‘Science is not for me?': exploring children’s and families’ engagement with science through the lens of identity

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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; Sjobeg & 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 UK, research has shown that the point of decline begins in the final year of elementary school (Murphy & Beggs, 2005).

Further recent evidence that children’s life-world experiences prior to 14 are the major determinant of any decision to pursue the study of science comes from a survey by OPM for the Royal Society (2006) of 1141 science, engineering and technology (SET) practitioners’ reasons for pursuing scientific careers. It found that just over a quarter of respondents (28%) first started thinking about a career in science, technology, engineering and mathematics (STEM) before the age of 11 and a further third (35%) between the ages of 12-14. Likewise, a small-scale longitudinal study that followed 70 Swedish students from Grade 7 (age 12) to grade 11 (age 16) (Lindahl, 2007) found that their career aspirations and interest in science were largely formed by age 13. Lindahl concluded that engaging older children in science would become progressively harder.

Such data demonstrates 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. Thus, we would contend that effort could be productively expended by: (a) understanding what are the formative influences on student career aspirations between the ages of 10 and 14; and (b) attempting to foster and maximize the interest of this cohort of young people in STEM-related careers.
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 2009; Ferry et al., 2000; Gilmartin et al., 2006; Stake 2006). For instance, Gilmartin et al’s survey of 1,126 10th grade students in Southern California argues that ‘overall findings suggest that family science orientation is strongly related to interest in becoming a physical scientist or engineer … regardless of gender, which 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 recognised that, whilst families are highly influential on science attitudes and participation, this relationship is complex (Atherton et al 2009). For instance, different patterns of participation and engagement with science have been noted in relation to different ethnic groups (e.g. Huang et al 2000). The research by Gilmartin et al (2006) also suggests that family influence may work in different ways for different ethnic groups, being stronger and with clearer messages in Latino and Asian families as compared to White and African American families.

Aschbacher, Li & Roth (2009) report that Asian American parents ‘stood out’ as providing ‘strong expectations and support for SEM careers in particular, which students said their parents viewed as offering desirable status, remuneration and stability’ (p.13). However, focus group and interview-based research conducted in the UK by the Institute of Physics and Royal Society of Chemistry (2008) on minority ethnic subject choices found that family influences were only identified as a ‘medium-influence’ factor by respondents. As noted by Gilmartin et al, the IoP/RSC research found that the influence of families varied between ethnic groups, being stronger for the UK Bangladeshi and Pakistani interviewees than for other ethnic groups. In particular, Pakistani and Indian interviewees were more likely than other groups to be steered away from physics and chemistry careers due to family members interest in more applied professions (such as medicine and pharmacy). In contrast to the US research, this UK study suggested that family influence was weakest for British Chinese students (although other UK research specifically on British Chinese pupils and their families suggests that family cultural
discourses play a very powerful role in shaping children’s expectations and aspirations, Archer & Francis 2007).

Numerous studies have looked at the role of the family in relation to the gender gap in science and engineering participation (e.g. Dick & Rallis 1991; Eccles 1993; Frome & Eccles 1998; Manis et al 1989, Tenenbaum & Leaper 2003, amongst others). For instance, Tenenbaum & Leaper found that parents were more likely to think that science is difficult for their daughters than was found in the case of sons.

Social class also plays a fundamental role in shaping children’s aspirations and educational engagement. The Royal Society SES and Science Education Report (2008) points to differences in science participation across social class and suggests that ‘parental educational involvement in their children’s education may be key influences on young people’s achievement’ (p.6) and that ‘parents living in areas of deprivation are more likely to perceive SES as a barrier to achievement in science […] and that patterns of discouragement and engagement among parents may be replicated among their children’s generation’ (p.6).

The analysis undertaken by Aschbacher, Li & Roth (2009) also shows that persistence in science (as either a high or low achiever) is strongly shaped by SES, with higher achievers tending to come from more affluent families with strong science social capital (e.g. family members in science-related professions) and a range of economic, social and cultural resources to draw on to support achievement. In contrast, they found that lower achievers had fewer SEM role models (other than in nursing) and often had little knowledge about science-related careers.

**Theoretical Lens**

In light of the above, the present paper seeks to contribute to existing work through an exploratory mapping of how families might shape the development (or curtailing) of students’ science interests, aspirations and engagement, paying particular attention to the patterns across ‘race’/ethnicity, gender and social class. The theoretical lens adopted brings together a conceptualisation of identity (e.g. Archer et al., 2010) with Bourdieu’s concepts of _habitus_ and capitals (economic, cultural, social and symbolic). The approach proposed here treats personal identity as a social phenomenon – constructed through
social structural relations across and within a variety of contexts (fields), such as the family.

Habitus has been proposed as a tool for understanding how the individual is socially constituted (being produced through their structural location). It evokes an inner core, or internal matrix, of dispositions which shape how the individual understands and makes sense of the social world. Habitus is inflected by the past and provides a framework for guiding future actions. It is inflected by ‘race’, social class and gender and shapes what is perceived as possible and as desirable, providing a practical ‘feel’ for the world, shaping ways of thinking, feeling and being (e.g. taken-for-granted notions of ‘who we are’, and ‘what we do’/ what is ‘usual’ for ‘us’).

Habitus is generally used in relation to the individual but the concept is extended here as a conceptual tool for exploring the family environment (or micro-climate, Aschbacher et al 2009) within which young children are growing up and starting to develop their ideas about science and their relationships (and dis/identification) with science. The notion of the ‘family habitus’ is used to refer to the milieu and context within which family’s operate – it seeks to go beyond simple conscious forms of identification with science (e.g. attitudes to / liking of science) to also encompass values and everyday practices. In this paper, the notion of ‘family (science) habitus’ is being deployed as a tool to examine the extent to which families construct a collective relationship with science sense through their everyday attitudes and practices and the extent to which this is shaped by their possession of particular sorts of economic, social and cultural capital. In particular, I attempt to explore the extent to which science is ‘woven’ into conscious and unconscious family life (or not).

In some ways, this conceptualisation of ‘family habitus’ echoes the notion of ‘institutional habitus’ that has been deployed in relation to contexts such as schools, universities etc (Reay 1998; Reay et al 2005), yet it also differs in key respects. Notably, it seeks to provide a ‘meso’ level between the micro (individual) habitus and the macro (formal) institutional habitus. It is inflected be social structures yet is also productive and transformative and seeks to understand the interface between structure and agency.
The notion of ‘family habitus’ is occasionally used in academic work conducted from a Bourdieuan framework e.g. Thomas 2001), but tends to be done in passing and is hence undertheorised (c.f. attempts to develop it by Tomanović, S. (2004) Habitus as the Cultural Context for Childhood, *Childhood*, vol. 11 no. 3: 339-360). Hence it is used tentatively and is deployed in an exploratory fashion alongside the notions of individual identity. The choice to explore its utility here as a conceptual tool is based on the capacity for ‘habitus’ to also include practices (not just ‘identifications’) and so is preferred to the notion of ‘family identity’. In other words, I am trying to situate and contextualise individual child and parent identities (and orientations to science) within the family context – to examine 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.

**The Study**

The ASPIRES project is funded by the ESRC as part of its Targeted Initiative on Science and Mathematics Education. It is a 5 year, longitudinal survey exploring science aspirations and engagement among 10-14 year olds. It comprises a quantitative online survey has been administered to a national sample of over 9000 10-year-old students, (who will be tracked and surveyed again at ages 12 and 14) and in-depth qualitative interviews with pupils (age 10) and their parents (who will also be tracked and re-interviewed at ages 12 and 14). This paper is based on ongoing analysis of the qualitative dataset, which comprises 187 interviews with parents and children drawn from 10 schools across the south/ east and midlands. I make reference to some of the survey analyses, but the primary focus is on the qualitative data (given that Jen has already covered survey in detail in her paper in this symposium, DeWitt 2010).

This paper draws on 73 of the 183 interviews with parents and their children (40 pupils and 33 parents) who were drawn from the larger sample, of Year 6 pupils and their parents. They were recruited from 10 primary schools in England, which were selected in order to cover a range of social/economic contexts, including multiethnic urban, suburban and rural and ‘working class’, ‘middle-class’ school populations. 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.
This paper provides an initial mapping of family relationships to science. It attempts to relate children’s identifications with science and their aspirations to their family contexts, seeking to examine the extent to which family habitus and possession of particular capitals can play a role in shaping (facilitating or curtailing) children’s potential identification and engagement with science. In other words, the paper asks how might we understand the relationship and nature of influence between the family context (and the family’s capitals and resources and sense of itself – ‘who we are’, its taken for granted practices, values etc) and the child’s developing ‘science identity’ (ie the extent to which they like, participate in and identify/align themselves in relation to ‘science’).

In a sense, the title of the paper (‘science is not for me’) is misleading – most children in the study reported enjoying doing science to some extent. The issue, as we have written elsewhere (Archer et al., 2010) – and as Jen has already discussed in her paper - was that this interest in ‘doing’ did not often readily translate into ‘being’ (wanting to pursue a science-related career).

**Mapping the Family’s *Scientific Habitus***

Analysis of the survey data suggests that parental attitudes to science exert an influence on children’s science aspirations. Indeed, parental attitudes to science and experiences of school science were the two variables that had the strongest relationship with students’ aspirations in science, with positive parental attitudes were associated with stronger aspirations in science. 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 towards science.

Moreover, parental attitudes to science were found to be more influential on children’s science aspirations than general parental involvement in child’s schooling or general parental aspirations. Indeed, the survey data suggest that whilst a family’s social structural locations is important (e.g. their social class, ethnicity, etc) family attitudes to science and their encouragement and fostering (or not) of science in their everyday family life seem to be *more* important.
In this paper I hope to explore this further through the notion of a family’s ‘scientific habitus’. That is, the extent to which a family’s liking and practising of science is embedded (‘woven’) into family life, their everyday lives and sense of self. E.g. doing science-related activities in spare time, the extent to which an interest in science is embedded in a family’s conscious and unconscious daily lives and their sense of self; as constituted (for instance) through pastimes, activities, leisure consumption, family practices (e.g. TV, books, topics of conversation) and in/through its social networks – and how all of this shapes/feeds into what becomes ‘thinkable’ and ‘desirable’ (especially in terms of aspirations).

In the survey, we found that just under a quarter (23.4%) of the sample said that they ‘never’ do any science-related activities outside of school, whereas just under 20% (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 never visit a museum or zoo (18.9%) and never watch a science related TV programme (18.8%) [cf. 35.5% who do so once a week - TV being the most widely cited ‘frequent’ science-related activity]. Multilevel modelling 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 gender, ethnicity and cultural capital. However, the relationship between these social structural variables was not straightforward and, indeed, aspirations in science and attitudes toward school science are more closely related to participation in science-related activities than are social structural variables.

In addition, multilevel modelling analyses revealed a range of variables that explained a significant amount of the variance in students’ aspirations in science, which included gender, ethnicity and cultural capital, but again, this relationship was not straightforward. Moreover, 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 these social structural variables, further suggesting that the relationship between gender, ethnicity and social class and aspirations is quite nuanced and complex.
In this paper, I draw on the qualitative data to help further flesh out the detail and complexity of identity and family context and relationships to science, with a view to trying to understand how children’s science identities might be fostered or curtailed. The data are interrogated to explore the range of relationships that families describe having in relationship to science and their practice (or not) of science-related activities.

The codings that have been developed (iteratively) from the qualitative data so far are:

**Strong/ ‘pro-science’ family contexts & identities:**
- ‘Science Families’: Families in which science is strongly embedded with pro-science child (N=8, mostly white and South Asian upper middle/middle class)
- ‘Pushing Science’ Families: Strong family science interest/capital, lesser child interest (N=5) (mostly white girls)
- ‘Doing it for the Kids’: Families with no pre-existing science interest but who have taken up science and embedded it in the family to support strong child interest (N=2)

**Ambivalent family contexts & science identities**
- ‘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
- ‘Pragmatic persisters’: child has no particular interest in science but a plan to continue with it in order to actualise a particular aspiration
- ‘Unrefined Interest’: an enthusiastic child with a high personal interest in science but whose family has low science capital and/or interest (mostly white UK and lower m/c/working class)

**‘Weaker’ science identities and family relationships to science**
- ‘Science as Peripheral’: Families and children with some interest in science but it is weakly embedded and weakly supported by capitals (N=13, 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)
These are now addressed in turn.

1. Strong/ ‘pro-science’ family contexts & identities:

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 whereas 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, with the ‘strongly embedded’ pattern being found exclusively among middle (N=4) and upper middle class (N=3) families. The survey also found that students from more well-to-do backgrounds (parents in professional occupations, with higher levels of cultural capital, attending private schools) report more positive parental attitudes to science – again, this was certainly borne out in our qualitative sample, with the independent girls school (Austen) families and children all being extremely pro-science.

The qualitative analysis so far indicates that the strongly embedded families are exclusively middle-class and are mostly white (N=5) or South Asian (N=2 + 1 Asian/White mixed heritage).

Within these families within which science is strongly embedded, three different ‘types’ of family have so far been identified: ‘science families’, ‘pushing science’ families and ‘doing it for the kids’ families, reflecting the extent to which science was a pre-existing (often generational) interest and source of identity within the family versus being a more recent interest which has been taken up and ‘woven’ into (embedded within) family life, (often in response to the child’s interest) and according to the extent to which the child themselves is engaged/identifies with science.

1.1 Science Families: ‘science is in our blood’

‘Science families’ often described how an interest in science permeated not only the nuclear but the extended family. It often went back through generations of the family, many of whom tended to have had careers in science-related fields (e.g. grandparents in
science-related careers) and science was embedded within family identity, being evoked as ‘what we do’ and related to the sense of ‘who we are. On an everyday level, 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 in 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 were also notably ‘on board’ and often expressed interests of their own.

For example, Hannah is a middle-class, White British girl who attends Austen School (independent girls 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: For instance, “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 programs 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 discuss and debate media coverage of science-related issues. This interest has also shaped their educational decision making. Maddison explains that they chose Austen school on the basis that it is “strong at science” and deliberately sought out a school with a strong science department and excellent facilities and teachers.

The strong embedding of science within the family ‘habitus’ seems to have been taken up by Hannah too, who is developing a strong science identity and aspires to be a chemist. This embeddedness is also exemplified (and contributed to) by Hannah’s older brother, whom Hannah ‘hero worships’ (in Maddison’s words) and is studying for an MSc 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’. At home she watches ‘all’ the science childrens TV programmes and the Discovery Channel (her parents regulate TV viewing for their children and push the Discovery channel above others).
Whilst all the strongly embedded families were middle-class, it was not limited to the independent sector or to White British families. 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 programmes about space (which he watches with his father) and, whilst he watches them, he finds 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 (describing one time how “at 2 O’clock in the morning I was about to fall asleep and he goes come here, I want you to watch this science program”). His mother “She still keeps a little bit of interest, but not as much as my dad”. But science is a regular topic of interest and discussion within the nuclear and extended family (who “talk a lot about science”). He has science social capital within his extended family too, in the form of his uncle who works at a space centre and a (female) cousin who is also really into science.

Like other families, Kaka (British Muslim Pakistani boy, Metropolitan school) has a father who is very interested in science and who actively seeks to foster and increase his son’s interest through the toys and activities that they present to their children. Kaka’s dad, Jack, describes his ‘love’ of physics and chemistry and his active ‘pushing’ of Kaka’s interest through buying science and electronics sets, and so on, which he hopes 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, because I really think that, um, when he gets into this stuff he’ll actually enjoy it, because he’s got that type of mind I think… But yeah, so hopefully yeah, we’ll actually push him into that”). This strong promoting of science was taken up by Kaka himself, who explained “I really, really love like science but I want to get better at science, so that’s why I want to become a scientist”.

Science was also notably woven into family relationships too. For instance, Isobel is the mother of Georgia (White British middle-class girl, South Coast School). She described how Georgia and her dad 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 and so on). Georgia also has a subscription to a children’s science magazine which she reads avidly. Isobel describes the time the two spend
together in this way as deeply meaningful – its “their special time together”. Notably their engagement in science-related activities is also educationally orientated i.e. it translates into educational capital through the introduction of an ‘academic’ angle, for instance, following up areas of interest in reference books. As Isobel explains, “… because he’s into all that, that’s their little time, you know? And so she knows if she talks to daddy about ‘wow, daddy what patterns that’, or whatever, he’ll be ‘oh well let’s go and get the book out and we’ll have a look’

This 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 science identities to thrive. As Aschbacher, Li & Roth (2009: 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, becoming High Achieving Persisters, 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 tend to also have positive attitudes about school science and stronger aspirations in science.

1.2 ‘Pushing Science’ Families (high parental interest and familial scientific family habitus, lower level of interest from child)

We have also identified five children so far who seem to have a strong science push from their parents which perhaps outweighs their own interest. So far, all these pupils are girls – although it remains to be seen as to whether this is a trend or a coincidence.

For instance, Vanessa (a Black African girl at Metropolitan School) is strongly pushed towards science by her father (Robbie), who has a degree in pharmaceutical science and is a science technician in a local secondary school. Venessa describes herself as ‘okay with science’ but sometimes finds it boring. She aspires to become a doctor, which she recognises is related to science, but her aspiration is not driven from a love of science.
She describes the strong science push she gets from home, “because my dad’s a scientist he would like me to get a bit interested in science.”. She talks about how his interest in science is exemplified by his “job and the clothes he’s got for science. He gets this long thing, some glasses and he seems to buy quite a lot of science things for me as well”. She has a microscope which she likes to use to look at blood and dad, Robbie, explains how he tries to build in science-related play and activities with an educational element 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”)

Vanessa watches some science TV programmes and science-related items on the news. The extended family scientific habitus is further reinforced by her auntie (with whom she explores chemicals and materials: “It’s kind of easy, she wants me to learn”) and her cultural background (“actually some African people like science a bit more, because science in Africa seems to be what’s more money getting”). Whereas Robbie describes himself as “I am 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.

1.3 ‘Doing it for the kids’ Families: Families weave child’s interest into family life and become more science engaged/ expert as a result

The final broad discursive demarcation identified among families with a strong embedding of science, was those families who did not necessarily have a strong pre-existing identification with science but who had woven a child’s interest in science into family life and who had collectively become 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 long-standing dream of becoming an astronaut. This seemed to have been sparked by a pivotal school trip a couple of years previously but has continued to cement and grow into a distinct sense of identity. Luna’s family are a bohemian, ‘artsy’ family with no pre-existing 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, not just at the individual level (supporting Luna to have science related toys, books and activities), but also by weaving this interest into everyday family conversations and practices (e.g. collective TV viewing).
Of course from a Bourdieuan perspective it is perhaps unsurprising that all the families in the ‘strongly embedded’ category are (so far) from middle-class backgrounds. The middle-classes are more likely to enjoy the material (economic) resources and the cultural knowledge and artefacts to facilitate and encourage a range of science-related activities (and are the most likely to espouse a set of values which advocates actively nurturing children in this way – see Lareau 2006). However, I would suggest that it is actually the specific scientific aspect which is embedded within these families that is critical to their fostering of their children’s interest and engagement with science – the success of which is enabled by their social class.

Moreover, a strong family embedding of science does not always translate into a highly engaged child who takes up a strong science identity, as hinted at by the ‘pushing science’ families.

2. Ambivalent contexts

2.1 ‘Interested but….’/ ‘Doing not being’

So far 10 children seem to fit this category, mostly lower middle-class and working class, spread by gender and ethnicity. These children all enjoyed science and engaged with it for pleasure in their spare time. They also all tended to have some sort of science-related capitals at home, with most families having a parent or extended family member who ‘enjoys’ science and finds it interesting. However this seems to be more of a benign interest (rather than the stronger pushing and embedding within families in the preceding section). Notably, however these children had all already ruled out science from their (anticipated) future aspirations (they are interested, but...). As we have written elsewhere (Archer et al 2010), this 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).

For instance, Indiana (White UK boy, Woodstock School) said that whilst he was interested in studying science further it did not form any part of his current aspirations
(which were all sports related). As he explained, “I’m not really, really into science and I’m not into science, I’m sort of in between”. He described how in his family there was some interest in science, especially among male family members (‘a couple of them really enjoy science. My uncle and my other uncle - and my dad sometimes enjoys it if he gets fascinated and gets hooked into it, but otherwise it’s not really anyone who’s interested in it”). Indiana explained “Because one of my uncles studied it at university I think and my other uncle just like is fascinated about the mould and the disgusting things”. But he continued “no one in our street seems particularly interested in science”.

Similarly Hedgehog (White UK 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 programmes 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. [Int: Any particular reason why not or …?] No, I don’t know it’s just that there’s some people who are really into it and you know want to be it, but like there are some people who are into it, but you know they don’t want to be a scientist”).

For some, the being/doing distinction seemed to reflect stereotypical images of scientists. E.g. Victoria2 (White Eastern European, working-class girl, Metropolitan Primary School) was obviously interested in science and did a lot of science-related activities in her spare time. She had lots of science books at home that she loved reading, she went to science museums, watched science TV programmes and had even been to a science Saturday school. She explained that her father was interested in science (“my dad, especially, he thinks Science is cool cos he used to study Science … and he says it used to be very interesting but at the same time, kind of boring because it’s like the hours”). However, she did not envisage continuing with science in the future “cos most scientists wear glasses and I don’t want to wear glasses and they’re a bit brainy and I don’t want to be brainy”).
For others, the ‘pull’ from other identities simply outweighed their own (and their family’s) interest and engagement with science. Eg. Tom (white, middle class boy, Calvin Stagg School) and his mum Katie – Tom being produced within the family as an ‘artistic’ child (Archer 2010).

2.2 Pragmatic Persisters

In contrast, we have also identified some cases in which an ambivalent (or ‘middling’) relationship to science within children and their families might be (potentially) outweighed by a pragmatic aspiration for a science-related (often medical) career. There was no particular home science capital or embedding of science within these families but there was a strong family/cultural discourse that advocated science-related jobs as aspirational career routes. This was found 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. Whilst 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 think that science is “OK” but “they don’t really talk about it”.

Similarly, Jake (Black African, working-class boy, Metropolitan School) describes himself as ‘yes and no’ into science but cites one of his various ambitions (all pushed by mum) as being ‘scientist’. He has tried the odd little experiment at home and looked up the occasional topic on the internet at home after doing an interesting topic in school. He has a biology book (on the body) at home too and watches some children’s science TV programmes. Within the family there is little science social capital and not that much interest per se from mother Bunmi, who says “I don’t have the interest, or maybe back home we don’t have enough equipment for science. And back home is a bit hard, it’s very hard. Physics, Chemistry, it’s really really hard – you just want to drop it”. She describes how Jake often calls out to her when he’s watching science TV programmes to ask her to look at what is going on but says that often doesn’t have enough time or interest to join him.
This is a theme that is taken up by Billy in his paper next (which he terms ‘engagement without interest’ (Wong 2010).

2.3 ‘Unrefined Interest’ (strong child interest, weaker family science capital)

This categorisation (N=6, mostly working-class families) tries to encapsulate the situation of a science-enthusiastic child who is located within a ‘science-neutral’ (or science capital-poor) family context. In this respect, the child’s interest is described as ‘unrefined’ (it is ‘raw’ and instinctive enthusiasm that is being enacted within formalised support of embedding within the family. 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 UK boy, Woodstock school) describes himself as ‘into science’, enjoying “Horrible Science” at home, watching some science children’s TV programmes and owning some science books. His experimenting was of the Coke/ Mentos variety (see Archer et al, 2010) but science was not woven at all into the family habitus. Indeed, like numerous other children, he said he had “no idea… not a clue” what his family think of science.

Similarly, Jack (Black African boy, Metropolitan School) says that he ‘really likes’ science lessons at school and would like to keep studying it in secondary (although its not specifically part of his future aspirations, which are to become a computer games designer or a runner). He has done the Coke & Mentos ‘experiment’ at home with his friends and watches some TV programmes but has no science books at home and no science social capital within his wider family. Describing his parents’ views on science he says “I don’t really know cos I never ask them them questions really […]They never talk about science.”.

There appears to be some resonance here with Aschbacher, Li & Roth (2009), 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:

‘Many students described their initial interest beginning when family members encouraged activities and engagement in science-related activities. However by high school, less than half reported that family members were still encouraging
such activities. Most Lost Potential students said their families were now far more focused on their completing high school and going to college than on science learning, interests or careers. Predominantly mid-SES, parents of Lost Potentials reportedly spoke often to their children about the importance of getting a college degree for a good job. Some offered specific advice, suggesting students should volunteer or join a club to bolster their resumes, but students said they never suggested SEM activities’ (p.10).

In other words, a neutral (albeit benign) family science orientation may provide a rather ‘poor soil’ in which science aspirations may find it difficult to take root and flourish.

3. Science as Weakly Embedded / lower science capital

3.1 ‘Science as Peripheral’

This is the largest category to emerge so far, comprising 18 students. Analysis of the survey data indicates that lower (low and very low) cultural capital is negatively associated with science aspirations – and this group in the qualitative data were predominantly working class and predominantly comprised White and Black families (Black families being disproportionately over represented).

It is important to note that this group did not lack interest per se – they certainly weren’t negative about science. It was more defined through its absence than its presence, being very weakly woven into children’s home lives with a marked lack of out of school science activities. In other words, the categorisation attempts to capture science as an absence rather than a negative relationship – it simply wasn’t a part of the daily family ‘fabric’ as compared to some of the families discussed earlier.

For instance, 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”. Many of these families do go to museums and watch some science-related TV programmes but they do so ‘generically’ and/or sporadically. They do not weave in
these activities to an active science interest or promotion of science, and often lack forms of science ‘capital’ (e.g. specialist knowledge, qualifications, interest, social connections).

For instance, Robyn is the mother of Charlie (a white UK girl, Forest Primary) who describes her daughter as not really having much science interest. Robyn agrees that this reflects her own lack of any real interest in science although the family have been on an outing to one of the science museums in London and will watch some nature programmes on TV. But as Robyn says “I don’t think that any of us are really that…” (science-y).

Likewise, Alan (a mixed race, working class boy from Midlands School) did not engage in any recreational science activities and had not heard of any of the children’s science TV programmes. His mother watches nature programmes and he likes programmes about venomous creatures but the family do not have any science social capital and Alan says he has no idea whether his mother and step father have any interest in science or not.

Finally, Victoria1 (White UK girl, Forest Primary School) seemed to have very little science ‘habitus’ at home at all – watching only the occasional science related TV programme, never visiting museums and not recalling any science-related topics of conversation within the family. However, her parents are generally supportive of her education and interested to talk to her about what she has learned at school. Her father, James, agrees that there is very little interest in science at home but they believe in the importance of supporting Victoria’s learning in general, so would go to a museum if it tied into a particular school topic. James’ own experience of science at school was “appalling … terrible” but equally he has a general appreciation of the potential value of the ‘hard’ sciences as a form of educational capital (i.e. their value in the jobs market).

For some families on lower incomes, or comprising lone parents, the costs of going to museums etc can also be prohibitive (e.g. see Shelly, mother of Connie, white working class girl, Forest Primary School), working to discourage fuller engagement.

The above echo the work of Aschbacher, Li & Roth (2009) who argue that their findings ‘highlight how few adults at home or school enthusiastically invite students to learn
about science or engineering, to value scientific ways of knowing, or to pursue an SEM degree or career’ (p.17).

The above also reflect how parents’ views on science can be shaped by their own experiences of studying science at school (Reiss 2001).

3.2 ‘Science as Irrelevant’ (Disinterested/ disengaged)

So far we have only identified three 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 programmes), conducted no experiments, and only ever having been on one trip to 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. They sort of … my dad must have preferred games, because he’s a football fanatic”.

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”).

Summary
The preceding mapping of the data that has been presented in this paper is graphically summarised as follows: (note some allocations straddle more than one box)
Table 1. Mapping Family Habitus and Relationships to Science

<table>
<thead>
<tr>
<th>Family capitals and relationships to science</th>
<th>High general capitals</th>
<th>Medium general capitals</th>
<th>Low general capitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Child aspiration and engagement</td>
<td>High science capitals/interest</td>
<td>‘Science Families’</td>
<td>‘Pushing Science’ families</td>
</tr>
<tr>
<td>Medium/ Low science capitals/ interest</td>
<td>‘Doing it for the kids’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low science capitals/ interest</td>
<td>‘Unrefined’</td>
<td>‘Doing not being’</td>
<td>‘Science as Peripheral’</td>
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<td>‘Pragmaticpersisters’</td>
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<td></td>
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<td>‘Science as Peripheral’</td>
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Ideas arising for Discussion

- This paper has only put forward some interim (provisional) ideas from ongoing analysis, but I would suggest that we can see some fine grain patterns of engagement emerging even though, as the quantitative data suggests, there is a general interest in school science among most children and families and most families are benign or generally supportive of the idea of their children doing well in science.
• The survey analyses suggested that it would appear that South Asian students report generally more positive parental attitudes to science. There were very few Asian students in our qualitative sample but: Yogi, Indian and Raza (Indian) and Tom (upper class, Pakistani) all exhibited a strong interest and Kaka (British Pakistani) had a stronger parental push. Within the ‘ambivalent’ category, several Sri Lankan girls also pointed to a family support for science, despite their own ambivalent interest.

• Our preliminary qualitative analyses also point to a distribution of students who classified themselves as ‘very into science’ from across different types of family relationship to science (‘science families’; ‘doing it for the kids’; ‘unrefined’ and ‘doing not being’). In our further analyses (and future longitudinal tracking) we would hope to be able to build on the work of Aschbacher, Li & Roth (2009) regarding the factors and circumstances which help foster or provide a pull away from science.

• Whilst the survey showed that children reported generally positive parental support for science, the qualitative data so far suggests that in some circumstances this is due to a more general parental support for children to do well and sometimes parents ‘hiding’ their own (lesser) interest in places in order to support children.

• Tracking in phases 2 and 3 will of course give us the next piece of the jigsaw puzzle and will test out the usefulness of our initial categorisations here.

• We might posit that different forms of engagement would respond to different sorts of intervention. For instance, the ‘Unrefined’ category would appear to be particularly fruitful for targeted intervention to build on the enthusiastic interest and to help it to become more embedded and supported within families. The ‘doing not being’ group might also benefit from interventions to broaden their understandings of careers from science, to build on the existing interest and to disrupt the ‘ruling out’ of science as a career based on often quite narrow conceptualisations of ‘being a scientist’. General scientific literacy work might be
usefully undertaken with the ‘science as peripheral’ group to fill the absence and to further build on the benign view of science.

- A theoretical point that I would like to examine further is to what extent the notion of family ‘habitus’ is useful or tenable in our analyses of children’s interest, engagement and aspirations in science. I am not sure it entirely works because it is based on an individualistic model in Bourdieu’s original conceptualisation. In particular, I would be interested in further exploring and working with the concept of the family ‘fabric’ and the extent to which science is ‘woven’ into it as a more workable concept that habitus, which is quite individualistic in its original formulation.

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