, discussing how an absence of capital/resources (both generic and science specific) and a family habitus aligned with the "accomplishment of natural growth" (Lareau, 2003) can disadvantage children from less privileged backgrounds from realizing and/or developing science identifications and aspirations.

We discuss how social inequalities coalesce within the family habitus/ capital relationship to hinder many working-class children from developing their potential inherent interest and enjoyment in the practice of science into either a (a) "refined" aspiration/ trajectory or (b) conceivable personal science identification or aspiration. In other words, we explore how, for these children, their enjoyment of "doing" science (in and out of school) does not translate into an interest in "being" a scientist. In particular, we suggest that even where working-class children develop a personal science-related interest/aspiration, the resources and family "cultural infrastructure" (family habitus) available to them are poorly equipped to enable the child to build/capitalize on their nascent interest. Hence we speculate that the child's interest risks remaining "raw" (with comparatively fewer opportunities and support to become "refined" in ways that will generate social advantage). Moreover we suggest that for many working-class children, the configuration of family habitus and the unequal distribution of capital within society combine to render science more of an "unknown" and "unthinkable" option.

The Interaction of Family Habitus, Capital, and Social Inequalities to Hinder the Development of "Refined" Science Aspirations

As illustrated in Table 1, we identified 12 families (predominantly White working-class) in which the child was very enthusiastic about science (and expressed science-related aspirations) but whose families possessed little, if any, science-related capital. While these families were certainly not "anti" science (expressing views that might be characterized as benign or neutral), we termed the child's interest as *raw* and *unrefined*, to capture how their instinctive enthusiasm is being enacted without the formalized support and embedding within the family discussed earlier (in relation to middle-class, science-oriented families). In other words, these were children who described themselves as "really into science" but whose interest is not necessarily threaded through the whole family. For instance, MacTavish (White U.K. boy, Woodstock School) describes himself as "into science," enjoying various science books at home and watching some science children's TV programs. His experimenting was of the Coke/Mentos[3] variety (see Archer et al., 2010), but science was not woven into the family habitus, reflecting a dearth of science capital within families. Indeed, like numerous other children, MacTavish said he had "no idea . . . not a clue" what his family thinks of science.

The difficulty for some working-class parents (particularly those from migrant backgrounds and those who were not fluent in English) to enjoy the resources of time and sufficient cultural knowledge/educational understanding to share and develop their child's science interest was exemplified by Jake (Black African, working-class boy, Metropolitan School) and his mother, Bunmi. While Bunmi explains that she is generally supportive of her son's science interests, she finds it hard to offer further support or reinforcement. She describes how Jake often calls out to her when he's watching science TV programs, asking her to look at what is going on, but feels she lacks the time and interest to join him. Consequently, Jake's self-reported engagement with science (e.g., his self-directed "experiments") out of school appears somewhat sporadic and haphazard.

There appears to be some resonance here with Aschbacher et al. (2010), who described how their "lost potentials" (students who initially described themselves as highly interested in science but who later dropped it) seemed to be influenced by a waning family "pushing" of science ("by high school, less than half reported that family members were still encouraging such activities;" p. 10).

We suggest that such combinations of family habitus and capital (within an albeit benign/neutral family view of science) may provide a rather "poor soil" in which science aspirations may find it difficult to take root and flourish. This point is underlined by Hidi and Renninger (2006), whose four-phase interest model suggests that an initial interest has to be sustained through lines of practice (Azevedo, 2010) if it is to develop and flourish. If there are no lines of potential practice and/or only restricted opportunities available to develop lines of practice, then it risks diminishing/"withering."

"Science as Unthinkable"

Across both the survey and the interviews, the majority of children could not envisage a future career in science for themselves. As discussed earlier, in the survey less than 17% of children could imagine becoming a scientist. In the interviews, 51 children were clear that they did not aspire to a career in science (counting across the three latter categories of ambivalent/"weaker" forms of identification, listed in Table 1). This resounding view was expressed despite children saying that they generally enjoy science at school and undertake some sort of science-related activities at home. Here, we discuss our understanding of the relationship between family habitus, capital, and child's interest in/identifications with science, suggesting that where there is an absence of strong family identification with science, this can produce a formidable barrier to potential future science participation, even among well-resourced middle-class families. Moreover, we suggest that the limits of possibility are even more constrained for working-class families, where the interplay of family habitus and the unequal distribution of both generic and science-specific capital in society means that for a sizeable proportion of working-class families and children, science is simply an "unthinkable" aspiration.

The first of these points is illustrated by the cases of Tom and Gus, both White middle-class boys from the independent Carver Boys' School. Both boys are high achievers (across the board), enjoy science, have some science capital within their families, and think that their teachers are excellent. Yet, as Tom says, "I just can't really picture myself being a scientist." For both boys, their aspirations appear to align with a family habitus that identifies strongly with "the arts" (which are constructed as dichotomous to "science"). As Tom's mother, Terri, explains, "We know more arts people than science people." Likewise, Gus relates his ambition to become a journalist within a family narrative of being "creative" in both the past and present (his grandparents were authors). In this respect, we suggest that the absence of discourse around or about science embedded within family habitus (and its construction as distinct from "the arts") can contribute substantially to these children coming to regard science as "interesting but not for me." However, as we shall now discuss, the consequences and potential mutability of this perception may "weigh" differently for those (predominantly working-class) children who lack Tom and Gus's privilege and their likely continued accrual of science-related social and cultural capital (e.g., high achievement in national science examinations).

In our sample, the majority of children who did not express science aspirations came from working-class backgrounds. These children tended to articulate the sentiment that while they enjoy "doing" science, they cannot envisage pursuing a career in science (i.e., they were "interested, *but* . . .").[4] They all enjoyed science and engaged with it for pleasure in their spare time. They also tended to have some notional science-related capital at home, with most families having a parent or extended family member who "enjoys" science and finds it interesting. However, this tended to manifest as a benign interest, with less "exchange-value" (i.e., less capacity to capitalize on resources and translate them across social fields to generate advantage), as compared to the middle-class families discussed earlier. Moreover, this interest was not embedded either materially or discursively within (and hence was not actively woven into) the family habitus.

For instance, Hedgehog (White U.K. working-class boy, Woodstock School) described how he loved researching space and NASA in his spare time ("I'm a bit of a space fan . . . I've got books and DVDs and everything."). He occasionally did experiments at home and watched various children's science TV programs and sometimes looked up science-related topics on the Internet. But he was also adamant that "I'm not really, really into science, but yeah, I do like it." He did not seem to have any particular science capital within his family, and there was no strong scientific "habitus" at home ("I've never really heard [parents] them say anything about science."). His interests also did not impinge onto his ideas for the future, reflecting the being/doing divide ("I don't know. I'm into science, but I don't think I'd ever become a science teacher, well you know science, scientist.").

Analysis of the survey data indicates that lower (low and very low) cultural capital is negatively associated with science aspirations. In the interviews, a sizeable proportion of working-class children reported a lack of science-related capitals and family habitus and expressed lower personal interest in science (Table 1, n = 23). We characterized science as marginal or *peripheral* to their everyday lives. Moreover, this grouping predominantly comprised working-class White and Black families (with Black families being disproportionately overrepresented), underlining the intersection of social inequalities in the uneven distribution of capital.

It is important to note that these families did not lack interest per se—they certainly were not negative about science. Science was more defined through its absence than its presence, being very weakly woven into children's home lives with little supporting science capital and a marked lack of out-of-school science activities. In other words, science was simply not a part of the daily family "fabric" (habitus) of these children's lives, which rendered it "unthinkable" as part of their imagined future lives. As Jane2, the mother of Dave (White working-class boy, Forest Primary School), explained, "I suppose in everyday life you don't get that much really to do with it [science] now." Likewise, Robyn (mother of Charlie, a White, U.K. girl, Forest Primary) agreed that her daughter does not really have much interest in science, which Robyn feels reflects her own lack of any real interest in science ("I don't think that any of us are really that . . . [sciencey].").

Many of these families *do* go to museums and watch some science-related TV programs, but they do so "generically" and/or sporadically. They do not weave these activities into an active science interest or promotion of science and often lack forms of science "capital" (e.g., specialist knowledge, qualifications, interest, social connections). Moreover, working-class parents and children were more likely to describe parental practices exemplified by the "accomplishment of natural growth" (Lareau, 2003) in which children's pastimes and aspirations were described as children's personal choices and interests (rather than being steered or "pushed") and were not embedded within an intensive, future-oriented family project of "development." As Shelly (White, working-class mother, Forest School) said of daughter, Connie, "I just want her to be happy really and to achieve as much as she can."

The combination of a lack of science capital and the absence of science within the family habitus was evident in many interviews. However, this did not equate with a "poverty of aspirations" or a lack of valuing of education among the families (as often assumed with U.K. education policy literature; see Archer & Francis, 2007). For instance, Victoria1 (White U.K. girl, Forest Primary School) and her father reported very little science interest/engagement within the family. Victoria watched only the occasional science-related TV program, never visited museums, and could not recall any science-related topics of conversation within the family. Her father, James, agrees that there is very little interest in science at home, but both he and Victoria agreed that they are generally supportive of her education and interested to talk to her about what she has learned at school. Like a number of other parents (echoing observations by Reiss, 2001), James described his own experience of science at school as "appalling . . . terrible," which contributed to a lack of both scientific interest and knowledge and marginalized science within the family habitus.

A lack of economic capital also mitigated against the integration of science within the family habitus, as for some families on lower incomes, or comprising lone parents, the costs of going to museums and so on were cited as prohibitive (e.g., see Shelly, mother of Connie, White working-class girl, Forest Primary School).

In other words, the extent to which science is "thinkable" and can be practically supported and encouraged within families through cultural, economic, and social capital is not spread randomly across the population: It is structured by social inequalities.

Perhaps encouragingly, we only identified a handful of students who claim to be very disinterested or disengaged from science. All three are White, working-class girls. Louise (Woodstock School) claimed to have no interest in science at all—she watched no science-related TV (being "bored" by all the science programs), conducted no experiments, and had only ever been on one trip to a museum ("once, like ages ago"). She also described her family as not really interested, saying, "I've never asked them . . . I don't think, just I don't think they really like subjects." Likewise, Lucy and Heather (both Midlands School) described being bored by science at school and did not engage in any science-related activities at home. Neither had any science social capital in their families and neither really knew what their families thought about science (Lucy felt that her mum "hasn't got much to do with science," and Heather said "I don't know about my mum and dad. I've never really asked them about science.").

While these girls were in the minority of our qualitative sample of 92 children, their accounts do contain echoes of themes that are discussed within the wider literature around girls/women and science. In particular, if "science" continues to be dominantly configured as the domain of the "old, White, middle-class male" (e.g., Carlone, 2004), then it is perhaps inevitable that those who appear to be among those most alienated from it will be working-class girls. Constraints of space do not allow for a full discussion of the ways in which discourses of femininity were implicated in making science "unthinkable" for (especially working-class) girls in our sample, but this is the subject of forthcoming work.

Discussion/Conclusion

This article has sought to augment existing knowledge of how, and why, families influence the development of children's aspirations through a detailed analysis of how capital and habitus can interact to render science a "thinkable" (conceivable or inconceivable) aspiration among a sample of 160 parents and 10- to 11-year-old children. Within this, we have also made a case for conceptualizing children's aspirations and attitudes to science as complex and socially embedded (and constructed) phenomena—our analyses indicate that aspirations are not simply individual cognitions residing within children's heads, unaffected by their social contexts. Rather, children's aspirations and views of science careers are formed within families, and these families play an important, albeit complex, role in shaping the boundaries and nature of what children can conceive of as possible and desirable and the likelihood of their being able to achieve these aspirations.

We employed the concept of family habitus as a tool to try to make sense of some of the ways in which families contribute to the formation of children's aspirations and their perceived "limits of possibility." We began by putting forward an argument for treating habitus in collective terms, suggesting that "because there are classes of experience there are also classes of habitus" (Reay, 2004, p. 434). Bourdieu considers the family to play a pivotal role in early childhood socialization; consequently, we envisaged that family habitus might prove an apt tool for analyzing data from 10 to 11 year olds and their parents, where we might expect a child's immature habitus to be highly influenced by family context.

Our analyses highlighted the importance of social class in facilitating or constraining children's potential science aspirations and identifications, even though the overwhelming majority of children in our sample reported liking science. The concept of family habitus sensitized us to not only the economic dimension of class inequalities but also the role of class cultural resources and practices within families, and the ways in which these can profoundly shape children's potential identifications with science. It highlighted the power of family practices, as "inequality permeates the fabric of the culture . . . [such that] key elements of family life cohere to form a cultural logic of child rearing" (Lareau, 2007, p. 117).

Family habitus enabled us to explain how broadly classed patterns of family relationships with science (in which it is experienced as either "thinkable/natural" or "unthinkable/unusual") relate to the distribution of particular types of capital and the ways, and extent to which, such capital is deployed within the family life. In particular, we identified the important interplay between the availability of capital (both generic and science specific) and the "unthinking" and taken-for-granted aspects of family life (e.g., everyday practices), which shape the ways children start to formulate their own aspirations and identifications with science.

We found that where middle-class family habitus, capital, and a child's identification with science were in alignment in favor of science, the result was particularly powerful, with families able to foster and capitalize on their child's interest, enabling them to occupy a strong and privileged position from which to potentially pursue these aspirations further. Science appeared as a "natural" choice within such families—albeit one that is actively nurtured and resourced. Even where such families lacked science-specific capital, they were able to mobilize generic middle-class resources to develop and support their children's interest in science. Our analysis also highlighted the intersection with ethnic/cultural discourses that (where configured as valuing science as a usual and appropriate aspirational route) further promoted and supported children's science aspirations.

In contrast, we found that within most working-class families, science was less "familiar," being more "peripheral" to parents' and children's everyday lives. These families tended not to possess the same quantity and quality of economic and science-related capital (cultural and social capital) to provide an equivalent basis for supporting the development of children's science-related aspirations. For example, where children were very keen on science and expressed a science aspiration, this interest was pursued individually, rather than as a family project (it was "raw"/"unrefined"). Moreover, where families also engaged in practices characterized by "the accomplishment of natural growth" (Lareau, 2003), they were less likely to actively "push" their children's aspirations in specific directions. Although some working-class minority ethnic families were able to draw on cultural discourses (of science as a desirable/appropriate career aspiration) that encouraged and supported science aspirations among children, these aspirations were still circumscribed to some extent by a lack of wider capital.

Despite these clearly classed patterns, our analyses also highlighted the nondeterministic nature of habitus, with examples of children "going against the grain" (Reay, Crozier, & Clayton, 2010) of home expectations. This agency worked both ways, with some children resisting a strong science "steer" from home and others proactively "choosing" science despite little awareness or science resources at home. However, we suggest that the interplay of family capital and habitus—while by no means deterministic—does provide a powerful structuring context that influences how children formulate their aspirations (informing what is considered thinkable and desirable) and the likelihood of their being able to pursue particular routes successfully:

> While the habitus allows for individual agency it also predisposes individuals towards certain ways of behaving. . . . As a result, the most improbable practices are rejected as unthinkable, but, concomitantly, only a limited range of practices are possible. (Reay, 2004, p. 433)

Hence, we suggest that even at the age of 10/11, many working-class children are *already* disadvantaged and at risk of falling out of the "leaky pipeline" that leads to a science career (Tai et al., 2006), even if they enjoy science. That is, the "starting grid" in the "race" for high status future careers in science is already highly staggered, with the interplay of family habitus and capital playing a key role in generating, exaggerating, or compensating for different starting positions.

In conclusion, we suggest that there is an urgent need to address the disparity in the societal distribution of science capital. More needs to be done within STEM participation policies to make science a "thinkable" career option for all; otherwise, we predict that careers in science will remain the preserve of the middle classes. Moreover, with the diminishing scientific and technological base within Anglo-Saxon and European societies, fewer and fewer families may be able to provide a context with the intrinsic cultural capital necessary to foster an interest in science—and while a concern for all, this will be most pronounced among disadvantaged communities.

This is, of course, no easy task. Our research suggests two potential avenues: First, the science education community might usefully further develop its work with families, particularly those from more socially disadvantaged backgrounds, to increase their access to science-related knowledge, resources, and social capital. As our research has shown, families provide an important context within which young people develop (and pursue or abandon) particular aspirations, with the interaction between family habitus and capital being particularly crucial. Increasing science capital and supporting families to see science as a "conceivable" and potentially desirable career option could provide a useful impetus and/or pillar of support for any nascent interest in science among these children. Second, it would appear important to increase both children's and parents' knowledge of the wide variety of careers from science (that is, how science qualifications can be useful for a diverse range of careers). This might not only be achieved through direct work with families but also (and perhaps more expediently) by embedding an awareness of careers from science into the school science curriculum. Based on our study findings, we suggest that this should begin during elementary school (and continue to be woven through high school). In this case, we would agree that science education needs to do more to highlight the exchange value of science qualifications for future employment (Adamuti-Tranche & Andres, 2008; Lyons & Quinn, 2010). The omission of any exploration of the value of career pathways (both within and without science) enabled by science qualifications seems at best puzzling and at worst perverse. Puzzling because it indicates a failure by science education to exploit a key factor that often motivates students to pursue and sustain their study of a subject that is commonly seen as difficult (Osborne et al., 2003). Perverse because the absence of any discussion of the possible careers offered by science fails to exploit an opportunity that education has to remediate the inequities in capital revealed by this study by providing students with important elements of cultural capital. Thus, the obligatory provision of such an awareness within the curriculum might enable more students to see science as a "thinkable" career option.

Notes

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[1]Over 10,000 students completed the questionnaire between October and December 2009 (Survey 2 in Autumn 2011 and Survey 3 in Autumn 2012). Following data cleansing (including removal of students who were not actually in Year 6 from the sample), 9,319 students remained in the sample for analysis. Students from 279 schools completed the survey. This sample represented all regions of the country and was roughly proportional to the overall national distribution of schools in England by attainment and proportion of students eligible for free school meals. In all, 248 state schools and 31 independent schools participated in the survey. Of the students who completed the survey there were: 50.6% boys, 49.3% girls; 846 (9.1%) in private schools, 8,473 (90.9%) in state schools; 74.9% White, 8.9% Asian (Indian, Pakistani, Bangladeshi heritage), 7.5% Black (Black African, Black Caribbean), 1.4% Far Eastern, 7.8% mixed or other. Because the study focuses in part on the impact of ethnicity

on students' aspirations, schools with higher populations of ethnic minority students were deliberately overrecruited to ensure sufficient numbers for analysis. The survey itself covered topics such as: aspirations in science, attitudes toward school science, self-concept in science, images of scientists, participation in science-related activities outside of school, parental expectations, parental school involvement, parental attitudes toward science, and peer attitudes toward school and toward school science.

[2]Kate Humble is a very popular television presenter in the United Kingdom, fronting a range of science and wildlife programs.

[3]A fun experiment that is popular among children, in which mint sweets (e.g., Mentos) are put into a bottle of fizzy Cola drink, resulting in a spectacular eruption.

[4]As we have written elsewhere (DeWitt et al., 2011), this lack of interest in becoming a scientist emerged strongly in our separate qualitative pilot sample of London primary school children, who expressed an interest in science but who stated that they did not want to become scientists in the future (and is borne out by the main survey data).

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