

# **Little fish, big streams: How do early in-class maths 'ability'-groups and early teacher judgements relate to primary school children's later maths self-concept?**

**Tammy Campbell**

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Centre for Analysis of Social Exclusion  
London School of Economics  
Houghton Street  
London WC2A 2AE  
CASE enquiries – tel: 020 7955 6679

## Key findings

- At age 11, **13%** of the children who took part in this research said they were **not good at maths**: **16%** of the 2299 **girls**, and **9%** of the 2164 **boys**.

### *Maths in-class 'ability' grouping*

- **83%** of the children were in-class 'ability'-grouped for maths at age seven.
- **15%** of all girls and boys who were placed in the **bottom** 'ability' group at age seven thought they were **not good at maths at 11**, compared to **7%** of children placed in the **top** group. This is after accounting and controlling for a wide range of factors, including maths cognitive test score at age seven, which proxies maths skills.
- **All boys** placed in the top group at age seven had very **low** chances of negative maths self-concept at age 11 – regardless of their maths skills.
- In contrast, only **high-scoring** girls placed in the highest 'ability' group had **positive** maths self-concept at age 11. Girls with **lower** scores at seven who were placed in the top group were **more** likely to go on to say they were not good at maths.

### ***Teacher judgements of children's maths ability***

- At seven, 43% of the children were judged 'above average' at maths by their teacher, 40% 'average,' and 17% 'below average.'
- **20%** of all girls and boys who were judged '**below average**' by their teacher at age seven thought they were **not good at maths at 11**, compared to **7%** of children judged '**above average**.' Again, this is after accounting and controlling for a range of factors, including maths cognitive test score at age seven.
- **All girls** judged '**below average**' by their teacher at seven were likely to have **negative maths self-concept at 11**, even if they scored high marks on the earlier maths cognitive test.

## Implications for policy and practice

- Maths self-concept is strongly related to [outcomes](#) including learning behaviours, subject choice and specialisms, attainment, and adult careers.
- This research finds that bottom maths 'ability' group placement seems to disadvantage all children, even if they have the same maths scores at seven as high-grouped peers. Meanwhile, top group placement is more advantageous for the self-concept of boys than for girls: it can be negatively related to self-concept for some girls.
- Therefore reforming the use of in-class 'ability' grouping for maths in early primary school could help boost maths progression, and contribute to closing gender gaps.
- At seven, children's skills and self-concepts are rapidly developing. Relegating children to a hierarchy of groupings at this premature stage can alter and shape their educational trajectories.
- This research finds also that teachers' reported judgements of children during early primary school are strongly associated with children's maths self-concept four years later, even when children have the same maths skills to begin with.
- The association between negative teacher judgement and negative maths self-concept is stronger for girls.
- This begs further consideration of and action on the impact of teachers' perceptions and beliefs about children, self-fulfilling prophecies, and pedagogic practices associated with different judgement patterns and styles.

# **Little fish, big streams: How do early in-class maths 'ability'-groups and early teacher judgements relate to primary school children's later maths self-concept?**

## **Introduction**

This research uses data for 4463 children, and their teachers and parents, who are taking part in the UK [Millennium Cohort Study](#) (MCS). This is a national survey following a large group of babies born at the turn of the century. Information is collected over time from families and schools, through methods including interviews, questionnaires, and cognitive tests. The analysis presented in this paper focuses on children who were living in England at age seven.

When the children were [seven](#) (and before that, at ages nine months, three years, and five years), they were visited in their homes by researchers who interviewed them, and their parents, gathering details of family circumstances, behaviours, and experiences. They also administered standardised assessments, including of maths and reading. Over the following months, MCS researchers went on to contact the children's teachers, who filled in [questionnaires](#), giving information on:

- whether the child was in-class 'ability' grouped for maths, and what group they were in;
- their judgement of the child's maths 'ability and attainment.'

Later, when the children were 11, and in the last year of primary school, they provided information for the MCS once more, including answers to this question:

- 'How much do you agree...I am good at Maths.'

16% of girls said they were not good at maths at 11, compared to 9% of boys.

Previous [research](#) has shown that 'ability' grouping can affect children's progress, and their self-perceptions. So the first question addressed by this study was:

*Does the maths in-class 'ability' group within which a child is placed at age seven predict negative maths self-concept at 11?*

Previous [research](#) has also shown that teacher judgements and assessments can impact trajectories through education, and that judgements can be biased by [gender](#). So the second question was:

*Does the judgement by their class teacher of a child's maths ability at age seven predict the child's negative maths self-concept at 11?*

The next question was:

*Do these relationships vary with a child's early concurrent maths skill (as measured by maths cognitive test score at age seven)?*

That is, the research examined whether any relationships between early 'ability'-grouping / teacher judgements and later self-concept depend on the children's early maths skill level at the time of grouping and judgement.

Lastly, given the disparity in maths self-concept between girls and boys, and known [inequalities](#) by gender in maths-related subject and career choices and pathways, the research asked:

*Do these relationships vary by gender?*

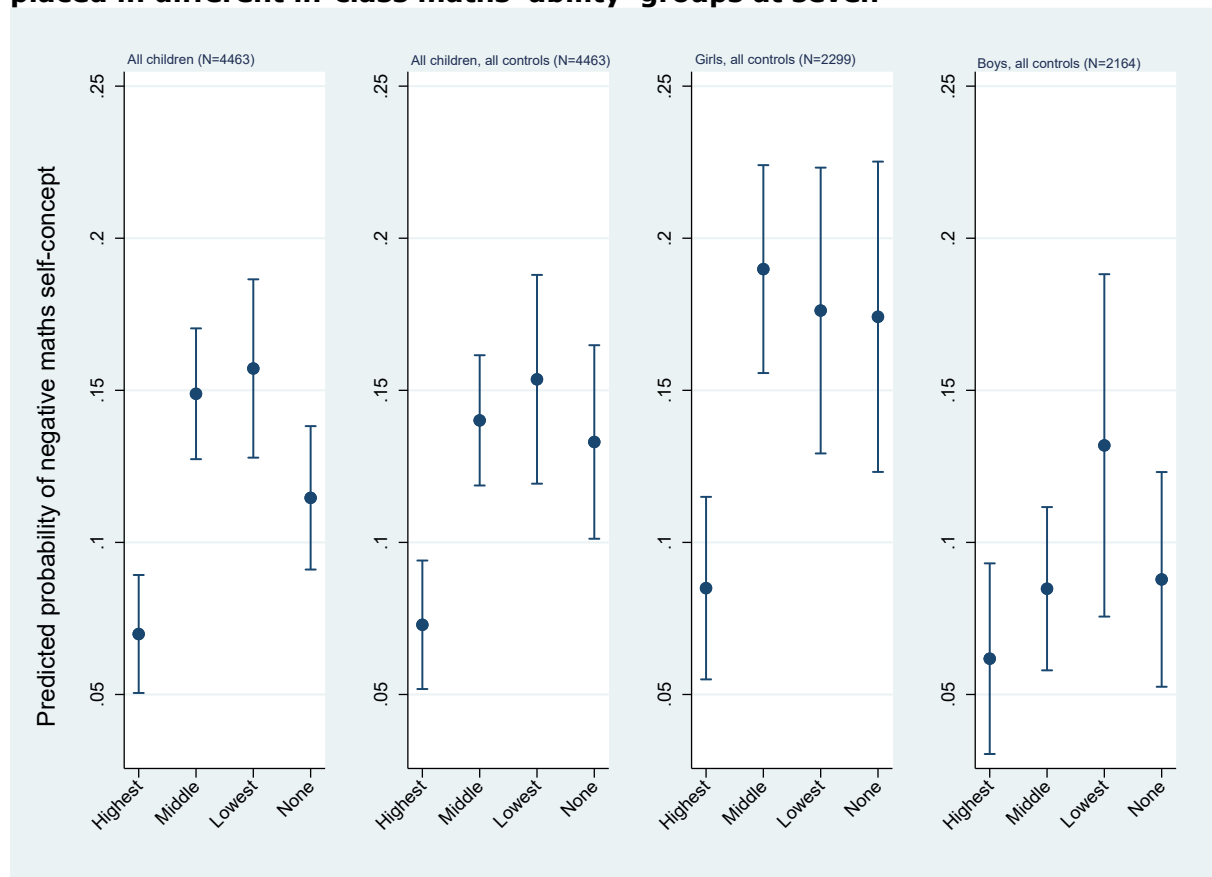
The figures below present predicted probabilities from logistic regression analyses which quantify the associations between earlier grouping / judgement, respectively, and later self-concept. These predicted probabilities describe the average chance of children in a given group (such as the chance of children in the top 'ability' group, or those who are judged 'below average') thinking they are not good at maths at 11.

Regression analyses allow control for factors that might explain raw associations. This enables more confidence that a key predictor of negative self-concept is 'ability'-grouping and / or teacher judgements, rather than something else that relates to and causes both the group placement / judgement and the child's perception of their maths competence (such as maths skill).

So the probabilities estimated from the regression models shown below include controls spanning a variety of factors that are likely to be associated with 'ability' group placement, teacher judgements of children, and children's self-concept: cognitive test scores at age five and seven, including maths score; child's month of birth; mother's education level; home language; family income-level; child's reported ethnic group; whether the child's teacher reports them having special educational needs; whether the child's parent reports them having difficulties with maths / reading; whether the child's parent reports helping them with maths / reading at home; teacher judgements of reading; and in-class grouping for reading. Predicted probabilities for results by 'ability'-group control for teacher judgement, and those for teacher judgement control for 'ability'-group.

## Results

**Figure 1: Probability of negative maths self-concept at age 11, for children placed in different in-class maths 'ability' groups at seven**

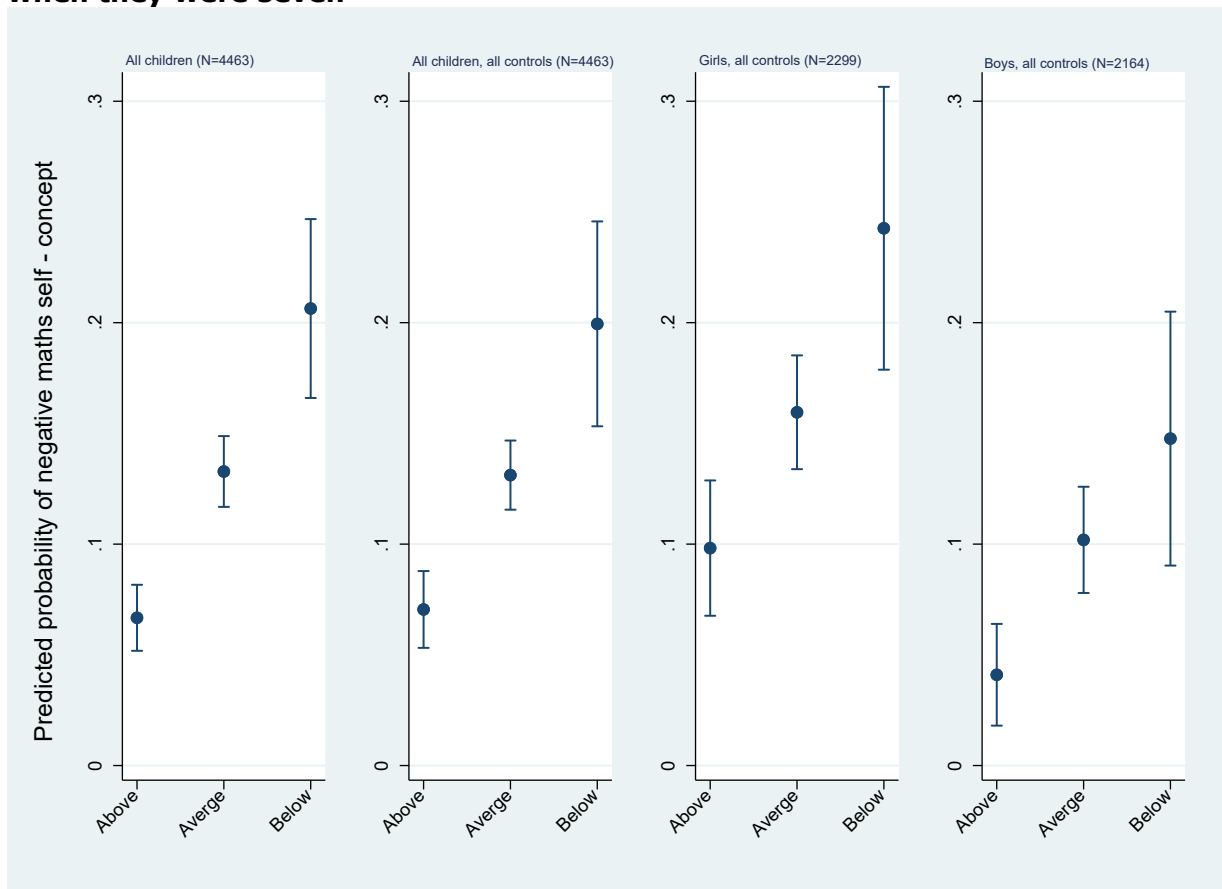


Source: Millennium Cohort Study, waves 3, 4, and 5. Whiskers = 95% confidence intervals around each estimate.

Figure 1 shows that maths in-class ability group at seven strongly predicts children's later self-concept. The first sub-graph shows all children, only controlling for teacher judgement, but not controlling for the rest of the factors listed above. The second sub-graph controls for all these factors, including maths test score, and this makes very little difference to predicted probabilities – suggesting an independent association between 'ability' group and self-concept four years later. 15% of children who were placed in the bottom 'ability' group at seven thought they were not good at maths at 11, compared to 7% of children placed in the top group. When the sample is split into girls and boys (the third and fourth sub-graphs), it is still the case for both that being placed in the highest group is positively associated with later self-concept.



**Figure 2: Probability of negative maths self-concept at age 11, for children judged 'above average,' 'average,' or 'below average' at maths by their teacher when they were seven**

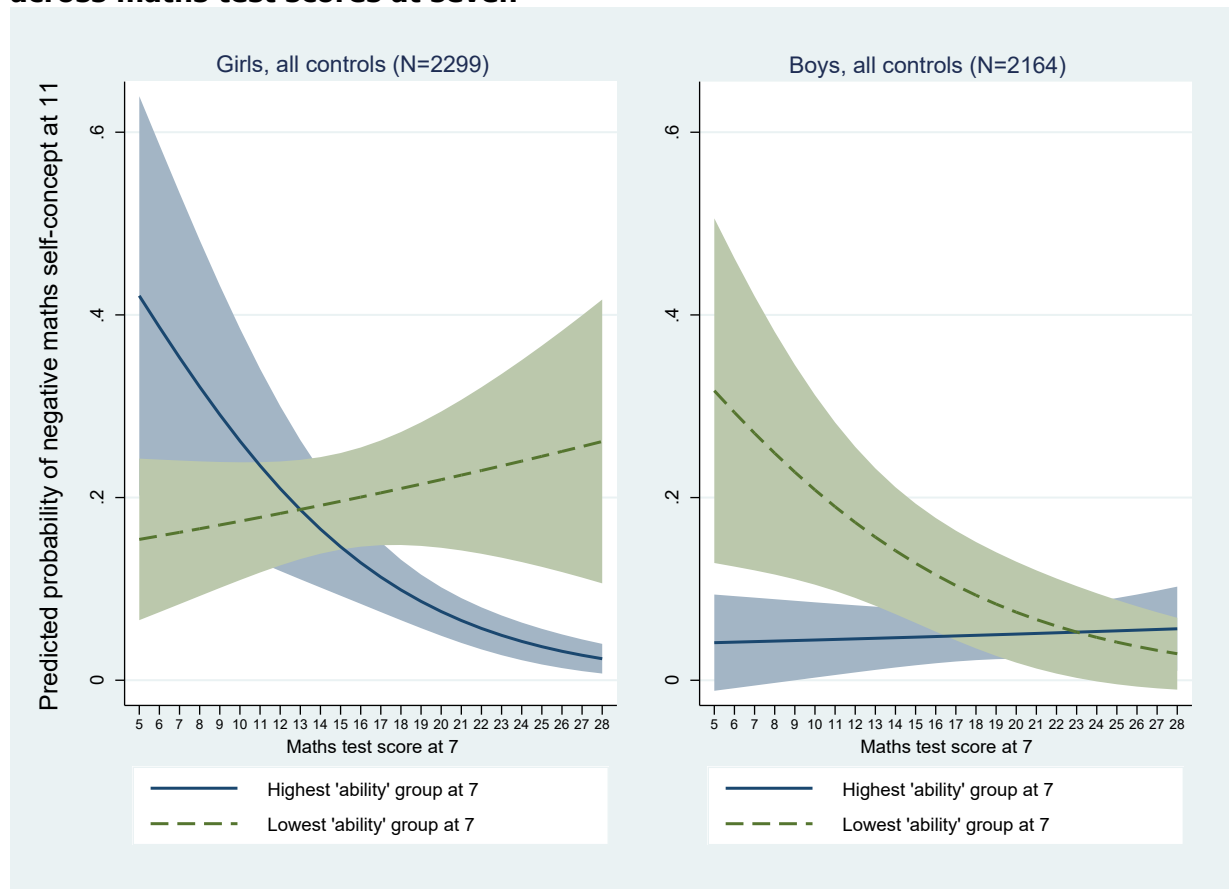


Source: Millennium Cohort Study, waves 3, 4, and 5. Whiskers = 95% confidence intervals around each estimate.

Figure 2 shows a similar, strong association between teachers' judgements of children at seven, and the children's self-concept four years later, at 11. The first sub-graph and second sub-graph show that adding controls makes little difference, again suggesting a direct link: 20% of all girls and boys who were judged 'below average' by their teacher at seven thought they were not good at maths at 11, compared to 7% of children judged 'above average.' The pattern also holds on average for girls and boys separately.

However, as shown by Figures 3 and 4, when relationships between earlier 'ability'-group / teacher judgement and later self-concept are broken down further by children's maths scores at seven, there are pronounced differences across girls and boys.

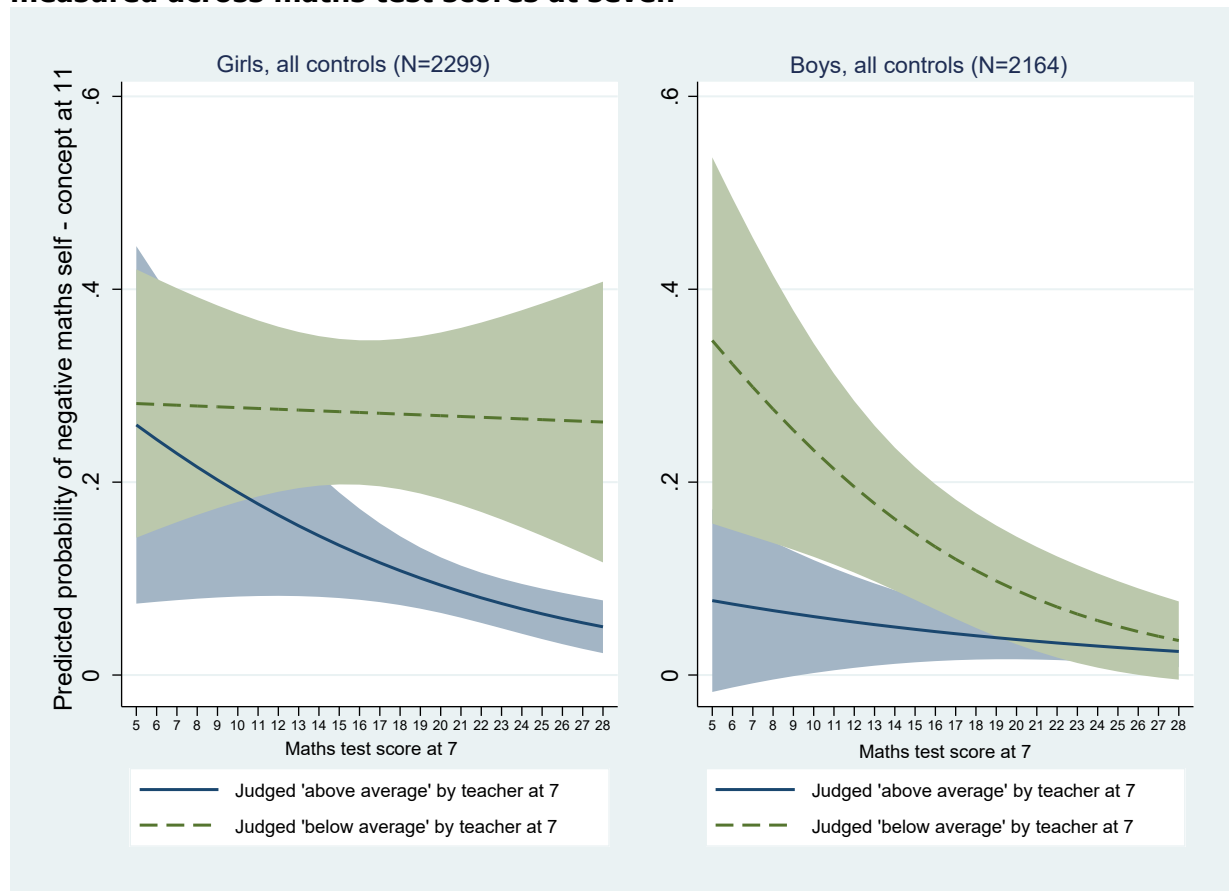
**Figure 3: Probability of negative maths self-concept at age 11, for girls and boys placed in different in-class maths 'ability' groups at seven – measured across maths test scores at seven**



Source: Millennium Cohort Study, waves 3, 4, and 5. Shaded areas = 95% confidence intervals around each estimate.

Figure 3 shows that all high-grouped boys – regardless of measured maths skill – have very low odds of reporting subsequently that they are not good at maths. Being placed in the highest group is positively related to later self-concept for all boys. In contrast, lower-scoring, high-grouped girls are more likely to have later negative maths self-concept: high-group placement does not play out in a uniformly positive way for girls' self-concept. Additionally, Figure 4 shows that, unlike boys, being judged negatively by their teacher at age seven predicts higher chances of negative maths self-concept at 11 for all girls, regardless of their maths skills at seven. Being judged 'below' average by their teacher has a long-term association with thinking they are not good at maths for girls, even if they scored highly on the maths test.

**Figure 4: Probability of negative maths self-concept at age 11, for girls and boys judged 'above average' vs 'below average' by their teacher at seven – measured across maths test scores at seven**



Source: Millennium Cohort Study, waves 3, 4, and 5. Shaded areas = 95% confidence intervals around each estimate.

## Summary and conclusions

Returning to the main questions of this research:

*Does the maths in-class 'ability' group within which a child is placed at age seven predict negative maths self-concept at 11?*

Yes, there is a strong association. With all controls, children in the lowest 'ability' group have 2.5 the odds of negative self-concept compared to those in the highest group, and corresponding predicted probabilities of 15% compared to 7% of saying they are not good at maths.

*Does the judgement by their class teacher of a child's maths ability at age seven predict the child's negative maths self-concept at 11?*

Yes, again, this association is substantial. After including all controls, children judged 'below average' have odds 3.5 times higher than those judged 'above average' of reporting not being good at maths at 11 – again, a substantive difference in predicted probabilities of 20% compared to 7%.

*Do these relationships vary with a child's early concurrent maths skill (as measured by maths cognitive test score at age seven)?*

*and*

*Do these relationships vary by gender?*

Yes, there are significant variations beneath the average, when boys and girls are considered separately and according to their maths score. All boys placed in the top group at seven had very low chances of negative maths self-concept at 11 – regardless of their maths skills. In contrast, only high-scoring girls placed in the highest 'ability' group had positive maths self-concept at 11. Girls with lower scores at seven who were placed in the top group were more likely to have later negative maths self-concept. Additionally, all girls judged 'below average' by their teacher at 7 were more likely to have negative maths self-concept at 11, even if they scored high marks on the maths cognitive test.

These substantial associations between both 'ability'-grouping and teacher judgements, and maths self-concept four years later, show that both are feasibly instrumental in forming primary children's maths self-concept, in ways that vary by gender. Therefore both should be considered as sites for change which could boost maths progression and contribute to closing gender gaps.

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This brief summarises findings from the following journal article:  
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If you would like to read more but cannot access the full article due to the paywall, please email for a personal copy.<sup>1</sup>

[t.campbell1@lse.ac.uk](mailto:t.campbell1@lse.ac.uk)

@\_TammyCampbell

Tammy Campbell is happy to be contacted with comments and questions, for discussion, and for press enquiries.

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UK+20 7955 6679      [a.nicholas1@lse.ac.uk](mailto:a.nicholas1@lse.ac.uk)      [sticerd.lse.ac.uk/case](http://sticerd.lse.ac.uk/case)

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