A Cross-Cultural Study of Family Influences on Executive Functions in Late Childhood.

Summary of the Research Project

Background

Within cognitive psychology, EFs are defined as the set of higher-order processes involved in goal-directed behaviours e.g., inhibitory control, working memory, cognitive flexibility, and planning). Over the last few decades, many researchers have charted the development of EF from birth through to adolescence [e.g., 1-11]. In early childhood, numerous studies have shown that children from Asia outperform children from North America and Europe on EF tasks (particularly on tests of inhibitory control and attention) [e.g., 12-15]. However, it is not known whether older children and adults show similar cross-cultural differences in EF. Moreover, existing cross-cultural studies have assumed that EF tasks index the same cognitive and social processes in children from different countries. A first goal of the current proposal is to address these twin issues. Specifically, this proposed study stands apart from the field by: (i) focusing on late childhood; (ii) the giving parents the same set of EF tasks e; and (iii) directly assessing measurement invariance.

Previous cross-cultural studies of EF have also assumed (rather than directly measured) contrasts in parenting, typically expressed as contrasts in socialization goals (i.e., individual autonomy vs. collective harmony, see 16 for a recent exception). However, multiple factors are likely to contribute to between-country contrasts in children's social environments. In particular, existing cross-cultural studies have ignored potential differences in parental EF. Clinical findings of poor EF in depressed adults coupled with a recent reported association between maternal depression and poor EF in young children suggest that parental EF skills (as well as socialisation goals) influence parenting. Yet very few studies have assessed EF skills in parents [see 17 for recent exception]. Yet theoretical perspectives highlight the likely importance of EF for effective parenting. Moreover, our second goal is to examine parental influences on EF in late childhood. In this respect, our study stands apart from the field by: (i) using brief questionnaires to assess parental socialization goals and well-being; (ii) including both structured and unstructured measures of parent-child relationships; and (iii) capitalising on the large sample size to conduct fine-grained analyses of the contribution of specific characteristics of parents on the development of EF skills in late childhood.

From a policy perspective, interest in EF has been sparked by the growing evidence for a robust relation between poor EF and academic difficulties (as well as between advanced EF skills and academic success). Researchers have yet to establish whether this relation between EF and academic achievement is independent of parental influences (e.g., involvement in child rearing and parenting style, education and EF skills). Again, most studies involve either adults or young children, such that little is yet known about possible developmental contrasts in the nature of association between EF and academic performance [e.g., 18-41]. This is important, as different aspects of EF are known to emerge at different developmental stages. Thus while inhibitory control seems to play a strong role in early childhood, cognitive flexibility may underpin the relationship between EF and academic achievement in late childhood [35,41]. Moreover, except for a few studies of young children [e.g., 13], little is known about whether the relation between EF and academic achievement is culturally specific. Our third goal is therefore to elucidate whether the interplay between parenting, EF and academic success in late childhood is similar or different for children from the UK and Hong Kong. Here, this proposed study stands apart from the field by: (i) gathering data on academic achievement in late childhood; and (ii) using path analyses to evaluate the contribution of parent and child factors on the link between EF and academic success (see Figure 1).

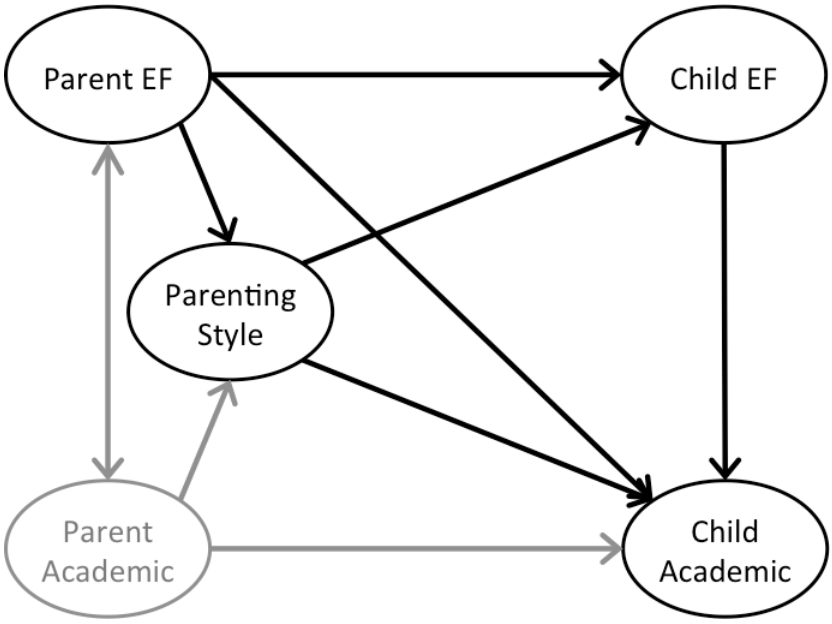

Figure 1. Graphical representation of the inter-relations between parent's EF/academic achievement and Children's EF/ academic achievement that will be explored in this research project using path analysis.

Table 1. Summary of Data Existing Before our Project that are Related to Our Main Goals (see Figure 1)

Research Area	*Europe/North America*	*Asia*	*Compare East-West*
Parent EF → Child EF	▨ 1	○	○
Parent EF → Child Academic	○	○	○
Parent EF → Parenting Style	○	○	○
Parent EF ←→ Parent Academic	● 2	▨ 2	○
Parenting Style → Child EF	● 3	▨ 3	○
Parenting Style → Child Academic	●	●	●
Parent Academic → Parenting Style	● 3	○	○
Parent Academic → Child EF	● 3,4	▨ 4	○
Parent Academic → Child Academic	● 3	● 3	▨ 3
Child EF → Child Academic	● 3	▨ 3	▨ 3

Legend: ○ no existing studies; ▨ 1-5 studies; ● 5-20 studies; ● more than 20 studies.
Notes: EC:[1] data collected from clinical samples only; [2] based on adults in cognitive psychology, no data specifically on parents; [3] all (or most studies) with 3- to 5-year-old children only; [4] parent academic background usually studied in terms of social economic status.

Sample

For this research project we recruited older children and their parents from the United Kingdom (UK) and Hong Kong (HK). The UK children were in year groups 6, 7 and 8; the HK children were in grades 5, 6 and 7. The slightly different school groupings were because of when school starts in the different countries. The children from both countries were between 10 and 13 years of age.

Most of the recruitment took place in schools. In some instances, we have children in the sample whose parents did not complete the study and parents whose children did not completed the study. Further, some participants did not complete all of the tasks. A summary of the final sample is included in Table 1.

Methodology

Measures

The overall goal of the study was to explore the relation between Parent EF, Child EF, Parenting practices, and Child Academic Achievement (see Figure 1 and Table 2). The study focused on:

- four aspects of EF: working memory, inhibition, cognitive flexibility and planning (collected from parents and children)
- two aspects of academic achievement: numeracy and literacy (collected from children only)
- overall general cognitive ability (collected from children only)
- six aspects of parenting: autonomy support, psychological control, warmth, rejection, structure and chaos (collected from parents and children)
- Additional measures of parenting: the parent-child relationship (answered by the child only), importance of self-concept and self-control (these last two tasks entered by the parents only.

Working Memory – The Patterns Challenge. The Patterns Challenge is a modification of the Corsi Blocks task and is administered through the PI's Thinking Games Website (http://instructlab.educ.cam.ac.uk/TGsummary/) to both children and parents in both countries. The instructions were administered in Cantonese for the HK participants and in English for the UK participants. The stimuli for the task were the same for both groups.

In this task, participants see nine boxes. The boxes are lit up in a sequence and the participant is asked to click on the boxes in the same order as the sequence. This task has two parts. In the first part – called Forwards – the participants click on the boxes in the same order as they are shown. In the second section – called Backwards – the participants click on the boxes in the reverse order. Each section starts out with only two boxes lighting up, with subsequent trials increasing in sequence length. The task ends when the participant makes five consecutive errors or they do all available trials.

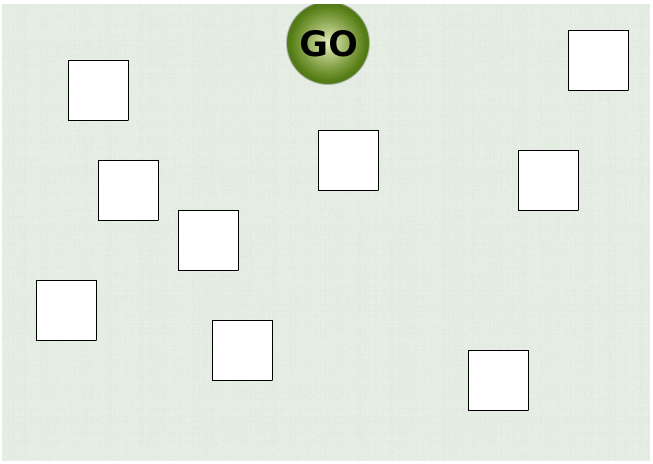

Figure 2. A Screenshot of the Patterns Challenge without any boxes lit up.

We collected response time and accuracy for each trial. We include the efficiency scores in our database. The efficiency score is the total number of correct trials divided by the mean response time to correct trials. The variables in the database for this task are Child_PatternsFW_EFF, Child_PatternsBW_EFF, Parent_PatternsFW_EFF, Parent_PatternsBW_EFF.

Inhibition – The Soccer Challenge. The Soccer Challenge is a version of the Stop Signal Task. It is administered through the PI's Thinking Games Website (http://instructlab.educ.cam.ac.uk/TGsummary/) to both children and parents in both countries. The instructions were administered in Cantonese for the HK participants and in English for the UK participants. The stimuli for the task were the same for both groups.

In this task, participants are instructed to press the left arrow when a soccer ball is on the left-hand side of the screen and the right arrow when the soccer ball is on the right-hand side of the screen. When the participants here the referee's whistle, then they are to not respond and wait until the computer moves to the next trial. There are three sets of trials, allowing for short breaks during the task. Each set includes 32 randomly presented trials, with aout 20% of the trails including the referees whistle – requiring the participant to inhibit their response.

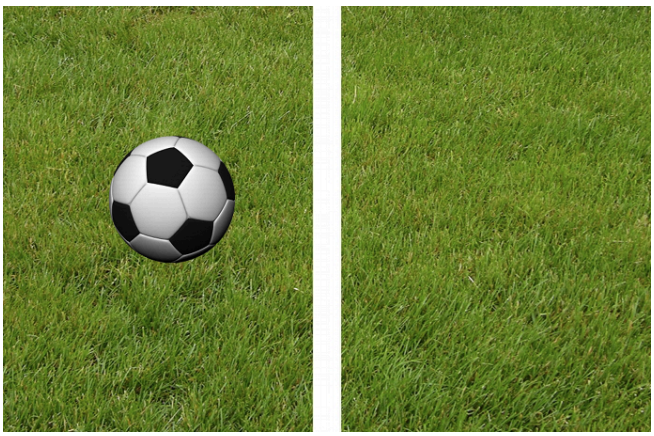

Figure 3. An example of a trial where the soccer ball is presented on the left-hand side of the screen.

We collected response time and accuracy for each trial. We include the efficiency scores in our database. The efficiency score is the total number of correct trials divided by the mean response time to correct trials. The variables in the database for this task are Child_Soccer_EFF, Parent_Soccer_EFF.

Cognitive Flexibility – The Figures Task. The Figures Task is a version of the task switching and measures cognitive flexibility. It is administered through the PI's Thinking

Games Website (http://instructlab.educ.cam.ac.uk/TGsummary/) to both children and parents in both countries. The instructions were administered in Cantonese for the HK participants and in English for the UK participants. The stimuli for the task were the same for both groups.

In this task, participants are asked to select one of two possible small figures that match a larger figure on either colour or shape. Whether they match based on color or shape depends on a specific trial – with cues presented at the top of the screen to indicate colour or shape. There are four different sets of trials – with the sets presented in a randomised order.

1. A set of 32 trials where the participant always selects the smaller shape that matches based on colour.
2. A set of 32 trials where the participant always selects the smaller shape that matches based on shape.
3. A set of 32 trials where sometimes the participant selects the smaller shape based on colour (C) and sometimes based on shape (S). The ordering of the trials are C-C-S-S-C-C-S-S … The first trial of this set is colour.
4. A set of 32 trials where sometimes the participant selects the smaller shape based on colour (C) and sometimes based on shape (S). The ordering of the trials are S-S-C-C-S-S-C-C … The first trial of this set is shape.

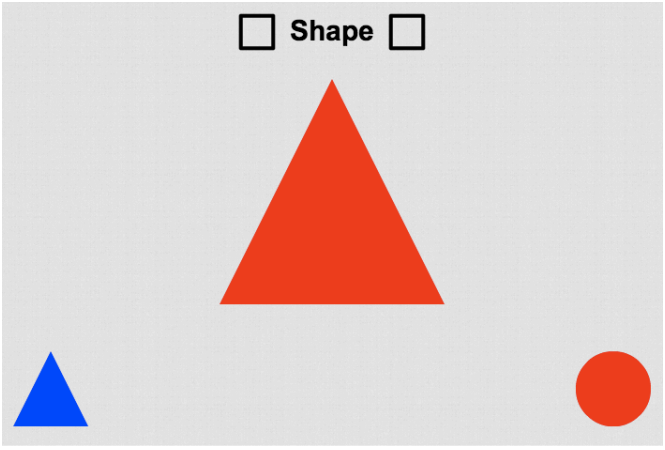

Figure 4. An example of a trial where task it to select the smaller figure that matches the larger figure based shape.

We collected response time and accuracy for each trial. We include the efficiency scores in our database. The efficiency score is the total number of correct trials divided by the mean response time to correct trials. The variables in the database for this task are Child_Figures_EFF, Parent_ Figures _EFF.

Planning – The Disks Challenge. The Disks Challenge is a version of the Tower of Hannoi. It is administered through the PI's Thinking Games Website (http://instructlab.educ.cam.ac.uk/TGsummary/) to both children and parents in both countries. The instructions were administered in Cantonese for the HK participants and in English for the UK participants. The stimuli for the task were the same for both groups.

In this task, participants are instructed to make the bottom row of boxes match the top row of boxes in as few moves as possible. Participants are given up to six attempts to solve a specific tower arrangement twice in a row. The task continues to increase in difficulty by increasing the minimum number of moves required to match the two rows. The task stops when a participant is unable to solve the task in two consecutive attempts or when they reach the most difficult item.

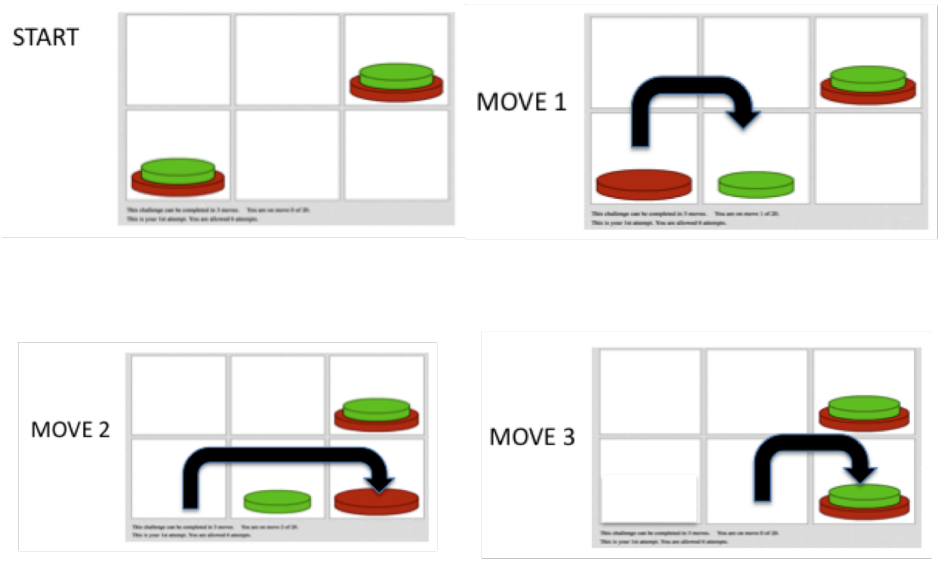

Figure 5. An example of a the Disks Task, with three moves.

We collected response time and accuracy for each trial. We include the efficiency scores in our database. The efficiency score is the total number of correct trials divided by the mean response time to correct trials. The variables in the database for this task are Child_Disks_EFF, Parent_ Disks _EFF.

Child Questionnaire. The specific questions used for the children's questionnaire can be found in these files: UK_CHILD_LongVersion.pdf and UK_CHILD_ShortVersion.pdf. The child questionnaire initially included four main sections, but due to participant fatigue, we did start administering a shorter version of the task that reduced the number of items based on analyses with the longer version. The child questionnaire was administered in English for UK children and in Cantonese for HK children.

> ***Autonomy Support / Psychological Control.*** This set of questions (questions 1-27 on pages 2-4 of the long version and questions 1-9 on page 2 of the short version) asked about the child's perception of their parents' supporting their autonomy or exerting psychological control. For each statement, a child selected one of five options: not at all true, a little bit true, kind of true, pretty true and very true. For data analysis purposes, these ratings were converted to values 1-5 and average scores were calculated for the autonomy support and psychological control sub-sets. The variables in the database for this task are: Child_OverallASPC, Child_AutonSupport, and Child_PsyControl.
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> ***Warmth / Rejection.*** This set of questions (questions 1-10 on page 7 of the long version and questions 1-5 on page 3 of the short version; note – only the long version contained the rejection quesitons) asked about the child's perception of parental warmth and rejection. For each statement, a child selected one of five options: not at all true, a little bit true, kind of true, pretty true and very true. For data analysis purposes, these ratings were converted to values 1-5 and average scores were calculated for the autonomy support and psychological control sub-sets. The variables in the database for this task are: Child_OverallWarmth, Child_Warmth and Child_Rejection.
>
> ***Structure / Chaos.*** This set of questions (questions 11-24 on pages 7-8 of the long version and questions 6-19 on pages 3-4 of the short version) asked about the child's perception of family organisation as structured or chaotic. For each statement, a child selected one of five options: not at all true, a little bit true, kind of true, pretty true and very true. For data analysis purposes, these ratings were converted to values 1-5 and

average scores were calculated for the autonomy support and psychological control sub-sets. The variables in the database for this task are: Child_OverallStructure, Child_Structure and Child_Chaos.

Parent-Child Relationship. This set of questions (questions 1-19 on pages 5-6 of the long version only) asked about the child's perception of how well they get along with their parents. For each statement, a child selected one of five options: not at all true, a little bit true, kind of true, pretty true and very true. For data analysis purposes, these ratings were converted to values 1-5 and average scores were calculated for the autonomy support and psychological control sub-sets. The variables in the database for this task are: Child_P-ChRelationship.

Metacognition. This set of questions (questions 1-18 on pages 9-10 of the long version and questions 1-18 on pages 5-6 of the short version) asked about the child's study habits, allowing for a self-report on some aspects of EF: planning, monitoring, and regulating. For each statement, a child selected one of five options: not at all true, a little bit true, kind of true, pretty true and very true. For data analysis purposes, these ratings were converted to values 1-5 and average scores were calculated for the autonomy support and psychological control sub-sets. The variables in the database for this task are: Child_Metacognitive_All, Child_Metacognitive_Planning, Child_Metacognitive_Monitoring, Child_Metacognitive_Regulating.

Parent Questionnaire. The specific questions used for the parent's questionnaire can be found in UK_PARENT.pdf. The parent questionnaire initially included four main sections and was administered in English for UK parents and in Cantonese for HK parents. The version here includes the consent questions as well as some details related to doing the computer tasks.

Autonomy Support / Psychological Control. This set of questions (questions 1-27 on pages 4-6) asked the parents to rate how much they provide autonomy support and psychological control to their child. For each statement, a parent selected one of five options: not at all true, a little bit true, kind of true, pretty true and very true. For data analysis purposes, these ratings were converted to values 1-5 and average scores were calculated for the autonomy support and psychological control sub-sets. The variables in the database for this task are: Parent_OverallASPC, Parent _AutonSupport, and Parent _PsyControl.

Warmth / Rejection. This set of questions (questions 1-10 on page 7) asked the parent to rate their own parental warmth and rejection toward their child. For each statement, a parent selected one of five options: not at all true, a little bit true, kind of true, pretty true and very true. For data analysis purposes, these ratings were converted to values 1-5 and average scores were calculated for the autonomy support and psychological control sub-sets. The variables in the database for this task are: Parent_OverallWarmth, Parent_Warmth and Parent_Rejection.

Structure / Chaos. This set of questions (questions 11-24 on pages 7-8) asked the parent to rate their family's organisation as structured or chaotic. For each statement, a parent selected one of five options: not at all true, a little bit true, kind of true, pretty true and very true. For data analysis purposes, these ratings were converted to values 1-5 and average scores were calculated for the autonomy support and psychological control sub-sets. The variables in the database for this task are: Parent_OverallStructure, Parent_Structure and Parent_Chaos.

Self-Concept / Self-Control. This set of questions (questions 1-10 on page 9 and questions 1-10 on page 10) asked to rate their child's self-concept and self-control for

the first 10 questions and to rate the importance of self-concept and self-control in the second 10 questions. For each statement, a parent selected one of five options: not at all true, a little bit true, kind of true, pretty true and very true. For data analysis purposes, these ratings were converted to values 1-5 and average scores were calculated for the autonomy support and psychological control sub-sets. The variables in the database for this task are: Parent_SelfConcept, Parent_SelfControl, Parent_SelfConceptImportance, Parent_SelfControlImportance.

General Procedures

The study was designed for group administration – thus shortening the time needed for data collection. As such, the EF tasks and parenting questions were administered online. The EF data were collected using a secured site designed by the PI and the questionnaires through Qualtrics. On occasion, there were issues with the Qualtrics site or internet access at schools that meant that some questionnaires were administered using paper versions of the online task.

All standardised tests were administered at paper-pencil tasks.

It took the parents about 45 minutes to complete the study and the children about 2 hours (with breaks).

Additional Comments

We have held back most of our demographics variables at this point in order to increase participant confidentiality. For example, we did ask parents and children questions to be able to identify their socio-economic status. However, most responses identify educational experiences and current jobs. We are in the process of coding those. We might add more variables later once they are scored further.

Owing to some difficulty with recruitment of parent-child pairs for this study, some of the standardised test data are not yet processed because we had to spend a lot of our time collecting data. Some blank cells for the Numeracy and Literacy cells will be completed shortly.

Finally, please contact the PI – Dr Michelle Ellefson (mre33@cam.ac.uk) for additional information or queries.

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