Multi-Sensory Effects of Interactive Toys on Children's Empathy and Collaboration Feelings: Developing and Evaluating 'Play and Design' Sections

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ABSTRACT

How to develop cooperation from childhood? In order to understand the relationship between sensory stimuli during play and cooperation, we developed and administrated 'play and Design' workshop sections. On these sections, 36 schoolchildren were divided in three groups. Two groups played different sensory team game challenges followed by Team Design tasks. A third group, considered our control group, performed the team design tasks before playing the games. For this paper, we based our analysis on two self reports, one administrated after the game section, and another after the team design section. Our results gave positive indications for the light and sound game stimuli group. Additionally, a strong correlation between the responses of the game and the team design self reports have been observed, indicating a relationship or maintenance of the children's perception during play and team design tasks. we believe our findings can help understanding the relationship between play and cooperation, aiding on the design of interactive toys and on the inclusion of children in collaborative design processes.

1. INTRODUCTION

For working in society, cooperation, or the act of working together towards a same end or goal, is often encouraged. Many factors can affect cooperation and, among them, Malinverni and Burgues (2015) find empathic or affective behavior to relate positively. Based on these assumptions, we have been asking *"how can we develop a more empathetic and cooperative society from childhood?"*. Playing is an irreplaceable way for children to learn, communicate, and develop affection (Santer, 2007). modern play tools, called `*Interactive toys*`, are using technologies that expand feedback possibilities. These toys can engage children through sensory stimuli such as light mechanism for sight; electronic sounds for hearing; or haptic inputs for touch (Delden, 2012).

Related with sensory perception and affection, Kansei is a Japanese field and term that describes the function of the brain, which would be the source of emotion, inspiration, intuition, pleasure, displeasure, taste, curiosity, aesthetics and creation (Beuttel, Yamanaka, 2010). While we can find stablished relations between play, empathy and cooperation (Hart, 2017), we could not find dedicated studies to the effects of sensory-stimuli on affective and cooperative play behaviors. Therefore, this research aimed to understand if and how different multisensory-stimuli on interactive play toys could affect cooperation on children. To achieve part of this understanding, we performed design sections for children involving play, sensory stimuli, and teamwork. With our procedures described on the next section, we are currently working on the following research question: *Can different sensory elements of interactive toys given during play activity affect our cooperation perception?*

2. METHOD

On this section, we are going to discuss our experiment elements and procedures, such as the game stimuli selection, the group preparation, the activity steps for each group, and our self-report tool for gathering data.

2.1 Game stimuli – Hikari Tsumiki

Hikari Tsumiki 2.0 is a building set, composed of different interactive blocks, where the goal is to create tangible circuit structures. The set contains blocks with electronic lights, sounds, and motors that can be activated by switches, movement, light, and sound sensors. This set was chosen due to its flexibility, since we could design different game challenges for the specific sensory blocks.

2.2 Sample preparation – creating the participant groups

We counted on the cooperation of 36 students of Liberty International school, aged 6 to 14, from second to ninth grade, and divided them in multi-age teams of four children. Prior to the experiment, individual interviews were conducted to pre-evaluate the empathy development of each student and their relationships with peers. After this step, we organized groups based on age, gender, grade, and empathy disposition.

With the Hikari blocks, we designed two team game challenges. One for playing with the light and sound blocks, and another with the motor blocks. among those groups, we wanted to see if the difference between stimuli would affect the way children perceived team interaction. After the game, children had to design together a new interactive toy, first through individual sketches, and then through team idea generation. A third group, considered our control, would perform the team design tasks before playing the games.

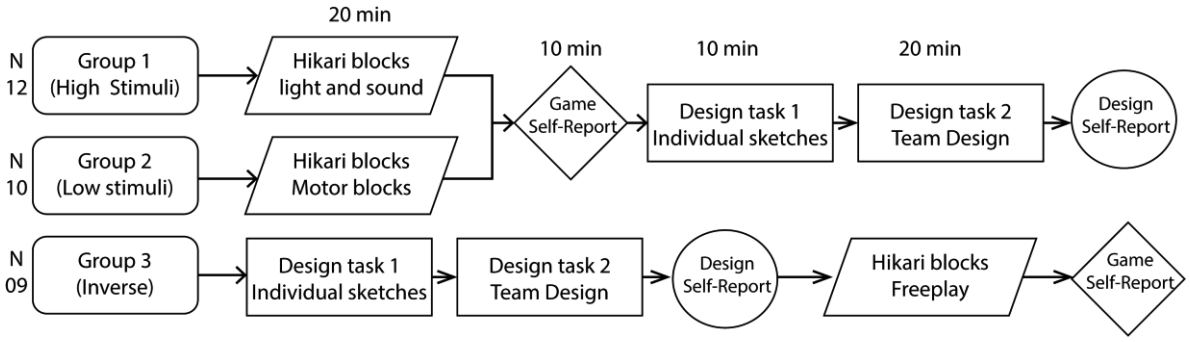

Figure 1: Flowchart illustrating the sample process.

2.3 Self-Report tool

A Self-Report composed of 10 questions was administered twice. once after the game section and another after the design section. Among its questions, we asked: “how fun was the activity you had”, “how easy was the activity you had”, “How good was the time of the activity”, How happy are you with your team”, “How helpful was every one of your team”, “How did you feel mostly during the task”, “how each friend felt during the task”, and “How much do you want to retry this task”. While most questions consisted of Likert scales of five levels, the feeling-related questions had a range of six emotions to choose.

3. RESULTS AND DISCUSSION

For analysing our data, we evaluated the groups' mean scores of the highlighted questions, attempted to evaluate the difference between means with Kruskall-Wallis Test, performed a co-relation analysis of the report questions with Spearman's Rank Co-relation test and evaluated the subtracted mean score of groups. Gender, Age, grade, and empathy frequencies have been observed to guarantee group stabilization. Both empathy-related questions were not answered in a satisfactory way, therefore, empathy was excluded from analysis and redesigned for posterior experiments.

On table 1, displaying groups' mean score of game and the design report questions, we can see higher evaluations of the light and sound group on every question, except "time suitability" for game report and "Want to Retry" on the design report. Although this finding is considered positive for the high-stimuli group, this relationship was not proven significant through the non-parametric Kruskall-Wallis test. The only significant difference happened on the "easiness" question of the game report (Sig. 0.48), however, more than sensory stimuli difference, this finding indicated a difficulty unbalance between groups. As an isolated parameter, difficulty did not seem to affect other factors.

Table 1. Mean score results per group game/design task.
** indicates higher score and ' indicates lower score.*

Groups	Fun	Easiness	Time Suitability	Team Happiness	Team Helpfullness	Want to Retry
Light sound	1.16*/1.50*	0.33*/1.0*	0.41'/1.0*	1.16*/1.33*	1.0*/1.08*	1.5*/1.5'
Motor	0.80'/1.40	-1.0'/0.0'	0.60/0.40	0.40'/1.00'	0.30'/0.40'	1.10'/1.70*
Inverse	1.00/1.11'	0.33/1.00	0.77*/-.2'	1.00/1.11	0.44/1.00	1.22/1.56

We followed to check, on the different groups, correlations between the questions of the game and the design task report, specially between the same questions. For the Light and sound group, the question "how fun" of the game report, strongly correlated with "How fun" (CC .876, Sig. 0.000) of the design task. The question "Team Happiness" correlated positively with the question "Time Suitability" (CC .581, Sig. 0.048) of the design report. The question "Team Helpfulness" of game also correlated with "Easiness" (CC .678, Sig. 0.015) and "Want to retry" (CC .661 Sig. 0.019) of the design task, as well as strongly correlated with "Team Helpfulness" (CC .780 Sig. 0.003) of the design task. Finally, the question "Want to Retry" of the game report strongly correlated with the question "How fun" (CC .733, Sig. 0.007) of the design report and correlated with the questions "Easiness" (CC .590, Sig. 0.043), "Team Happiness" (CC .596, Sig. 0.041), and "Want to Retry" (CC .577, Sig. 0.049) of the design task.

For the inverse section group, the question "How fun" of the design task report correlated with "Team Happiness" (CC .668, Sig. 0.049) of the game report. The question "want to retry" of the design task report correlated with the questions "How Fun" (CC .779, Sig. 0.013), "Team Happiness" (CC .769, Sig. 0.016), and "Want to Retry" (CC .777, Sig. 0.014) of the game report. For the motor group, we could not find correlations in

between reports. We can see more correlation indications on the light and sound group, especially on the questions “How fun”, “Team Happiness”, “Team Helpfulness” and “Want to Retry” with those possibly being key factors of the relationship between play and teamwork. Finally, as an attempt to further explore this correlation between questions, we evaluated the mean scores of the game and design reports subtractions. Although also not significant, we have found that the overall variance did not surpass 1 point in between the scale, with most of participants maintaining the same score between questionnaires. the motor group showed the greatest difference between game and design reports, and the inverse group showed the least difference between the reports.

4. CONCLUSIONS – FUTURE STEPS

While we could observe differences between the group mean scores with higher mean scores to the light and sound, our results were not statistically significant. This can be both due to a low population or to lack of significant differences in between stimuli groups. Strong correlations between the same report questions of the game and the team design tasks, however, could be observed, pointing that the impressions children had during game sections can affect posterior team design tasks, possibly more so than the other way around. Explanations and elements of this relationship should be better explored.

We must consider a Bias in this hypothesis, however, as other factors such as an inclination to answer the same response, seen on the subtraction frequency between reports, regardless of the stimuli can also be possible. Therefore, for our future steps, we plan to better evaluate the relationship between play and teamwork activities among children. After stablishing this relationship, we will look back into sensory elements of play activity that can affect empathy and teamwork feelings.

Video analysis of children relationship during game and design activities, as well as analysis of design creations can bring new light into this research and shall be also considered for our future steps. As a pilot experiment, our findings helped opening way for future studies that explore the relationship between sensory games and children teamwork, helping both on the development of new interactive play tools, and on the creation of new collaborative design approaches with children.

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REFERENCES

Beuttel, Yamanaka, 2010. *Kansei Research and Design*. Retrieved August 27, 2017, from: http://www.geijutsu.tsukuba.ac.jp/~tyam/KRaD.pdf

Delden, 2012. *Towards a Socially Adaptive Digital Playground*, IDC 14(1) 355-358

Hart. 2017. *Inclusion, Play and Empathy*, Jesica Kingsley Publishers

Malinverni, Burgues, 2015, *The Medium Matters: The Impact of Full-Body Interaction on the Socio-Affective Aspects of Collaboration,* IDC 14(1) 89-98

Santer, Griffiths, Goodall, 2007. *Free play in early childhood: a literature review*, National Children`s Bureau