



PROJECT PROPOSAL

Neuroscience of Decision Making PSY307-Monsoon 2021

GROUP NUMBER: 4

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STUDENT ROLL NUMBERS: 2019152, 2019190, 2019101, 2017023, 2017144

Instructions:

- Please think of an original idea related to any area of Decision Making and plan a short study to experimentally test that idea. You may refer to the studies that we've been discussing in the course, the course books and relevant papers for examples to come up with your own idea. You may look at a list of credible sources for scholarly papers here: **Conferences_Journals_CognitiveScienceIIITD.pdf (attached)**. Please note that the list is not exhaustive and IIITD does not have a subscription to most of them. You may have to refer to the articles which are free to download or hosted by authors on pre-print servers (ArXiv, bioRxiv, PsyArXiv, etc.) or other portals, such as Research Gate.
- Based on the demands of your research questions you may choose a human/non-human experimental system to test your hypotheses. Elaborate your study and its plan under various heads in the document below so that it is comprehensible and coherent. Instructions with each head briefly describe what is expected in each section. You may append extra sheets at the end of each section. Word counts are indicative and less may be written.
- Please cite your sources (within the body of text and then provide a reference list at the end) in the APA citation format (<https://www.mendeley.com/guides/apa-citation-guide>).
- Please use only this MS-WORD template and write the proposal in single-spaced, font type Arial 10 or 11 on a word processor. Figures/Illustrations created manually or digitally may be inserted wherever necessary but they should be original to the extent possible. For example, if an illustration is trying to show a testable process occurring in the brain, you may use a template of the brain from freely available images (with reference) but the rest of the illustration should be originally created.
- **Strict deadline for submission is 11:00 PM (29th October, Friday). Each group is required to submit ONLY ONE PROPOSAL. Please note that submissions after this deadline will not be evaluated and will score ZERO (all group members of the submission).**
- **Please DO NOT PLAGIARISE any part of this submission. It will be dealt strictly as per IIIT-D policies. The expectation is to produce an original written piece.**
- A separate announcement about presenting the project proposal will be made in due time.

Title:

Analysis of decision making skills involving Prioritization and Adaptive re-prioritization of multiple tasks in children to achieve maximum productivity and influence by parents in Decision-making process

Aims

Background : We know that Decision making is the process of making choices by identifying a necessity, gathering information, and assessing alternative options. Most of our decision-making skills have evolved by making wrong decisions and learning from them. However, most children are not given the luxury of making their own decisions when it comes to doing their daily duties and lack proper experience in real-world activities due to their small age. Thus it becomes hard to conclude how a child's brain structurize, formulate and prioritize several resolutions that come on the way. The fact is that our decisions are indeed influenced by the present context, external mediators and facilitators, emotional memory and learned intellectual disciplines.

An essential question is, what do children do with all the routine, ordinary, everyday things they encounter? How do they know what is important and how to manage the tasks at hand effectively without any external source guiding or forcing them?

So it becomes crucial to realize how children come up with decisions and use their executive function skills like prioritization. Our life is the sum of all our choices, and hence it becomes fairly important to understand the factors involved, processes, abilities, and underlying patterns to frame a meaningful model resembling the steady growth of our decision-making skills since childhood. It is well observed that parents play an essential role in the decision making involving scheduling a child's daily tasks. Sometimes these decisions result from a mutual understanding between the child and the parent, and sometimes the parent solely takes it. Shared decisions between parent and child are associated with higher academic performances of the child (Lundberg, S., Romich, J.L. & Tsang, K.P, 2009). A study examining mother-child interaction suggests that healthy mother-child relationships reflect better academic performances of the child in the future (Morrison, Kauffman, Pianta 2003). It is quite evident from these that shared-decision making between parent and children are instrumental in the academic growth of the child. But how far does Shared-decision making affects, boosts or hinders the decision making capability of a child and the outcomes associated with any particular activity ?.

Specific Aim 1: We analyze productivity among children in the age group of 6-11 years when different decision making agents and influencers are involved.

The decision agents are responsible for task prioritization and adaptive task reprioritization, whereas the children are the task executors. The aim is to get a qualitative measure of the productivity of children in terms of the percentage of tasks completed and the accuracy of the completed tasks under different decision agents.

Specific Aim 2: Across the age of 6 to 11, when do children become better at decision making involving task prioritization and execution, resulting in high productivity.

Specific Aim 3: To compare and contrast the influence of parents' involvement in the decision-making regarding prioritization of high demanding tasks of children of 6 to 11 years.

Proposed Methodology

In this entire research, we are focused on how well the children can use their decision making and executive function skills like task strategizing and adaptive re-prioritization to maximize their productivity across age groups from 7 to 12 years. Furthermore, we would also measure the variance in productivity observed firstly when the children are forced to do the tasks as per their parent's decision and secondly when the parents guide and influence their children to do each task.

1) Dividing Children into groups and sets based on Age and Decision-making method :

According to the age groups, the children are categorized into three groups :

Group 1: 7 to 8-year-olds.

Group 2: 9 to 10-year-olds

Group 3: 11 to 12-year-olds.

**No categorization based on the gender of the child is considered.*

There will be three sets of sample sets for every age group on which the study will be performed.

Set 1: Consists of children only; they are responsible for task prioritization and execution.

Set 2: Consists of both children and their parents, parents are responsible for task prioritization, and children need to execute as per the parents' instruction.

Set 3: Consists of both children and their parents, parents are allowed to influence/guide their kid about the tasks, but the child is given the free will to execute the task as he/she wishes.

Children in all three sets are required to complete the multiple task assessment within a strict single deadline. Data points per child consisting of the number of tasks completed, the accuracy of each task and the percentage of adaptive decisions made to re-prioritize the tasks are compared across each age group in all three sets. This set of data and comparisons will give a clear idea of how well children across the age of 7 to 12 are at decision making involving prioritization and adaptive re-prioritization. It also gives a clear picture of how effective is parents' role in decision making involving the daily routine tasks of their children.

The study is planned to be conducted in a school on a weekend with the presence of participants and a few school staff.

2) Recruitment of children (Using Persistence scale) :

The study requires children who are physically and mentally healthy to complete the tasks. It is not mandatory to do all the tasks to 100 percent completion but to be advised to do the maximum no. of tasks possible. Children who may leave the assessment mid-way because of uninterestedness, laziness, mental disorders (ADHD, ADD.), physical incapacities will bring considerable deviations in the data points, and the final results would be less reliable.

The recruitment of healthy school-going children will be done based on the "*persistence*" factor in them as persistence is considered the quality to sustain in times of difficulty, and the same will be required to complete the assessment within the deadline. The persistence measurement test will be conducted using a questionnaire prepared as per "*A Scale for Measuring Persistence in Children*" (Lufi and Cohen, 1987).

The children who score above a certain threshold in the test would be considered participants in the study and are suitable to be placed in any of the three sample sets.

3) Recruitment of parents for sets 2 and 3 (Influenced Decision-making):

Only parents of the children selected for the study through the persistence measurement test would be scrutinized to decide whether the child and the parent should be placed in Set 2 or Set 3.

The main criteria which decide the placement of the child and parent in Set 2 or Set 3 are the parenting style adopted by the parents. The reason being for Set 2, we need a child-parent pair, where the parent has a dominating authority and could direct the child to do the tasks as per the prioritization of the parent. Whereas to be placed in Set 3, the child-parent pair should have mutual understanding established among them as parents in this set play a huge role in influencing and motivating the kids about the tasks at hand. The categorizing of the parent will be done based on a questionnaire as per the research paper "*Authoritative, authoritarian, and permissive parenting practices: Development of a new measure*" (Robinson & Mandleco, 1995). Based on the score, parents who fall into any of the required three categories will be considered ;

Authoritative: This set of parents are very conscious about the upbringing of their children. This set imposes rules on their children and is very strict about children following them. They do not consider their children's opinions and solely decide what their kids should be doing.

Permissive: This set of parents are very lenient with their kids. They are usually very encouraging and considerate about their kids' problems, but they are not over-involved.

Uninvolved: Fundamentally, this set of parents are not much involved in the child's development in any manner. They want their children to grow on their own without any intervention from their side. Parents for this category are selected if they do not participate in the study programme or have not answered all the questions promptly in the assessment.

4) Addition of Children and Parents in respective Sets :

Children whose parents fall into the uninvolved category are placed in Set 1; if the parent falls into the authoritative category, then the child-parent is placed in Set 2, and if the parent falls into the permissive category, then the child-parent pair is placed in the Set 3.

5) Nature of tasks given to Children :

Activities used to measure Decision-making in children in this study are selected according to a set of guidelines. These activities apart from being child-friendly must also have a proper clarity of purpose so that all children will be on the same grounds with respect to any activity that they would perform in this research study (Gerison, 2001). Also, as we have participating children across different ages we must ensure that the activities are demanding enough for their respective age groups. Activities selected on these guidelines involve Logical thinking, Fine Motor skills, Reading and Listening skills, Memory skills and Physically demanding activities with increasing level of complexities as age groups increases. This is done in order to closely resemble the real-life scenario where the child is faced with the challenge of prioritizing a list of activities as they would face in their daily-life. List of activities used in this study are ;

1. Paper Cutting (Fine Motor skills) : Different images are given in a sheet. The child has to cut out the image carefully from the sheet. The contour details of images given increase with increase in age groups to make the task more challenging.
2. Reading : A Comprehension passage is given to the child. Following up are a set of sentences taken from the passage with missing words or questions based on understanding of the passage.

3. **Physically Demanding Tasks** : A number of saplings are given to the children for planting. Such a task would test their skills of decision making as it involves physical participation, leading to tiredness which might affect the performance of other activities. So, the decision in prioritizing this task in a particular order matters a lot.
4. **Listening (Attention and Memory)** : A recorded video/audio of a topic has to be listened to by the children, followed by questions from the same.
5. **Puzzles and Riddles (Logical thinking)** : A set of puzzles and riddles are given and children are required to solve them.

6) Setting of appropriate Deadlines:

These activities have to be done within a given deadline. Deadline is selected using a sample set taken from the same age group among the participating children. Suppose, we have around 'X' number of children from a particular age group participating in this research. A small randomly picked sample set consisting of around p% of X will be used for arriving at an approximate deadline. Out of this p%, the mean of total time taken by the first q% of children is our average deadline, Davg. A small amount of time t, is subtracted from Davg, (i.e.) $D_f = D_{avg} - t$, where D_f is our finalized deadline duration for that particular age group. Hence, we have arrived at a deadline duration that is proper enough for our study where we need to calculate the role of decision-making in prioritizing multiple tasks within a challenging and reasonable deadline duration for children of different age groups.

$$D_f = D_{avg} - t,$$

Where, t is a small duration of time

Davg is mean of first q% of random p% children selected as a sample set from particular age group

7) Keeping track of the Initial and Adaptive Decision making process:

Before starting with these activities, the decision maker should list out the order in which they have decided to perform the tasks (in the "Before Activity" column of the given sheet) which represents their Initial Decision Making. Once the timer has begun and children have started with the activities, they can change their order of performing tasks based on their preference at the moment, they constantly need to mark the change in their activities when they are re-prioritizing the activity execution in the "During Activity" column of the given sheet, which is a representation of the no. of times the adaptive decisions are made.

8) Measuring Amount and Accuracy for each activity :

Amount of work done and Accuracy are both measured in terms of percentage in order to maintain uniformity in deriving results from multiple, un-related activities. The calculation of percentages for each activity are as follows;

Activities	Amount of work done (%)	Accuracy (%)
Paper Cutting (Fine Motor skills, Attention)	No of paper cut-outs done out of the total images given	Total area of the image = P sq. units Extra area other than the image (which should have been removed) = Q sq. units Area of image cut off (which shouldn't have been removed) = R sq. units

		$\text{Percentage accuracy} = 100 - ((Q+R)/P)*100$ <p>(Image processing softwares like OpenCV are used for this purpose)</p>
Reading	Questions attempted out of total available questions	Correct answers out of the attempted questions
Physically Demanding Tasks	No. of saplings planted out of the total saplings given	No. of saplings planted properly, in right orientation and watered to the right extent out of the total saplings planted (Finalised based on observation)
Listening (Attention and Memory)	Questions attempted out of total available questions	Correct answers out of the attempted questions
Puzzles and Riddles (Logical thinking)	Puzzles attempted out of the total Puzzles given	Puzzles solved correctly out of the Puzzles attempted

The overall trends in Amount of work done and Accuracy is calculated by the Mean of the percentage values of Amount of work done and Accuracy from each activity.\

9) Observations and Inferences from collected data :

Graph No.	Observations/Inferences	X-axis legend	Y-axis
1	Gives a clear idea about how much work has been completed on an average, across all the age groups in each set.	Avg. amount. of task completed	Across Groups falling in a particular Set.
2	Gives a clear idea about how much work has been completed on an average, across all the sets in each age group.	Avg. amount. of task completed	Across different Sets falling in a particular Group.
3	Gives a clear idea about how much work has been accurately completed on an average, across all the age groups in each set.	Avg. Percentage Accuracy in work done	Across Groups falling in a particular Set.
4	Gives a clear idea about how much work has been accurately completed on an average, across all the sets in each age group.	Avg. Percentage Accuracy in work done	Across different Sets falling in a particular Group.
5	Gives a clear idea about how many adaptive decisions on an average did children in each age group in a particular	Avg. No. of Adaptive decisions made	Across Groups falling in a particular Set.

	set made.		
6	Gives a clear idea about how many adaptive decisions on an average did children in each set in a particular group made.	Avg. No. of Adaptive decisions made	Across different Sets falling in a particular Group.

Anticipated outcomes

Based on the Observations recorded on the previous table, we can gain the following insights about decision-making in children.

Graphs 1 and 3 give us an idea about what mode of Decision making; Independent or Influenced (Forced and Shared) helps children better in expressing their decision-making capabilities and how outcomes are influenced by the different sets of Decision making as discussed above.

To get a proper understanding of the expected results, we have taken the study and experiment conducted in some research papers as our basis for assumptions and anticipated outcomes . As indicated by prior research done on the relevant area (**Shelly,2009**), the tasks given to young children are irrelevant and are controlled by parents , but a child's say increases with time. Papers have indicated that involvement of children in decision making increases with age from 9 till 12 years (Yee and Flanagan 1985) while the autonomy of their decisions maps over ages 12 to 17 years(Dornbusch, Carlsmith et al. 1985). Given this data, it is quite evident that children in Set 2 and Set 3 would perform better as compared to children in Set 1 for the first two age groups (7-8, 9-10).

Another article conducted an interesting experiment (**Allesandro,2018**). The experiment comprises two agents :- child and parent. The child performs tasks for $L > 1$ periods and the parent is active for $T < L$ periods . The child has to perform tasks in every period. The child chooses action A in the starting of each period and at the end of each period, the parent gives feedback . The child then corrects his action according to the feedback . But then after the feedback time got over, the child could not better himself anymore. The results suggested that parental feedback resulted in a good outcome in task completion of children. This experiment thus, goes by our original assumption that parental guidance positively influences the child's performance in the elementary age.

From the above two articles, if we connect the dots :- firstly , the decision making power increases with age in elementary group 7-11 and secondly, parental feedback corrects the errors in child's performance and improves the outcomes experienced in the doing of multiple activities. Hence, collectively , we can conclude that the age group of 7-8 in children , who do not have evolved thinking and have no adult supervision will thus be on the lowest ladder of productivity and perform better under forced or influenced decision-making support from parents. Age group 11-12 with no supervision can make better decisions due to growth of experience over years. Also, it might be observed that children falling in Set 1 will perform better as their self-confidence and self-esteem is high due to their independence in the decision making process.

Another interesting observation would be the influence of Adaptive decision making in the reprioritization of tasks and the productivity associated with degree of adaptive decision making done.

References

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