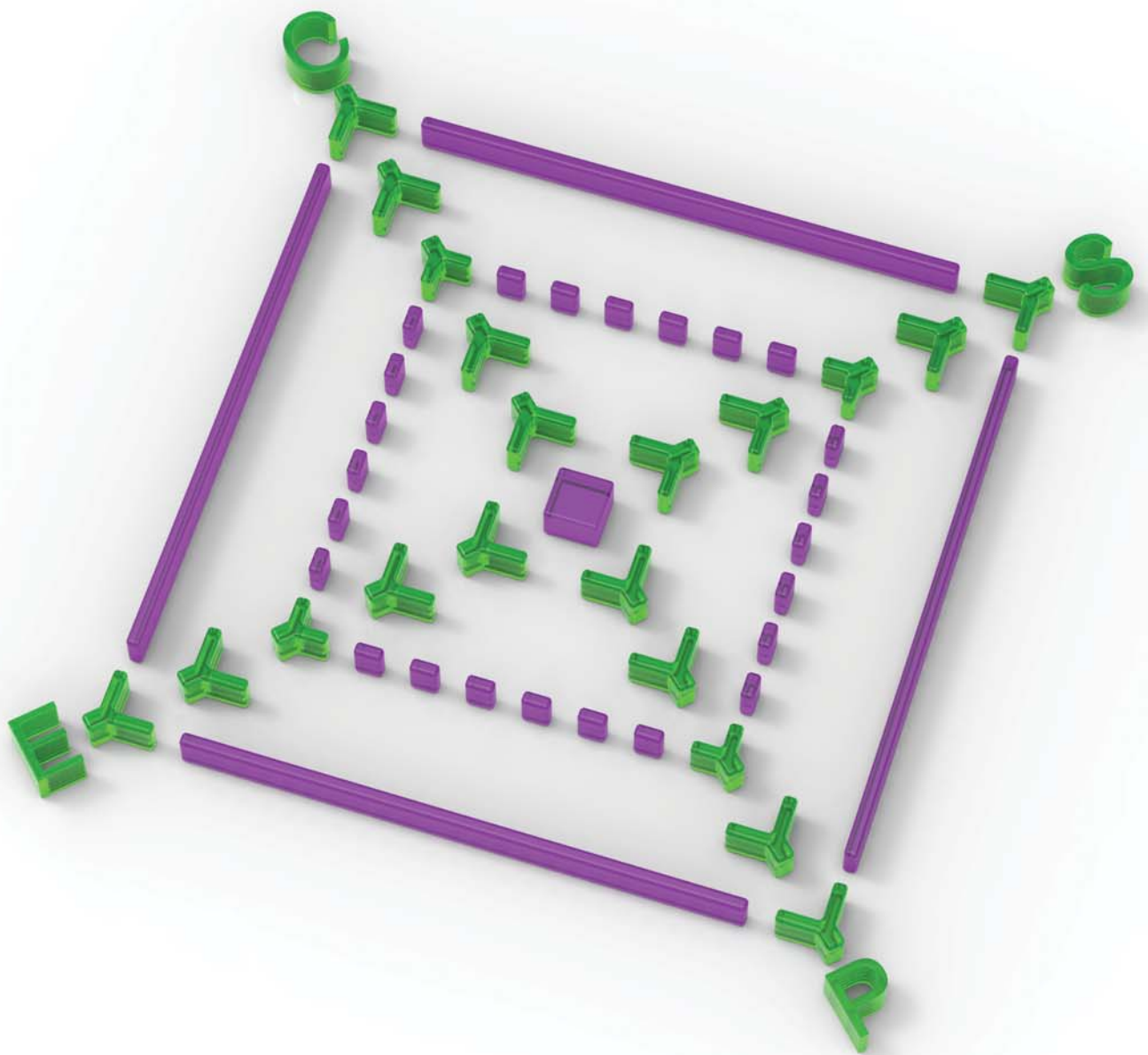


Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

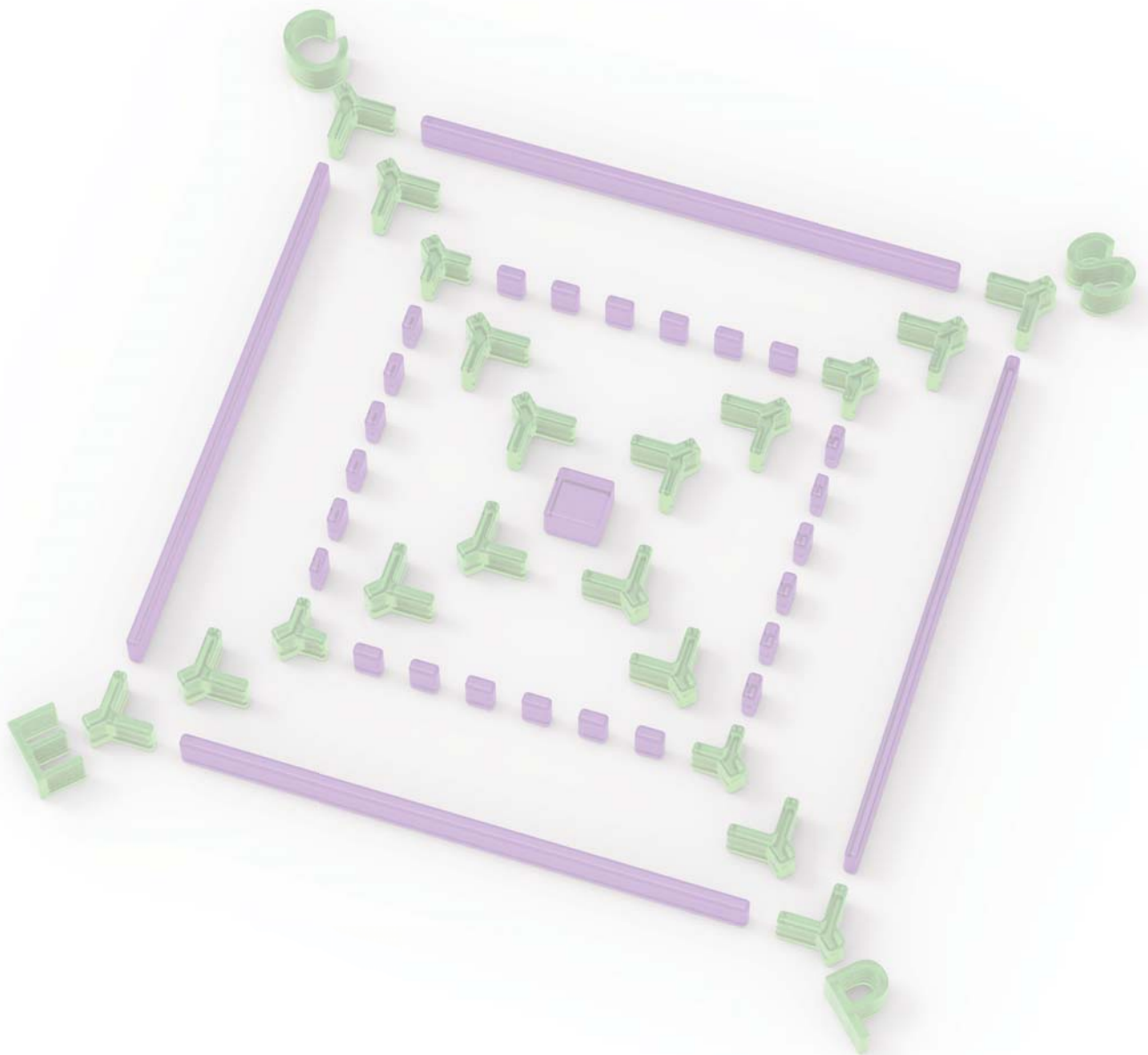
Exploring the Phygital: An Assessment of Modern Play Objects.



Chaz McManus

Exploring the Phygital:

An Assessment of Modern Play Objects.



A thesis presented in partial fulfilment of the requirements for the degree of Master of Design at Massey University, Wellington, New Zealand / Chaz McManus

Fig. 1:



Fig. 2:



1.0

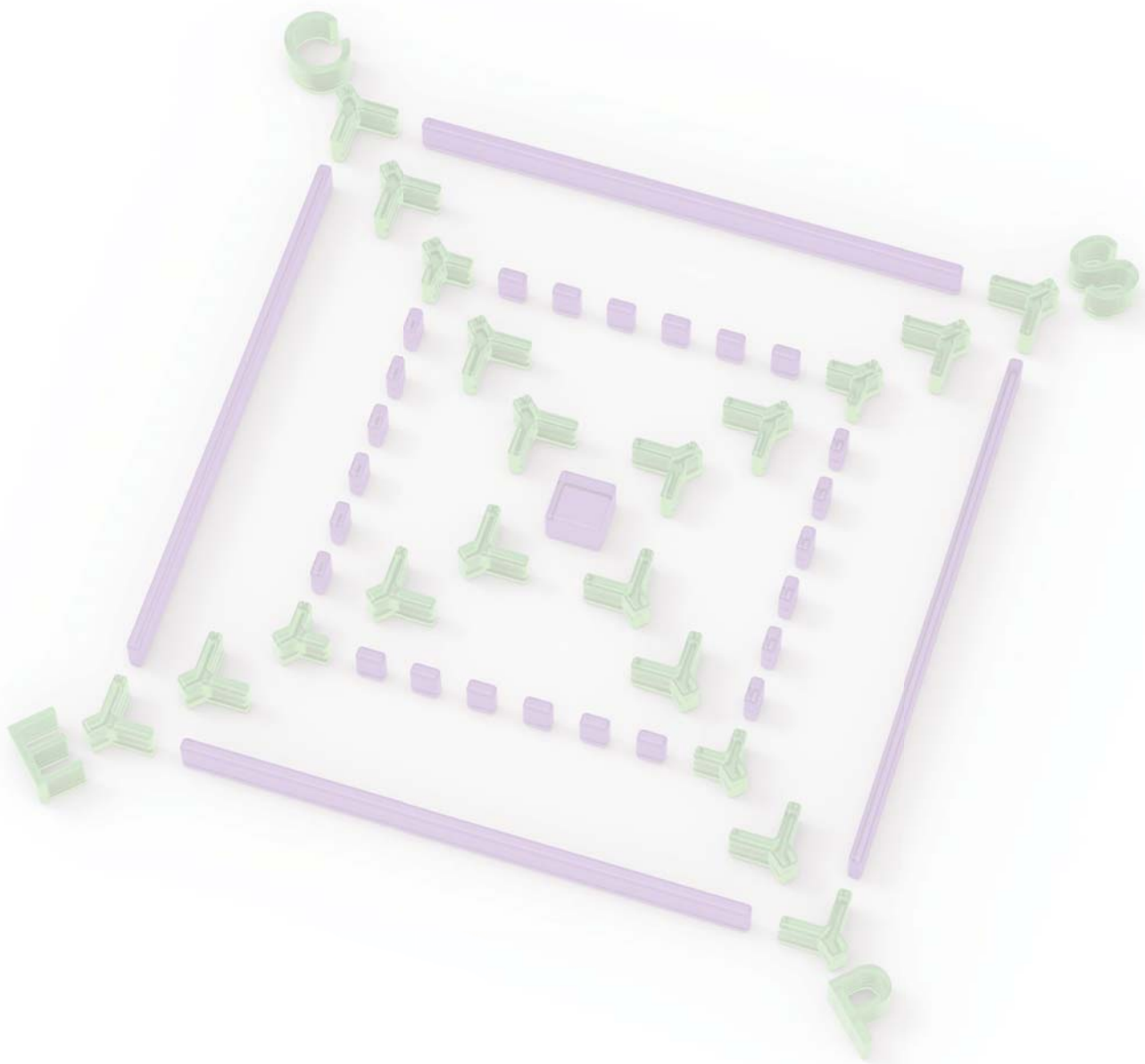
Abstract:

The rise in household electronics, video games and computers - coupled with a parental perception that unguided outdoor play is unsafe - has led to an increase in children playing alone indoors (Gray, 2011). The result of this is a decrease in time spent engaging in spontaneous, unstructured play. Play theorists Burdette and Whitaker, (2006) find this concerning, as the decrease of unstructured playtime can present serious issues for the cognitive, emotional, physical and social development of children.

This change in the way children are playing is a result of the industry creating new types of *play-objects* and experiences; integrating physical and digital elements known as *phygital play-objects* (Trautman, 2014). Through my observation, the resulting play experiences for children lack *balance*. I have conceived the term *balanced play* to reflect my goal for *Phygital* play experiences, where the benefits of that play are spread equally across the areas of cognitive, emotional, physical and social development.

This investigation explores the benefits of play. Then uses this to form a guideline for *balanced play* experiences. It identifies the developmental stage of six to nine year olds and the ways a decline in play potentially affects their development. From this research, I produce a framework for assessing balanced play experiences when children use *phygital play-objects*.

This is achieved via the presentation of a design assessment tool and a *balanced phygital play-object* of my design created using this tool.



1.1

Acknowledgements:

Jamie Bull;

For your mentoring and friendship.

Pair Meema;

Thank you for always being there.

Tanya Marriott and Stuart Foster;

I couldn't have asked for better supervisors.

Craig Hobern;

Your time helping with circuits was greatly appreciated.

Brad Heappey;

Our weekly Pizza's kept me sane.

Ross, Mon, Justin and Jason;

The sense of community in our studio was real.

To those mentioned and unmentioned. Thank you for your kindness, support and love, it undoubtedly got me through. To quote Tom Hanks (the greatest actor that has ever lived) feels silly and appropriate, so here it goes.

“Man... believe me, the power and the pleasure and the emotion of this moment is as constant as the speed of light. It will never be diminished, nor will my appreciation and the meaning between two simple words that I can only offer you here: Thank you” (T.Hanks, 1995)

2.0 Contents.

1.0 Abstract:

1.1 Acknowledgements.

2.0 Table of Contents:

2.1 Definitions and Glossary.

3.0 Introduction.

4.0 Research Questions.

5.0 Methodology: My Process of investigation:

5.1 Reading, writing and diagram building.

5.2 *Play-Object* Testing.

5.3 Case Studies.

5.4 Group Critique.

5.5 Drawing, Conceptualising and Prototyping.

5.6 Persona and Scenario Building.

5.7 Discussions with Industry Professionals.

5.8 Observations of Children.

6.0 Literature review:

6.1 The characteristics of children (6-9 years).

6.2 Definition of Play.

6.3 Benefits of play.

6.4 The Effects of Play:

6.4.1 Cognitive.

6.4.2 Emotional/Social.

6.4.3 Physical.

6.5 The decline in play and its effects on child development.

6.6 The Value of Play Experiences:

6.6.1 The value of *Play-Objects*.

6.6.2 The value of digital play.

6.7 Technology and Play:

6.7.1 The Integration of Digital and Physical.

6.7.2 Using Nintendo to identify a future trend.

6.7.3 Children's Device Usage.

6.7.4 The imbalance of current *Phygital* play.

7.0 A summary of research: identifying an opportunity.

8.0 *Balanced play.*

9.0 Design Parameters:

- 9.1 Initial Design Parameters.
- 9.2 Final Design Parameters:
 - 9.2.1 Design Tool Parameters.
 - 9.2.2 Product Design Parameters: *Play-object*.
 - 9.2.3 Product Design Parameters: Application.

10.0 Design Tool: An Assessment Method for Balanced Play:

- 10.1 The Values for Positive and Balanced play.
 - 10.1.1 Cognitive Values.
 - 10.1.2 Emotional Values.
 - 10.1.3 Physical Values.
 - 10.1.4 Social Values.
- 10.2 Design Tool Process.

11.0 Design Process: The Poli Play-Toolz System.

12.0 Final Design: The Poli Play-Toolz System:

- 12.1 The Poli.
- 12.2 The Application.
- 12.3 The Imagi-shell.
- 12.4 The Play-Toolz.
- 12.5 The Basic Poli Play-Toolz Set.

13.0 As a Platform for Further Development:

- 13.1 The Design Assessment tool.
- 13.2 The Poli Play-Toolz System.

14.0 Reflection and Conclusion:

- 14.1 Significance of the Project.
- 14.2 In response to my first research question.
- 14.3 In response to my second research question.
- 14.4 In response to my second research question.
- 14.5 Concluding Statement.

15.0 Appendix:

- 15.1 Arduino Code.
- 15.2 Persona's.
- 15.3 Journey Mapping.
- 15.4 Venn Diagram (Full).
- 15.5 Forms
- 15.6 References.
- 15.7 Images
- 15.8 Bibliography.

Examples of *phygital play-objects*:

Fig. 3: ViewMaster VR.



Fig. 4: Sphero



Fig. 5: Disney Infinity (PS4).



2.1

Definitions and Glossary:

Phygital: Relates to the hybridization or combination of both physical and *digital play* experiences.

(See Fig. 3, 4 & 5).

Digital play: is any type of play imbued with technology, this can be anything ranging from digital environments on a gaming device to *phygital* or app-enabled *play-objects*. Examples: Cellphone, console and computer gaming.

Play-object: Is a term I coined. It is used as a method of referring to multiple styles of objects that can be used as playthings. Examples: Gaming consoles, *phygital* objects, blocks (Lego) and found items.

Balanced play: Is another term I coined that indicates the balance of a *play-object* in relation to the developmental potential it holds for a child or user.

Play-tools: is a concept that I use to identify this perspective on *play-objects*. This perspective views these play-objects as the tools a child uses during play.

Fig. 6:

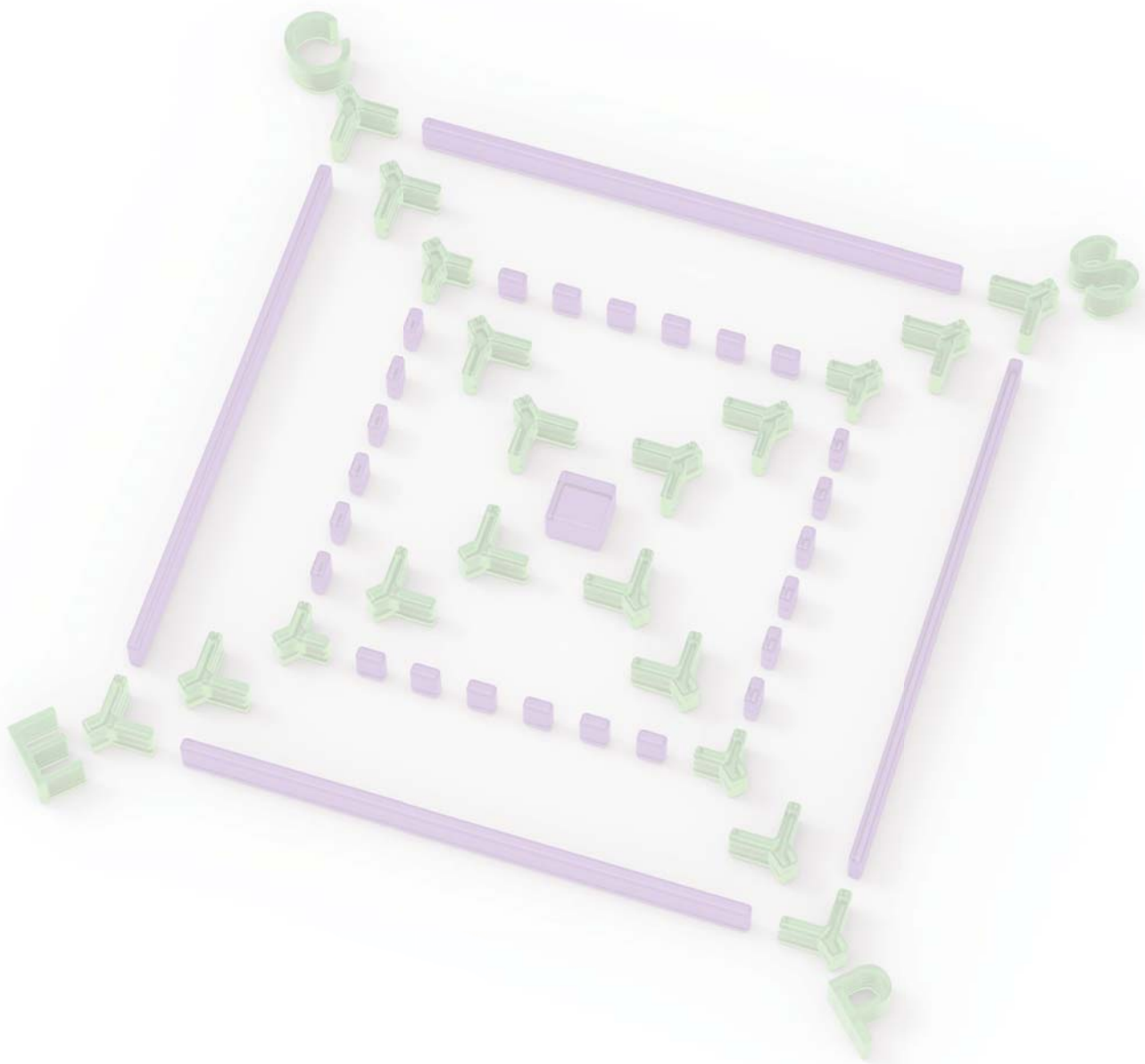


3.0 Introduction:

The way children interact with *play-objects* affects them in a multitude of ways. They access and experience a vast range of emotions such as joy, envy, and anger (Goldstein, 2012). *Play-objects* inspire creativity and learning, allowing for invention or re-experience, often acting as keys to the imagination or memories (Guyton, 2011). These effects can be fleeting or stand the test of time, and can present themselves as habits, ideas or even perspectives (Baskale, Hatice, Bahar, Zuhail, Baser, Günsel, & Ari, Meziyet, 2009). As Ackerman (2011) describes; touch is the first sensory input we develop and is widely regarded as the foundation of both physical and cognitive development in children. And touch is fundamental to all play.

Understanding the role that objects have in relation to the cognitive, emotional, physical and social development of children is the topic of key interest to this work. My primary motivation is understanding the ways *play-objects* and environments impact the play experience and development of children aged 6 – 9 years. This research aims to create a simple system as a guideline for the design and development of play opportunities that promote healthier childhood experiences.

The project began with the observation of the rise of contemporary (digitally infused) *play-objects*, the evolution in play that has followed, and the effects these objects have on children. Evolution in the way we play has always existed, with the invention of new and interesting toys and games being created and released every year. This process of evolution has recently undergone a transformation, most notably as the result of the integration of more accessible and sophisticated technology. However, the way children between the ages of 6 and 9 are currently

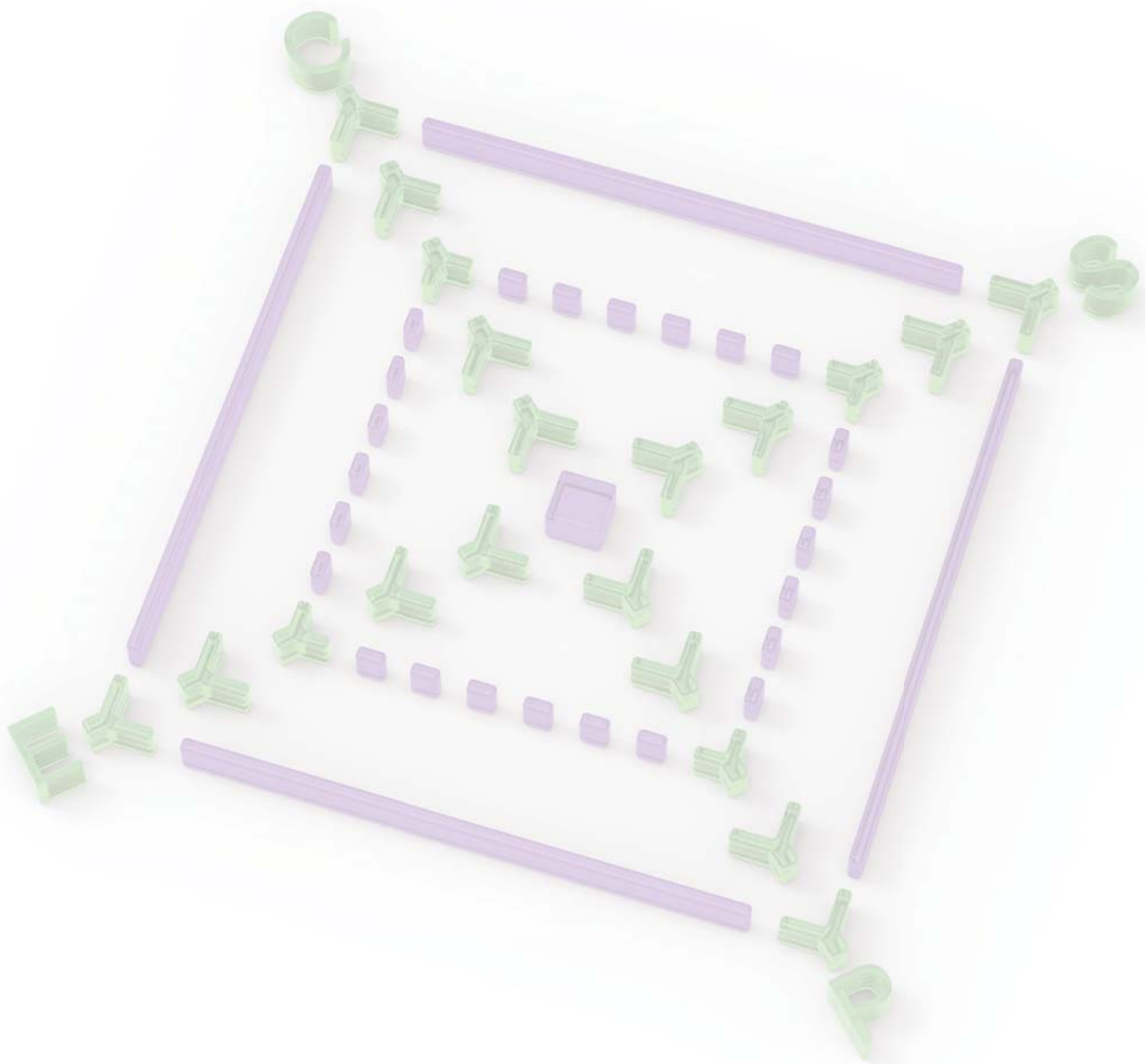


playing, may potentially have both reduced and negative developmental outcomes. Bird and Edwards (2015) state that, “technological play makes it difficult for children to separate meaning from object... [and] that technological play reduces the level of complexity evident in children’s pretend and imaginative play.”

Modern, technologically enhanced toys and experiences have undoubtedly changed the way children play. During my previous study of children’s play, I began forming the question: Has the value of this generation of children’s play declined in contrast to previous generations, and if so, what does this mean for the future of play itself? During my research it has become clear that a diverse range of professionals from backgrounds such as education, psychology and the toy industry itself, have begun their own investigation into declining free-play. Most concluded that for one reason or another the value in modern children’s play is in fact dropping at an alarming rate (Gray, 2011; Elkind 2003).

As Elkind (2003) indicates, the source of this decline is not clear or defined, merely observed. His observation identifies two leading factors. The first indicates, *digital play* experiences are replacing more traditional toys and frequently lack the benefits those traditional toys afforded.. The second indicates, parental fear of outdoor danger has resulted in a generation for whom indoors or overly structured play is becoming normal and encouraged (Burdette and Whitaker, 2006; Gray, 2011; Elkind, 2003). I believe that these two factors work in tandem in affecting children’s play. The issue of declining play which Burdette, Gray and Elkind all suggest affects children’s social, psychological and physical development, results in long term negative impact. This presents a problem that can and should be resolved. As an industrial designer, this provided the starting point for the compilation of data and literature for ongoing design thinking, and to be used to support the guidelines for future technology driven *play-objects*. This formed the foundation for my research.

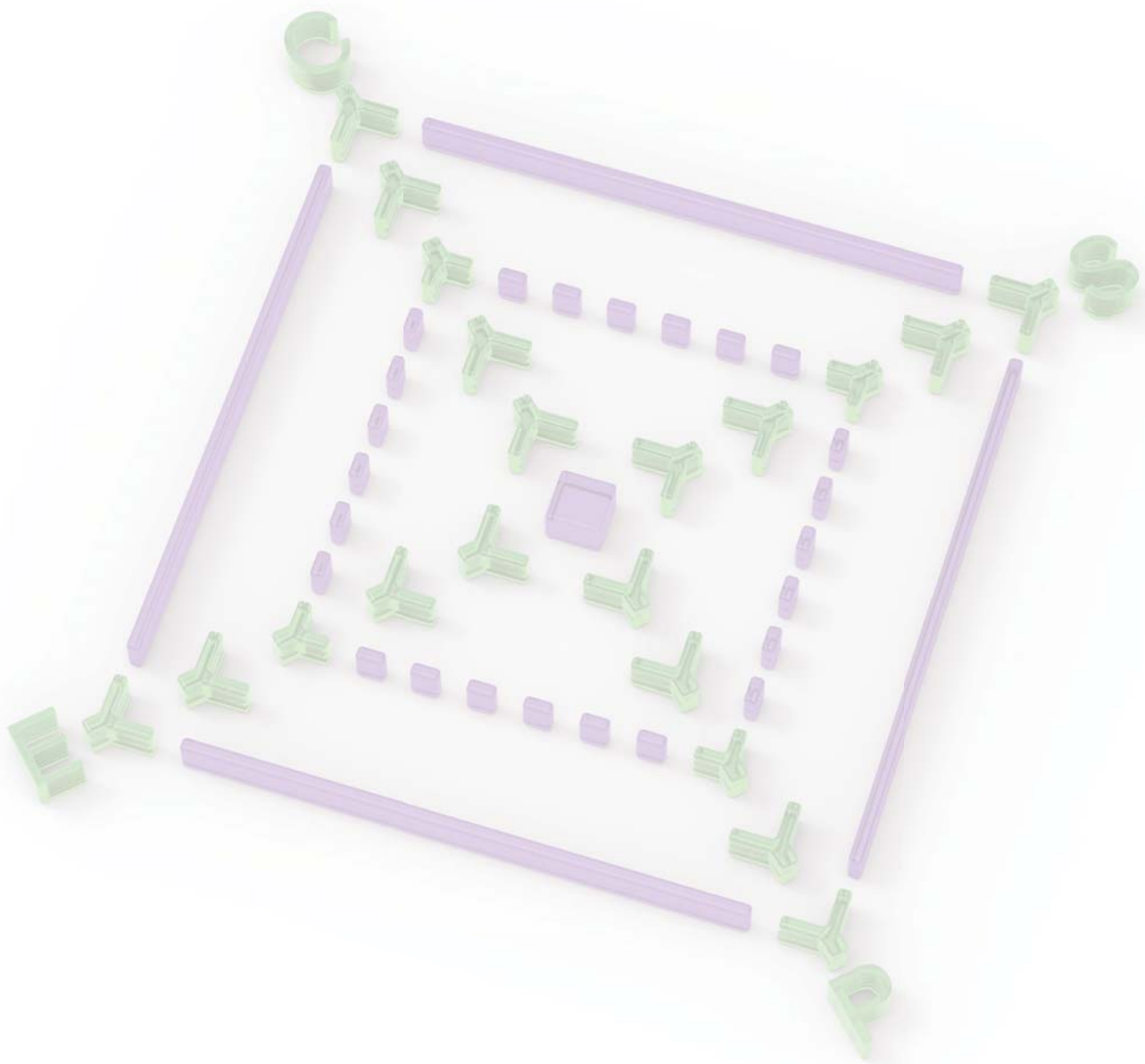
During my research, it became clear that guidelines for the design and creation of research-grounded *play-objects* (specifically those aimed at a child audience) do not exist



in an easily accessible form. Although some guidelines do exist (Gielen, 2009; Hinske, Langheinrich and Lampe, 2008; The Toy Man, 2012), they are either difficult to obtain, open to interpretation, or do not provide reasoned explanations. It is unclear why there is this shortcoming relating to the meaningful development of *play-objects*, so only educated assumptions can be made (Elkind, 1998). I believe it is the combination of many factors. Looking at the industry, there appears to be little consideration given to the value of how play fuels child development. A disconnect between the digital and physical design communities within both the gaming and toy industries, in conjunction with corporate / inter-toy company secrecy, results in their guidelines (apart from economic) being inaccessible. Basically, design decisions appear to be made based on their potential economic success, negating the potential contribution of any design analysis tool from toy makers to the industry. Equally, relieving them of any form of accountability to their consumer. The basis of my design parameters is to address the shortcomings of the current toy industry approach to toy design.

My aim with this project is to develop an accessible design assessment tool that is focused on the values of *balanced* child development (cognitive, emotional, physical and social) using *phygital* play.

I have chosen this area because it is a relatively new genre of toy design where advances can still be made. My project has relevance because the toy industry has been following the same methodology for decades. It has no fundamental need for change, unless economically driven. Burdette and Whitaker (2006) identify the gaming industry as contributing to a decrease in time spent engaging in spontaneous, unstructured play. The advances in technology and market competition are bringing these two industries together, forcing change. My goal is for this change to include design which maintains the positive benefits of play for children. As Yelland (2015) states, “making new technologies available alongside traditional materials (e.g. blocks) enable and extend playful explorations. *Phygital* design is a growth industry and I believe it is possible to make a positive contribution at this stage of its development.



My design assessment tool is intended to be a visual process used as a reference point when iterating during the design process of a toy. The purpose is to ensure each of the four areas of child development are in *balance*. I acknowledge it could be perceived as a checklist for making the perfect toy, but it is designed as a referencing tool, to be used to combat the decline in play experiences. Using this tool will identify strong and weak points in the design with respect to *balanced play*. As an example of the successful use and potential further application of the design tool, I have designed my own *phygital play-objects*: The Poli Play-toolz system. This is a toy system that meets all the design assessment tool criteria of *balanced play* in the four areas: cognitive, emotional, physical and social. The need for the existence of a research based *phygital play* design assessment tool is important to me for three main reasons. The emergent hybridization of the gaming and toy industry has reached a point where analysis of former and current designs can be made. Application of this analysis has the potential to create a standard for a healthier form of this play genre to be produced. And finally, this offers a potential solution to the very serious issue of declining free-play.

My process to create the design tool, and *phygital play* objects, has been achieved via a four step approach.

1. The comparing and contrasting of literature (specifically that of learning and play theorists).
2. My own process of design (including drawing/conceptualising, creating physical models and evaluating existing products),
3. Speaking to industry professionals about literature and design to better my understanding.
4. User testing with children within the age bracket.

Further testing of my product would be necessary beyond the end of this project to verify things such as: the cost, the material strength of the product, and to clinically validate its ability to generate *balanced play*.

Fig. 7:



Fig. 8:

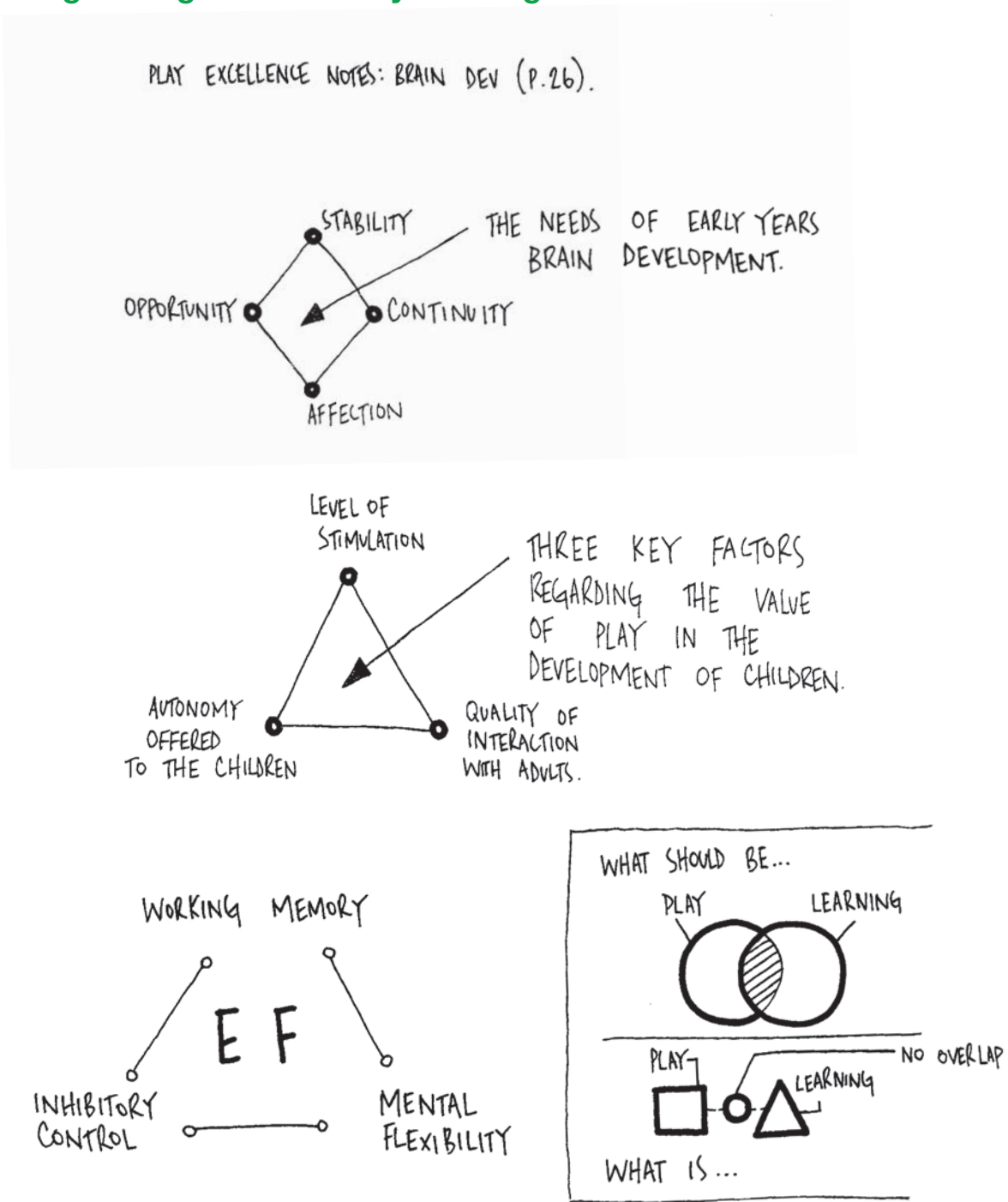


4.0

Research Questions:

1. Can 6 - 9 year old children experience *balanced play* through the use of *phygital* objects?
2. Can well designed objects re-introduce *balanced play*, to combat the proven decline of unstructured play?
3. What is the criteria for *balanced play*?

Fig. 9 Diagrams from my Workings:



(Burdette and Whitaker, 2006; Moyles, 2015; Zelazo, 2013)

5.0 Methodology:

My research is comprised of primary and secondary investigations into play and learning theory. This included reading the relevant literature, *play-object* testing, drawing and prototyping my own designs and validation from industry professionals.

5.1 **Reading, writing and diagram building:** (See Fig. 9).

I began with the reading of theories and concepts relating to play and learning. I designed diagrams and concept sketches to help establish connections between the theories I was reading. Being a visual person, I developed a repeating pattern of reading followed by drawing. This enabled me to understand these theories which informed and inspired my initial concepts.

5.2 **Play-Object Testing:**

I made a brief investigation into the physical dimensions of toys, and their relationship to the physical development of children, along with the concept of play landscapes (playscapes). This involved a mixture of more reading, combined with, playing with toys, games and experiences that involved a combination of small and large spaces with differing levels of physical and digital play. This hands-on exploration with these toys and games was recorded through an evaluation sheet of my own design (see appendices). This information was then incorporated within a diagram identifying where these existing play experiences resided within a structured/unstructured, physical/digital matrix. This then enabled me to identify what key elements could be found in existing *phygital* play experiences. This

Examples of Prototypes:

Fig. 10:



Fig. 11:

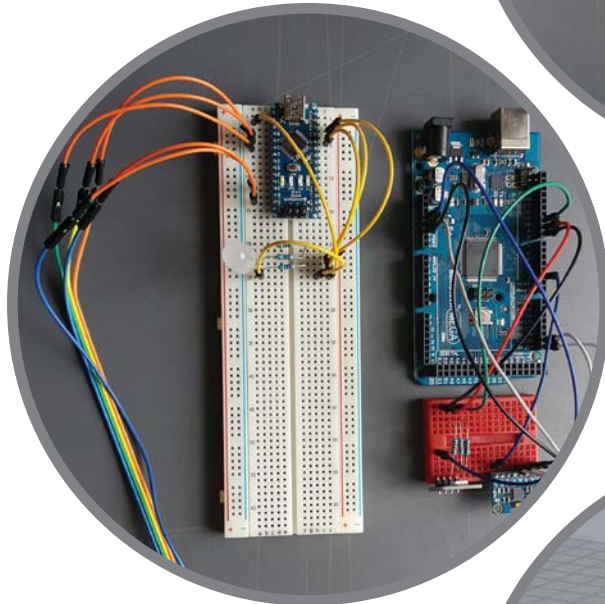
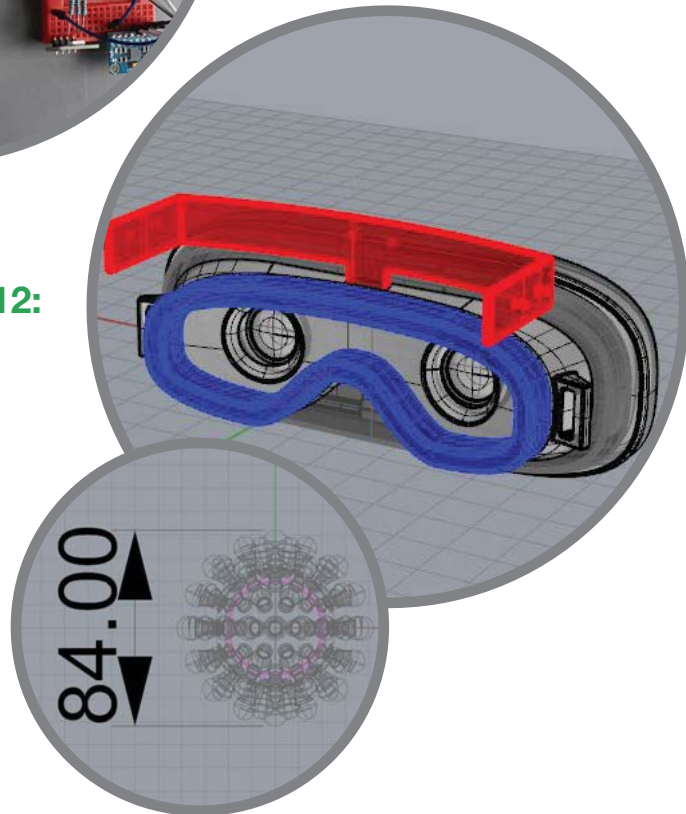


Fig. 12:



resulted in identifying two initial design pathways for further investigation plus, an initial set of criteria to support these.

5.3

Case Studies:

I began an investigation into Nintendo and the play/toy market. Through observations of past and present activity, I understood the general trajectory of the toy industry. *Digital play* experiences are becoming a more portable experience, a trend that will most likely increase. This led to my design project focussing on App-enabled toy experiences. I analysed the aesthetic style and integration of objects within a range of play based apps. Below are some of my preferred imagery taken during this observation.

5.4

Group Critique:

I engaged in three critique's. These were ten minute presentations followed by a twenty-minute discussion. The critiques were extremely useful during my exploration process. They offered insight into the strengths and weaknesses in my designs, and new perspectives on the way each object could be used or played with. Shortly after my first critique a design focus emerged and the concept of the *Play-Tool* was born.

5.5

Drawing, Conceptualising and Prototyping:

(See Fig. 10 / 11 / 12)

Approximately three months after my initial critique, the concept of *Play-Tools* became the primary focus of my research. I went through a cyclic stage of design, consisting of drawing and using CAD to digitally prototype my designs, to understand their form and physical scale. As the design became more refined, a physical prototyping stage was added to this cycle. I began investigating a framework to create an assessment tool, to produce *play-objects* that would promote more *balanced play*. This was done using a paper prototyping structure.

Fig. 13: Examples of the Cue-cards and Designs they Produced.

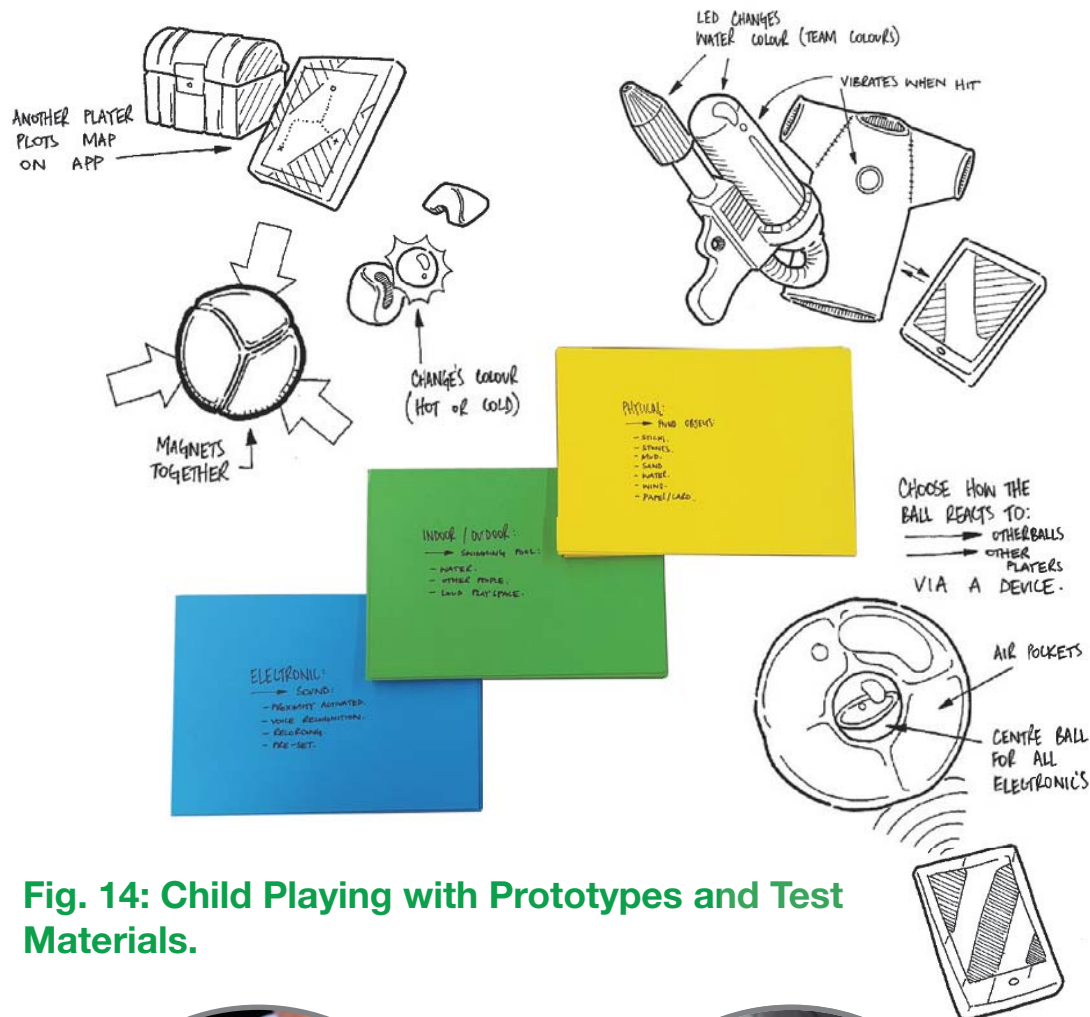


Fig. 14: Child Playing with Prototypes and Test Materials.



5.6

Persona and Scenario Building:

I constructed three sets of fictitious persona's (see appendices). These personas enabled me to visualize the progression of child development in a more subjective and empathetic way. The use of personas enabled a better understanding of the wants and needs of my target age bracket from their perspective.

Scenarios and journey mapping were then used with these persona's to better understand how my target age bracket would respond to the *play-objects* I designed. This process of design was enhanced by use of design scenario cue cards (Fig. 13). These cue cards consisted of physical, digital and environmental elements that were chosen at random to engage a starting point for ideation. I combined the ideas generated from these design scenarios with existing concepts relating to my research. This led to my final design.

5.7

Discussions with Industry Professionals:

When I reached a level of understanding where I felt comfortable speaking with professionals about the theories I had been researching, I began discussions with industry professionals. These discussions with toy designers, play therapists and psychologists gave me a deeper understanding of my design methods. These conversations enabled me to confidently build my assessment tool for *balanced play*, and have it examined by industry professionals.

5.8

Observations of Children:

(See Fig. 14).

The Kiwi Conservation Club (a national child focussed organization) allowed me to engage in a brief amount of user-testing within their game testing programme. This confirmed the importance of the inter-relationship between the digital and physical components of the Poli Play-Toolz System.

Fig. 15: The Characteristics of Children Aged 6 - 9 Years.



Intellectual:

- Learning the relationship between cause and effect.
- Memory improving.
- Can identify and group objects by size, shape and colour.
- Can be distracted easily.

Physical:

- Enjoy testing limits leading to:
- Improving combined gross motor function i.e. running and kicking a ball.
- Fine motor skills improving (will need less help with daily tasks)
- Writing/cutting shapes becomes more accurate.

Emotional:

- Has begun forming an opinion of the world around them.
- Better at controlling own behaviour (rules and games can be coped with better).

(Allen, 2004; Moyles, 2015; Parent further)

6.0 Literature review:

In the upcoming sections I identify the characteristics of 6 – 9 year olds; what play is; the benefits and effects of play; and the importance it holds in child development. I will then discuss the decline in play, and its negative impact on child development. I will finish by exploring the value of both physical and digital *play-objects*.

6.1 The characteristics of children (6-9 years):

Children develop different physical and mental abilities at different stages of life. Allen (2004) indicates these developments usually follow a set path, and he breaks these down into three stages: Random exploration (1 – 3 years); active unsystematic exploration (3 – 6 years); and systematic exploration (6 – 9 years). Each of these stages indicate what types of investigation, movement and emotional exploration are taking place at that age bracket. These distinct developmental stages confirm why children of similar ages share similar characteristics.

Around the age of six children enter their systematic exploration stage. During this stage children are beginning to establish: the concept of right and wrong; the relationship between cause and effect; and build an understanding of how their actions affect others (Rycus & Hughes, 1998). The parenting website Kidspot (2017) describes the characteristics of 6 to 9 year olds as being very enthusiastic about life, usually resulting in them being quite outgoing or bossy (for more on this see Fig. 15).

Children between the ages of 6 to 9 years, are at the systematic exploration stage of their development. This is the entry age for using *phygital play-objects*. During this stage, children's level of development matches the abilities

Fig. 16:



necessary to operate and play with *phygital play-objects*. At a cognitive level, they understand rules and their thinking is becoming logical and rational. At the emotional and social level their morals are developing and they can adapt behaviour to fit different situations. And at the physical level, the main development is the increase of fine motor skills. (Rycus & Hughes, 1998)

6.2

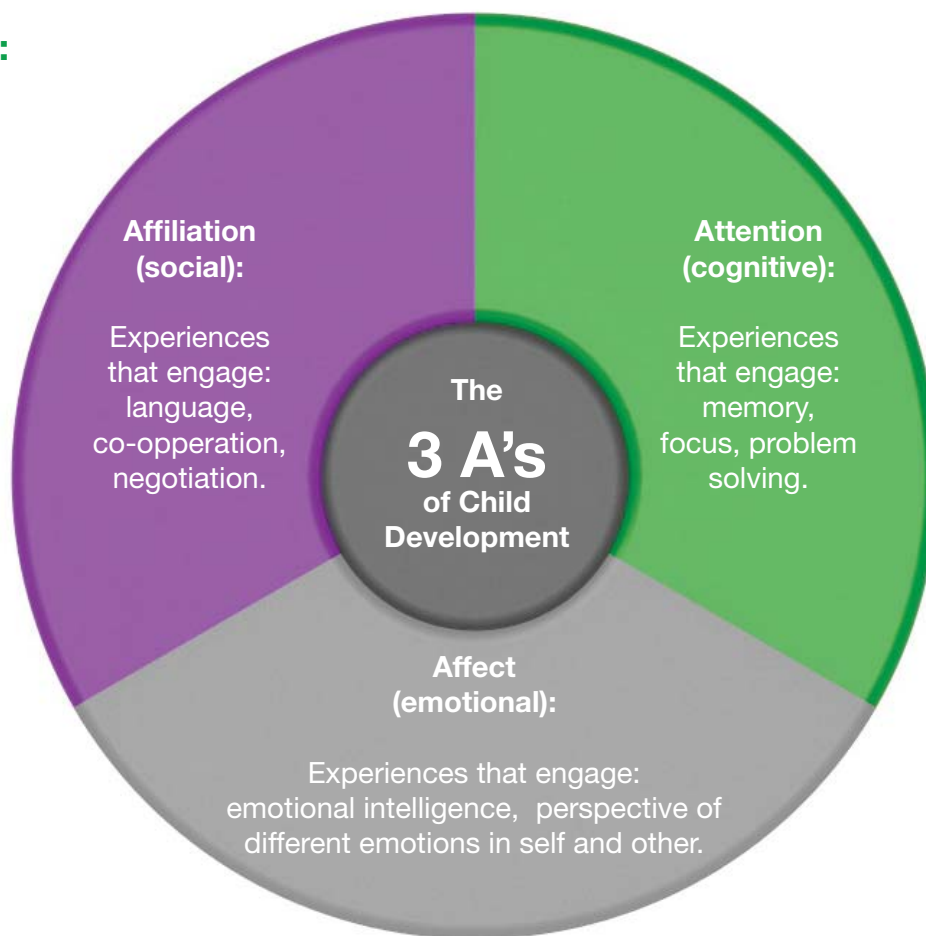
Definition of Play:

Play is described by Play England as, “children choosing what they want to do, how they want to do it and when to stop and try something else. Play has no external goal set by adults and has no imposed curriculum. Although adults usually provide the space and resources for play and might be involved, the child takes the lead and adults respond to cues from the child (Santer, 2007).

Play itself can also be broken down into its different parts. Whitebread (2012) details these types of play as: physical, play with objects, symbolic play, pretence/sociodramatic play and games with rules. He argues that “although each type of play has a main developmental function or focus... all of them support aspects of physical, intellectual and social-emotional growth”. The direction of this investigation aligns itself with the fourth type of play Whitebread (2012) describes: pretence/sociodramatic (also known as pretend play). He points out that this type of play is regarded as the most common form of play engaged in by young children. He also continues to explain that it is often labelled as fantasy or imaginative play as, “pretend play is often characterized and perceived as free-play”.

Free-play is an unstructured process that enables children to learn valuable life lessons at their own pace, enabling them to explore and experiment with their own bodies, minds and environments in a way that best suits them. Or as Gray (2011) defines “the term free-play refers to activity that is freely chosen and directed by the participants and undertaken for its own sake, not consciously pursued to achieve ends that are distinct from the activity itself”. Further explanation of free-play’s unstructured nature is highlighted by Santer (2007) who explains that, choice and

Fig. 17:



(Burdette and Whitaker, 2006)

boundaries are fundamental to understanding free-play. Boundaries should be constructed in such a way that they encourage a child's ability to manage their own play, so that they can reap the benefits that this play autonomy provides.

When we think about play experiences, it is often difficult to separate them from the objects and spaces used during that play. This is because objects and spaces fuel the imagination and thus play. Or as Goldstein (2012) outlines, children's play can be enriched and prolonged through positive interaction between objects and space. It is my belief that well designed, research backed objects hold the key to healthier play experiences. These *play-objects* should be designed in such a way that the impact of their developmental role for children at play, can be fully realized.

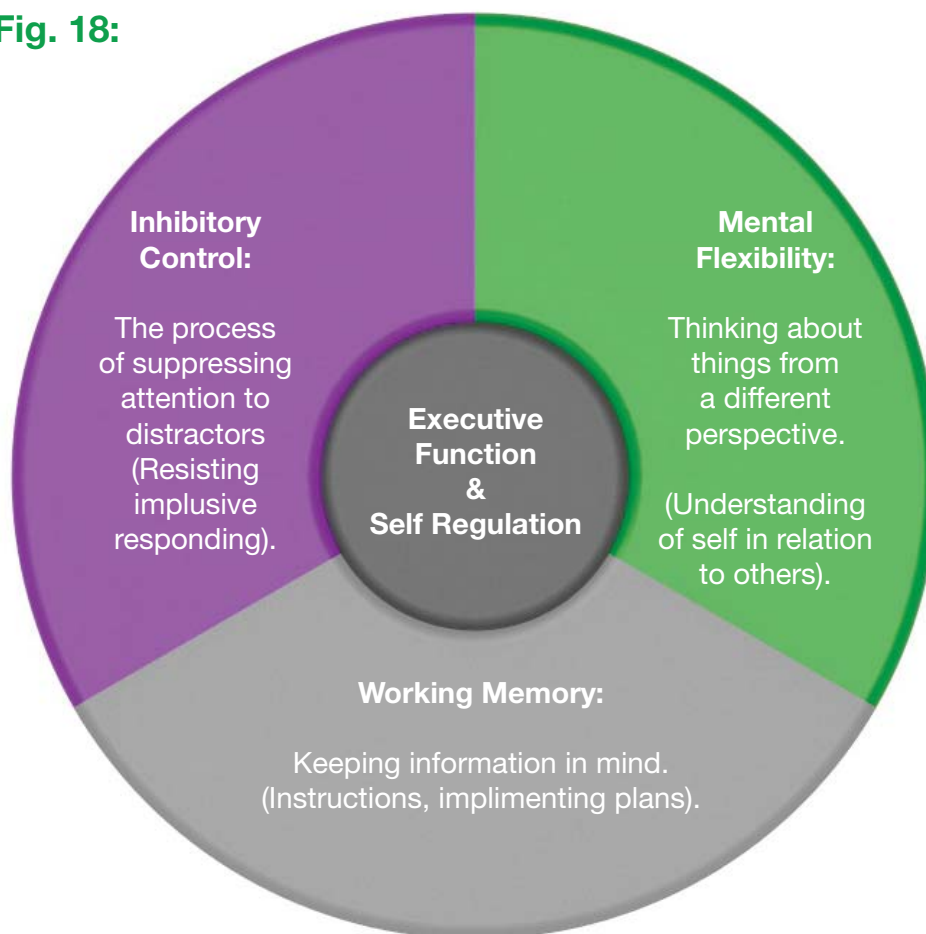
6.3

Benefits of play:

Play experiences serve child development in a multitude of ways. From the establishment of physical abilities, such as fine and gross sensory-motor function to the testing and acquisition of emotional intelligence and cognitive reasoning. Through play experiences with their peers, children between the ages of 6 – 9 learn appropriate communication and social behaviours including sharing, cooperating, and respecting others. As Moyles (2015) explains “play is a fundamental, innate characteristic of childhood... (that has the) capacity to motivate children and engender positive, long lasting learning dispositions”. She goes on to mention that “research evidence highlights that playing is... central to children's spontaneous drive for development, and that it performs a significant role in the development of the brain, particularly in the early years.” As Burdette (2006) points out “play has the potential to improve all aspects of children's well-being: physical, emotional, social and cognitive.” She goes on to note that a child's well-being can be further explained using the three A's. This trifecta of developmental domains (seen left in Fig. 17) allows us to visualise the requirements of any given child's needs, in terms of their early year's development.

It is apparent that the more a child's play is aligned with these three A's, the higher the probability for

Fig. 18:



(Zelazo, 2013)

rich developmental situations to occur. When these requirements are met, play can realise its full potential. This occurs because they are free to subconsciously shift between the three domains of their wellbeing as they see fit during each moment of their play. As Bradford (2015) confirms, “Children are naturally drawn to play experiences and many concentrate for long periods in their chosen play... [this] offers children the chance to be in control and to feel competent with relevant, meaningful and open ended experiences”.

When children shift between these three areas they engage in even higher levels of development such as self-regulation and executive function, two very closely linked skills children take into their adult life (see Fig. 18). Executive function and self-regulation are described by Zelazo (2013) as skills that are “the mental process that enable us to plan, focus attention, remember instructions, and juggle multiple tasks... the brain needs this skill set to filter distractions, prioritize tasks, set and achieve goals, and control impulses”. Therefore it is clear that play experiences hold unquestionable value within the development of children, providing the ability for children to reach their full potential at their own pace.

Play provides children with the tool’s, environments and situations necessary to inspire, challenge and encourage healthy forms of interaction and learning. The information above is vital to an understanding of why play is so important to a developing body and mind, and it also alludes to how a decline in play may affect these developmentally vital years. Many of the theories above (such as Burdette’s Three A’s) will become key elements within the design tool.

6.4

The Effects of Play:

As mentioned in previous sections, the benefits of play can be separated into three main areas, Cognitive, Emotional/ Social and Physical. The next three paragraphs further discuss how each area affects development, focusing on the target age bracket of this design investigation (6 - 9 years).

“Society should seek every opportunity to support play... Play is so critically important to all children in the development of their physical, social, mental, emotional and creative skills that society should seek every opportunity to support it and create an environment that fosters it... The child’s capacity for positive development will be inhibited or constrained if denied free access to the broadest range of environments and play opportunities.”

- Welsh Assembly Government Play Policy 2002.

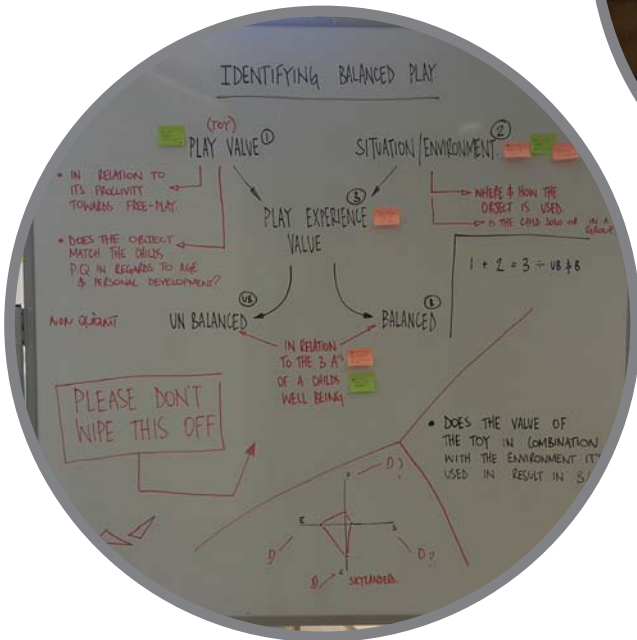
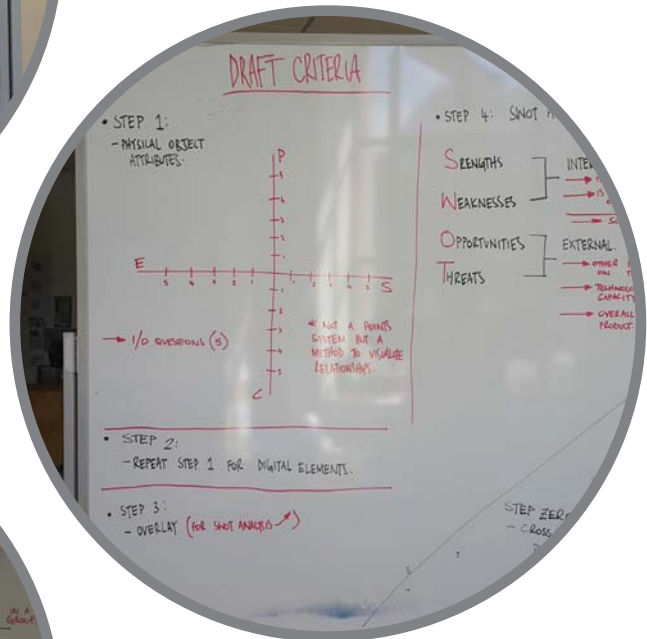
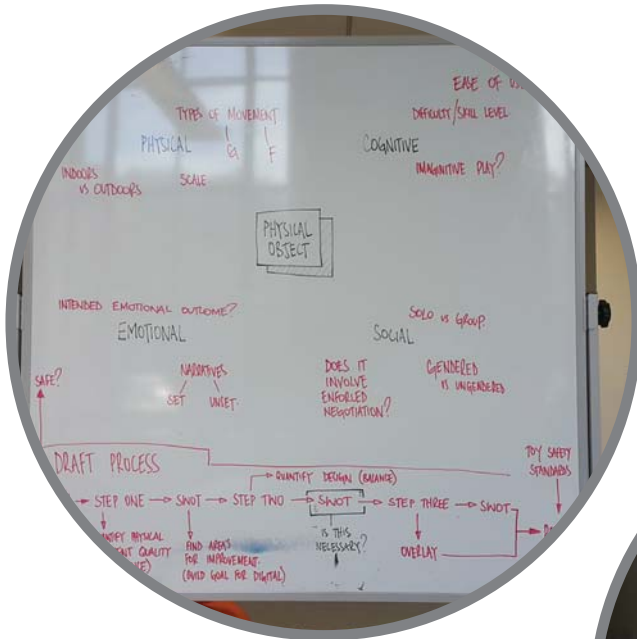
6.4.1 Cognitive:

Cognitive development is informed through play in much the same way as educational activities. As Goldstein (2012) demonstrates, the “cognitive processes” associated with play, mirror learning in many ways and present themselves as skills such as executive function and self-regulation. He goes on to mention that the exploration supported by free-play has the potential to enhance many qualities associated with intelligence or as he puts it “school readiness”. The exploration that is occurring between 6 and 9 years of age provides “a much better understanding of the relationship between cause and effect” (raisingchildren.net) resulting in an increase in problem solving and sequencing as they become “more sophisticated in understanding the concept of time”. (parentfurther.net). As Lusko (1990) states, a milestone around this age is “[their] thinking becomes more logical and rational [as they] develop the ability to understand people’s perspectives”.

6.4.2 Emotional/Social:

Emotional intelligence is key to a child’s construction of meaningful relationships; the management of their own behaviour; and the building of their own moral foundation. This is all achieved through the expansion of their own use of language. As explained by the Australian Ministry of Health Website Raisingchildren.net (2016), at this age a “child’s morals and values are developing, they might share strong opinions about whether things are right or wrong. They will also be more aware of what others are doing”. These skills and viewpoints are evident in social interactions via pretend play: a platform where children subconsciously test and learn from both their own and their friends and their family’s emotional intelligence. As Bergen (2002) affirms, “research has shown some clear links between social and linguistic competence and high quality pretence; thus, engagement in such pretence with peers may assist children’s development in these areas”.

Fig. 19: Whiteboard Drafts of First Design Tool.



6.4.3 Physical:

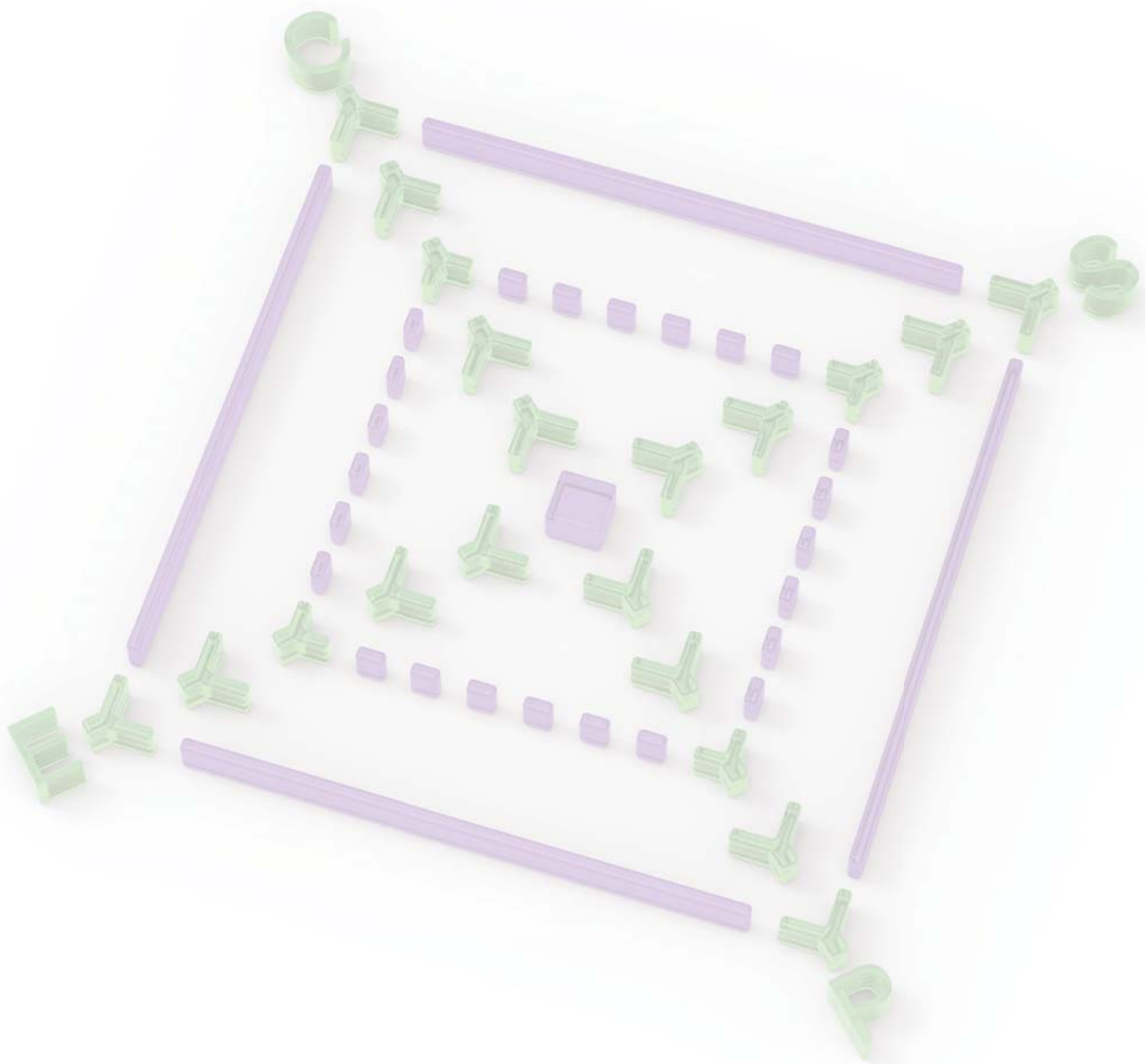
An observable change in physical abilities is possible within this age group. As Allen (2004) finds, the advancement in fine motor development pushes the change from “palm contact” to fingertip manipulation and exploration. Gross motor function also experiences a massive increase during this age bracket as children begin “testing physical limits and develop more complex moving skills... (such as) combining gross motor skills, like running to kick a ball or skipping while turning a rope” (Raising children, 2016). These physical developments allow children to further engage and explore their environments, and objects around them as they see fit, thus providing further exploration and learning opportunities. The link between physical ability and health is common throughout society. Although as Burdette (2006) points out, this knowledge is usually focused around the concept of fitness and exercise, not on the way it informs cognitive, emotional and social development.

In summary, during discussions and reflection upon my research with professionals within the sensory and play therapy industries, these three areas of development were reconfigured into four areas of examination. This was done to simplify the process of investigation around play experiences, making it easier to understand and assess their developmental benefits. These reconfigured areas became known as, physical (sensory), emotional (affect), social (affiliation) and cognitive (attention) which, as validated by these professionals, became the foundation of my design tool (See Fig. 19).

6.5

The decline in play and its effects on development:

It is well established amongst theorists that play has changed dramatically over the past two decades (Gottlieb, 2014). Observers have noted the most significant change has occurred in the amount of time children spend in unstructured activities. Downey (2004) concurs that during this period, the average American child has experienced a loss of twelve hours of unstructured free play each week.



Many play and development theorists claim a mixture of three main elements are to blame for this reduction in unstructured play time (Burdette, 2005; Gray, 2011).

1. Parentally enforced team-sporting and extra-curricula activities.
2. Parents fear of letting their children play alone beyond the borders of the home.
3. The introduction of technology into the home such as television, personal computers and gaming systems.

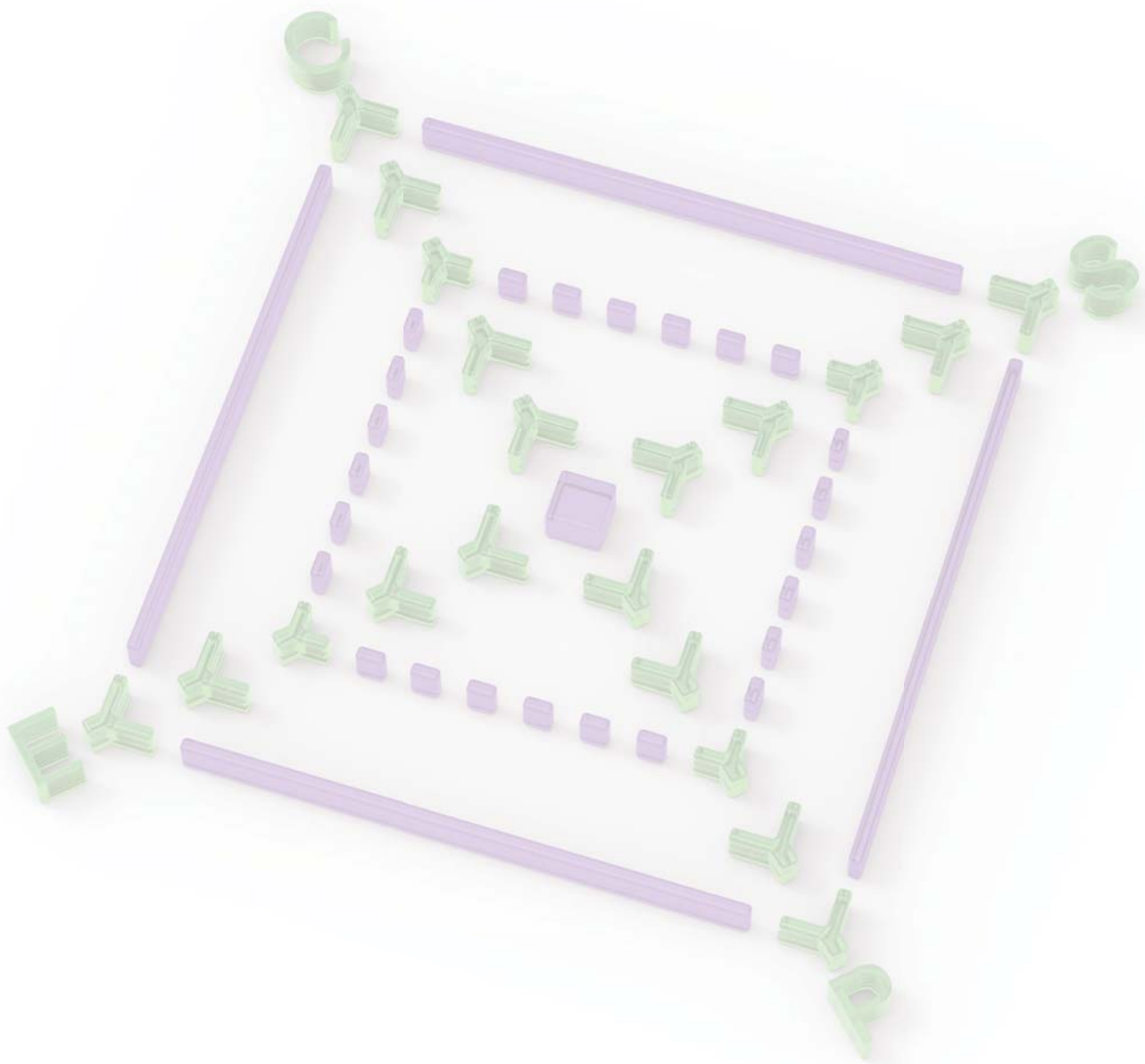
The contribution technology has made to the decline in play is only recently coming to light. In contrast to previous generations, the combination of these three elements above create an unusual play paradigm for the modern child, resulting in overly structured or confined play environments.

Rowan (2009) believes the effects of this decline in play is evident “as children are connecting more and more to technology, [and] society is seeing a disconnection from themselves, others and nature.” He explains this disconnect presents itself in the form of developmental disabilities such as obesity, problems with sensory processing plus pathological disorders such as anxiety and depression (Rowan, 2009). Gray (2011) confirms the decline in children’s unstructured activity parallels the alarming increase in developmental disabilities. This increase, has been accompanied by a decline in empathy and a rise in narcissism amongst today’s youth and is, “exactly what we would expect to see in children who have little opportunity to play socially.” (Gray, 2011). Another negative effect of current technologically imbued play, is its tendency to limit the development of social engagement.

6.6

The Value of Play Experiences:

In this segment, I will introduce the idea of the value of *play-objects*. This will be broken into two parts: traditional *play-objects* and then the digital play experience.



6.6.1 The value of *Play-Objects*:

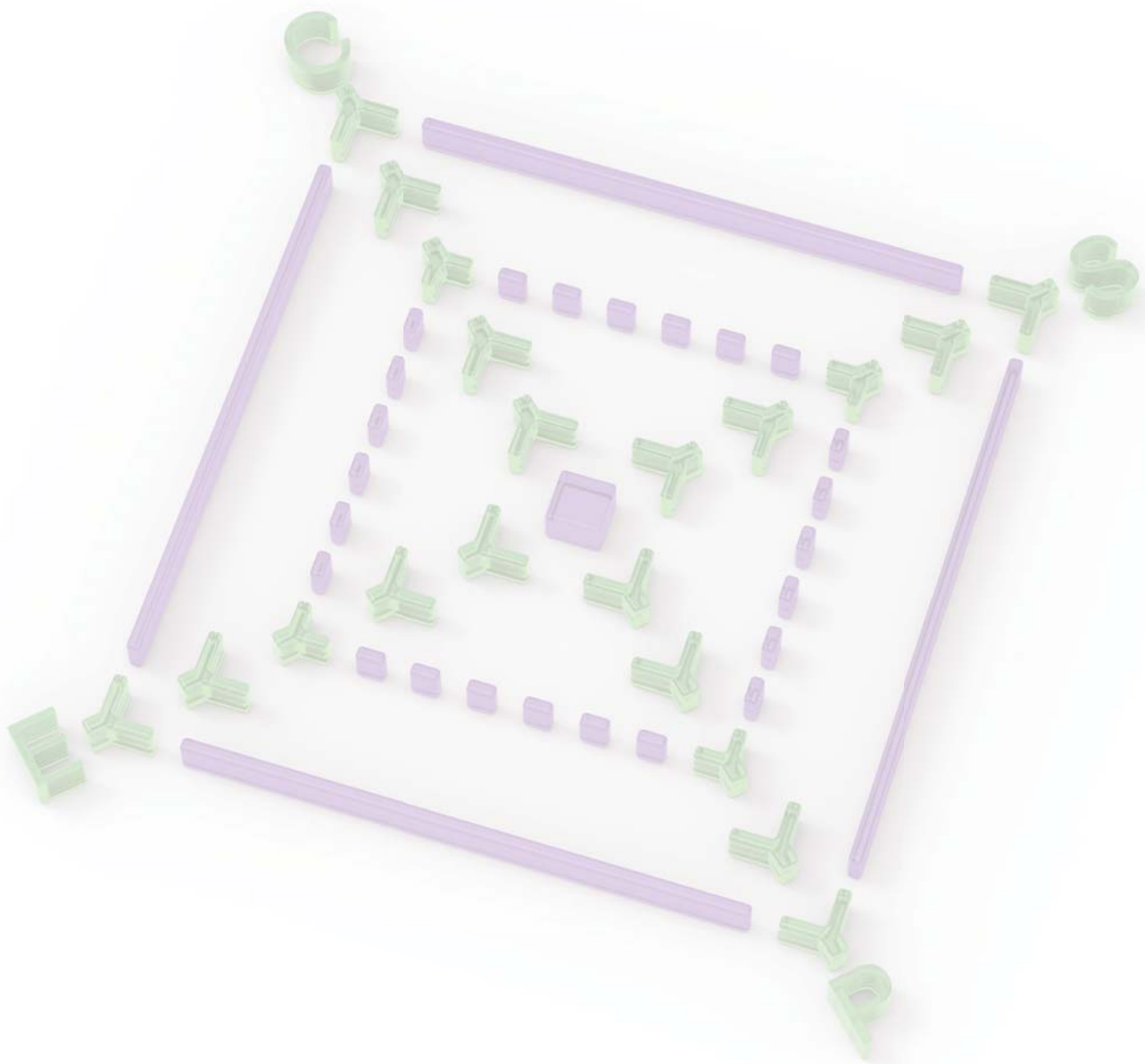
The value of *play-objects* can be viewed from two different perspectives.

As Auerbach (2012) explains, toys are objects that children can interact with, which allow them to stimulate or develop their bodies, minds and emotions through problem solving and social interaction and negotiation. These interactions help create strong emotional bonds with the environment, with playmates, and with the objects themselves. Healthy growing bodies and minds and meaningful friendships are formed. Auerbach (2012) has identified that by understanding the developmental growth that *play-objects* offer, the value of a *play-object* can be found.

Yet, development and learning are not usually the reason why children play. For children between the ages of 6 and 9, the most common answer is we play because it's fun, identifying that joy is the main motivator for play (Auerbach, 2004). I believe this value of joy must be promoted in the design of *play-objects*.

Different types of play-objects hold different levels of value during play. Auerbach (2004) confirms this through her concept of play quotient, a process for determining the play intelligence required for many of the types of play children engage in. Using this method Auerbach is able to match a child with the correct objects and activities to inspire healthy play. Unfortunately, like many other processes surrounding the analysis of *play-objects*, Auerbach's method is not intended for designers. As such this evaluating process is both difficult to access and complex to understand, thus limiting its value and use in the design of *play-objects* for healthy play activities.

Other organisation's such as, Learning Works (2012) build on Auerbach's work, to promote developmentally healthy activities. For example, they explain that during the 6 to 9 age bracket, activities need to be very physically and socially driven with a heavy focus on outdoor and fantasy exploration. They promote these forms of play because of the developmental play value these activities hold and



the challenge they present to this age bracket. It is this challenge that makes them stimulating or enjoyable.

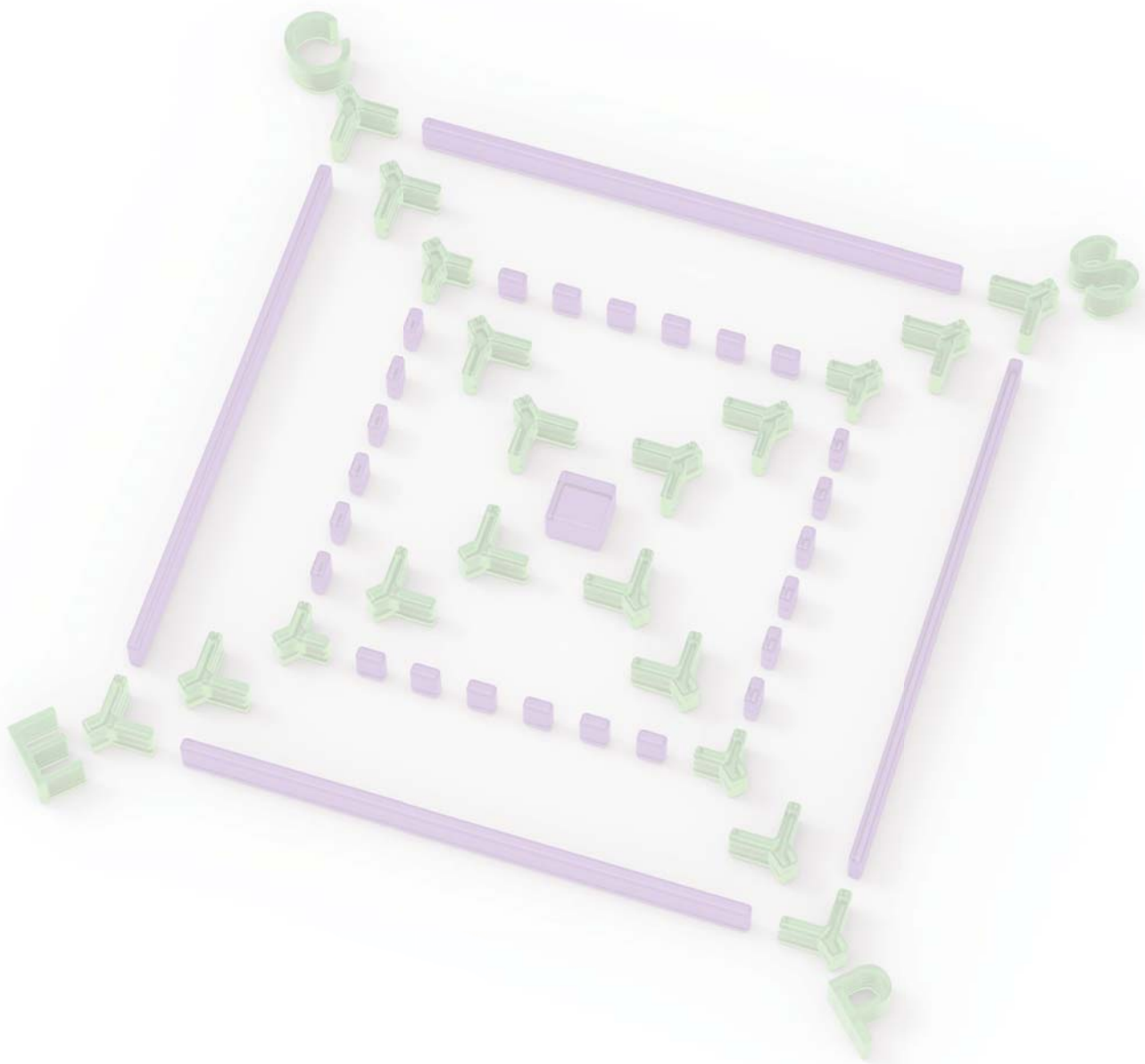
Taking into account the above it could be considered that the motivation and benefits play provide are often the same thing viewed from different perspectives. Richer developmental play opportunities create higher levels of enjoyment in children's play and vice versa. This can be related back to the four areas of child development discussed earlier (cognitive, emotional, physical and social) and supports the idea that the higher or more balanced these areas are during play the more positive or healthier a child's play will be.

6.6.2 The value of *Digital play*:

Digital Play is technology imbued play. This can be any play experience that is informed by a digital means. There is currently little concrete evidence indicating potential positive or negative effects of digital play. This lack of evidence is not surprising considering the relatively short time traditional toys and technology have been co-existing in play.

There are two main opposing viewpoints on the value of *digital play*. Downey (2004) states, "experts are divided as to the value of technology to development". The first viewpoint he describes, suggests the involvement of technology with play directly improves cognitive development and various other skills associated with digital media. Those of the second viewpoint believe technology stifles social engagement, through its overly prescribed nature, resulting in less meaningful linguistic interaction leading to negative behaviours later in life.

Downey (2004) further reveals one researcher who aligns himself with neither perspective. David Elkind believes the current methods of investigation do not attempt to understand the holistic nature of the modern child's digital environment, focussing too much on individual devices or scenarios. He suggests, "many manufacturers have a limited sense of the developmental paths that children follow or pedagogical understanding of the way



children learn” (Elkind. 1998). As a result, the potential developmental value of many toys today are limited, whether they include technology or not. Elkind’s view (1998) alludes to the need for more research-grounded *play-objects*. In my eyes this shifts the question from the value of technology in play to, how technology can be integrated in a way that best supports healthy play. Auerbach (2004) supports this with her outlook on electronic games and media suggesting their potential for negative play experiences is due to their method of integration rather than their connection to technology. This aligns with perspectives such as Moyles (2015) who suggest that, the value of technology may reside in its ability to attract and expand on traditional play experiences.

Given the emerging market in digitally infused play objects (*phygital play*) and the high levels of device use amongst children, technology fuelled play experiences are inescapable. It has been established that the value of digital *play-objects* can be determined in more ways than one. With respect to *phygital play-objects*, I believe the integration of the physical and digital elements should be designed with the focus on the digital components supporting the physical. This will ensure the play experience isn’t dictated by the digital component. The value of *phygital play-objects* designed this way will then have the potential to maintain the values of traditional play.

6.7

Technology and Play:

In the upcoming sections I identify the integration of digital and physical *play-objects* as a relatively new genre of play; a likely trajectory for this new genre; children’s usage of *digital play* devices; and the *imbalanced* outcomes of current *digital play* opportunities.

6.7.1 The Integration of Digital and Physical:

Over the past ten years the toy industry has seen the rise of a new form of play that aims to hybridize physical and digital elements into one experience. Dubbed *phygital* toys or the play-to-life/app-enabled genres. The differences between these genres is very simple.

Images of Current Phygital Play Objects:

Fig. 20: Skylanders (PS4).



Fig. 21: Furby.

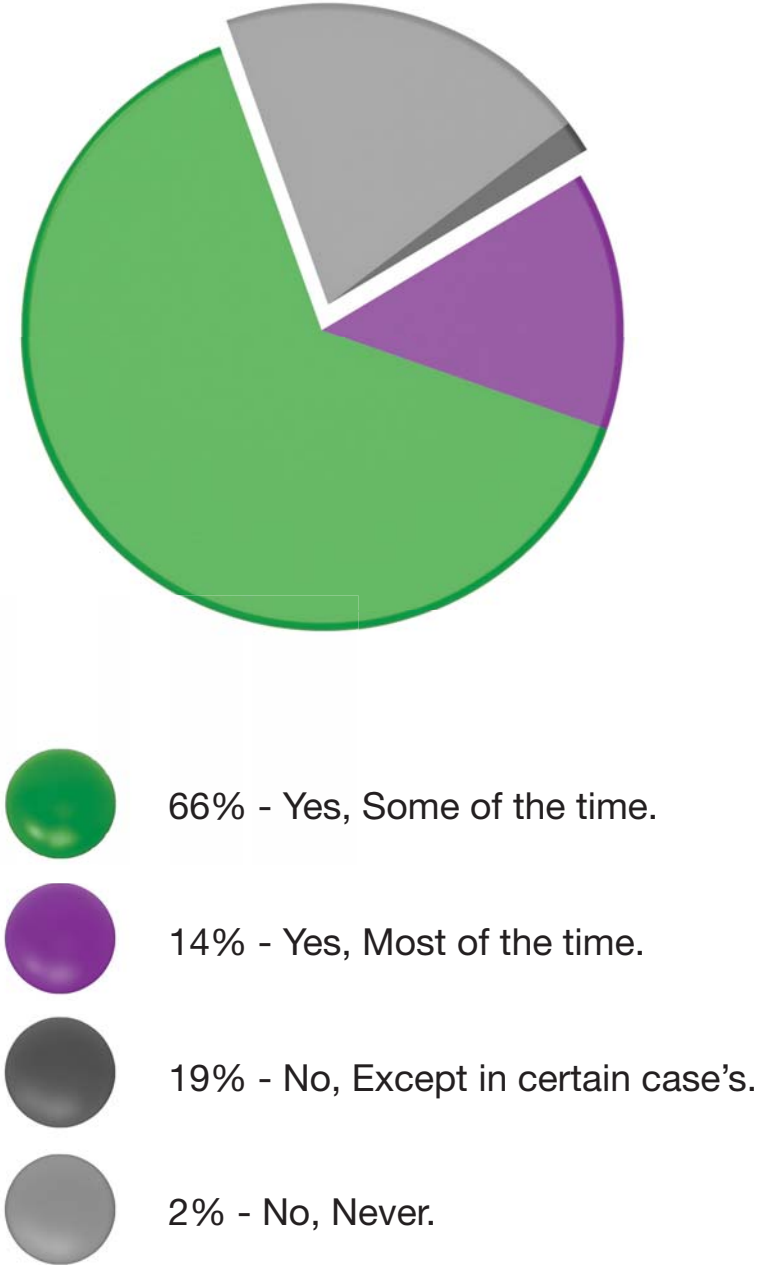


Toys-to-life usually refers to *play-objects* that are used with at home gaming consoles or computing systems. They are usually found in the form of small statue-like *play-objects* such as Skylanders or Amiibo's, and commonly use radio frequency to interact with their digital systems (see Fig. 20).

App-enabled toys are operated via an application, controlled through a smart device such as a tablet or a cell phone. These *play-objects* commonly take the form of remote control style toys such as the Sphero or Anki Overdrive; but also, seem to be an area where retro *play-objects* can make their comeback such as the new Furby range (see Fig. 21).

These *play-objects* and their digital systems currently lack what I regard as *balanced play*. This opinion is supported by Trautman (2014) who describes, “these objects as being perceived as video game accessories and have been labelled not as toys but interaction figures that facilitate (*digital*) play”. What Trautman means by this is, these objects serve no real value to play within the play experience itself, merely providing access points to their digital content. Pope (2015) confirms this by stating, “unless a digital play experience is open-ended and self-directed, the child can only ever experience what a UX [user experience] designer wants them to”. This overly structured play experience along with the removal of unstructured activity in play, becomes an issue relating to child development.

Fig. 22: Device Usage in Children Aged 3 - 8 Years.



6.7.2 Children's Device Usage: (See Fig. 22).

Technology is changing the way children play (Roman, 2009). As Unantenne (2014) indicates, as children's accessibility to technology has increased, similarly a wider range of digital play opportunities have become available to them. They state sixty-seven percent of children between the ages of 3 to 8 use their parents devices. A further eighteen percent have access to a shared family device; and another fourteen percent use their own. Unantenne (2014) goes on to claim that fifty percent of 6 to 8 year olds engage with these devices for longer than one hour per sitting, at least once per week. Children's device usage is expected to increase, given the introduction of new technologically imbued play experiences every year.

6.7.3 The imbalance of current Phygital play:

The *phygital* play products currently on the market offer an *imbalanced play* experience. This play experience is overly structured, resulting in reduced free-play. (Trautman, 2014) (Pope, 2015). When I discuss the balance of a *play-object*, I am referring to how well that object influences the four areas of a child's development (cognitive, emotional, physical and social). I use these four areas as a reference for objectively comparing the developmental qualities of *play-objects*. I have evaluated popular forms of *phygital play-objects* to be used as an example of this *imbalance* (see Fig. 23 on the following page).

To demonstrate how widespread this issue of *imbalance* is, I created a Venn diagram. This diagram plots *play-objects* from each major genre of the toy industry along two axis: unstructured / structured, and traditional / digital. The representation below shows where the current *phygital* play market resides on each axis (see Fig. 24 on the following page).

I believe that to design *phygital play objects*, that offer a *balanced play* experience, both the physical and digital components need to be of equal value and support each other in a cyclic manner (see Fig. 25 on the following page).

Fig. 23:

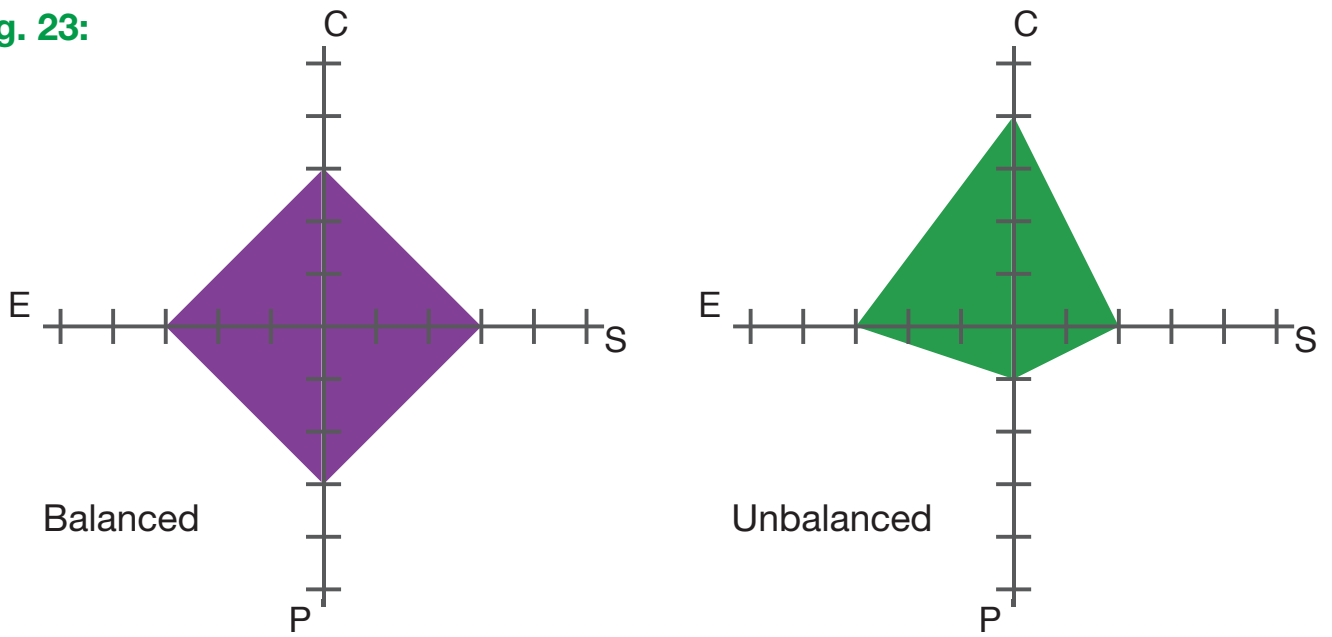


Fig 25:

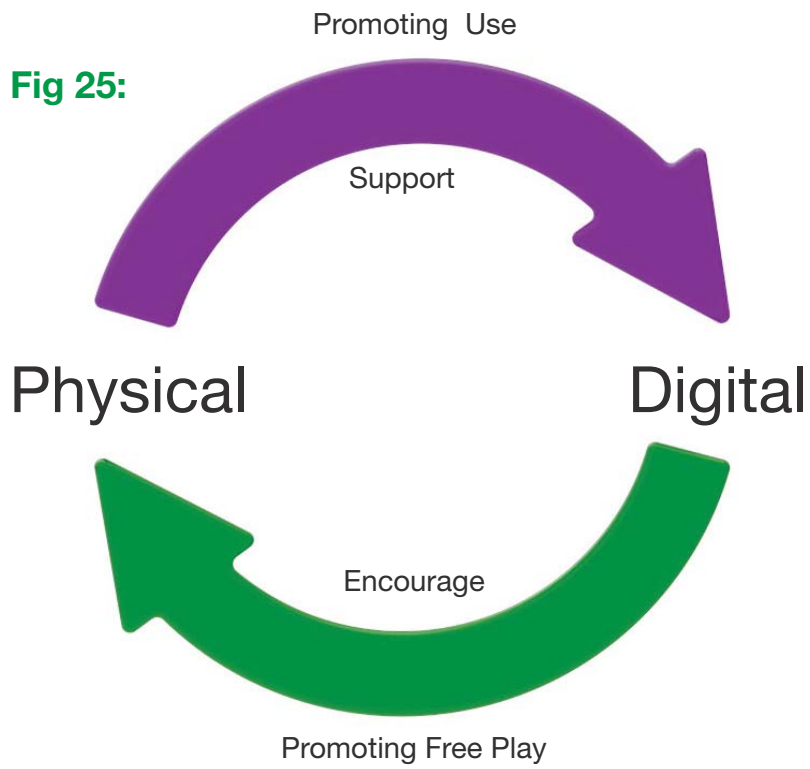
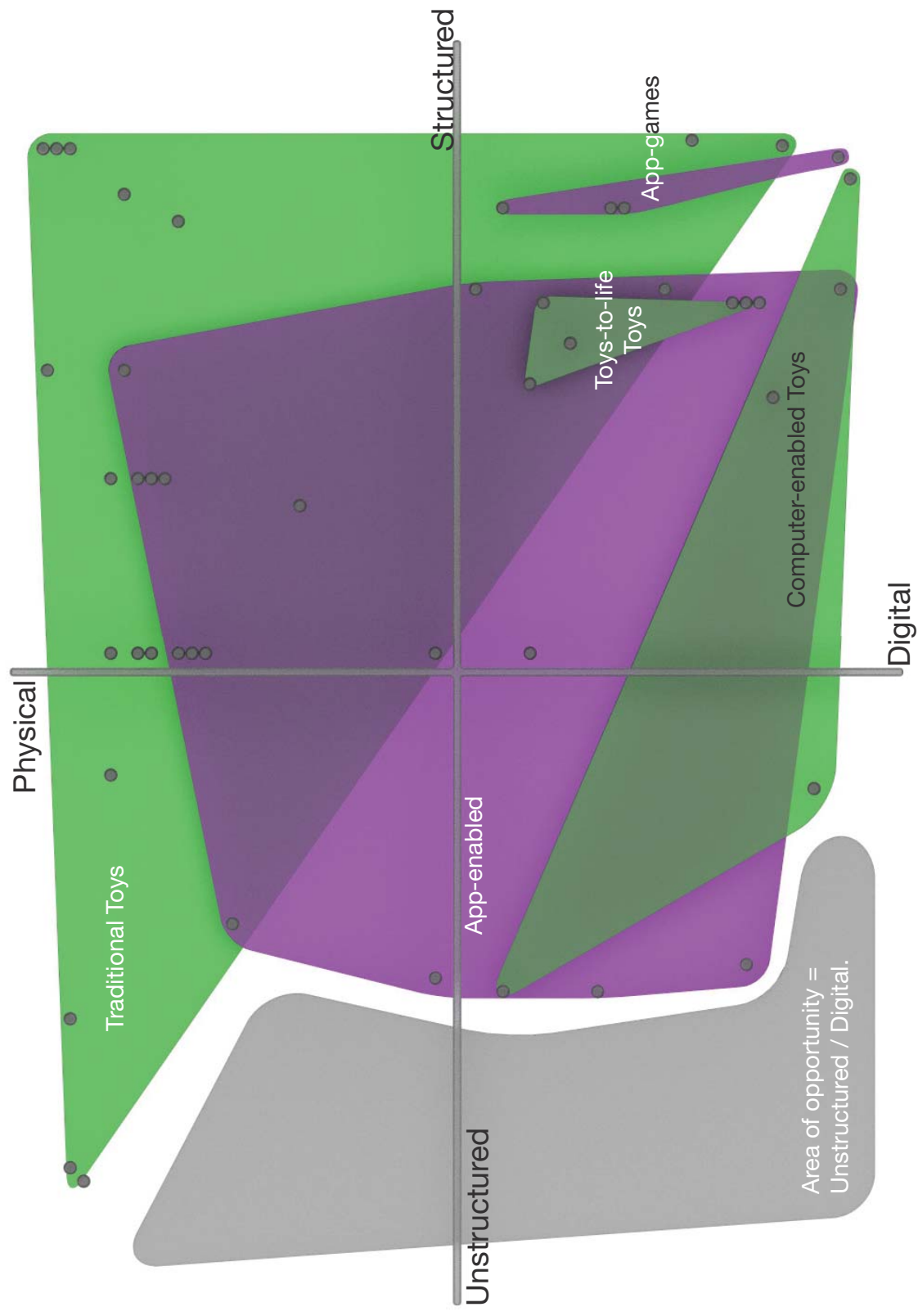
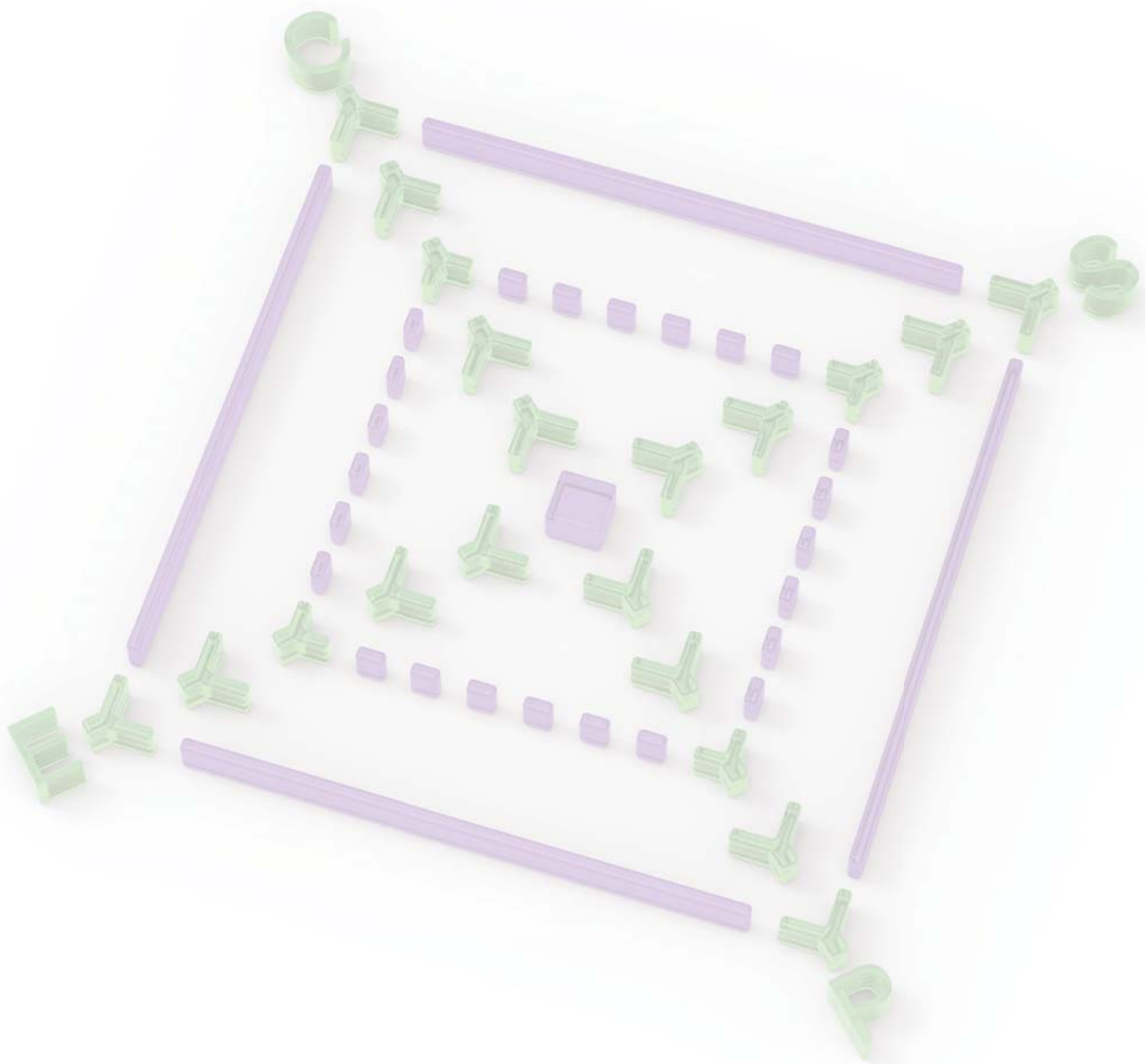


Fig. 24. Venn diagram: area of opportunity here.



Note: For full breakdown on this diagram see appendices.



7.0

A summary of research: Identifying an Opportunity.

During my research, I explored the recognised importance of play in child development (Moyles, 2015). I examined how play is changing, becoming a more structured, technologically imbued (*phygital*) experience; and how this change in play is affecting child development in negative ways (Burdette and Whitaker, 2006). I identified the age bracket of children that are most affected by this change in play experience; children of 6 - 9 years (Allen, 2004). The abilities and skills developed in the 6 - 9 year age bracket allow for the possibility of unmonitored use of digital forms of play.

Research has shown that using current *phygital play-objects* results in an imbalance in the four areas of child development (cognitive, emotional, social and physical). This imbalance between these *play-objects* and experiences, results in negative developmental outcomes in modern children's play (Elkind. 1998).

The imbalance in the way children now play indicates the need for a research grounded design tool to guide the development of more *balanced play-objects*, to combat the observed decline in unstructured play. These *balanced play-objects*, would enable children to play socially in unstructured situations, in a range of environments that are considered safe by parents. Ultimately, they would enable children to play with *phygital play-objects* in a *balanced* way, allowing for developmentally richer forms of play to flourish (Yelland 2015). This was validated for me by discussions with professionals in the industry (Callaghan, Milne, Jourdain, Ranchhod, personal communications, 2017).

After I identified the need for a design tool, I created the criteria that would guide the design process for *balanced*

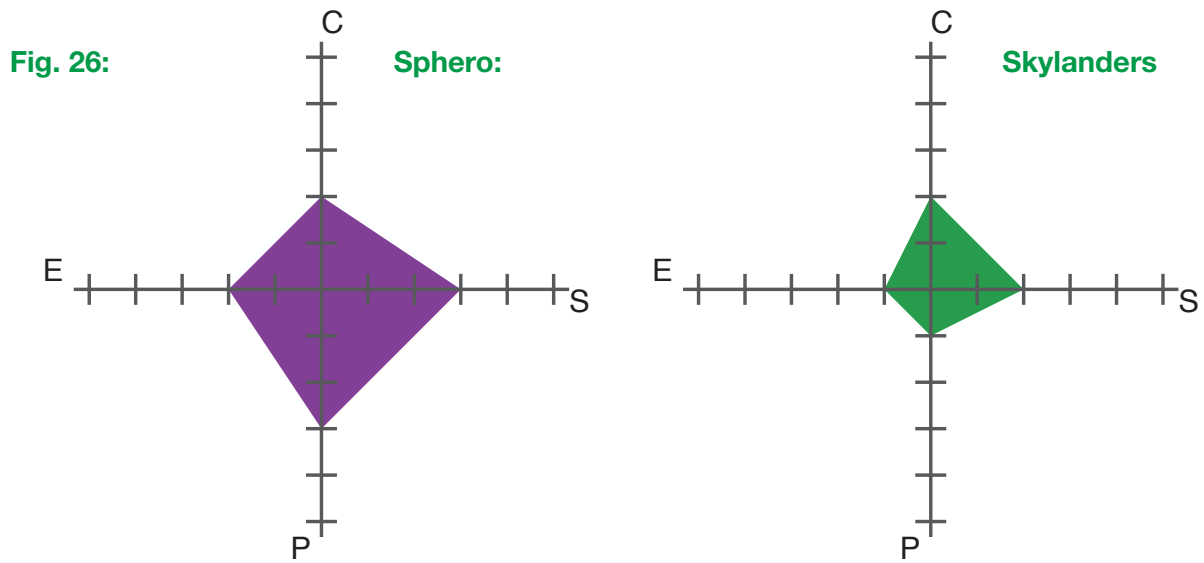
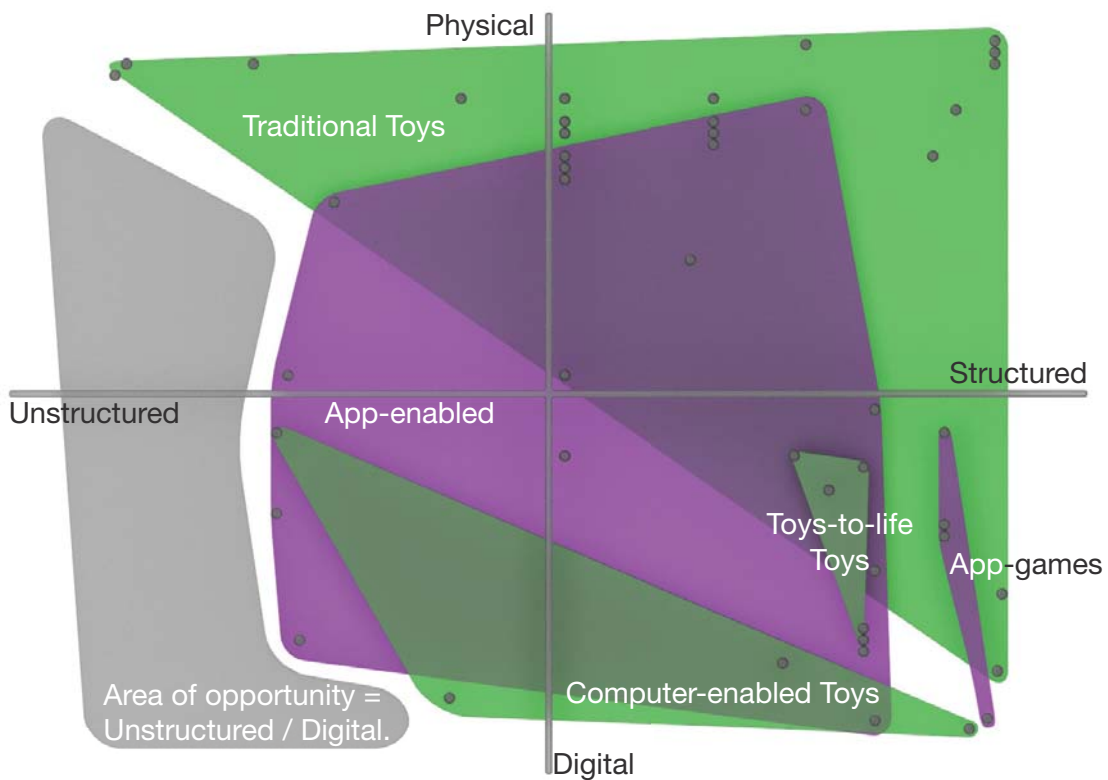


Fig. 24. Venn Diagram: Area of Opportunity.



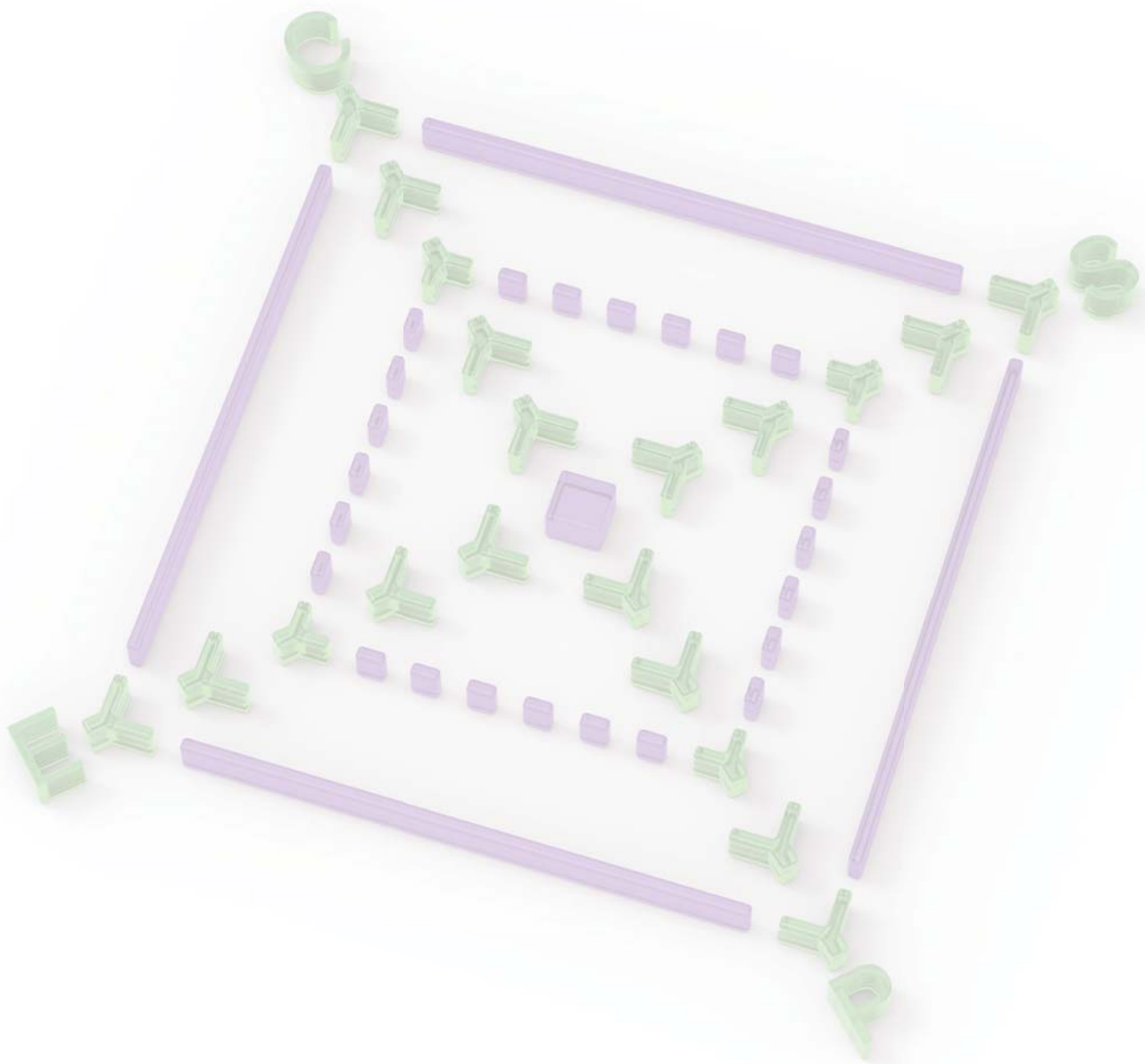
Note: For full breakdown on this diagram see appendices.

play-objects. To do this, I evaluated the industry and existing *play-objects* on the market. From this I created two methods for examining *play-objects*. To the left are examples of the results of my *play-object* examination methods.

The first example provides a visual representation of developmental imbalance of two different types of *phygital play-objects* (See Fig. 26). These visual representations provide a means for the assessment of the *play-objects* by identifying areas of strength and weakness, and what areas of a child's development they will each affect.

The second example maps each type of *play-object* within two axis: physical / digital and structured / unstructured (See Fig. 24). As depicted in the Venn diagram, current *phygital play-objects* and experiences produce a very structured form of play. These structured forms of play prevent the benefits of playful exploration, such as free-play from occurring and stifles the development of children who interact with them (Burdette, 2005; Gray, 2011).

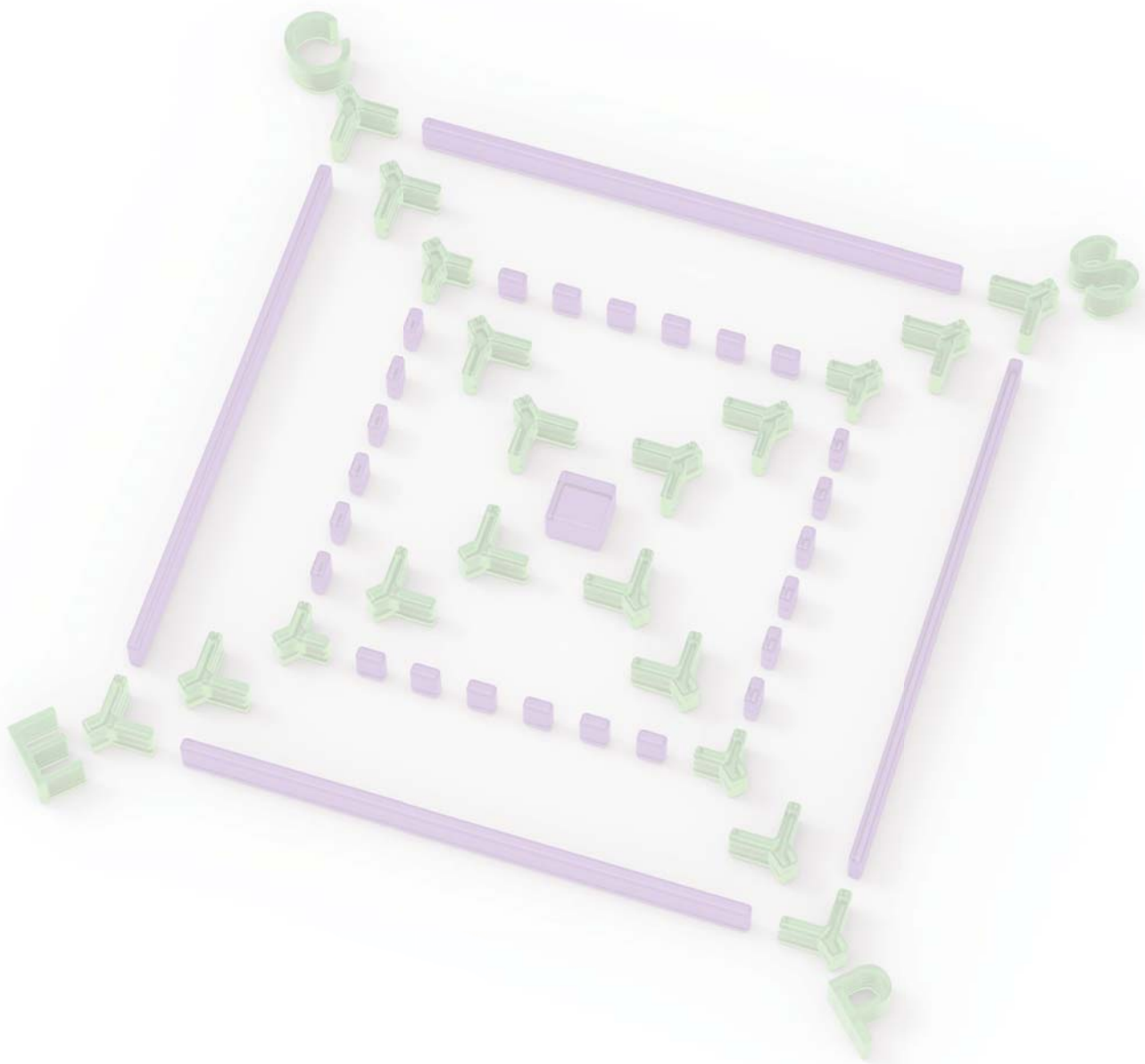
My research indicates that *phygital play-objects* need to offer unstructured play experiences. Therefore, I have designated the unstructured / digital domain of *play-object* design to be the area of opportunity and the focus of this project.



8.0 *Balanced play:*

Balanced play is a term I have coined myself. It is not necessarily a mode of play, but the balanced outcome of play. As discussed, play holds incredible value within a child's developmental years and has already been broken down into four key areas: cognitive, emotional, physical and social development. To achieve *balanced play*, each of these four areas need to be of equal value. Finding these values is the basis of my assessment of *balanced play*.

According to D. Milne (personal communication, March 6, 2017), a process for the assessment of *play-objects* would be integrated into the iteration phase of design, allowing designers the opportunity to strengthen their concepts or prototypes before going to market. It is my belief that this concept of developmentally *balanced play*, and a tool for its assessment, would be most easily adopted by toymakers designing *phygital objects*. This is because, as indicated by Gaudiosi (2015), *phygital play-objects* are a growth industry and market.



9.0 Design Parameters:

The following subsections explain: my initial criteria when I began this research and the developed criteria for each part of my exegesis: My design tool process; the product that reflects this process: and the device application that the product uses.

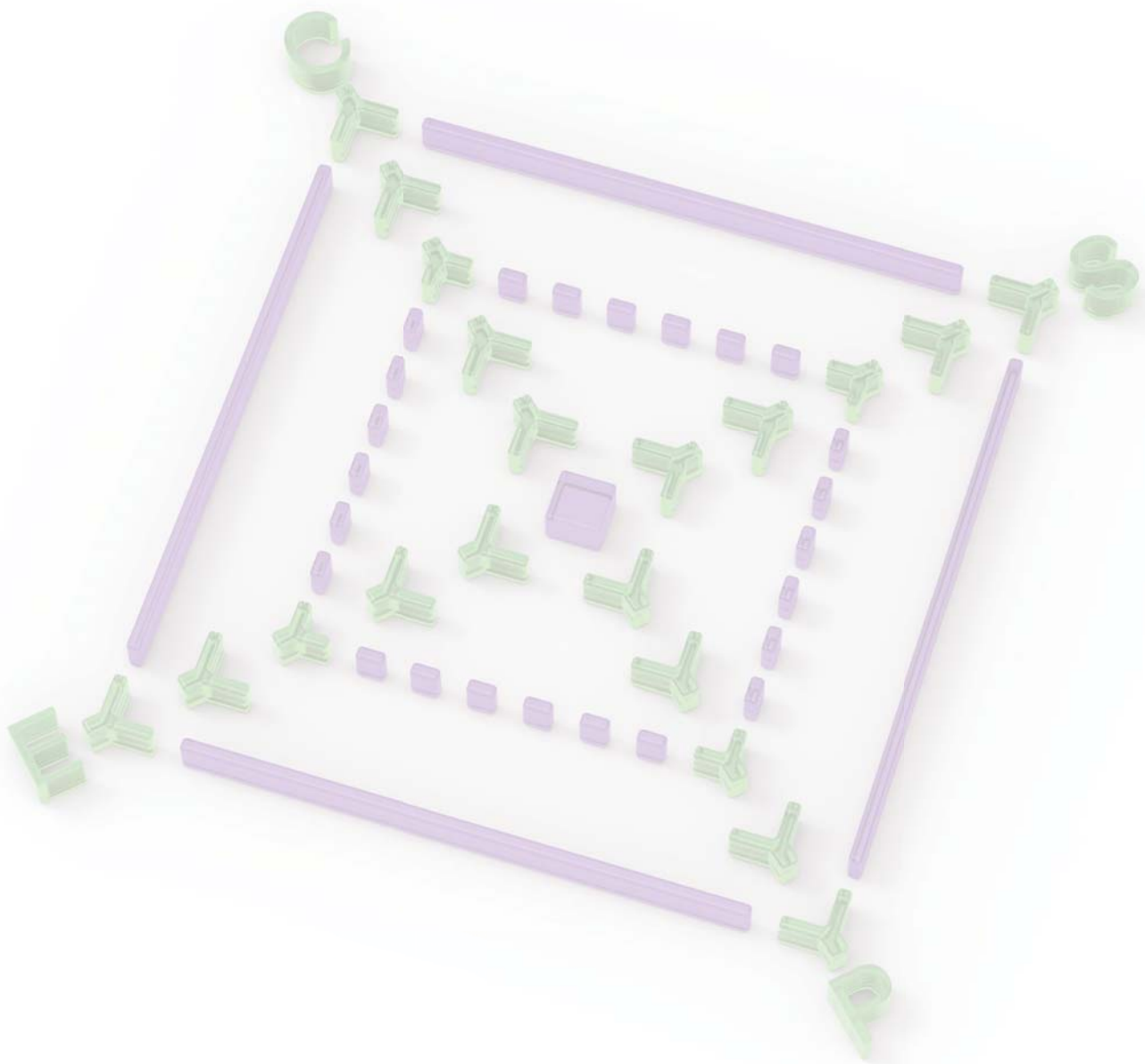
9.1 Initial Design Parameters:

I established the criteria listed below towards the end of my third month of investigation. During this period a substantial amount of time was spent understanding play via reading, writing and diagram building of play and learning theories.

My initial criteria for a hybridized (*phygital*) play system :

- Designed for use by 6 - 9 year olds.
- Focuses on both fine and gross motor function activity.
- Aims to create *balanced play* through consideration of Burdette and Whitaker's (2006) three A's and a cyclic physical/digital nature.
- Allows children to freely access pretend play.
- Is accessible.

At this stage in my research I was unsure exactly what *balanced play* could be and how it enhanced child development. In hindsight, it is interesting to note nothing needed to be removed from these criteria. They either remained the same or evolved.



9.2

9.2 Final Design Parameters:

The following subsections detail my final developed parameters and are broken into three parts: The design tool, the *play-object*, and the application used with it.

9.2.1 Design Tool Parameters:

My design tool is a process for designing a *play-object* that results in *balanced play*. It will need to be: simple to use and understand; accessible to designers and others who wish to use it; and most importantly grounded in research validated by industry professionals. This process provides a framework for how it is integrated into design workflow. It will also need some form of an example of its use, either through diagrams or instruction.

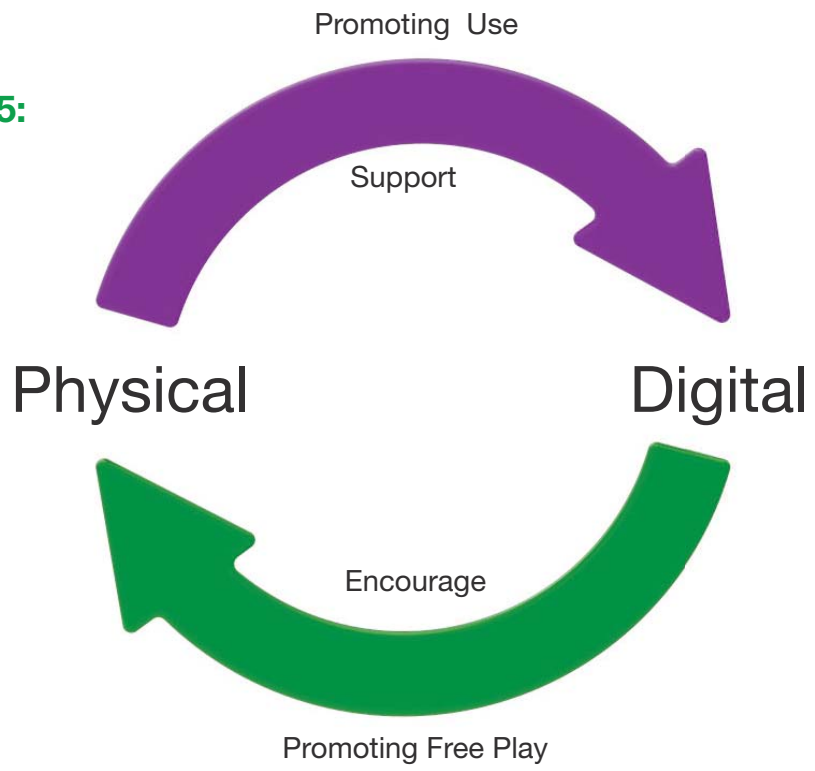
9.2.2 Product Design Parameters: *Play-object*.

I have long believed toys to be more than simple playthings. I consider them as *play-objects* with potential to impact on children's growth. Over the course of my research and design, my perspective developed as I understood the extent to which *play-objects* fuel each area of child development.

Reflecting on the ways play affects child development coupled with my concept of *balanced play*, I believe the design of my *play-object* needs to adhere to the following criteria:

- Be designed for use by 6 - 9 year olds.
- Create *balanced play* through using my design tool.
- Use physical and digital elements in a cyclic nature.
- Remain unstructured and allow children to freely access pretend play.
- Be flexible enough to be used in different environments.
- Offer caregivers peace of mind in terms of their children's safety i.e use of materials.
- Incorporates found objects i.e branches, pencils.
- Be accessible i.e cost.

Fig. 25:



9.2.3 Product Design Parameters: Application.

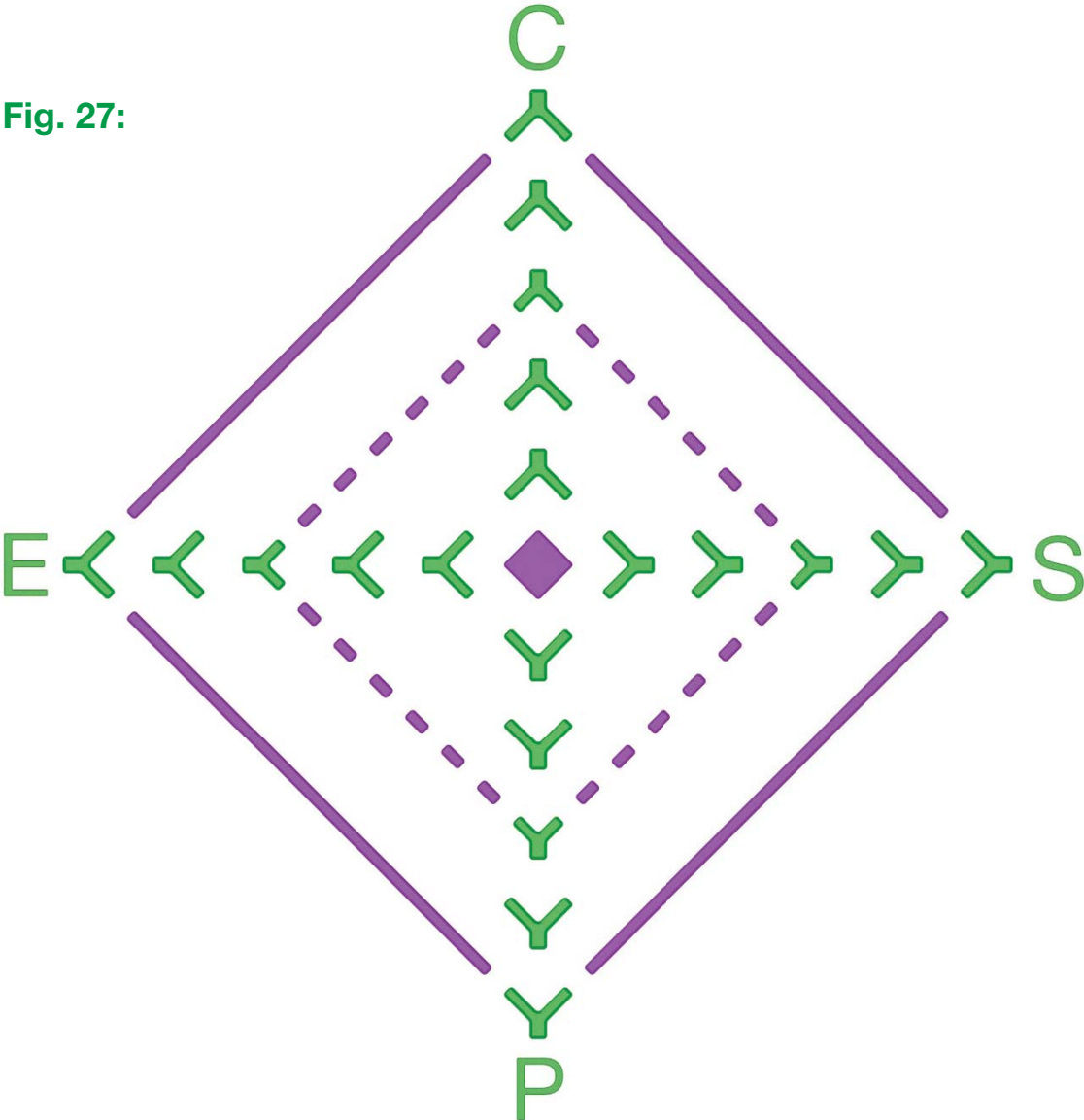
The criteria for the application component of the *play-object* is simpler than the physical area of its design. The presence of digital elements such as the application would be to encourage or support the physical components of the play-object. (see Fig. 25).

Through reflection of research; the analysis of existing *phygital play-objects*; and discussions during critiques, I believe the integration of the application should be kept to a minimum. I believe this because, the importance of the application resides in its ability to provide an understanding of how children might interact with the physical component of the play system. having a minimal effect on the flow of any child's given play.

The following is a breakdown of criteria for the application:

- Encourages and supports *balanced* physical play.
- Provides examples of use for the physical components of the play system.
- Is simple and easy to use for children aged 6 - 9 years.
- Allows for the customization of *digital play-object* elements or features.
- Is free to download and use, or is incorporated into the cost of the *play-objects*.

Fig. 27:



10.0

Design Tool:

An Assessment Method for *Balanced Play*.

To achieve the design parameters, I had developed for *balanced play* I began thinking how this tool might look and function. I had two things in mind: One, it would need to be used in a similar way to a SWOT analysis tool (Strengths, Weaknesses, Opportunities and Threats). Two, it would need to be simple and extremely visual in its method of analysis.

For this assessment to work correctly, each of the four areas of development need to be broken down into their key parts. It is these parts that will direct and evaluate what aspects of a *play-object's* design fits into each area allowing for a visual representation to take shape.

Using this graph (depicted in Fig. 27) as a map for each area of development, a visual representation of a *play-object's* values can be generated. I believe it is via this visual representation that toy makers and designers will understand the concept of *balanced play-objects*. This will potentially further their understanding of how their designs may inform the development of the children that use them. This will help combat the current decline in free-play children are experiencing.

10.1

The Values for Positive and *Balanced play*:

As a result of the information found in literature, and my personal communications with professionals (Callaghan, Milne, Jourdain, Ranchhod, 2017), the key parts of each area of development became clear and defined. These key parts were prioritized, and for the sake of simplicity, capped at five equal parts. These parts were then separated into each of their four areas as follows.

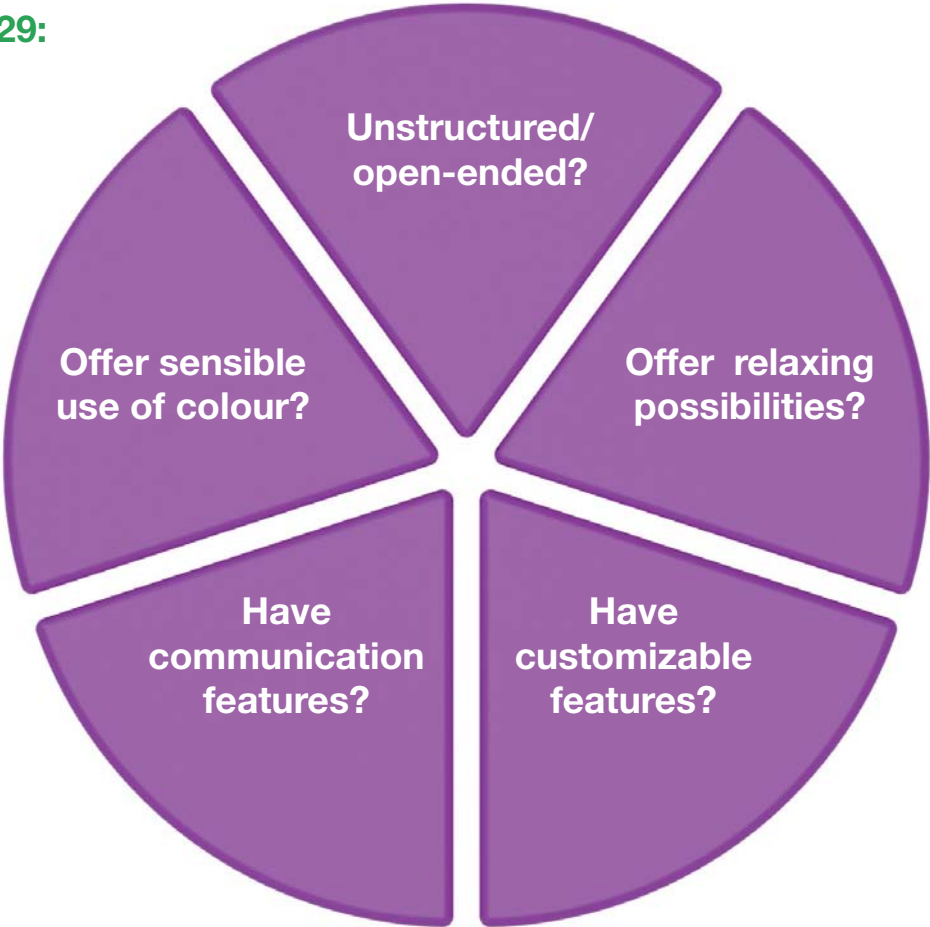
Fig. 28:



10.1.1 Attention / Cognitive Developmental Values:

- Does the play experience require intense focus and memory?
 - Sequencing, memorising, balancing, threading.
 - Problem solving.
- Does the play experience focus on specific skills?
- Does the play experience present an achievable challenge?
 - Age group appropriate.
 - Are instructions required or examples given?
- Does the play experience inspire imaginative play?
 - Aspects are open to interpretation.
 - Easily integrated with other objects.
 - Promote creativity and decision making.
- Does the play experience contain or encourage elements of surprise?

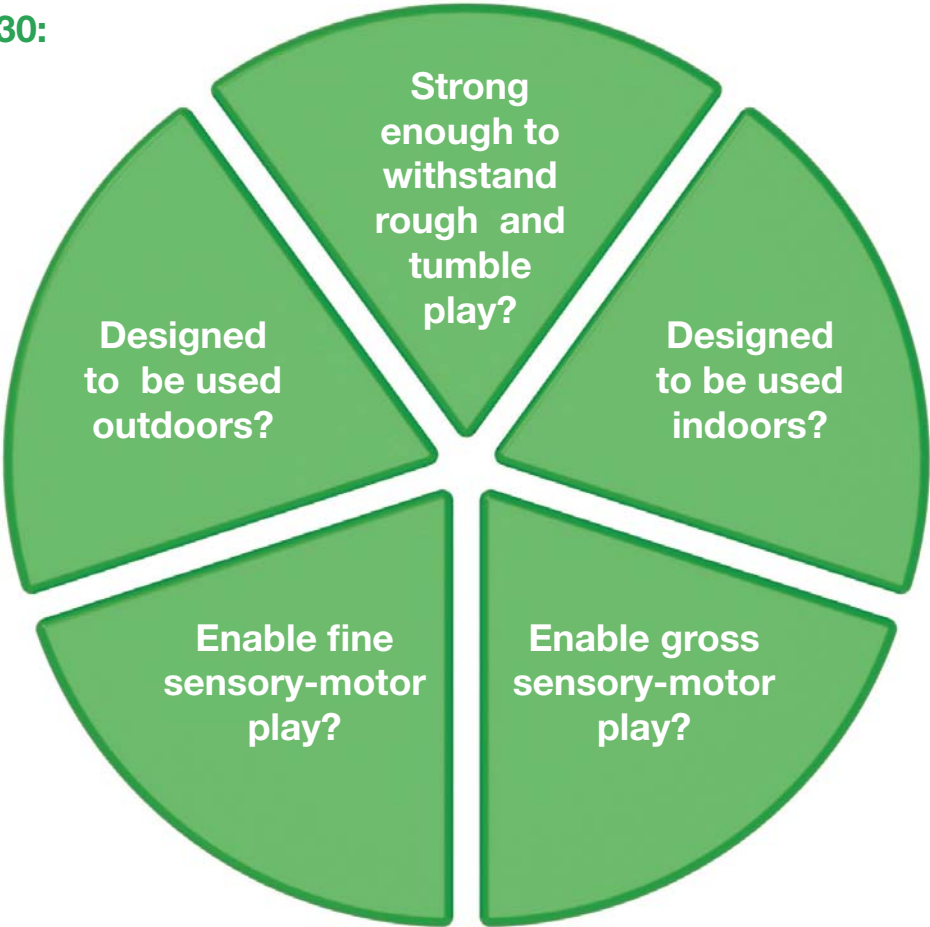
Fig. 29:



10.1.2 Affect / Emotional Developmental Values:

- Is the play experience unstructured?
 - Open ended, flexible.
 - Free of narrative/license driven play.
- Does the play experience offer relaxing possibilities?
 - Is it comforting?
 - Is it soft/cuddly?
 - Does it respond to mood or touch?
- Does the play experience have customizable features?
 - Personalisation, self expression.
 - Pose-ability, can be reconfigured.
- Does the play experience have communication features?
 - Expressive qualities (displays feelings).
- Does the play experience offer sensible use of colour.
 - Age and gender appropriate.

Fig. 30:



10.1.3 Sensory / Physical Developmental Values:

- Is the play experience designed to be used outdoors?
 - Does it engage sensory exploration through textures and sounds?
 - Are these *play-objects* able to get wet, muddy, left in the sun.
- Is the play experience designed to be used indoors?
 - Is it relatively quiet and designed for a contained play-space.
- Does the play experience enable fine sensory-motor development?
 - Does it engage small movements focusing on eye or digit manipulation, listening, whispering, stacking, balancing, careful placement of objects.
- Does the play experience initiate gross sensory-motor development?
 - Large body or sensory movements/activities.
 - Running, jumping, climbing, yelling, rolling.
- Is the *play-object* strong enough to withstand rough and tumble play?
 - Strong construction and durable.

Fig. 31:



10.1.4 Affiliation / Social Developmental Values:

- Can the play experience occur alone?
 - Is the full experience possible during solo play?
- Is the play experience designed to be used in a group?
 - Group or team activities.
 - Does it involve a network?
 - Sharing of skill levels (competitive).
- Are parents and caregivers able to become involved without controlling the play experience?
 - Is it appealing to an adult?
 - Can adults remain neutral during the play experience?
- Does the play experience require or inspire negotiation or rule building?
- Does the play experience involve collecting and trading?



Fig. 32:

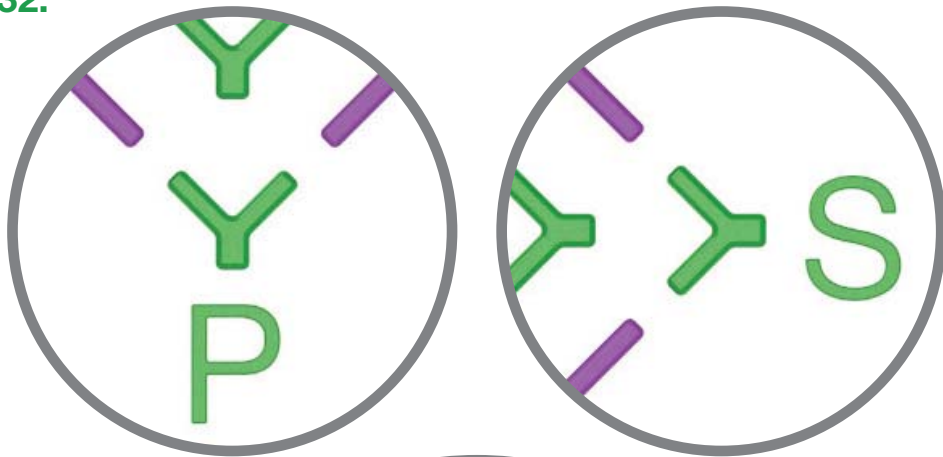
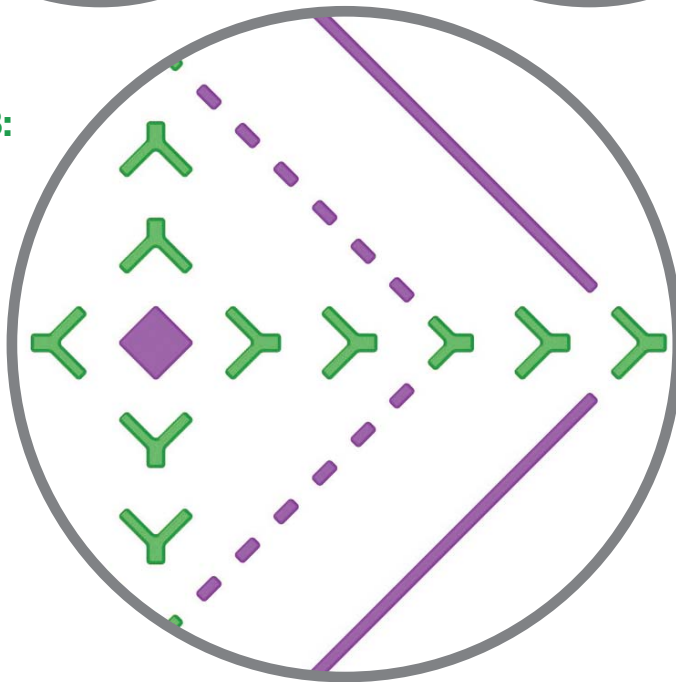


Fig. 33:



10.2

Design Tool Process:

The Design Assessment Tool is a simple process to follow.

Before beginning this process it is recommended that a small amount of reading is undertaken to further understand child development.

Suggested readings:

- Allen's: Toys, Games and Media.
- Burdette & Whitaker's: Resurrecting Free Play in Young Children.
- Moyles': The Excellence of Play.

More information on these can be found in the references section.

Each axis represents one of the four categories of child development: (See Fig. 32).

Cognitive (C), Emotional (E), Physical (P) and Social (S).

The five markers along each axis represent the key developmental values that should feature in a *balanced play-object*.

Play-objects are assessed using these values which are then totalled and marked along each axis. (Values are detailed on the next page.)

Note: Each value carries equal weight. Plotting starts in the center working its way outwards (See Fig. 33).

Fig. 34:

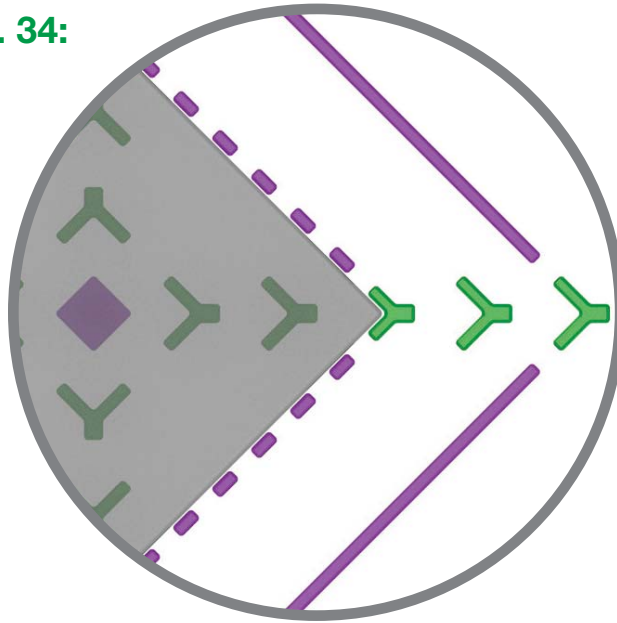
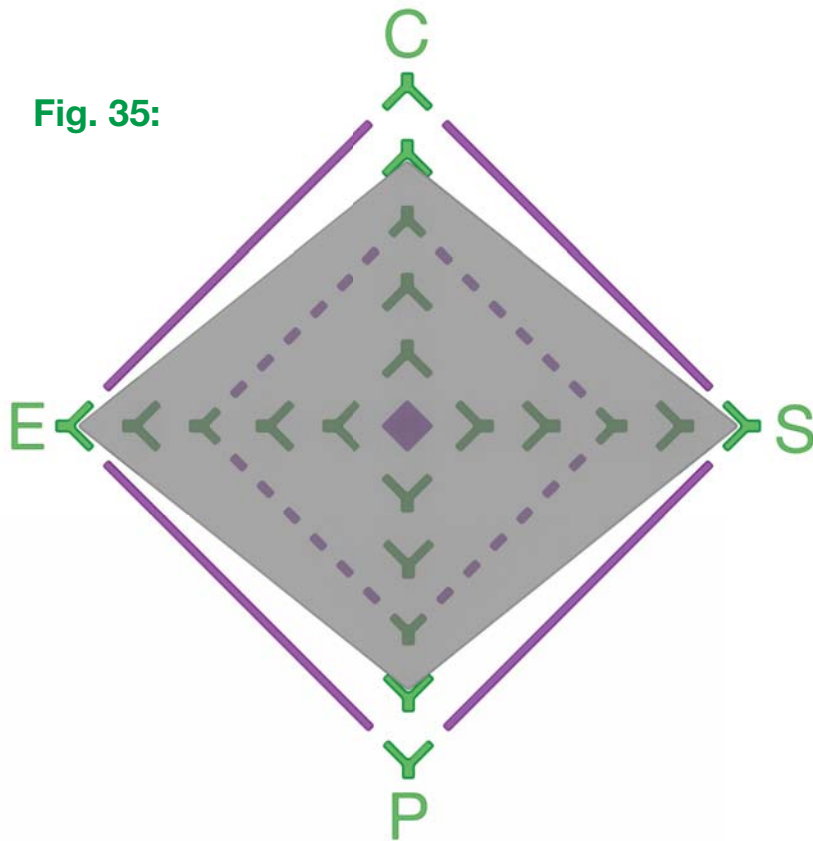


Fig. 35:



10.2

Design Tool Process (continued):

A minimum of three markers along each axis is required for a *play-object* to be labelled *balanced* (indicated by the dashed line).

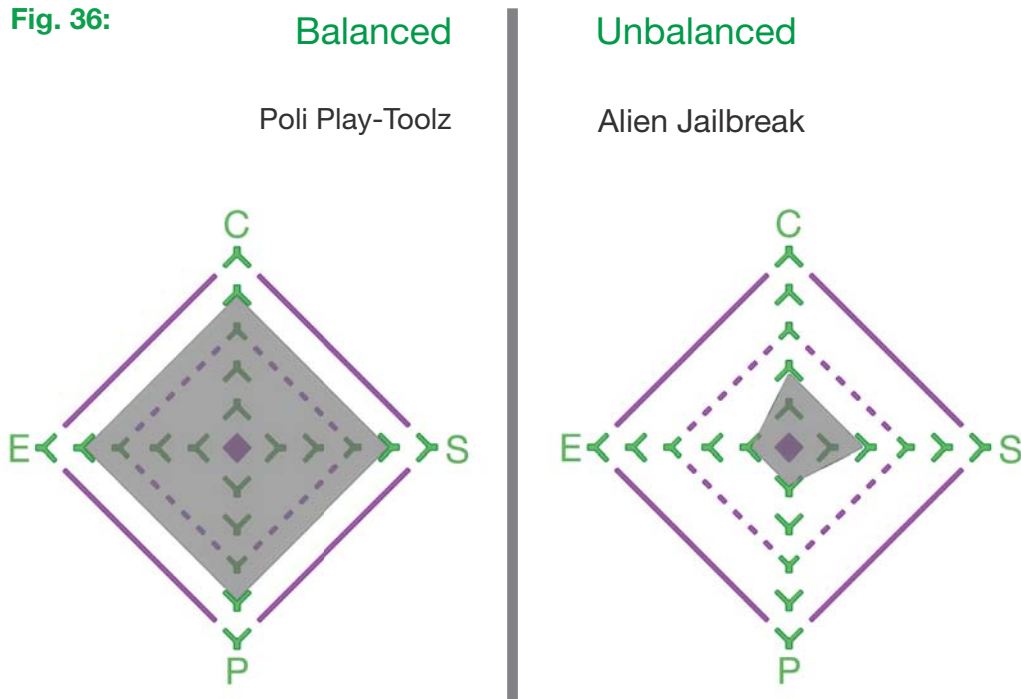
Note: This three marker minimum establishes a standard that ensures healthy *balanced* play.

When an equal number of values are marked along the horizontal and vertical axis (C-P & E-S) *play-objects* are still in balance if there is a variation between axis.

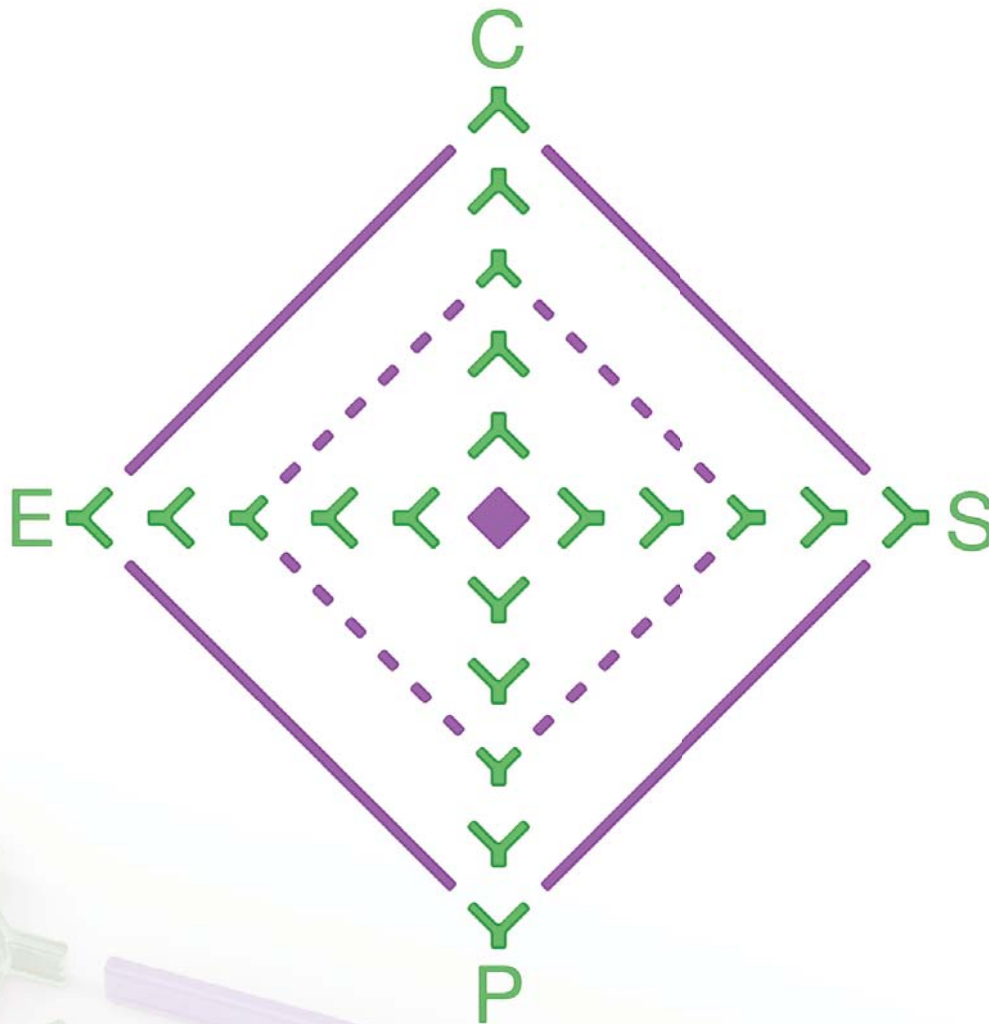
Note: This allows for the design of *play-objects* to focus on certain types of play and still offer a *balanced* play experience.

When the values for each axis have been identified the next steps are to plot, then connect all four together. This creates a visual representation of the *play-objects* balance. Below in figure 36, an example of both a *balanced* and an *unbalanced* *play-object*.

Fig. 36:



Design Assessment Tool:



Total of values:

Cognitive Developmental Value: ___/5
Emotional Developmental Value: ___/5
Physical Developmental Value: ___/5
Social Developmental Value: ___/5

© 2017 CHAZ MCMANUS ALL RIGHTS RESERVED

10.3

Design Assessment Tool Form:

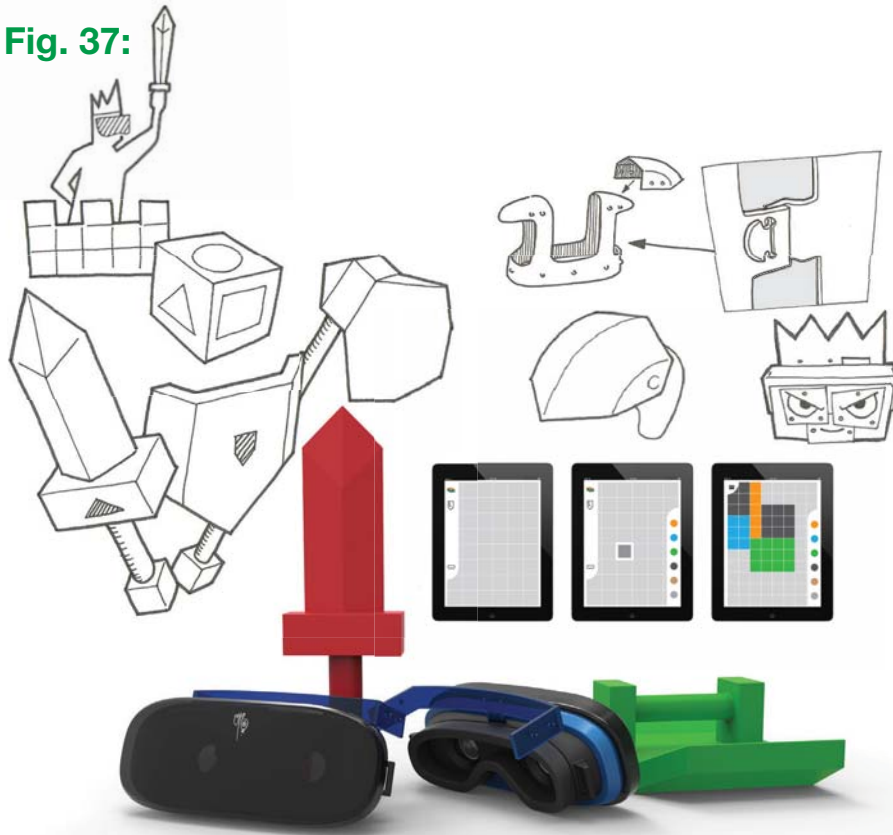
To the left is an example of the Design Assessment Tool form that is filled out during the process of evaluation.

See appendices for the full size (A4) form.

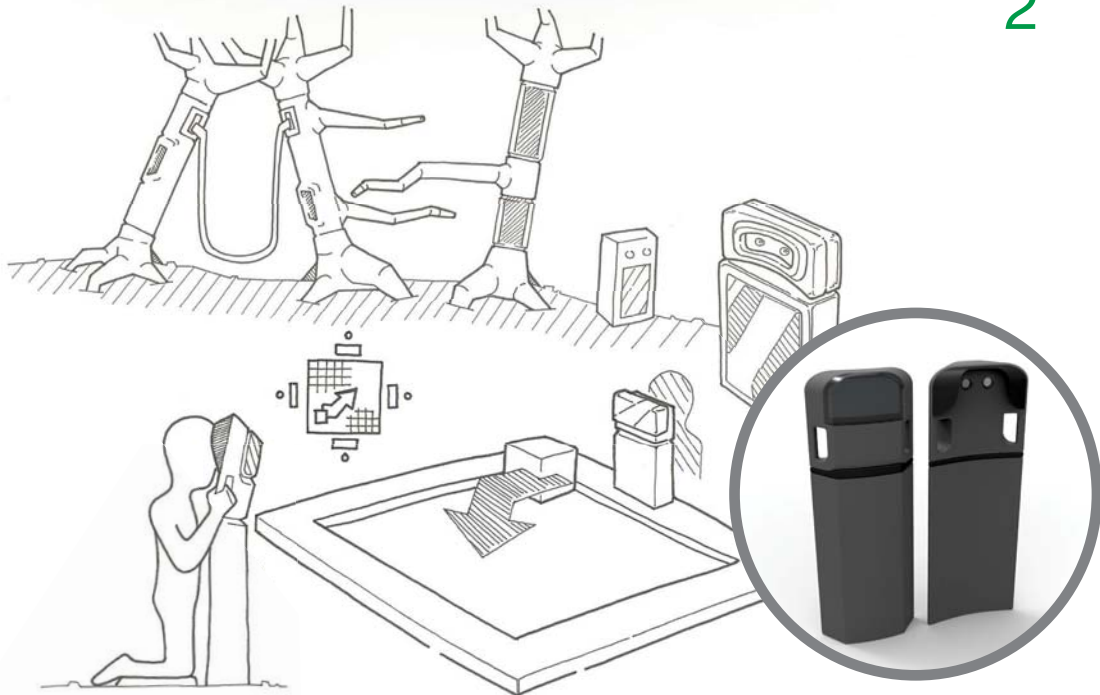
I can confidently say that *play-objects* that meet these criteria for positive play will provide developmentally rich play experiences for children aged 6 - 9. This has been validated by two play therapists; a visual therapist; and a lead educational toy designer (Callaghan, Milne, Jourdain, Ranchhod, personal communication, March 2017). For the play experience to be deemed balanced, it needs to score an equal number of parts along the same axis, i.e. cognitive to physical and emotional to social.

“The assessment tool is really useful to check whether a toy is building a child or adults skills and their abilities to locate, to observe, to connect with something outside themselves via their imagination and to respond as a whole person... as well as that what’s really important is the ability to spot and respond to the unexpected and the delightful which can take us somewhere we hadn’t previously thought to go, and I think the phygital assessment tool appraises a toys potential in all of these areas.” (Callaghan, 2017).

Fig. 37:



1
2



Three design milestones informed the direction and style of my final design of The Poli Play-toolz System. For a more comprehensive look at this process I have compiled my concepts, research notes, thoughts and workings in a separate workbook.

I developed the idea of a *play-tool* in response to my research question, and formed the design parameters as a result of my research. The idea stemmed from Maria Montessori's concept of children's play being the equivalent to their parent's job or work time (Lillard, 2013). For me, this means children's toys can be regarded as the tools they use to accomplish and guide their play. Defined as *Play-tools*: I believe these *play-objects* would need to be able to be used in unstructured ways so that they enable children to experience the full benefits of play.

I began exploring what my *play-tools* might look like, and the ways they could potentially function during play. The first milestone along my *play-tools* design process was shortly after my first critique when I presented the two possible design directions below (See Fig. 37).

These two directions were:

1. An App-enabled augmented reality headset that would allow children to apply digital materials and textures to papercraft style objects, such as a sword or shield.
2. A technologically imbued public playground that allowed the customization of its components. Many of these customizable components could then be further augmented via a digital experience.

Fig. 38:



Fig. 39:



The goal of both these designs was to encourage and enable children to materialise their imaginations via digital augmentation. Discussions during critiques regarding these two directions helped ascertain the scale and scope of what a *play-tool* should be. There was a consensus that direction One was the way forward, as it was both more achievable in scale and was perceived as a closer representation of what a *play-tool* might be. Feedback about the integration of found objects and more ambiguous *play-object* forms was noted and reflected upon during further iterations of the *play-tool* concept.

The *play-tool* I designed and named the Orb-Lox became the second milestone in my design process. This design (See Fig: 38) represented a change in my thinking on how physical play-objects would be integrated into app-enabled play systems. Focussing on the separation and customization of each digital element commonly found in modern *phygital* toys.

Each Orb-lox design consisted of two main parts:

1. The Orb: being spherical objects covered with six points of connection.
2. The Lox: being technologically imbued parts that could be customized via an application and then connected to any of the six connection points found on the Orb. The Lox were broken into two categories, activators (Switches) and reactors (visual or physical feedback). Activators contained electronic components such as, accelerometers and light sensors, while reactors would respond with lights or haptic feedback such as vibration and sound. (See Fig. 39).

The idea behind the Orb-Lox design was to enable children to enhance their imaginative play via these customizable electronic components, with the goal of inspiring free-play.

Fig. 40:



Fig. 41:



After my second critique, this Orb-Lox design was altered to involve the integration of found objects. This integration allowed me to minimize the number of parts and cost of the Orb-Lox. This development in the design caused me to question the materiality of the Orb-Lox (See Fig. 40).

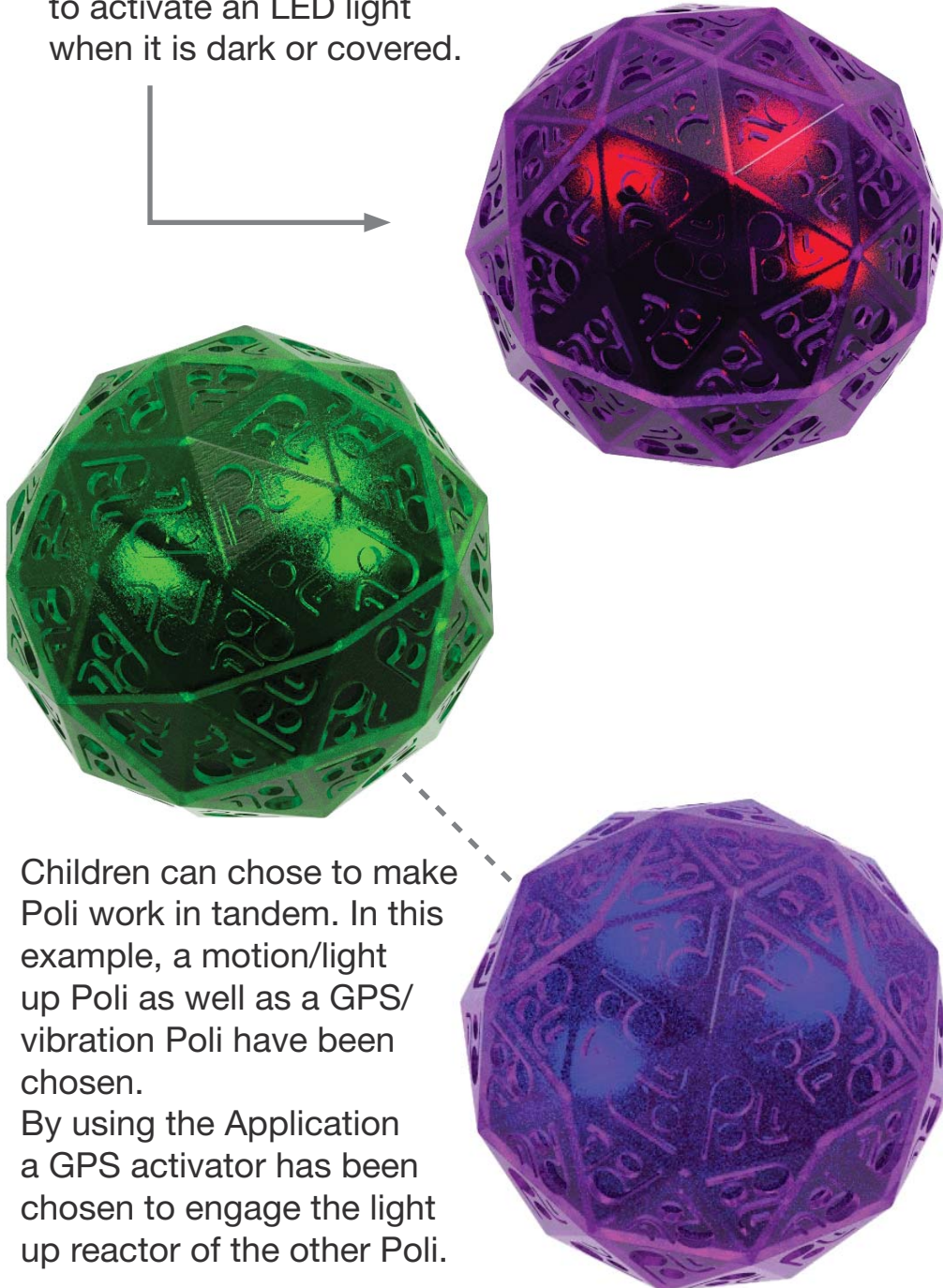
I then chose materials that could withstand rougher types of play, and that would allow for connection methods that would release if too much stress was applied to them. Flexible rubberized parts were added into the design, minimising the possibility for the objects to be used in potentially dangerous ways.

My third and final design milestone was when I developed a new locking/joining mechanism, resulting in a new format of the play-tool design, dubbing it the Bobble Berry (See Fig. 41). This came as a response to both the discussions during my second critique and my change in thinking around the integration and use of found objects and flexible materials.

I consider this design to be the inception of the Poli (my final design). The Bobble allowed for more attachments to be used at once and is the first iteration of the Orb-Lox where electronic parts were housed inside the Orb rather than each attachment. After discussions with my supervisors and other designers it became apparent that the connection point had a major flaw: each 'bobble' or connection point would be prone to tearing and was a potential choking hazard. This led me to redesign the Bobble's connection method, resulting in a variation of the design that began to resemble my final *play-object*.

Fig. 42:

This Poli uses a light sensor to activate an LED light when it is dark or covered.



Children can chose to make Poli work in tandem. In this example, a motion/light up Poli as well as a GPS/vibration Poli have been chosen.

By using the Application a GPS activator has been chosen to engage the light up reactor of the other Poli.

12.0

Final Design:

The Poli Play-Toolz System.

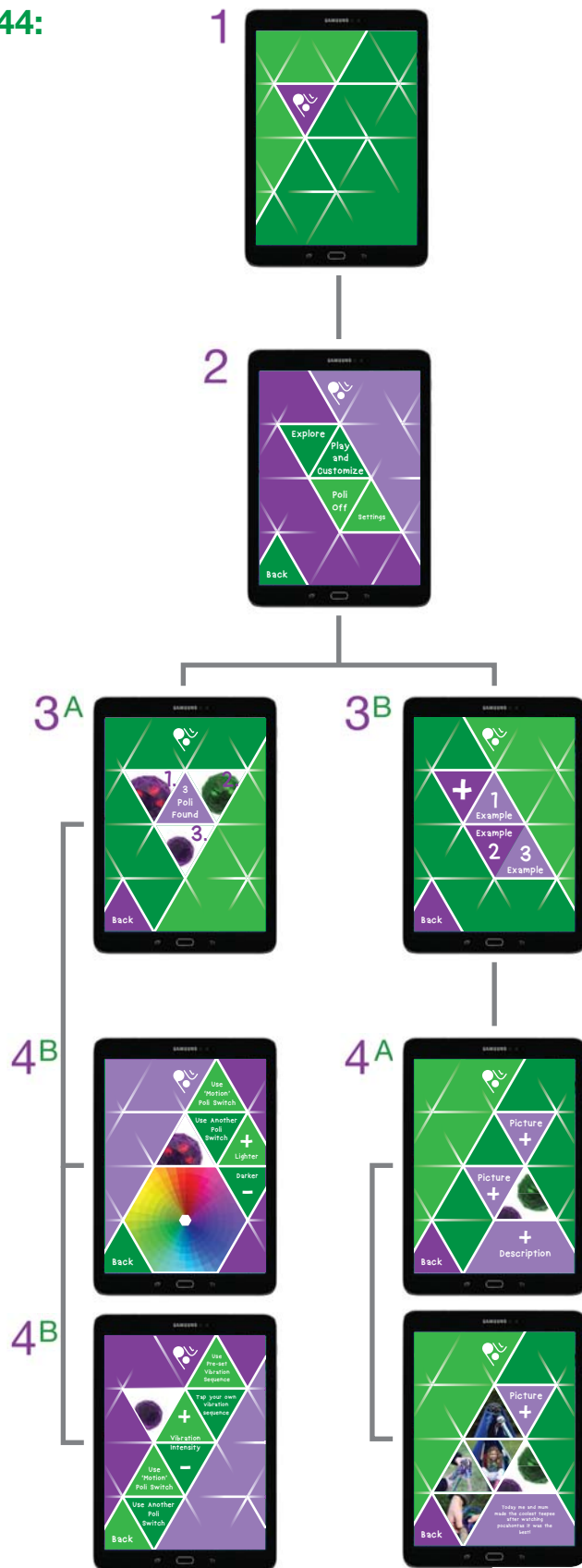
The Poli Play-Toolz system can be regarded as four separate components that make a whole: The Poli (A plural name for a set of three objects); the Application that controls each Poli; the Imagi-shell; and the Play-Toolz. These next subsections will explain the Poli Play-Toolz system and offer ways it can evolve and develop. This play system is my response to my design tool. Other *play-objects* created using the same tool may be developed in a very different way.

12.1

The Poli:

Poli are small geometric balls containing electronic parts, and are what I consider the heart of the play system. Their parts fall into two categories: activators (a switch) and reactors (a form of feedback). The activators and reactors are all different and range from GPS or motion switches, to sound or vibration based feedback. Every Poli contain three multi coloured lights and are controlled via an Application. This Application allows children to choose how each activator functions as well as enabling the customization of each Poli's reactor. The possibilities for these combinations are near endless. Figure 42 demonstrates three examples of Poli to be included in a starter set of the Poli Play-Toolz System.

Fig. 44:



12.2

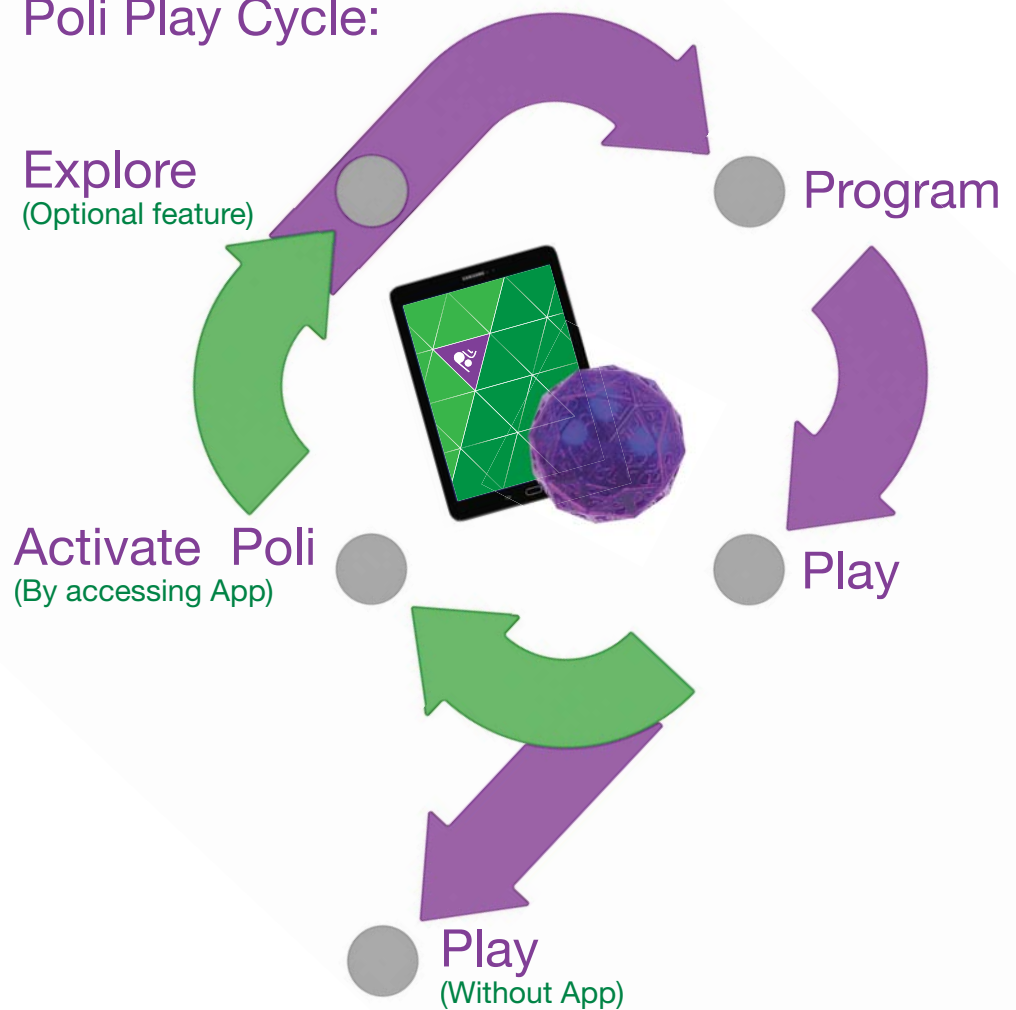
12.2 The Application:

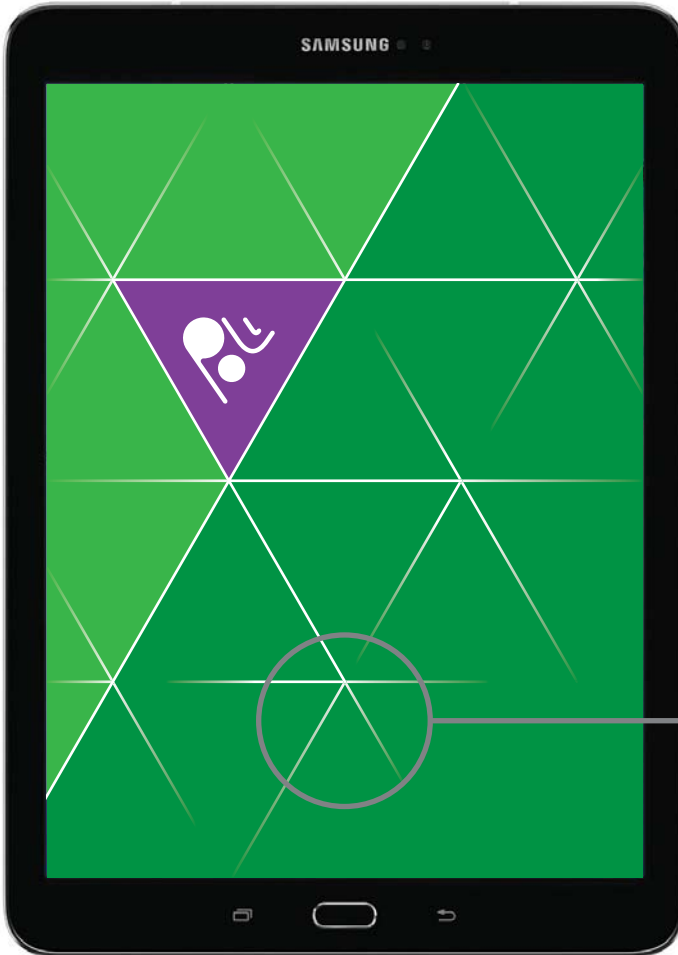
This is my first Application design and has been developed to serve as an example of how the integration of physical and digital components should be handled. Application development is not the focus of my exegesis, however I offer an example below as I consider the Application to be the brain of my play system.

The interface flow can be seen to the left in figure 44, while each part of the App is explained over the following pages.

Fig. 43:

Poli Play Cycle:





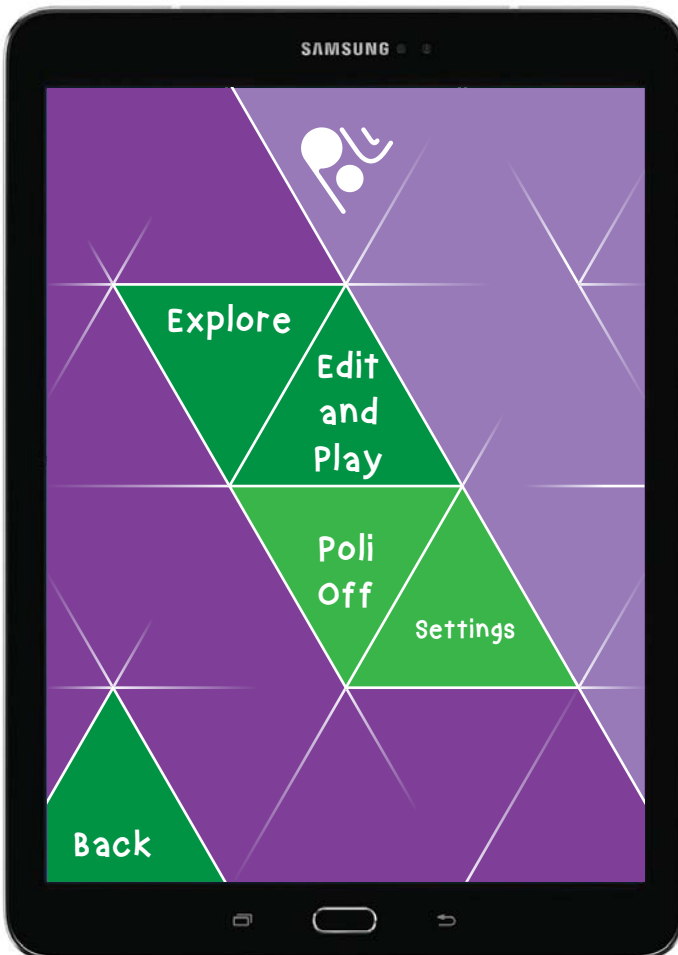
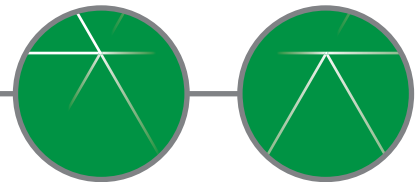
Start-up screen

Appears for brief second before fading into the main menu screen.

App-wide animation:

The triangle matrix of lines is designed to represent the faceted surfaces of the Poli.

Each line grows and shinks over time in a seemingly random order.

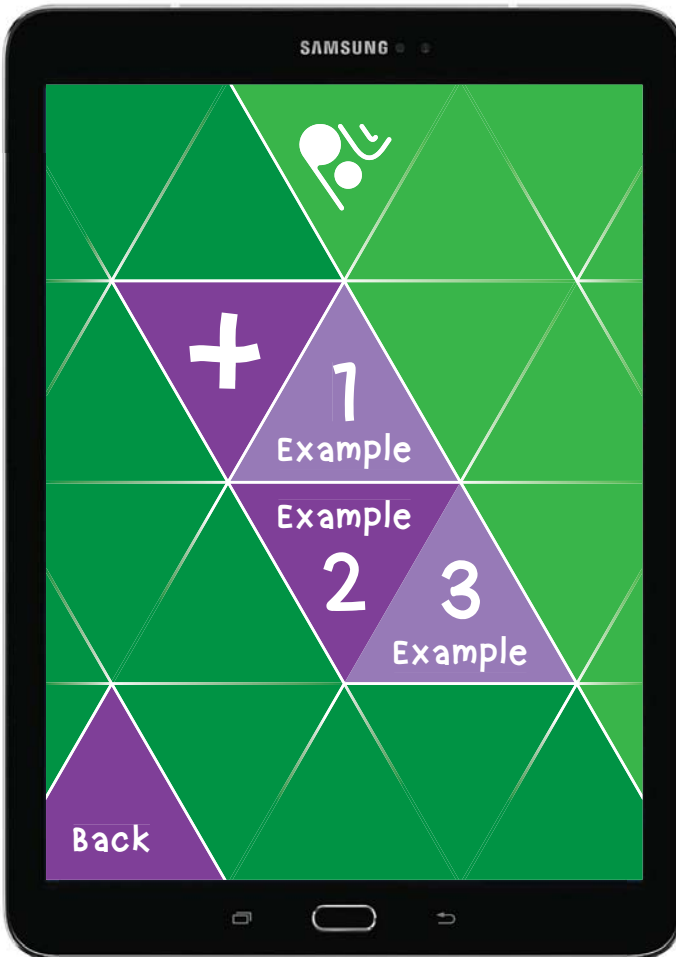


Main Menu Screen

From here, every section of the Application can be reached.

This screen sets up the flow of buttons and interactive spaces. These areas are always coloured with the opposite colour within the colour scheme.

The triangle matrix animation continues to function on this and the following screens.



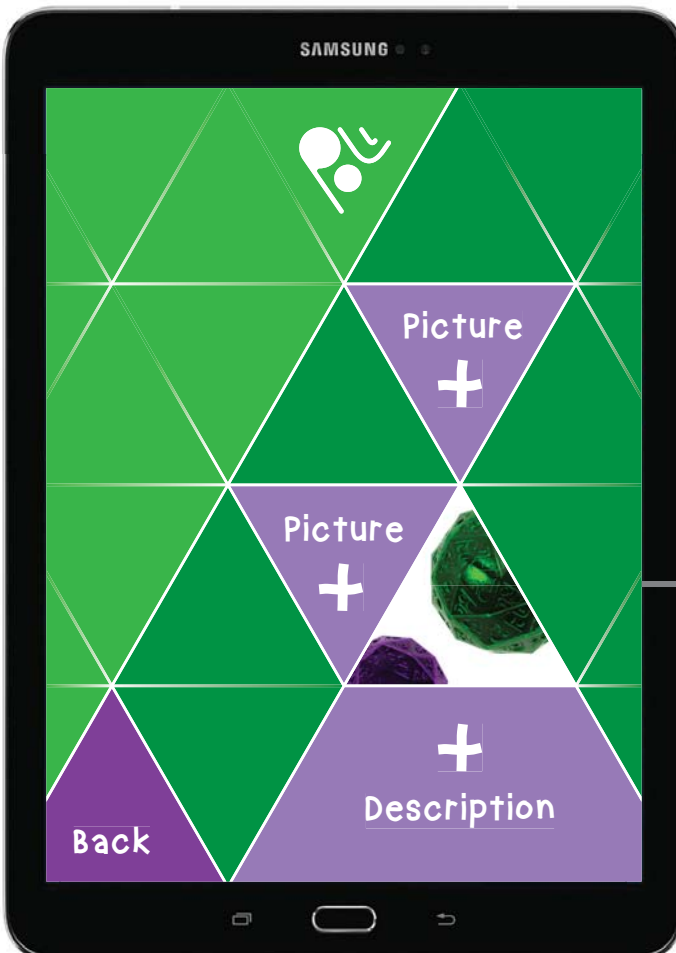
Explore Screen

This screen allows children to upload their own creations and view other uploads for inspiration and ideas.

The concept behind this is that it allows children to problem solve and work out how to use the toy without detailed instructions.

Everytime an upload is made it receives it's own new button.

To the right you can see three example areas and a plus that leads to the upload idea screen, each of which would have the same layout.



Upload/Example Screen

Here you can see areas for images and descriptive information as well as an animated Polu tile indicating which Polu are active in each example or upload.

App-wide animation:



Each area containing white (including guide sections) is an animated section where all operational or selected poli will freely float around. When tapped these animations will simulate their Polu function.

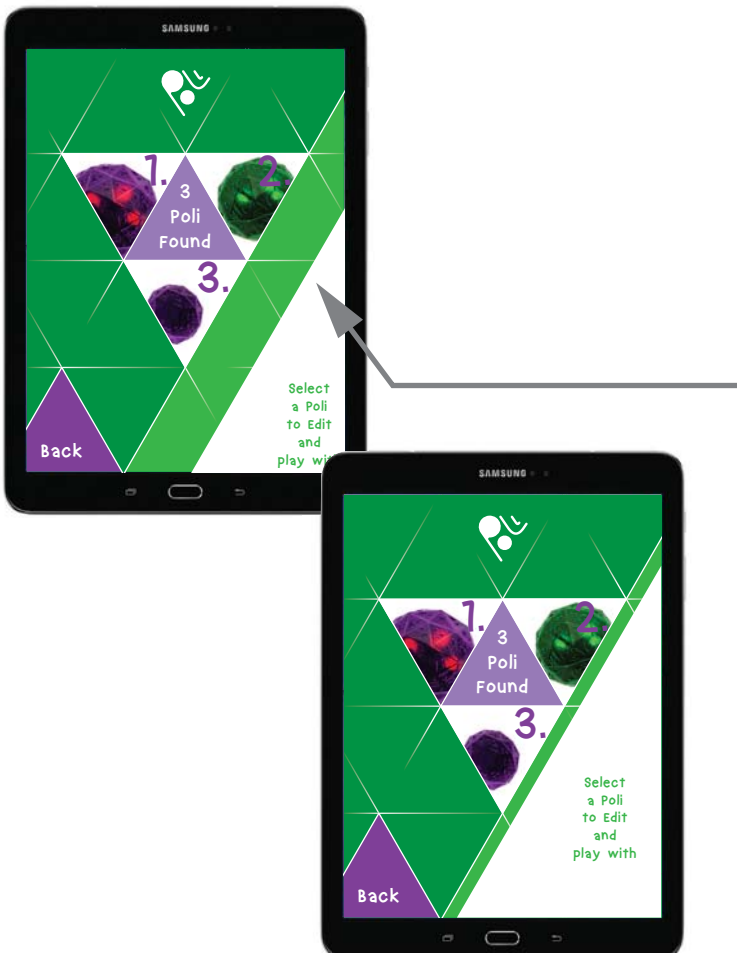


Edit & Play Menu

This screen acts as both the on switch for Poli (pre-loaded into the bluetooth section of the device) and as a menu for entering the edit area of the app.

If no editing occurs then each Poli will remain set on the previous edit/play settings chosen by their owner.

These white triangular areas continue to use the animation shown on the previous screens explanation.



Animated Guide

If a child pauses on a screen for too long (10 seconds) an animated guide will appear.

These guides emerge in a sliding motion from the corner of unused areas of the screen.

If inactivity continues they will disappear and reappear after another 10 seconds, creating an endless loop.



Edit Screens

On these screens interaction with the Poli, through the App, can be experienced.

Here children can change the way their Poli activate and react to their physical involvement with the toy.

On the screens to the right you can see examples of two Poli. The top image is the interface for changing the colour or shade of a light up Poli. The bottom image shows another interface for a vibrating Poli.

Each physical Poli are able to be activated either by themselves or via another Poli's switch, an example of this selection process can be seen below.

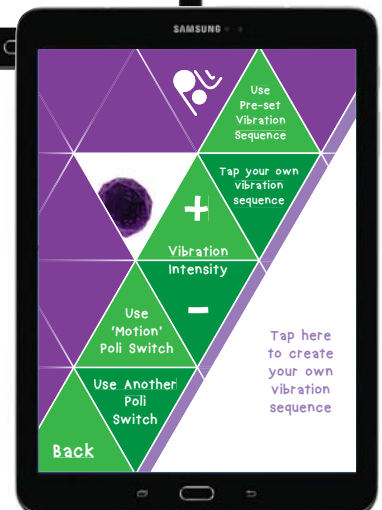
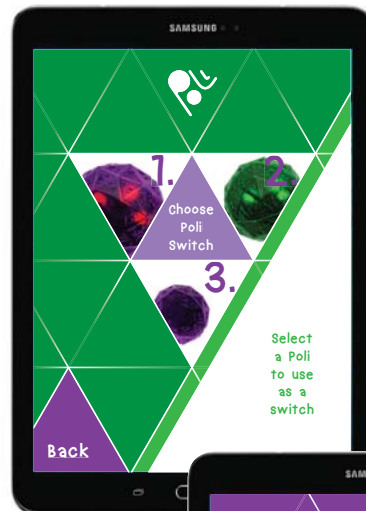
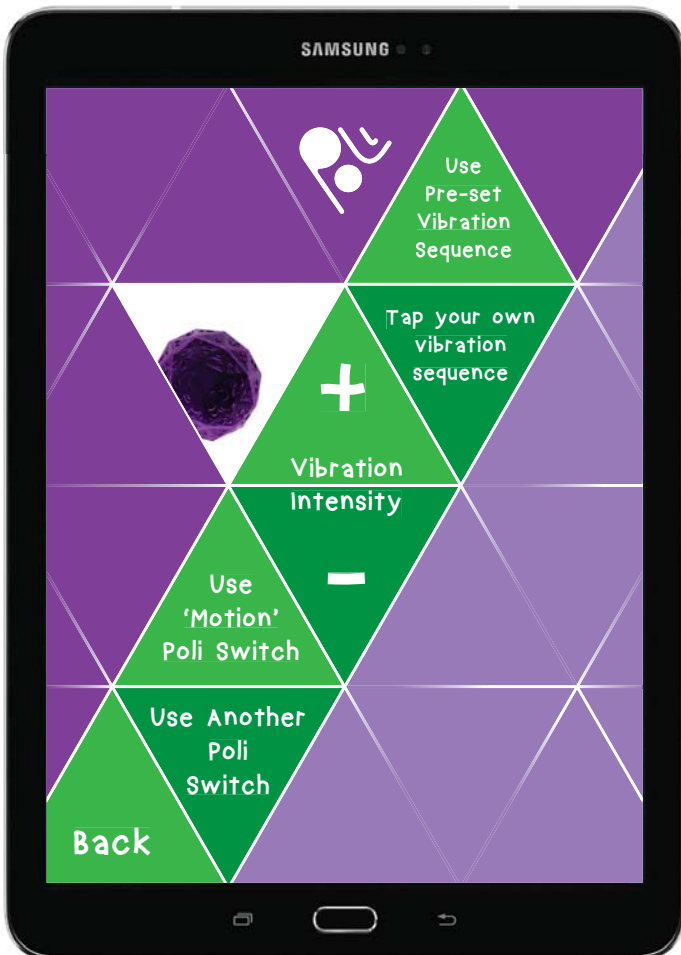
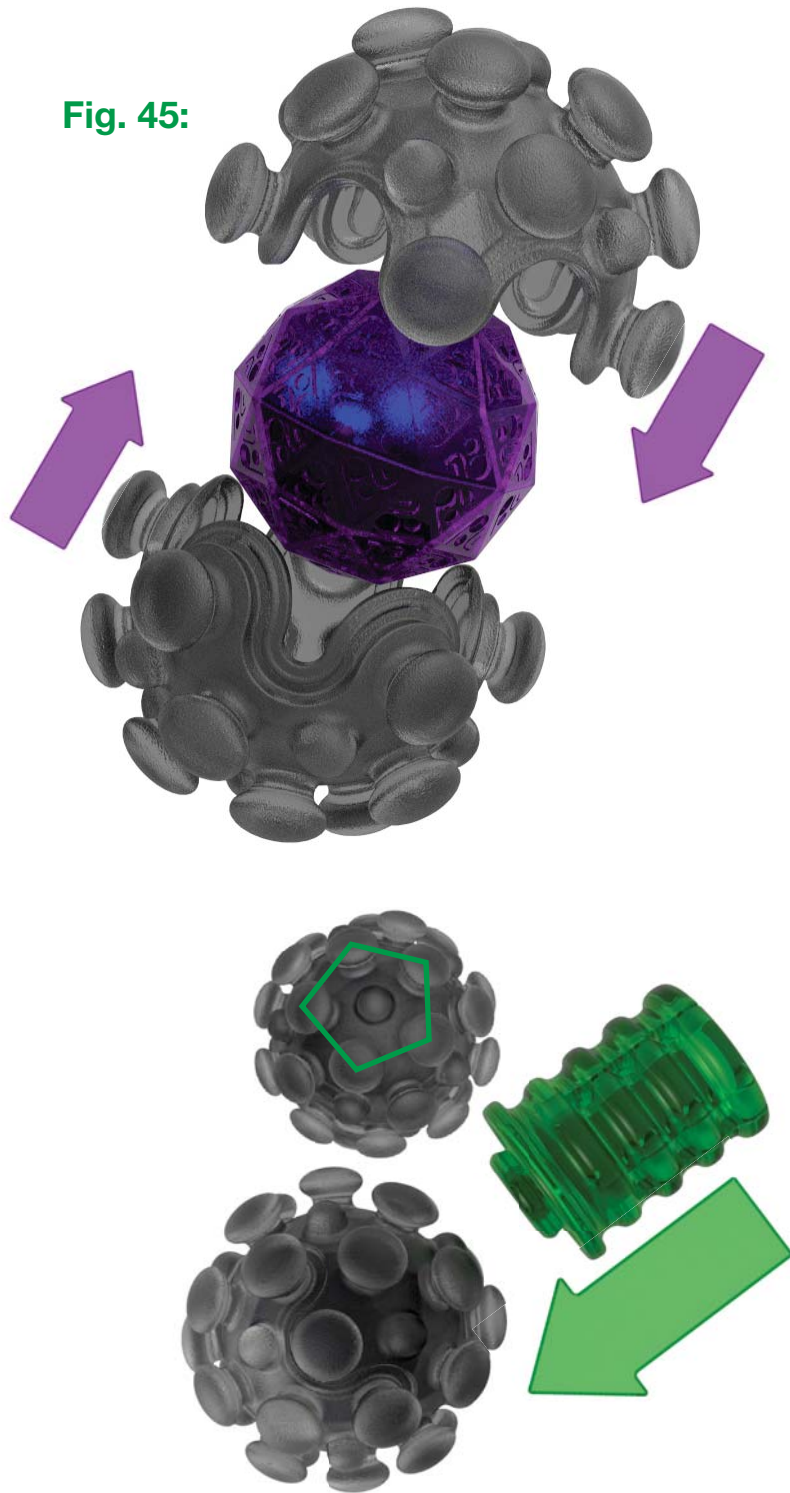


Fig. 45:



12.3

The Imagi-shell:

Shells for the Poli serve more than one purpose. They protect the electronics inside each Poli, and they are the connection method for the Play-Toolz: The add-on objects that allow for extended play with found objects.

The Poli Play connection method (see Fig. 46) allows Play-Toolz to be plugged into any of the multiple pentagon shaped spaces in the bumps found over the surface of the Imagi-Shell. Figure 45 offers an example to how a Poli fits inside an Imagi-Shell plus how Play-Toolz Plug into the shell.

Fig. 46:



This Poli is housed in half an Imagi-Shell that is connected to one of the Play-Toolz.

Fig. 47:



Play-Toolz Example One:

This Play-Toolz is designed for potential use with branches, long sticks and rope. Examples of use could be building a branch-fort or wizards wand.



Play-Toolz Example Two:

This Play-Toolz is a shape that fits pens and or rope through it's holes. Examples of use could be to make a blanket fort or a spiders web.



Play-Toolz Example Three:

This Play-Toolz is a watch-like band that uses a clipping method of attaching. Examples of use could be to create handcuffs or hang a light up Poli in a Bunk bed.



Play-Toolz Example Four:

This Play-Toolz is specifically designed for paper towel tubes and broom handles. It has flexible sections to allow for different sizes of tubes and handles as well as holes for further creative options.

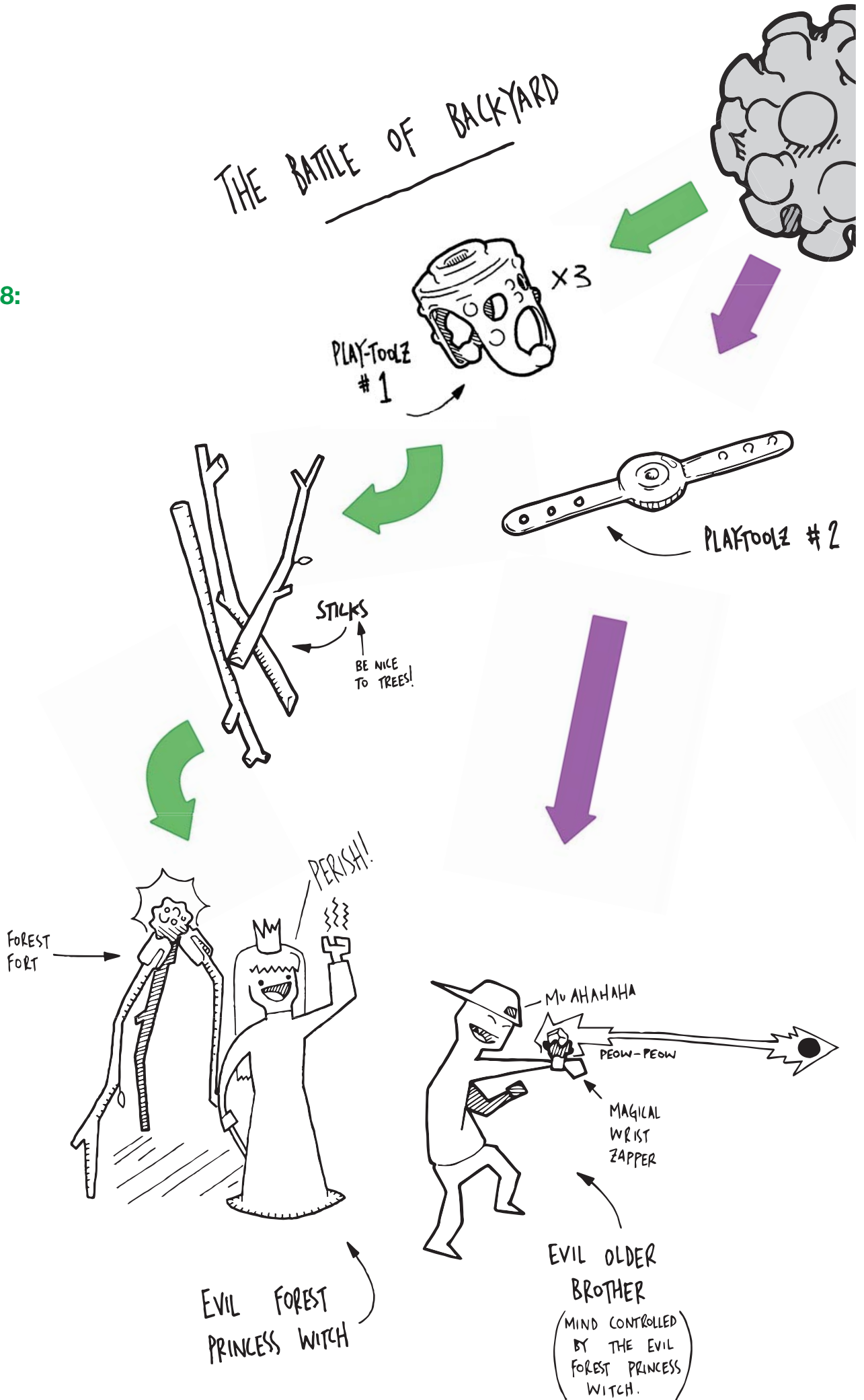
12.4

The Play-Toolz:

I have designed four Play-Toolz to be used as add-ons to the Imagi-shell and Poli. These serve as an introduction to the possibilities for further design. Each of the Play-Toolz is made from flexible rubber material, so they can be bent and twisted to extend their options during play. Figure 47 further explains possible uses for each of the four Play-Toolz that could be included in a starter set of the Poli Play-Toolz System.

THE BATTLE OF BACKYARD

Fig. 48:



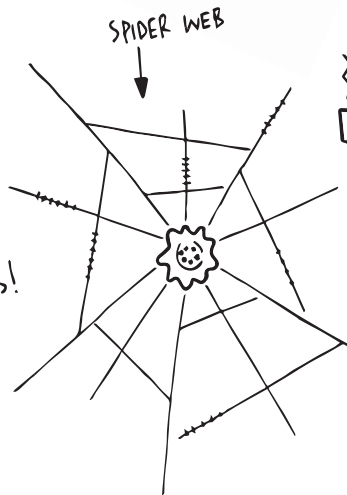
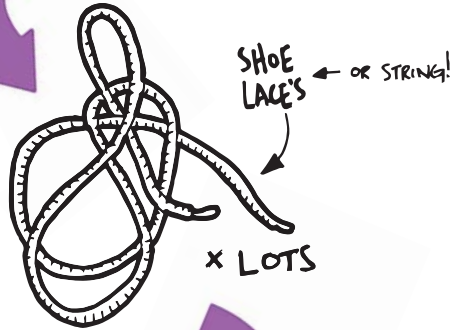
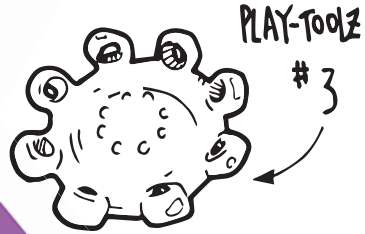
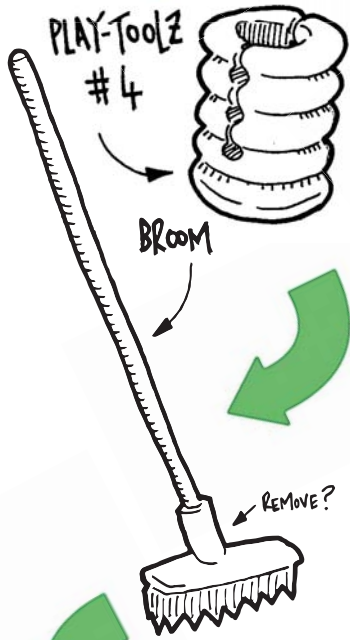
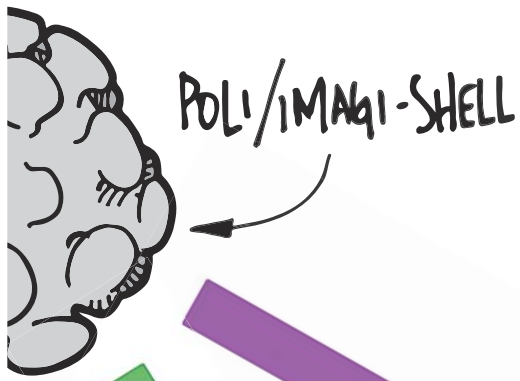


Fig. 49:



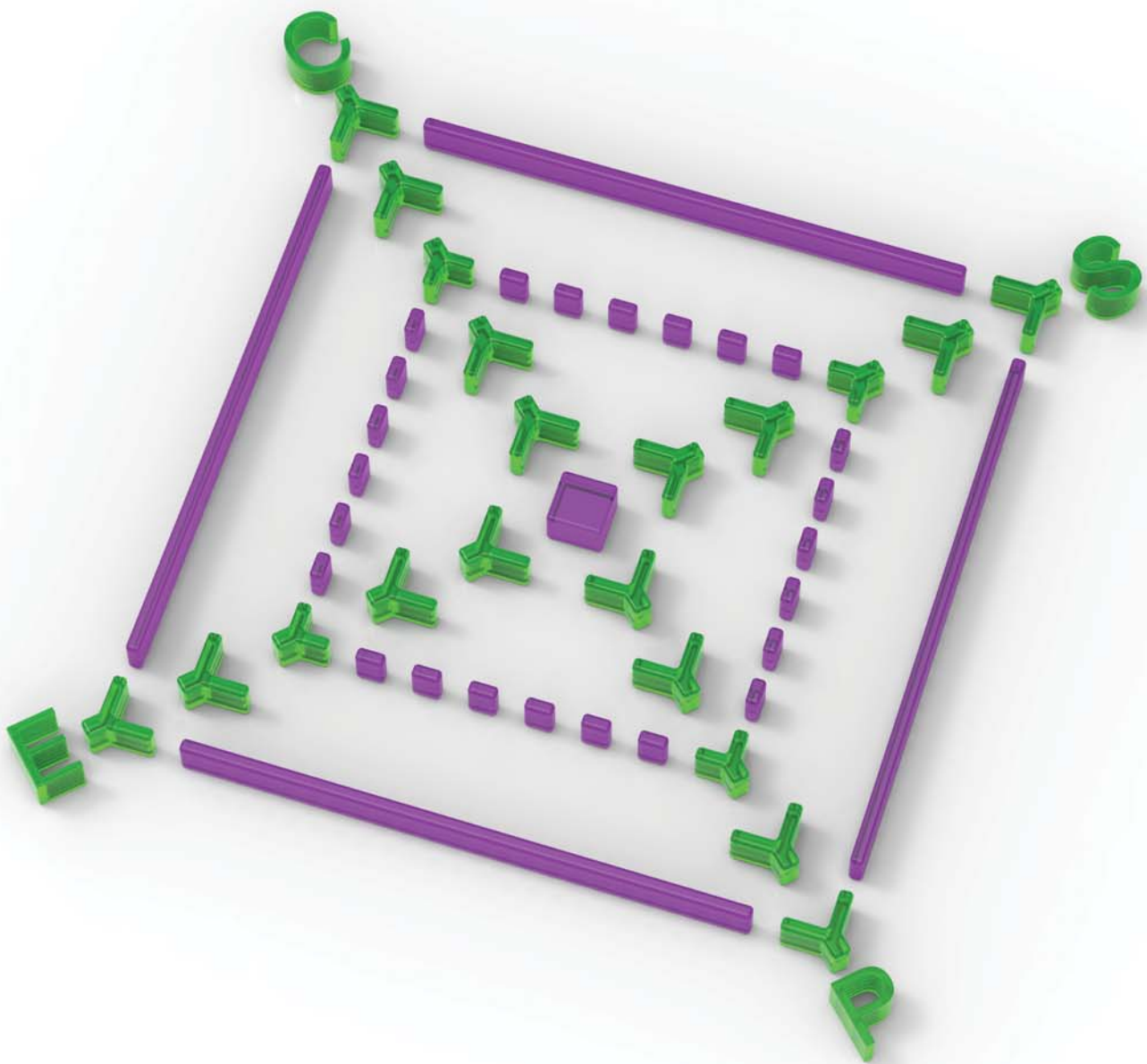
12.5

The Basic Poli Play-Toolz Set:

When a Poli is safely housed inside its Imagi-shell and Play-Toolz are connected, it can then be used as a large-scale construction style toy. This larger construction style focuses on the encouragement of open-ended free-play. This is achieved because of its ability to integrate found objects which allow children to customize and adapt their play experiences. The different shapes of the Play-Toolz inspires the use of found objects, such as household items like brooms and paper roll tubes.

At this stage, I envisage the basic set to include:

- Three Poli.
- One Application download link.
- One Imagi-Shell.
- Four Play-Toolz (One of each design).



13.0 A Platform for Development:

The following are some options for future development, I believe this project deserves a life beyond this masters.

13.1 The Design Assessment tool:

Testing in an industry setting will be required to gain a deeper understanding of the different ways this tool can be utilized. As *phygital play-objects* develop each axis of the tool may need to increase or change in some way.

Then the next step could be the digitization of the design assessment tool into an Application and/or online system.

For the industry, this could result in:

- A network for companies to compete for the most balanced play-object possible.
- A more intuitive system for designers to understand child development.

For the general population, including parents and primary school staff, this could result in:

- The assessment of the toys and *play-objects* already in use.
- A validation system for the purchasing of toys and *play-objects*.

Fig. 50:



Fig. 51:



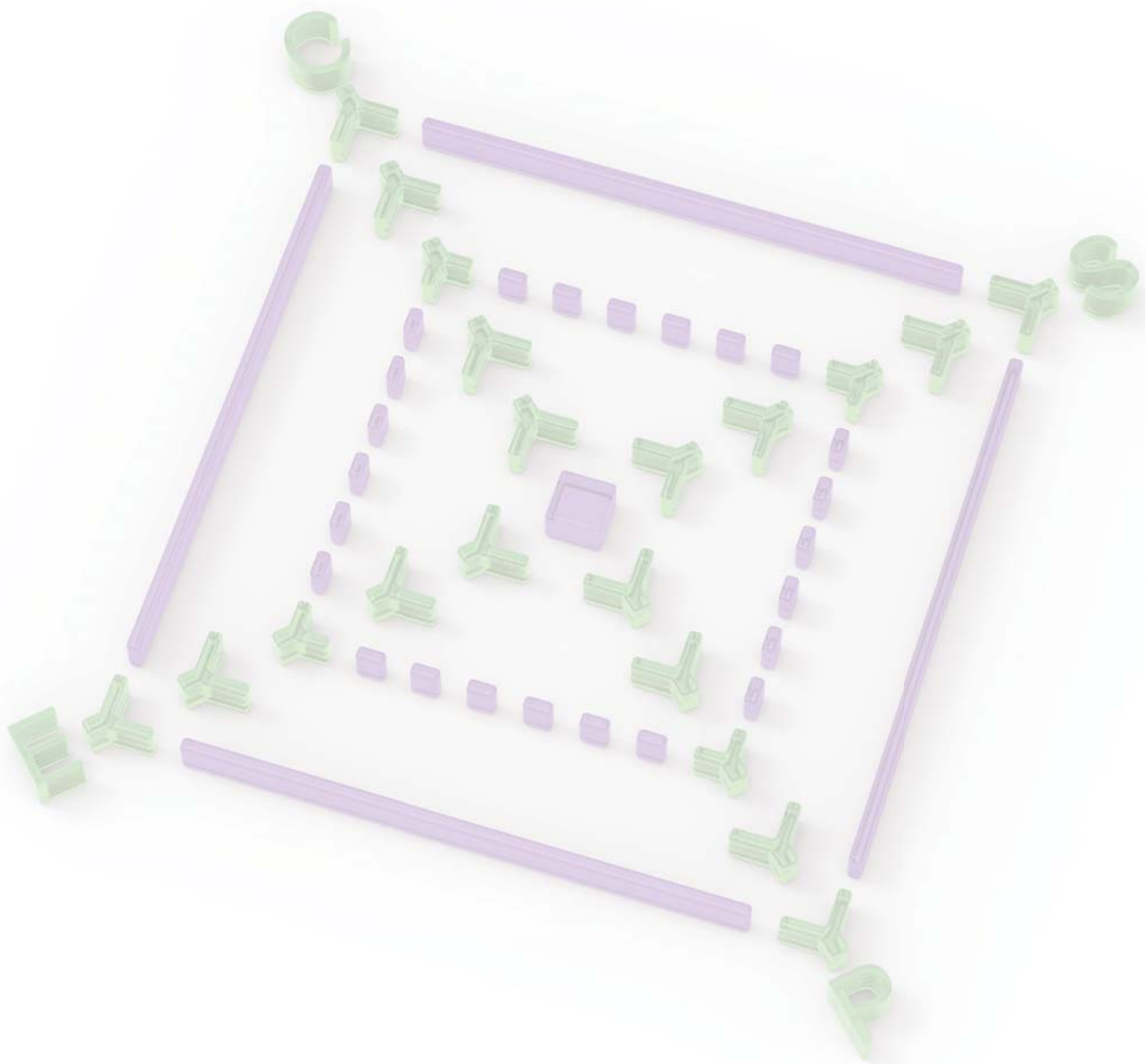
13.2

The Poli Play-Toolz System:

The next stage is to create a complete working version of the play system which would enabling full user testing. To achieve this the team would need to add a User Interface Designer for the Application and an Electrical Engineer for designing and building the *play-object* systems circuitry. This complete working prototype would allow closer examination of how the Application is integrated into each Poli and how often each electronic function is used throughout play.

Further developments could include:

- Different types of Imagi-shell (e.g furry or plush).
- More variation on the types and shapes of play-toolz.
- Further investigation of electronic functions.



14.0

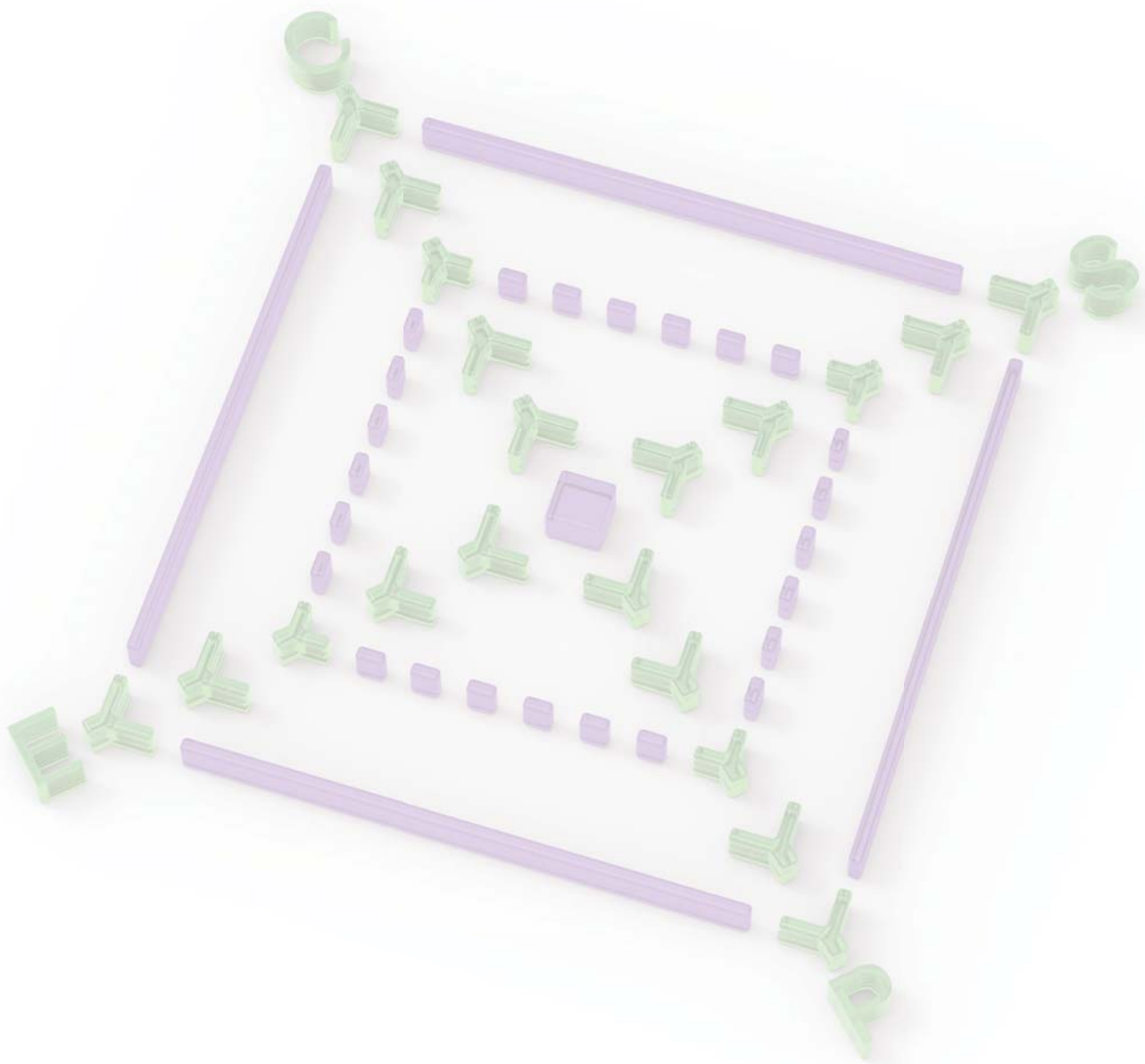
Reflection and Conclusion:

I have a lifelong passion for play and *play-objects*, and with this project I have continued to explore meaningful toy design, building on from my fourth-year major project. This Master's project was my attempt to bring together current research on the developmental impact phygital *play-objects* have on children, with a play-object of my design that supports my definition of *balanced play*. My research on child development enabled me to create an industry validated method for assessing the balance of play-objects in relation to the four key areas of child development. This design tool enables its user to assess, track and adjust designs to achieve balanced play, and I used it to create a phygital play object that scores a four out of five on each axis of child development, making it a *balanced play-object*.

14.1

Significance of the Project:

In general, most of what I learned about the topic is contained within this thesis. My most important discovery was about the amount of time in modern children's daily life devoted to structured activity. The key outcome of this is, unstructured play time has declined significantly over the past 20 years with Gotlieb (2014) describing this as, "Play becoming an in-between activity"; and, when children are playing, they are often choosing structured play activities such as *digital play* experiences. This decrease in unstructured play can present serious issues for the cognitive, emotional, physical and social development of children. With the need for *phygital play-objects* that would combat the decline in unstructured play time as observed by play theorists Burdette (2005), Downey (2004) and Gottlieb (2014); the significance and focus of this project is to offer a method and *play-objects* that will allow for unstructured play opportunities.



14.2

In Response to my First Research Question:

Can well designed objects re-introduce balanced play, to combat the proven decline of unstructured play?

There is insufficient research for me to state empirically that the decline in unstructured play is resulting in negative outcomes for children. However, there is a growing consensus among theorists that this is the case (Elkind;1998; Gray, 2011; Burdette and Whitaker, 2006).

Developing the concept of *balanced play*, enabled me to explore new ways *phygital play-objects* can encourage children to engage in healthier forms of play. This led to a design tool of my own design. This design tool was validated by a developmental therapist who affirmed it made sense and represented healthy *balanced play*. It is this validation and my process of observation that gives me the confidence to claim my *design tool* and the Poli Play-toolz system are *balanced* and would promote unstructured free-play.

My research has proven that current *phygital play-objects* offer structured play experiences. I have made a strong case for *balanced phygital play-objects* that have the potential to combat the perceived negative effects of the decline in unstructured play. I have confirmed this with two play theorists, a developmental therapist and a product designer. These professionals have validated my criteria and definition for the term *balanced play* (Callaghan, Milne, Jourdain, Ranchhod, personal communications, 2017).

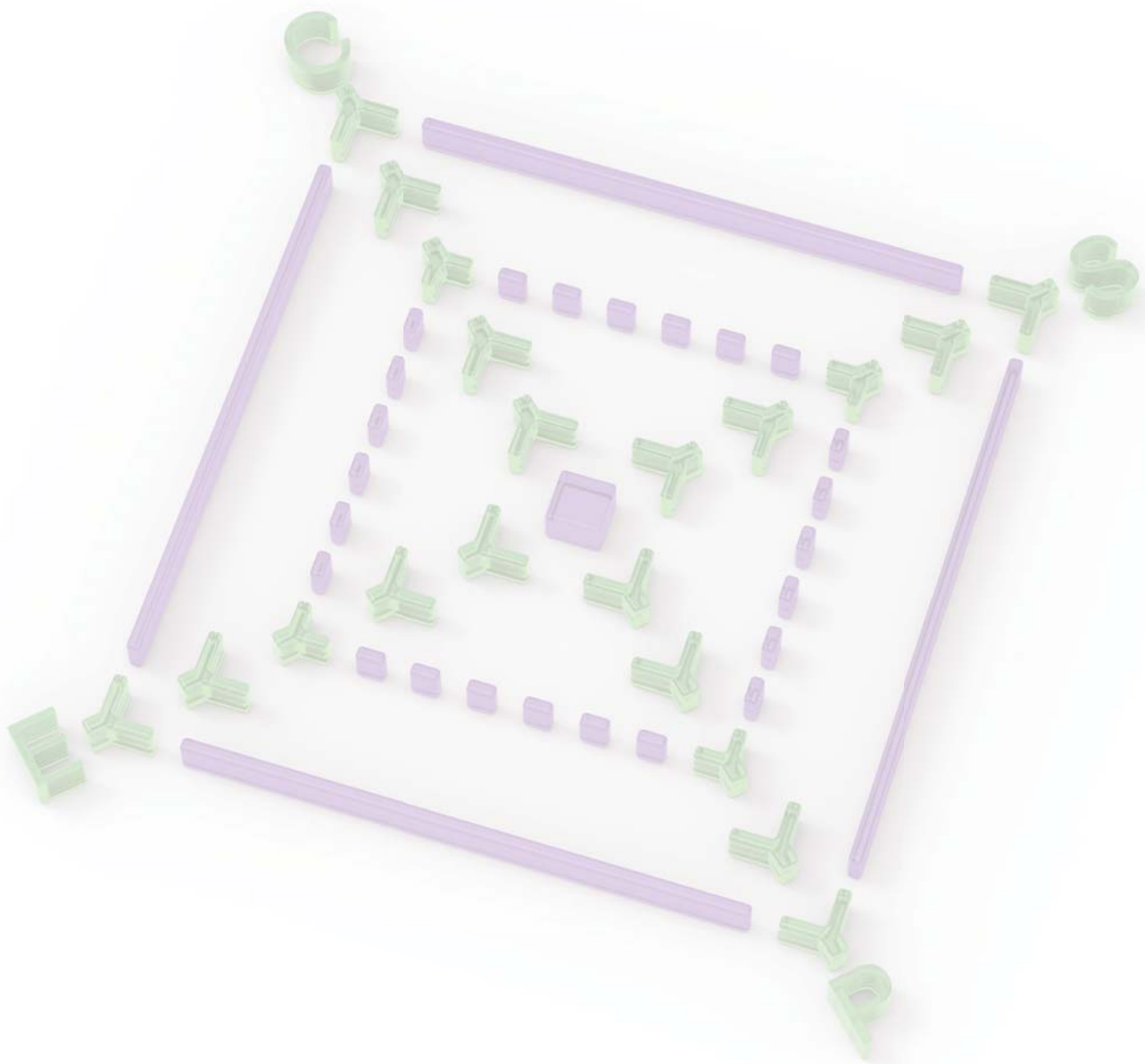
14.3

In Response to my Second Research Question:

Can 6 - 9 year old children experience balanced play through the use of phygital objects?

Children between six and nine years can experience *balanced play* by using *phygital* objects.

Research indicates, children in this age bracket utilize digital devices on a regular basis (Unantenne, 2014).



14.4

In Response to my Third Research Question:

What is the criteria for balanced play?

The assessment tool demonstrates how to design a *play-object* meeting the criteria for *balanced play*. In *balanced play* the four key areas of child development (cognitive, emotional, physical and social) must be of equal value. The values for each of these areas can be found in section 10.1.

14.5

Concluding Statement:

As part of this project I made positive connections with professionals in the child development industry. These professionals informed the direction and development of the design tool, and thus my *phygital play-object* design.

The Design Assessment Tool and the Poli Play-Toolz System are now a reality. Both are at the stage for further development. Industry validation has proven the Design Assessment Tool works and anyone who uses it can confidently assess and produce *phygital play-objects* that encourage and support *balanced play*.

I believe this project was a success, and I conclude this thesis with a quote from one of the aforementioned industry professionals.

“The assessment tool is really useful to check whether a toy is building a child or adults skills and their abilities to locate, to observe, to connect with something outside themselves via their imagination and to respond as a whole person... as well as that what’s really important is the ability to spot and respond to the unexpected and the delightful which can take us somewhere we hadn’t previously thought to go, and I think the phygital assessment tool appraises a toys potential in all of these areas.” (Callaghan, 2017).

```

const int analogInPin = A1;
int sensorValue = 0;
int outputValue = 0;
#define Bulb 1
bool blinkState = false;
int ledRGB = 150;
int ledold;
int change;
int ledoutput;
void setup() {
    }
void loop() {
    sensorValue = analogRead(analogInPin);
    ledold = led(sensorValue);
    if(change < 10){
        ledoutput = ledoutput + 3;
    }
    if(change>11){
        if (ledoutput > ledRGB){
            ledoutput=ledRGB;
        }else{
            ledoutput =-2;
        }
    }
    if(ledoutput >= 252){
        ledoutput = 255;
    }
    if(ledoutput <= 1){
        ledoutput = 1;
    }
    analogWrite(Bulb,ledoutput);
    delay(20);
}
int led (int rate) {
    ledRGB = map(rate, 100, 480, 0, 255);
    change = ledold - ledRGB;
    change = abs(change);
    if(ledRGB >= 255){
        ledRGB = 255;
    }
    if(ledRGB <= 1){
        ledRGB = 0;
    }
    return ledRGB;
}

```

15.0 Appendix:

15.1 Coding for poli:

To the left the coding for each prototype Poli test model can be found. This was created with the help of Craig Hobern at Massey Universities FabLab.

This circuit enables an LED to be activated with an accelerometer sensor.

Fig. 52:



15.2

Personas:

Persona One (Primary):

Apinya is a nine year old girl of Thai decent. Her family are situated in the upper middle class having moved to Auckland when she was four. Her mother and father own a restaunt (mother: accountant, Father: Chef). Apinya lives a very structured life, attending multiple different extra-curricular activities every week which are enforced / monitored by her parents. Apinya has two younger brother, both are very loud.

Extra-curricular activities:

- Tutor (for school subjects) - Once a week.
- Piano - Twice a week.
- Girl guides - Once per week.
- Hockey - Once per week.

Nature:

- Shy.
- Quiet.
- Happy most of the time.
- Hides in her room every chance she gets.

Likes:

- Reading.
- Weekend cartoons.
- Spending time with dad in the kitchen (When he is available).

Dislikes:

- Loud environments.
- Looking after her siblings.
- Being outdoors.
- Being forced to participate in a sport.

Play-Object Goal:

- Something to keep her brothers away from her.

Fig. 53:



Persona Two (Secondary):

Niko is a six and a half year old boy of Maori/Pakeha decent. His family are currently lives in Burnside, Christurch and has always lived in New Zealand. He lives alone with his mum who works as a teacher and afterschool care volunteer at the same primary school he attends. He attends after school care three days a week (3pm - 6pm). This consists of unstructured play within a designated area (both indoors and out). His mum makes him complete his homework each day before he joins the other for play.

Nature:

- Loud.
- Rough.
- Messy.
- Bit of a trouble maker.
- Kind and honest.
- Happy.
- Gets bored easily.

Likes:

- Climbing trees / being in the bush.
- Watching his mums boyfriend play playstation.
- Watching TV (morning cartoons before school).
- Insects.
- Getting muddy.

Dislikes:

- Spending so much time at school.
- Reading.
- Sports (games with too many rules).

***Play-Object* goal:**

- Something he can use outdoors.

Fig. 54:



Persona Three (Tertiary):

Joel is a 34 year old Australian man who has shared custody with his two 6 year old twins. He is currently a manager at The Warehouse in Hastings, Hawkes Bay.

Joel see's his children two days a week (usually the weekend) and struggles to to cope with the time he misses out on while his children are with their mother.

Nature:

- Stubborn.
- Usually quiet.

Likes:

- Sport.
- Loves his two boys.
- After work drinks.

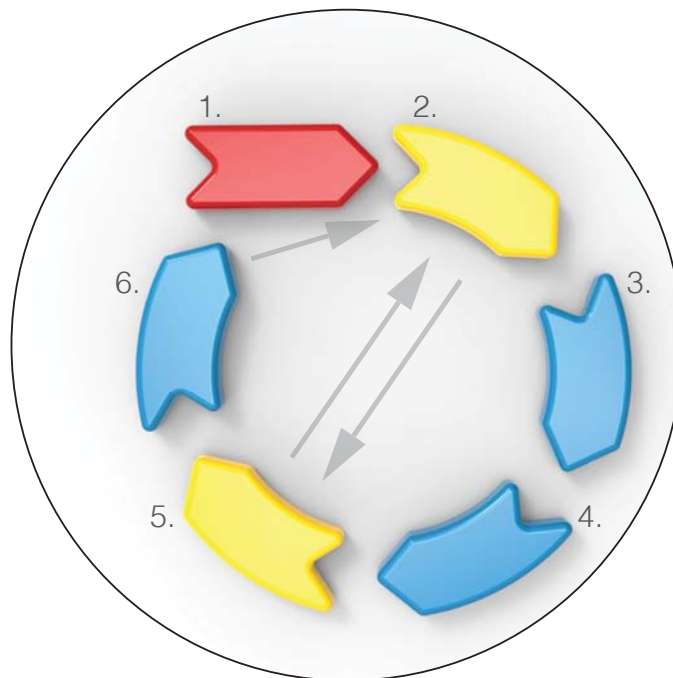
Dislikes:

- When his children are bored on the weekends/ days they are with him.
- His small apartment.

Play-object goals:

- A meaningful toy he can use with both his son's on the weekend.

Fig. 55: Orblox User Journey Map:



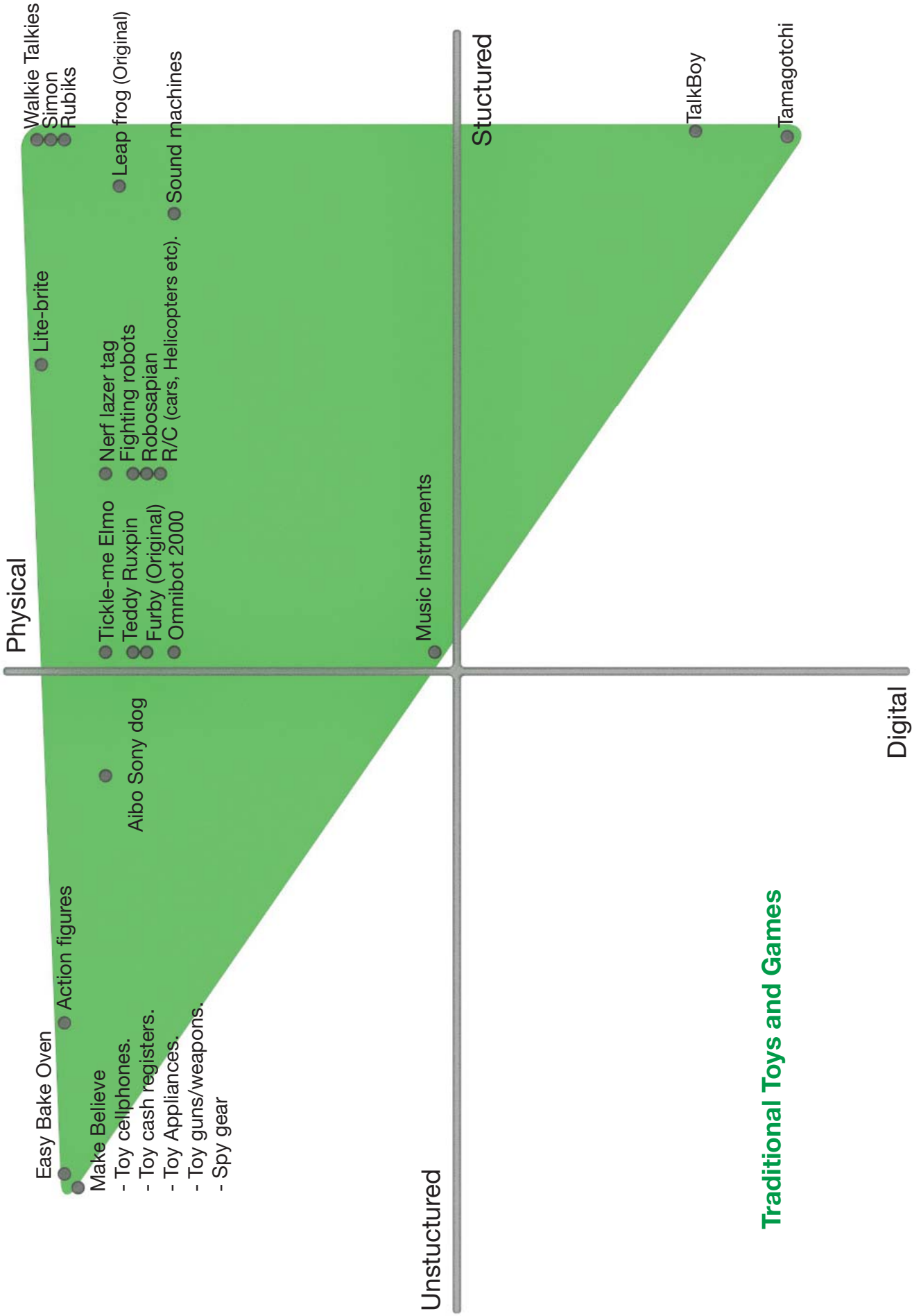
1. Selection.
2. Environment.
3. Mode Selection.
4. Connection.
5. Play.
6. Charge.

15.3

Journey Mapping:

Journey mapping was an integral part of my design process. This process fed directly off the persona's I had created allowing me to better understand the needs of my user and the functions and elements of each design I created. To the left is an example of some of the maps generated while I was designing the first Orb-Lox iteration.

Fig. 56:

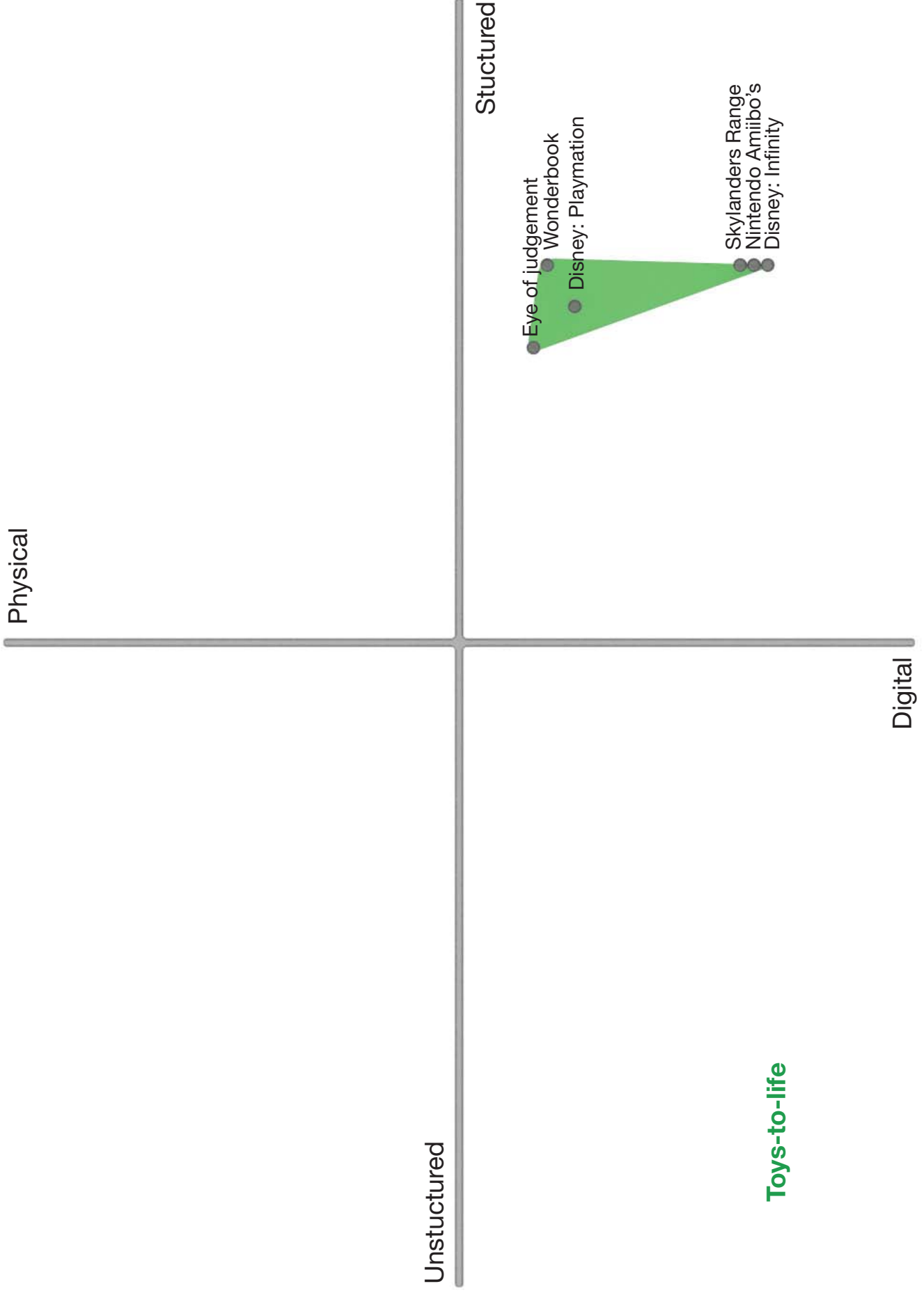


Traditional Toys and Games

15.4

Venn Diagrams:

Over the following pages are larger/seperated images of the Venn diagram I created that led to my area of opportunity.



Physical

Unstructured

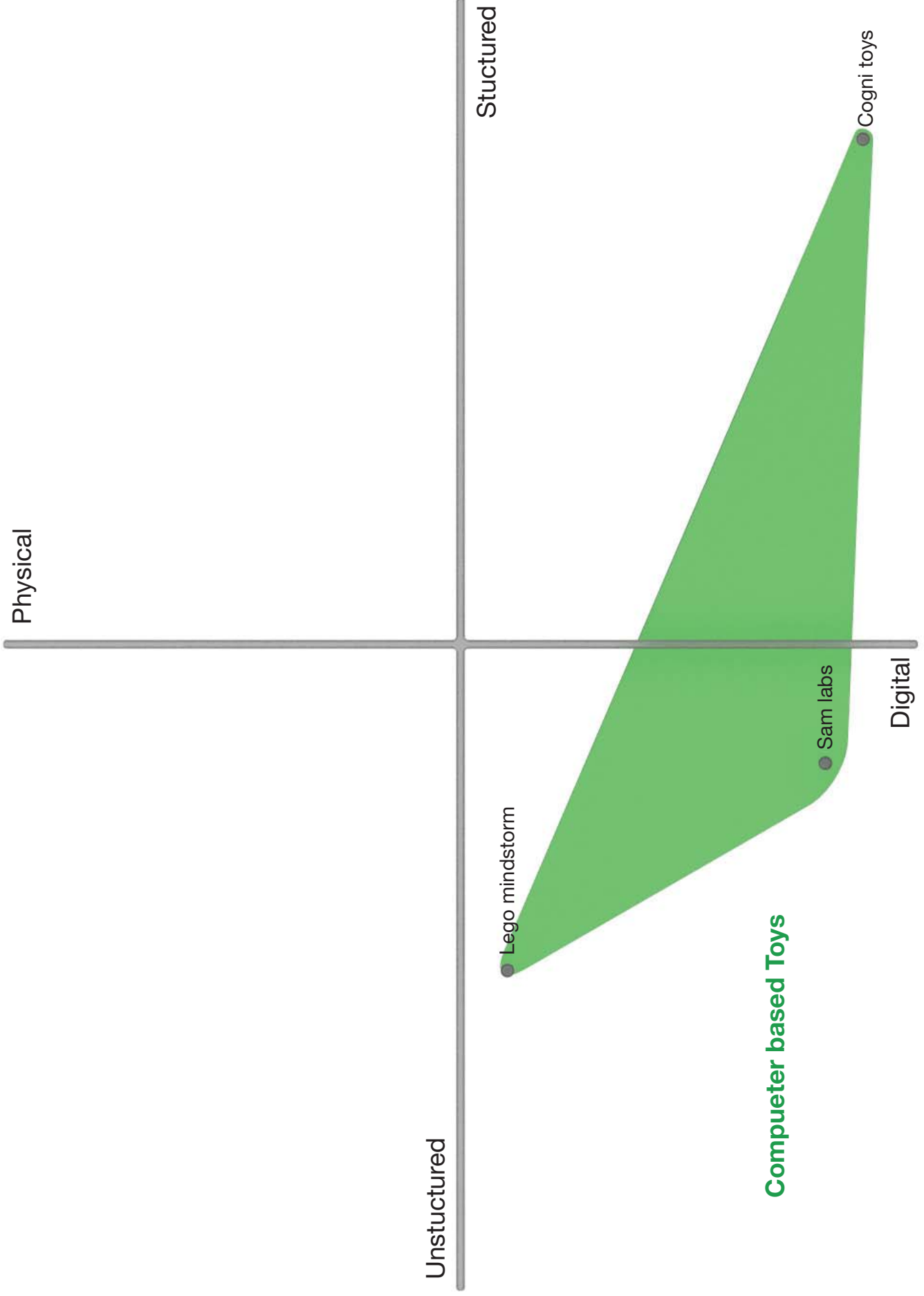
Structured

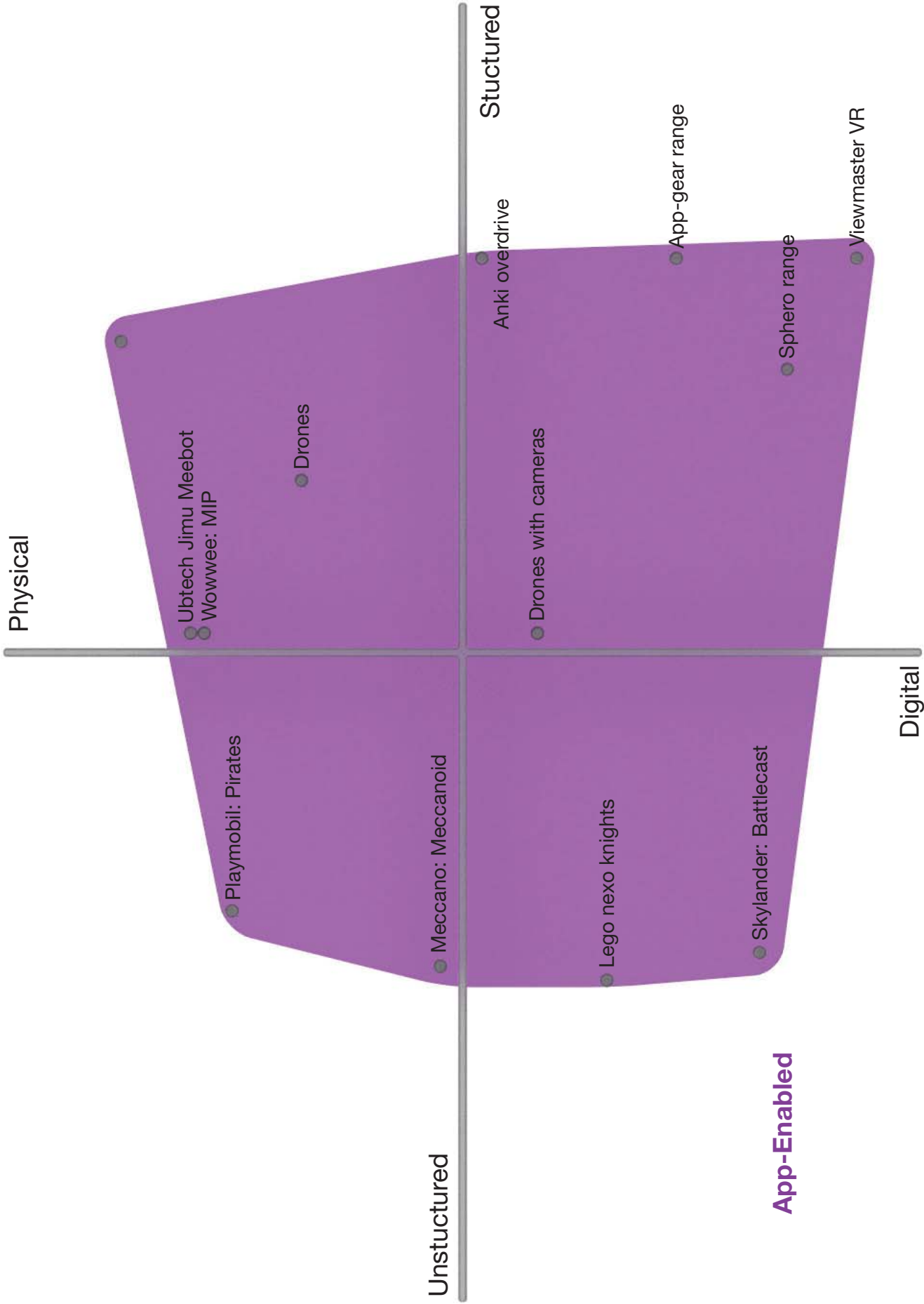
Digital

Pokemon GO

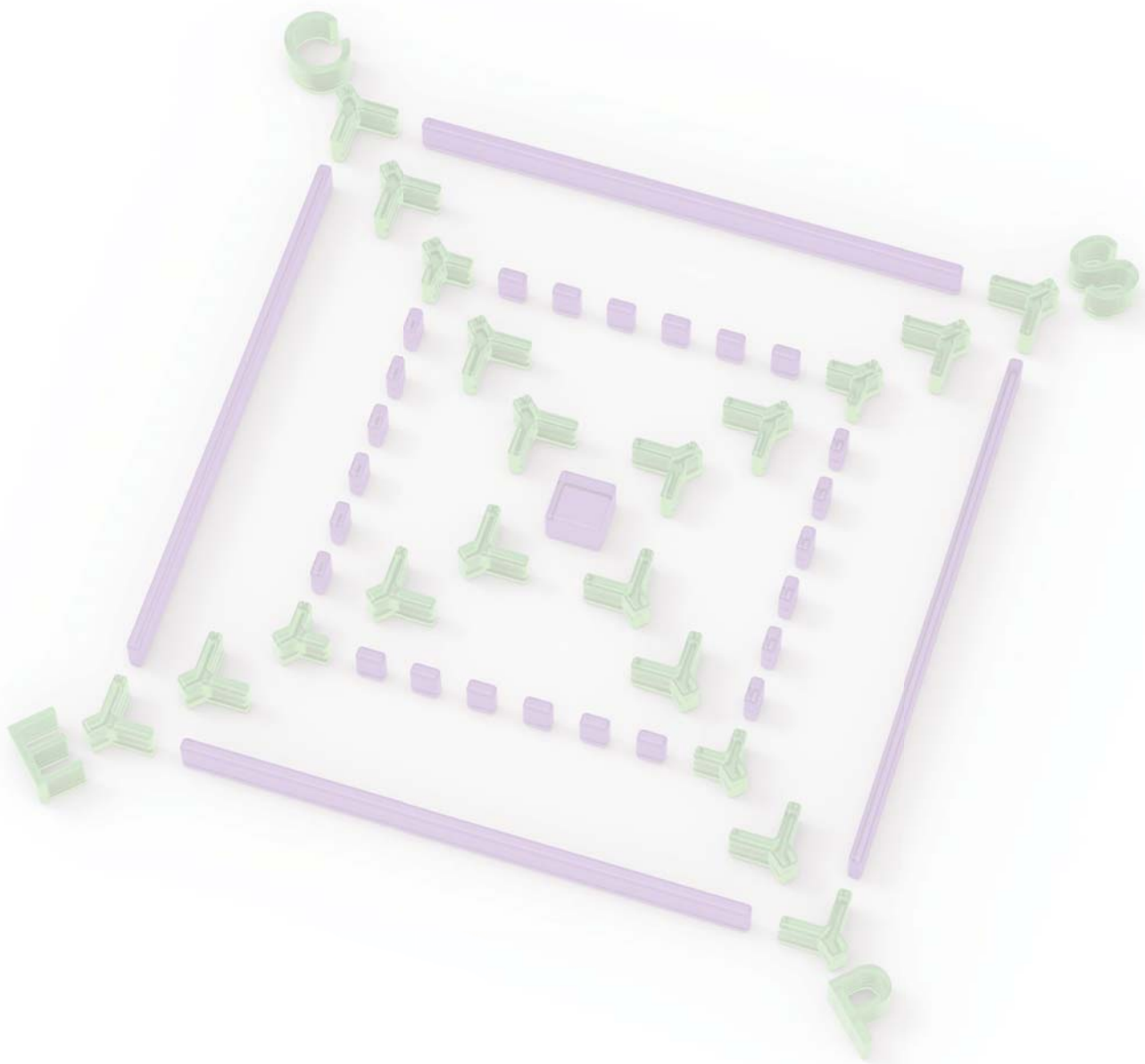
App-enabled books
Quiver

Application Games





App-Enabled



15.5

Forms:

Consent and Participation forms for both interviews with professionals and actors for filming/imagery plus an example of a *play-object* evaluation form can be found on the following pages (All original copies can be found in the workbook).



MASSEY
UNIVERSITY
TE KUNENGA KI PŪREHURŪA

UNIVERSITY OF NEW ZEALAND

Name: POORNIMA RANATHOR

Email: POORNIMA@PLAYSENSE.CO.NZ

City: WELLINGTON

Exploring the Phygital

MDes 2017

by Chaz McManus

Participant Consent Form

This consent is valid for a period of five (5) years

I have had the details of the project Exploring the Phygital explained to me. My questions have been answered to my satisfaction, and I understand that I may be asked further questions at any time.

Please circle one for each clause...

- I **agree** / ~~do not agree~~ to the documentation of my participation in this research.
- I **agree** / ~~do not agree~~ to that my participation in this research can be attributed to me.
- I **agree** / ~~do not agree~~ to the audio recording of my participation in this research.
- I **agree** / ~~do not agree~~ to the photography of my participation in this research.
- I **wish** / ~~do not wish~~ to have the audio tapes or photographs sent to me.
- I **would like** / ~~would not like~~ a copy of this document.
- I **am willing** / ~~not willing~~ to be contacted.

I agree to participate in the research project Exploring the Phygital under the conditions I have outlined above.

Signature:

Date: 9-3-2017

Full name printed:



MASSEY
UNIVERSITY
TE KUNENGA RI PŪREHUOA

UNIVERSITY OF NEW ZEALAND

Name: POORNIMA RANSHUN

Email: POORNIMA@PLAYSENSE.CO.NZ

Organisation: PLAY THOUGHTS

City: WELLINGTON

Exploring the Phygital

MDes 2017

by Chaz McManus

INFORMATION SHEET

This information is valid for a period of five (5) years

Researcher Introduction

This is a project of Chaz McManus' design. Chaz is currently undertaking Postgraduate study at Massey University, College of Creative Arts in Wellington focusing on play-objects (toys) that incorporate both physical and digital experiences.

Project Details

This project explores the current state of play experiences available to the modern child (namely physical and digital hybridized toys). The project aims to illustrate ways these modern children can benefit from healthier forms of this hybridized play through the better understanding of the affects these toys have on play and development. The final outcome of his exploration will be a criteria for the correct implementation of physical and digital play elements into any given hybrid play experience.

Participant Recruitment

Chaz is interested in the views and experiences of industry professionals with-in the areas of social, emotional and cognitive development to better his own understanding of the relationship between play, learning and developmental growth.

Participant Involvement

Chaz would like to record you in an informal interview conversation about your perspective on the area of his investigation. You will not be asked about any personal information, situation or background.

Data Collection

The information gathered during this process will be used to better understand the topic of investigation and may be used to cement or back up concepts and ideas Chaz presents in his final exegesis.



MASSEY
UNIVERSITY
TE KUNENGA KI PŪREHURUA

UNIVERSITY OF NEW ZEALAND

Name: SHARON E. CALLAGHAN
Email: sharon.callaghan.nz@gmail.com
Organisation: HEAR FOR FAMILIES AUDITORY PROCESSING DISORDER
DEVELOPMENTAL MOVEMENTS AND VISION
City: WELLINGTON CENTRE H4FAPD NZ

Exploring the Phygital

MDes 2017
by Chaz McManus

INFORMATION SHEET

This information is valid for a period of five (5) years

Researcher Introduction

This is a project of Chaz McManus' design. Chaz is currently undertaking Postgraduate study at Massey University, College of Creative Arts in Wellington focusing on play-objects (toys) that incorporate both physical and digital experiences.

Project Details

This project explores the current state of play experiences available to the modern child (namely physical and digital hybridized toys). The project aims to illustrate ways these modern children can benefit from healthier forms of this hybridized play through the better understanding of the affects these toys have on play and development. The final outcome of his exploration will be a criteria for the correct implementation of physical and digital play elements into any given hybrid play experience.

Participant Recruitment

Chaz is interested in the views and experiences of industry professionals with-in the areas of social, emotional and cognitive development to better his own understanding of the relationship between play, learning and developmental growth.

Participant Involvement

Chaz would like to record you in an informal interview conversation about your perspective on the area of his investigation. You will not be asked about any personal information, situation or background.

Data Collection

The information gathered during this process will be used to better understand the topic of investigation and may be used to cement or back up concepts and ideas Chaz presents in his final exegesis.



MASSEY
UNIVERSITY
TE KŪNENGA KI PŪREHURŪA

UNIVERSITY OF NEW ZEALAND

Name: SHARON E. CALLAGHAN
Email: sharon.callaghan.nz@gmail.com
City: WELLINGTON N.Z.

Exploring the Phygital

MDes 2017
by Chaz McManus

Participant Consent Form

This consent is valid for a period of five (5) years

I have had the details of the project Exploring the Phygital explained to me. My questions have been answered to my satisfaction, and I understand that I may be asked further questions at any time.

Please circle one for each clause...

- I agree / do not agree to the documentation of my participation in this research.
- I agree / do not agree to that my participation in this research can be attributed to me.
- I agree / do not agree to the audio recording of my participation in this research.
- I agree / do not agree to the photography of my participation in this research.
- I wish / do not wish to have the audio tapes or photographs sent to me.
- I would like / would not like a copy of this document.
- I am willing / not willing to be contacted.

I agree to participate in the research project Exploring the Phygital under the conditions I have outlined above.

Signature:

Date: 27.02.17

Full name printed:

SHARON E. CALLAGHAN

Name: Shirley Jourdain
Email: shirley@jourdain.net.nz
Organisation: Te Aroha Noa Community Services
City: Palmersdon North

Exploring the Phygital

MDes 2017
by Chaz McManus

INFORMATION SHEET

This information is valid for a period of five (5) years

Researcher Introduction

This is a project of Chaz McManus' design. Chaz is currently undertaking Postgraduate study at Massey University, College of Creative Arts in Wellington focusing on play-objects that incorporate both physical and digital experiences.

Project Details

This project explores at the current state of play experiences available to the modern child (namely physical and digital hybrids). The project aims to illustrate ways these modern children can benefit from healthier forms of this hybridized play through the better understanding of the effects these toys have on play and development. The final outcome of his exploration will be a criteria for the correct implementation of physical and digital play elements into any give hybrid play experience.

Participant Recruitment

Chaz is interested in the views and experiences of industry professionals with-in the areas of social, emotional and cognitive development to better his own understanding.

Participant Involvement

Chaz would like to record you in an informal interview conversation about your perspective on the area of his investigation. You will not be asked about any personal information, situation or background.

Data Collection

The information gathered during this process will be used to better understand the topic of investigation and maybe be used to cement concepts and ideas Chaz presents in his final exegesis.



MASSEY
UNIVERSITY
TE KUNENGA KI PŪREHUROA

UNIVERSITY OF NEW ZEALAND

Name: Shirley Jourdain
Email: shirley@jourdain.net.nz
City: Palmerston North

Exploring the Phygital

MDes 2017
by Chaz McManus

Participant Consent Form

This consent is valid for a period of five (5) years

I have had the details of the project Exploring the Phygital explained to me. My questions have been answered to my satisfaction, and I understand that I may be asked further questions at any time.

Please circle one for each clause...

- I agree / do not agree to the documentation of my participation in this research.
- I agree / do not agree to that my participation in this research can be attributed to me.
- I agree / do not agree to the audio recording of my participation in this research. N/A
- I agree / do not agree to the photography of my participation in this research. N/A
- I wish / do not wish to have the audio tapes or photographs sent to me. N/A
- I would like / would not like a copy of this document.
- I am willing / not willing to be contacted.

I agree to participate in the research project Exploring the Phygital under the conditions I have outlined above.

Signature: Shirley Jourdain

Date: 24/05/17

Full name printed: Shirley Jourdain



Name: Duncan Milne
Email: duncan@juniorlearning.com
City: Auckland

Exploring the Phygital

MDes 2017
by Chaz McManus

Participant Consent Form

This consent is valid for a period of five (5) years

I have had the details of the project Exploring the Phygital explained to me. My questions have been answered to my satisfaction, and I understand that I may be asked further questions at any time.

Please circle one for each clause...

- agree / do not agree to the documentation of my participation in this research.
- agree / do not agree to that my participation in this research can be attributed to me.
- agree / do not agree to the audio recording of my participation in this research.
- agree / do not agree to the photography of my participation in this research.
- I wish / do not wish to have the audio tapes or photographs sent to me.
- I would like / would not like a copy of this document.
- I am willing / not willing to be contacted.

I agree to participate in the research project Exploring the Phygital under the conditions I have outlined above.

Signature:

Date:

6 March 2017

Full name printed:

DUNCAN MILNE



MASSEY
UNIVERSITY
TE KUNHGA KI PŪRFHURŌA

UNIVERSITY OF NEW ZEALAND

Name: Hamish Conway
Organisation: TGLED LTD
City: WGMN

Date 8/5/17

Project Title:
Exploring the Phygital

Researcher:
Chaz McManus

TALENT RELEASE FORM

TALENT RELEASE

I understand that by the signing of this document I am giving the researcher of this project the authority to utilize any footage or imagery taken during the process of this particular shoot for the purpose of research.

I understand that any imagery or footage taken throughout this process will only be used in digital and print formats relating to the project and will not be uploaded to any websites or other media other than that of Massey origin.

I also understand that all printed and digital copies of this imagery or footage that do not reside within the final outcome of this project will be destroyed upon the completion date of the researchers study.

Signature of Producer

8/5/17

Date

Signature of Talent

Date



MASSEY
UNIVERSITY
TE KUNENGA KI PŪREHURŌA

UNIVERSITY OF NEW ZEALAND

Name: Ashraf Alharbi

Organisation: Security-Assessment.com

City: Wellington

Date 1/5/2017

Project Title:
Exploring the Phygital

Researcher:
Chaz McManus

TALENT RELEASE FORM

TALENT RELEASE


I understand that by the signing of this document I am giving the researcher of this project the authority to utilize any footage or imagery taken during the process of this particular shoot for the purpose of research.

I understand that any imagery or footage taken throughout this process will only be used in digital and print formats relating to the project and will not be uploaded to any websites or other media other than that of Massey origin.

I also understand that all printed and digital copies of this imagery or footage that do not reside within the final outcome of this project will be destroyed upon the completion date of the researchers study.

Signature of Producer

Date



Signature of Talent

1/5/2017

Date



MASSEY
UNIVERSITY
TE KUNENGA KI PŪREHURŌA

UNIVERSITY OF NEW ZEALAND

Name:

Lacey Whubbs

Organisation:

Family Start

City:

Wellington

Date

1-5-17

Project Title:
Exploring the Phygital

Researcher:
Chaz McManus

TALENT RELEASE FORM

TALENT RELEASE

I understand that by the signing of this document I am giving the researcher of this project the authority to utilize any footage or imagery taken during the process of this particular shoot for the purpose of research.

I understand that any imagery or footage taken throughout this process will only be used in digital and print formats relating to the project and will not be uploaded to any websites or other media other than that of Massey origin.

I also understand that all printed and digital copies of this imagery or footage that do not reside within the final outcome of this project will be destroyed upon the completion date of the researchers study.

Signature of Producer

Date

Signature of Talent

Date

1-5-17

Play Object Personal Evaluation Sheet

Object Name:

Price:

Recommended Age:

Complexity:

Format / Genre / Device:



Process:

List the process taken from start to finish when using the object (draw images if needed). Rate your experience of each step of the process out of ten.

1. _____ _____	1. /10
2. _____ _____	2. /10
3. _____ _____	3. /10
4. _____ _____	4. /10
5. _____ _____	5. /10
	Average: /10

Notes:

- ◆ What was your over all impression of this object? /10

- ◆ How did it feel in the hand? /10
Dimensions: H: ____ L: ____ W: ____ Weight: _____
- ◆ How intuitive was the product out of ten? /10
Were instructions necessary? YES / NO
- ◆ What was your enjoyment level and your favourite part? /10

- ◆ What learning aspects did the object offer? (Circle):
Gross Motor function Fine Motor Function Maths Spelling
Logic/Problem Solving Other: _____

Marketed as a YES
learning object: NO

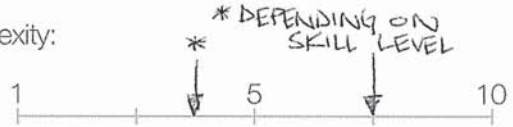
Play Object Personal Evaluation Sheet

Object Name: SPHERO

Price: \$260.00

Recommended Age: 8+

Complexity:



Format / Genre / Device:

APP-ENABLED ON CELLPHONE

Process:

List the process taken from start to finish when using the object (draw images if needed). Rate your experience of each step of the process out of ten.

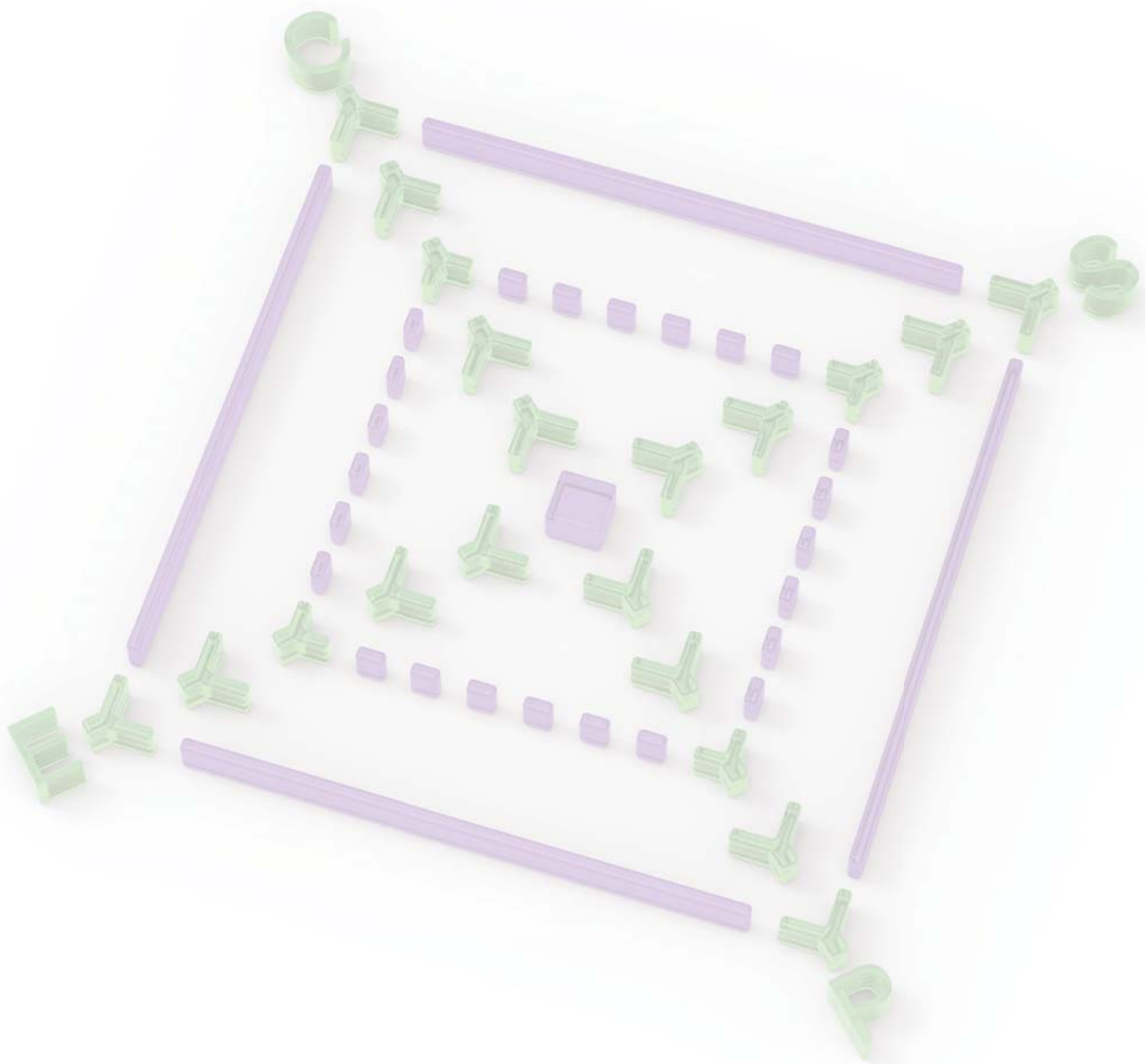
- | | | |
|--|----|-------|
| 1. <u>OPENING BOX</u>
- AWESOME PACKAGING. - FEEL LIKE I WILL DAMAGE RUBBER SHELL | 1. | 10/10 |
| 2. <u>BLUETOOTH SETUP</u>
- THIS IS A NIGHTMARE SO FAR | 2. | 2/10 |
| 3. <u>QUICK IN APP INSTRUCTIONS</u>
- ABOUT TO GIVE UP - KIND OF ANNOYING (BROKEN PLAY CYCLE) | 3. | 2/10 |
| 4. <u>MOVING SPHERO AROUND</u>
- INTERESTING BUT STRANGELY HARD. | 4. | 5/10 |
| 5. <u>WHAT NOW?</u> - NO PROMPTS
- WILL TRY CODING APP NEXT. | 5. | 1/10 |

Average: 4/10

Notes:

- ◆ What was your over all impression of this object? 7/10
COOL - INTERESTING TO USE
GOT BORED OF IT FAST
→ LIKE A REMOTE CONTROL CAR
- ◆ How did it feel in the hand? 7/10
 Dimensions: H: 80 L: 80 W: 80mm Weight: LIGHT.
 - NO NEED TO WEIGH IT.
- ◆ How intuitive was the product out of ten? 4/10
 Were instructions necessary? (YES) / NO
 → BLUETOOTH PROCESS CONFUSING
- ◆ What was your enjoyment level and your favourite part? /10
 → MORE A COOL GEEK STATUS SYMBOL
THAN ANYTHING ELSE
 → DID NOT LEND ITSELF TO ANY PARTICULAR TYPE OF PLAY
- ◆ What learning aspects did the object offer? (Circle):
Gross Motor function Fine Motor Function Maths ^{→ CODING?} Spelling
 Logic/Problem Solving Other: _____

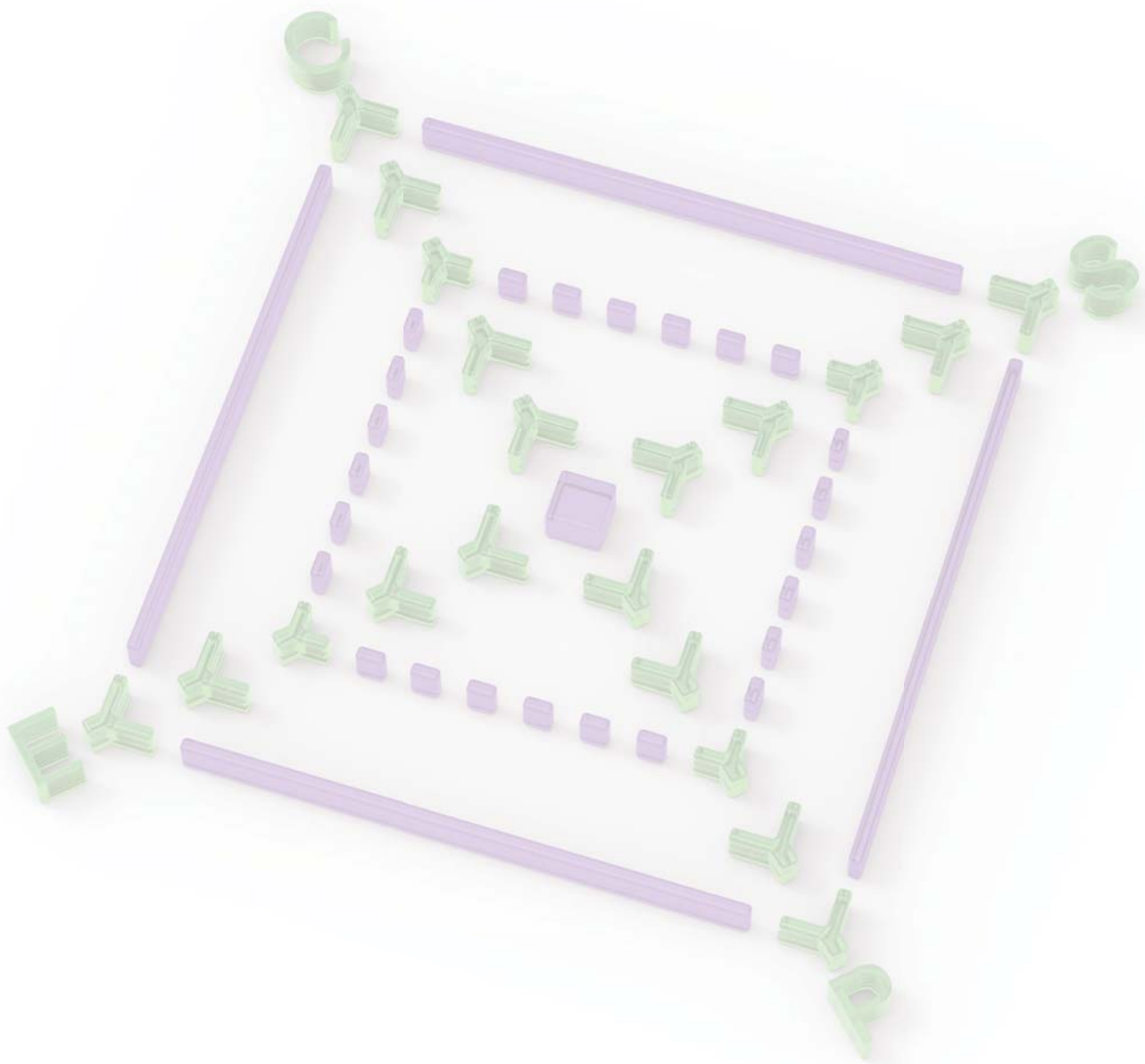
Marketed as a learning object:	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
--------------------------------	--



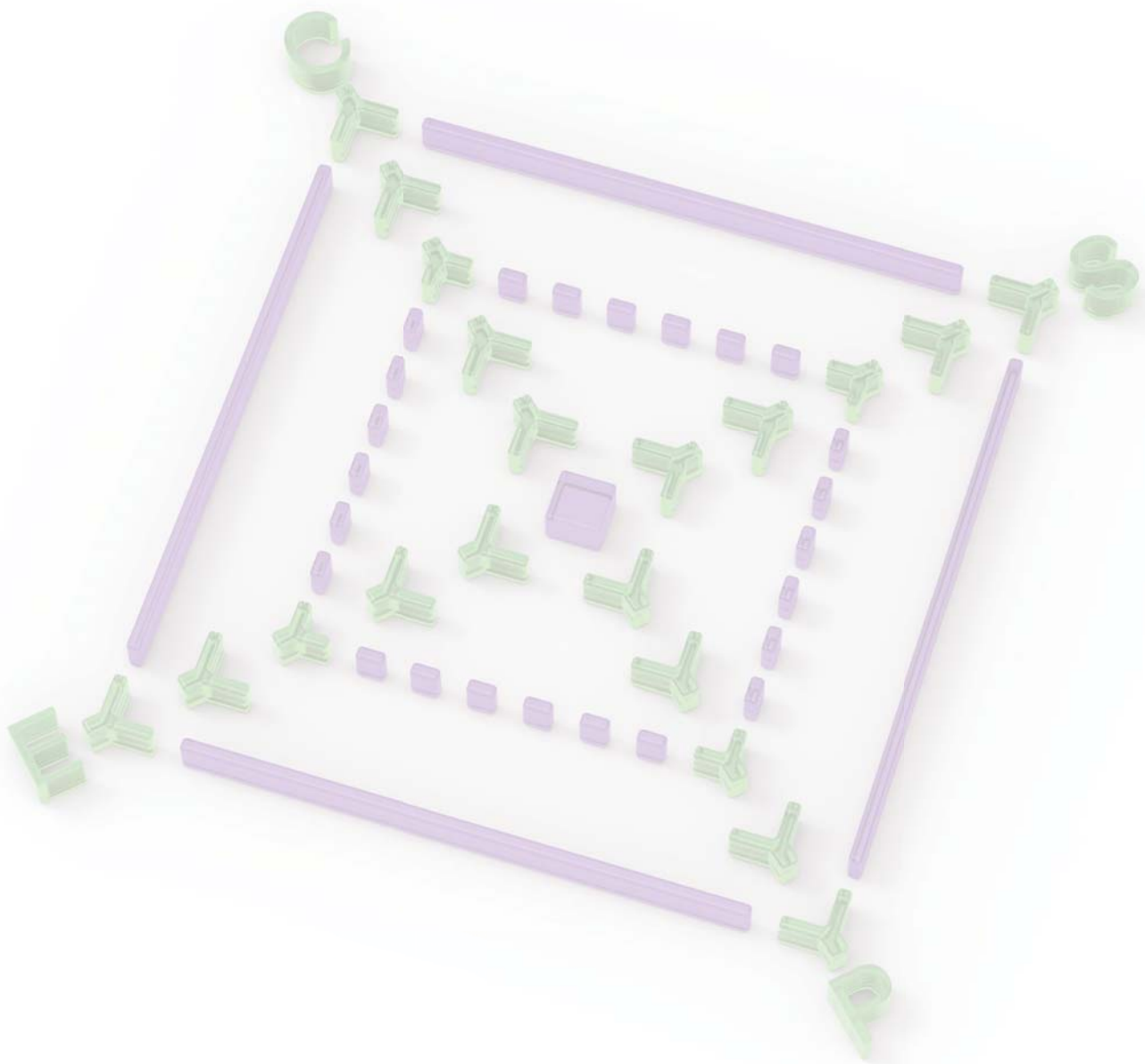
15.6

References:

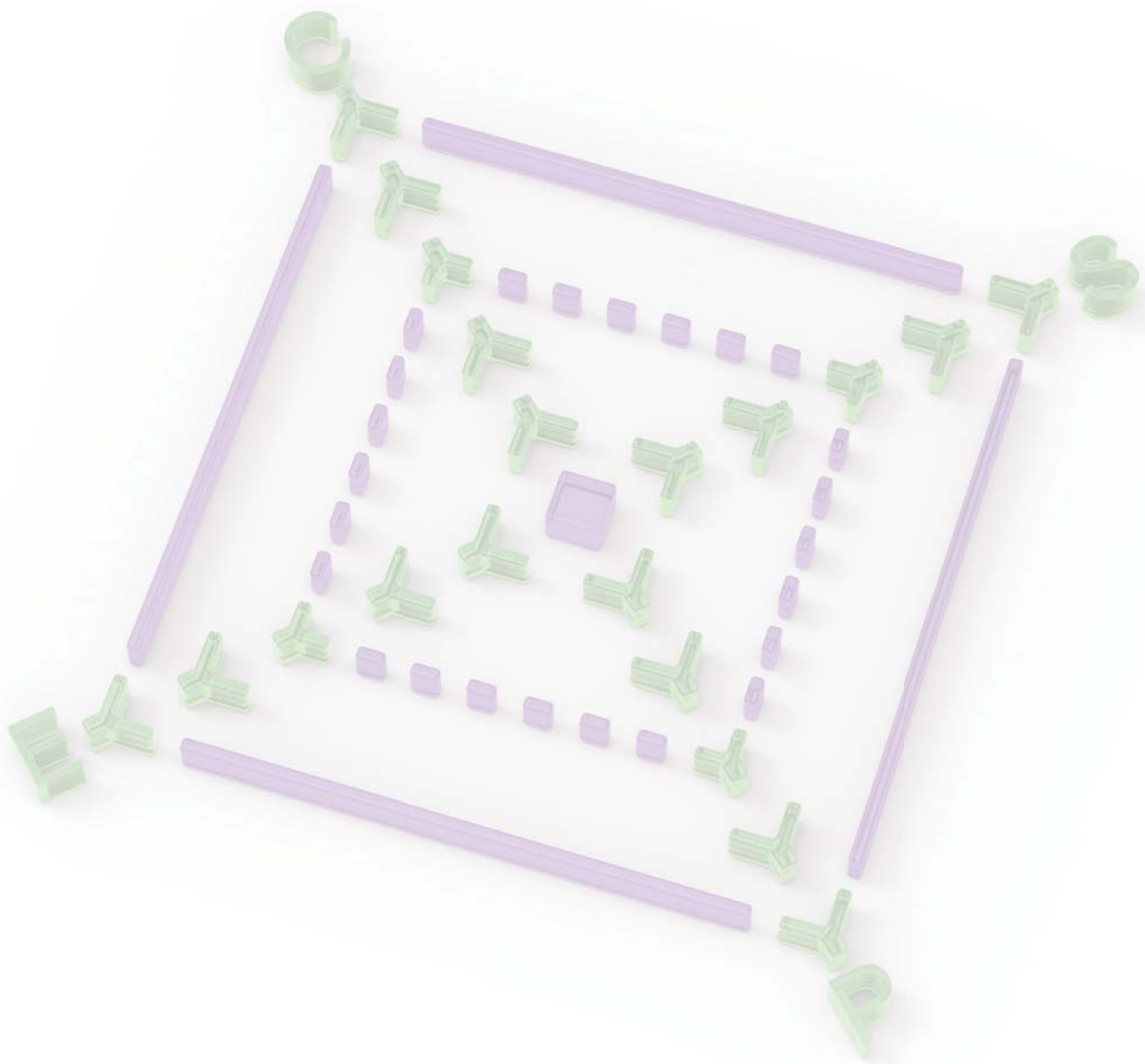
- Allen, M. (2004). *Toys, Games and Media*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Ackerman, J. (2015). Toucha-Toucha-Toucha-Touch Me: Morality, Learning, and the Haptic Origins of Cognition. Retrieved from: <http://www.psychologicalscience.org/observer/toucha-toucha-toucha-touch-me-morality-learning-and-the-haptic-origins-of-cognition#.WKeMb-iYbxA>
- Auerbach, S. (2012). *Marinations 32 Interview: Dr Toy*. Retrieved from: <https://youtu.be/49pIEeR2f2A>
- Başkale, Hatice, Bahar, Zuhale, Başer, Günsel, & Ari, Meziyet. (2009). Use of Piaget's theory in preschool nutrition education. *Revista de Nutrição*, 22(6), 905-917. <https://dx.doi.org/10.1590/S1415-52732009000600012>
- Bergen, D. (2002). The Role of Pretend Play in Children's Cognitive Development. *Journal of Early Childhood Research and Practice*, 4(1).
- Bird, J., Edwards, S. (2015). Children Learning to Use Technologies Through Play: A Digital Play Framework. *Journal of Educational Technology*. 46(6), 1149-1160.
- Bradford, H., & Moyles, J. (2015) *The Excellence of Play* (4th Ed.). Berkshire, England: Open University Press.
- Burdette, H. L., Whitaker, R. C. (2006). Resurrecting Free Play in Young Children. *The American Medical Association*. 159: 46-50.
- Callaghan, S. (2017). *Poli: Film Day* [Video File]. Shadow Alley Films. Wellington, NZ.
- Dictionary. (2017). Retrieved from: <http://www.dictionary.com/browse/criteria>



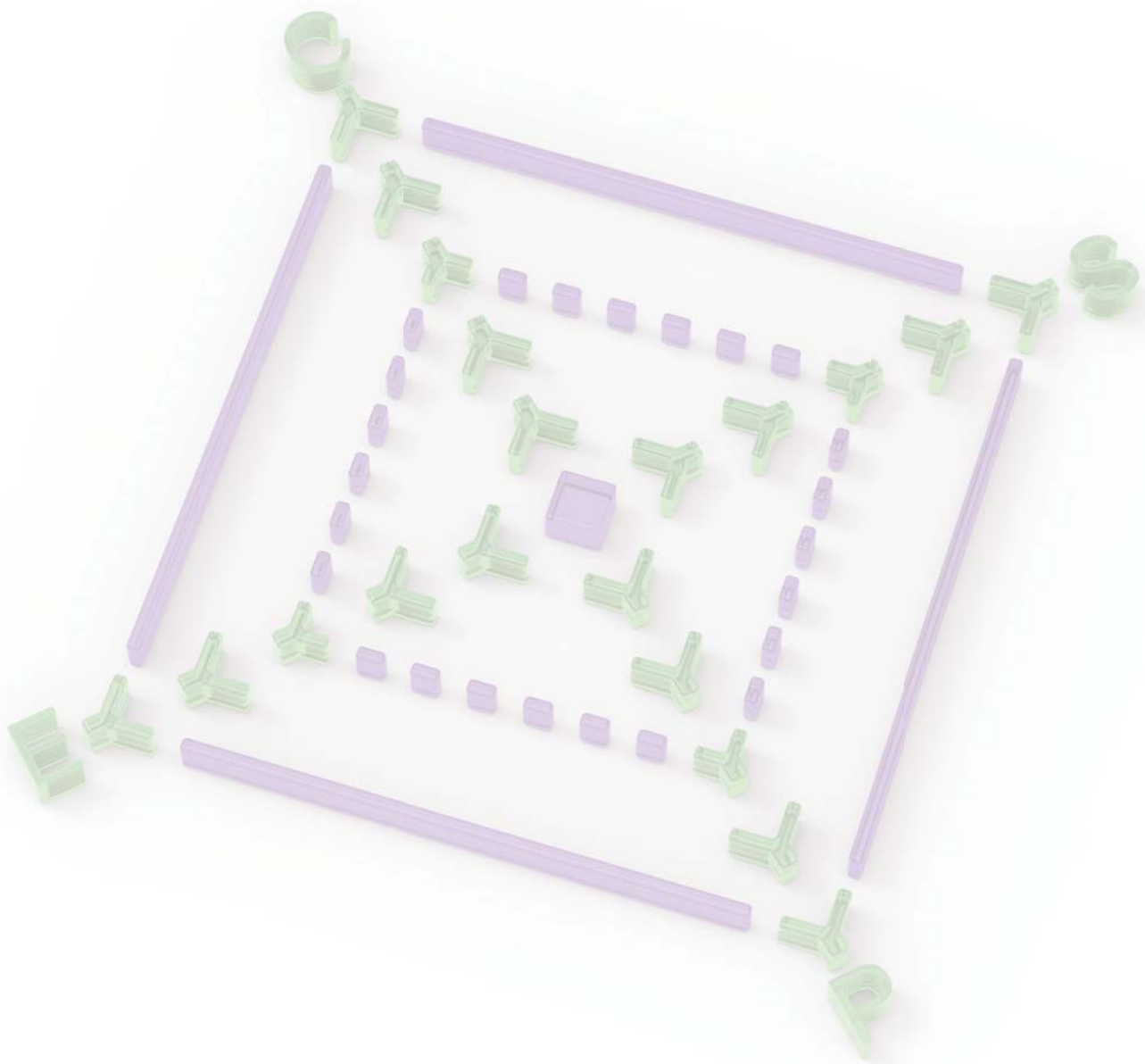
- Downey, S., & Hayes, N., & O'Neill, B. (2004). Play and Technology for Children Aged 4-12. Dublin, Ireland: Centre for Social and Educational Research.
- Elkind, D. (1993) Concrete Operations [Video file]. Davidson Films. Retrieved March 23, 2017, from Education in Video: Volume I.
- Elkind, D. (2003). Technologies Impact on Child Growth and Development. Retrieved from: <https://www.cio.com/article/2441936/it-organization/david>
- Fisher, P. A. (2016). InBrief: Executive Function: Skills for Life and Learning. Retrieved from: <http://developingchild.harvard.edu/science/key-concepts/executive-function/>
- Gaudiosi, J. (2015). This billion dollar market didn't even exist five years ago. Retrieved from: <http://fortune.com/2015/07/24/toys-to-life-market/>
- Gielen, A. (2009). Essential Concepts in Toy Design Education: Aimlessness, Empathy and Play Value. Retrieved from: <https://repository.tudelft.nl/islandora/object/uuid:238fb5cb-5610-4ec0.../download>
- Goldstein, J. (2012). Play in Children's Development, Health and Wellbeing, Brussels, Fuel Design.
- Gottlieb, R. (2014). About Global Toy Experts. Retrieved from <http://www.globaltoyexperts.com/>
- Gray, P. (2011). The Decline in Play and the Rise in Psychopathology in Child and Adolescents. American Journal of Play, 3(4), 443-463.
- Guyton, G. (2011). Young Children: Using Toys to Support Infant-Toddler Learning and Development. Exchange Magazine. September, 50-56.
- Hanks, T. (1995). Tom Hanks: 67th Academy Awards Speech. Retrieved from: <https://youtu.be/Vd420MYpGek>



- Hinske, S. Langheinrich, M. Lampe, M. (2008). Towards Guidelines for Designing Augmented Toy Environments. Retrieved from: <https://www.vs.inf.ethz.ch/publ/papers/hinske2008dis.pdf>
- J. S. Rycus, & R. C. Hughes, (1998). Developmental Milestones Chart. Retrieved from: http://www.rsd.k12.pa.us/Downloads/Development_Chart_for_Booklet.pdf
- Kidspot, (2017), Six to Nine: Social and emotional development. Retrieved from: <http://www.kidspot.com.au/parenting/child/child-development/6-9-social-and-emotional-development-2>
- Learning works. (2012). Creating a Healthy Play Diet and Child Development: Ages 6-9. Retrieved from: <http://learningworksforkids.com/2012/03/digital-play-and-child-developmental-ages-6-9/>
- Lillard, A. (2013). Playful Learning and Montessori Education. *American Journal of Play*, 5(2), 157-186.
- Madson, H. (2016). How Nintendo Changed Video Games. Retrieved from: <http://twinfinit.net/2016/10/nintendo-changed-game-video-games>
- Mertala, P., & Sarenius, V. M. (2016). The Value of Toys: 6-8-Year-Old Children's Toy Preferences and the Functional Analysis of Popular Toys.
- Moyles, J. (2015). *The Excellence of Play* (4th Ed.). Berkshire, England: Open University Press.
- Parent further. Ages 6-9: Developmental Overview. Retrieved from: <http://www.parentfurther.com/content/ages-3-5-developmental-overview>
- Pope, G. (2015). *The Modern Child: Biology, Culture and Society - and Play*. Retrieved from: <http://linkedin.com/article/the-gen-z-division/>



- RaisingChildren.net (2016) Retrieved from: http://m.raisingchildren.net.au/articles/child_development_6-8_years.html
- Reeves, B. (2011). <http://www.gameinformer.com/b/features/archive/2011/04/26/the-nintendo-difference-nintendo-s-impact-on-the-gaming-landscape.aspx>
- Santer, J. (2007). Free Play in Early Childhood: A Literature Review. London, England: National Children's Bureau.
- The Toy Man. (2012). The Toy Man: Product Guide. Retrieved from: www.thetoyman.com/guidelines.html
- Trautman, T. (2014). The Trouble with Toys. Retrieved from: https://nytimes.com/2014/11/27/business/tech-toys-that-can-make-the-video-screen-passe.html?_r=0
- Unantenne, N. (2014). Mobile Usage Among Young Kids: A Southeast Asia Study. Singapore: Tickled Media.
- Whitebread, D. (2012). The Importance of Play: A report on the value of children's play with a series of policy recommendations. Brussels, Belgium: University of Cambridge.
- Yelland, N., & Moyles, J. (2015). The Excellence of Play (4th Ed.). Berkshire, England: Open University Press.
- Zelazo, P. D. (2013). Executive Function and the Developing Brain: Implications for Education. Retrieved from: <https://youtu.be/r2-j7pqOfoU>



15.7

Images:

Figure 1: Child and father playing Playstation.

Retrieved from: <http://www.geeknode.co.za/wp-content/uploads/2016/11/Dad-Son-PLaying-Video-Games.jpg>

Figure 2: Two girls using Nintendo Gameboy SP's

(google image search). Retrieved from: <http://img.gawkerassets.com/img/17nmns68y9w3vjjpg/original.jpg>

Figure 3: Viewmaster VR (Google image search).

Retrieved from: https://i5.walmartimages.com/asr/b202acbf-3486-4d63-8ad9-c05407d86f5e_1.c1581e110e322e78454f5a66531a2b05.jpeg

Figure 4: Sphero (Google image search).

Retrieved from: https://i5.walmartimages.com/asr/b202acbf-3486-4d63-8ad9-c05407d86f5e_1.c1581e110e322e78454f5a66531a2b05.jpeg

Figure 5: Disney Infinity PS4 (Google image search).

Retrieved from: <http://sg-live-02.slatic.net/p/2/ps4-500gb-disney-infinity-30-console-bundle-export-set-5892-6304328-5bd766234be76d924765652a46705f1c.jpg>

Figure 6: Child playing with blocks (Google image search).

Retrieved from: <http://www.langmobile.com/wp-content/uploads/2013/10/boy-plays-with-blocks-WEB-SIZE.jpg>

Figure 7: Child thinking 1 (Google image search).

Retrieved from: <https://static1.squarespace.com/static/568d9255a2bab89bf8716fa7/t/56956d28b204d5fa51831202/1452633386729/Boy+Thinking.jpg?format=2500w>

Figure 8: Child thinking 2 (Google image search).

Retrieved from: <http://blog.kidsemail.org/wp-content/uploads/2013/11/thinking.jpg>

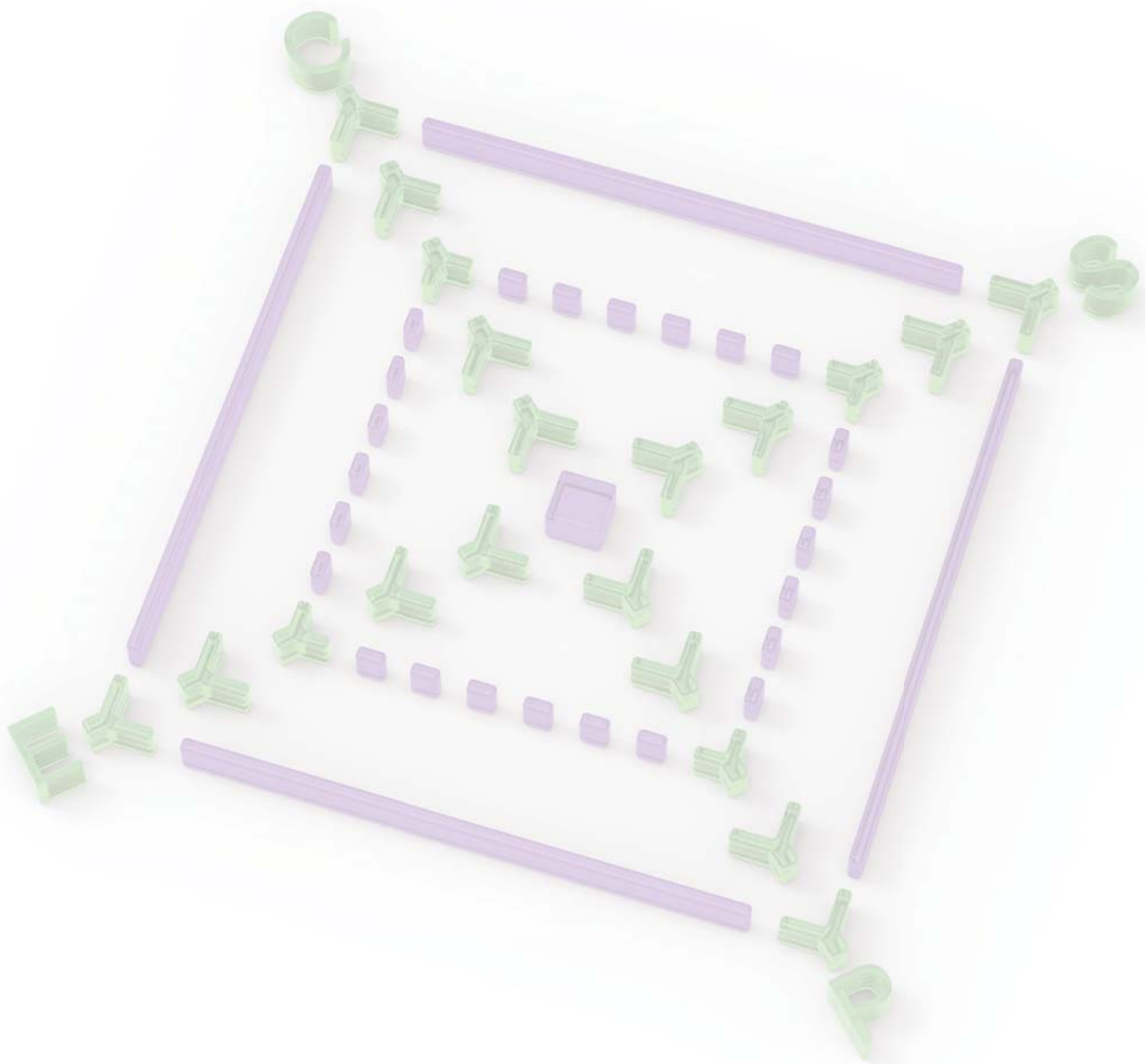


Figure 9: Diagrams from my workings.

Based on the following research:

Burdette, H. L., Whitaker, R. C. (2006). Resurrecting Free Play in Young Children. The American Medical Association. 159: 46-50.

Moyles, J. (2015). The Excellence of Play (4th Ed.). Berkshire, England: Open University Press.

Zelazo, P. D. (2013). Executive Function and the Developing Brain: Implications for Education. Retrieved from: <https://youtu.be/r2-j7pqOfoU>

Figure 10: Examples of prototypes: Test connections.

3D Print printed via: www.shapeways.com
Tanya Marriott.

Figure 11: Examples of prototypes: Arduino circuits.

Figure 12: Examples of CAD work (My own designs).

Figure 13: Examples of cue cards and designs they produced.

Figure 14: Children playing with prototypes and test materials. Images taken by Tanya Marriott.

Figure 15: The Characteristics of children ages 6 - 9 years
Based on the following research:

Allen, M. (2004). Toys, Games and Media. Mahwah, NJ: Lawrence Erlbaum Associates.

Moyles, J. (2015). The Excellence of Play (4th Ed.). Berkshire, England: Open University Press.

Parent further. Ages 6-9: Developmental Overview. Retrieved from: <http://www.parentfurther.com/content/ages-3-5-developmental-overview>

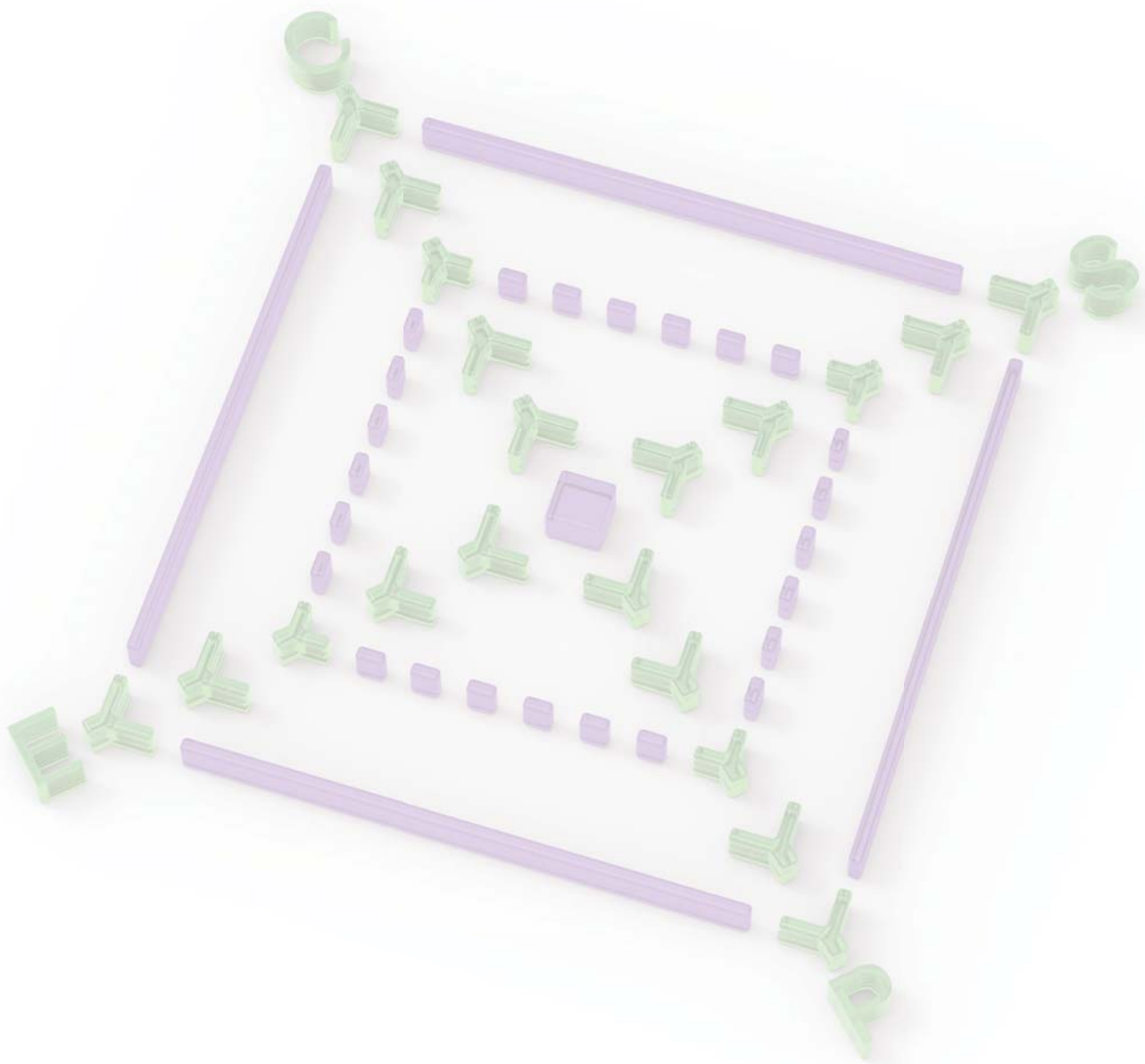


Figure 16: Children playing (Google image search).
Retrieved from: http://www.quickanddirtytips.com/sites/default/files/images/4511/girls_playing.jpg

Figure 17: The 3 A's of child development.
Original information retrieved from:

Burdette, H. L., Whitaker, R. C. (2006). Resurrecting Free Play in Young Children. The American Medical Association. 159: 46-50.

Figure 18: Executive Function and Self Regulation.
Original information retrieved from:

Zelazo, P. D. (2013). Executive Function and the Developing Brain: Implications for Education.
Retrieved from: <https://youtu.be/r2-j7pqOfoU>

Figure 19: Whiteboard drafts of first design tool.

Figure 20: Current phygital play-objects.
Retrieved from: http://www.conrad.com/medias/global/ce/9000_9999/9500/9560/9563/805876_BB_00_FB.EPS_1000.jpg

Figure 21: Current phygital play-objects.
Retrieved from: <http://s3.amazonaws.com/digitaltrends-uploads-prod/2016/07/Furby-connect-hasbro.jpg>

Figure 22: Devise usage in children aged 3 - 8 years.
Original information retrieved from:

Unantenne, N. (2014). Mobile Usage Among Young Kids: A Southeast Asia Study. Singapore: Tickled Media.

Figure 23: Diagrams I created myself.

Figure 24: Venn diagram: An area of opportunity. Diagram I created myself.

Figure 25: Diagrams I created myself.

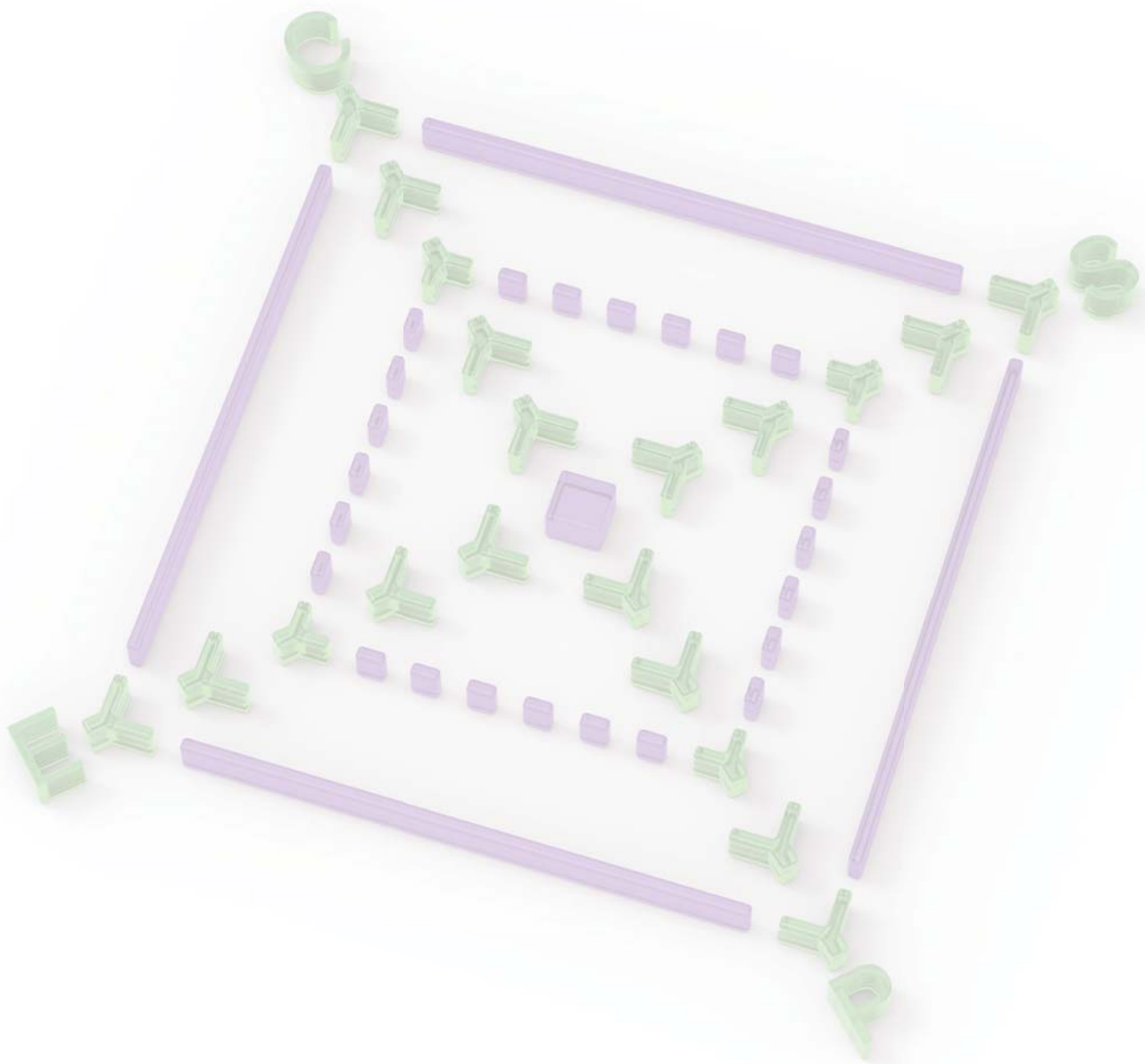


Figure 26: Diagrams I created myself.

Figure 27: Design Assessment Tool Graph.

Figure 28: Cognitive developmental values infographic.

Figure 29: Emotional developmental values infographic.

Figure 30: Physical developmental values infographic.

Figure 31: Social developmental values infographic.

Figure 32: Process: Design Assessment Tool.

Figure 33: Process: Design Assessment Tool.

Figure 34: Process: Design Assessment Tool.

Figure 35: Process: Design Assessment Tool.

Figure 36: Process: Design Assessment Tool.

Figure 37: Crit one: Two design directions.

Figure 38: Orblox designed by Chaz McManus.

Figure 39: Orblox attachments designed by Chaz McManus.

Figure 40: Orblox 2.0 designed by Chaz McManus.

Figure 41: Bobble-Berry designed by Chaz McManus.

Figure 42: Poli explanations designed by Chaz McManus.

Figure 43: Poli play cycle designed by Chaz McManus.

Figure 44: Application wireframe designed by Chaz McManus.

Figure 45: Imagi-Shell explanations designed by Chaz McManus.

Figure 46: Poli housed in Imagi-Shell using Play-Toolz.

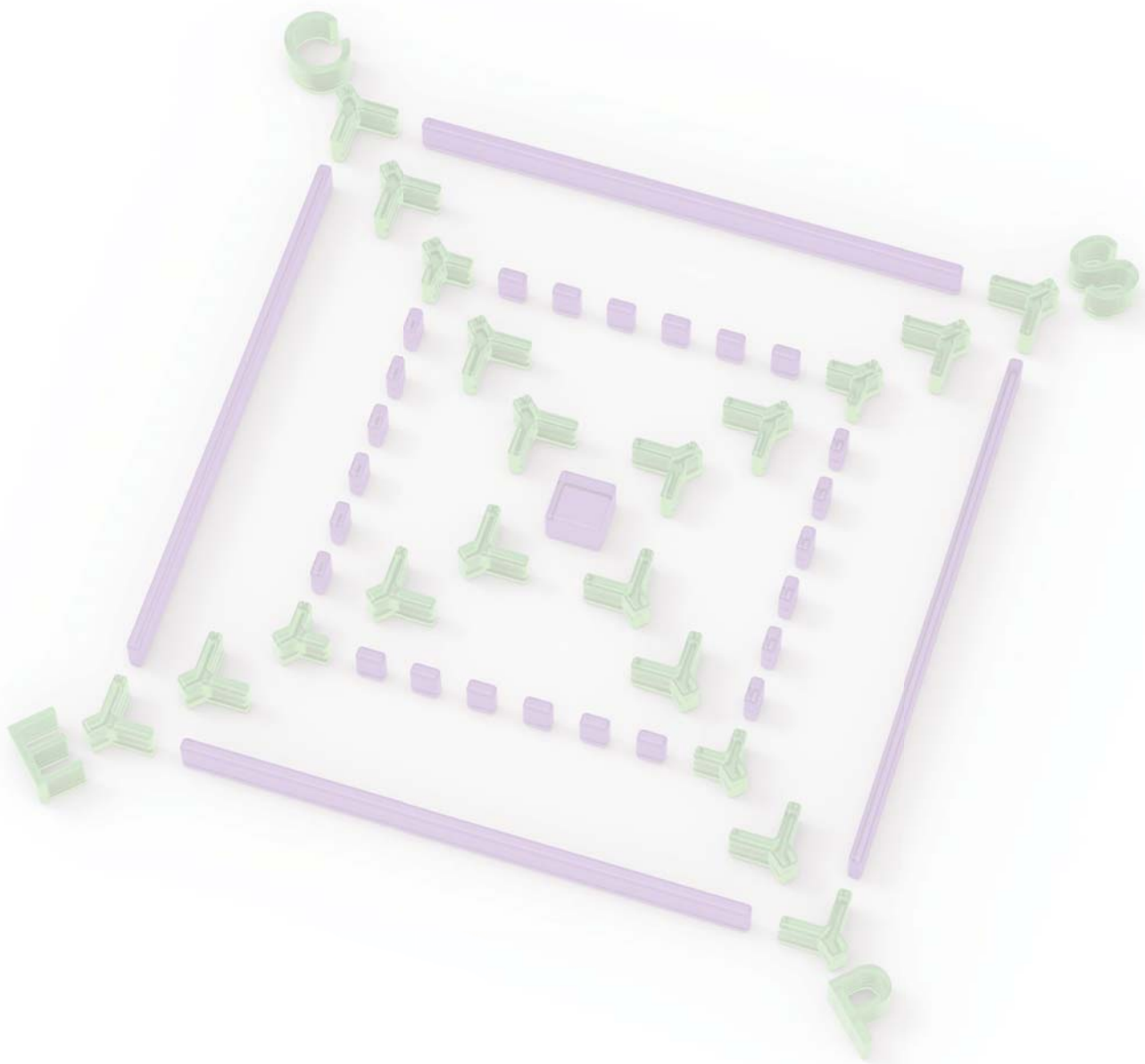


Figure 47: Play-Toolz Explanations designed by Chaz McManus.

Figure 48: Poli Play-Toolz system: Illustration of use.
Designed by Chaz McManus.

Figure 49: Poli Play-Toolz Render.

Figure 50: Child Actresses.
Image taken by: John Conly.

Figure 51: Poli Play-Toolz Play-objects.
Image taken by: John Conly.

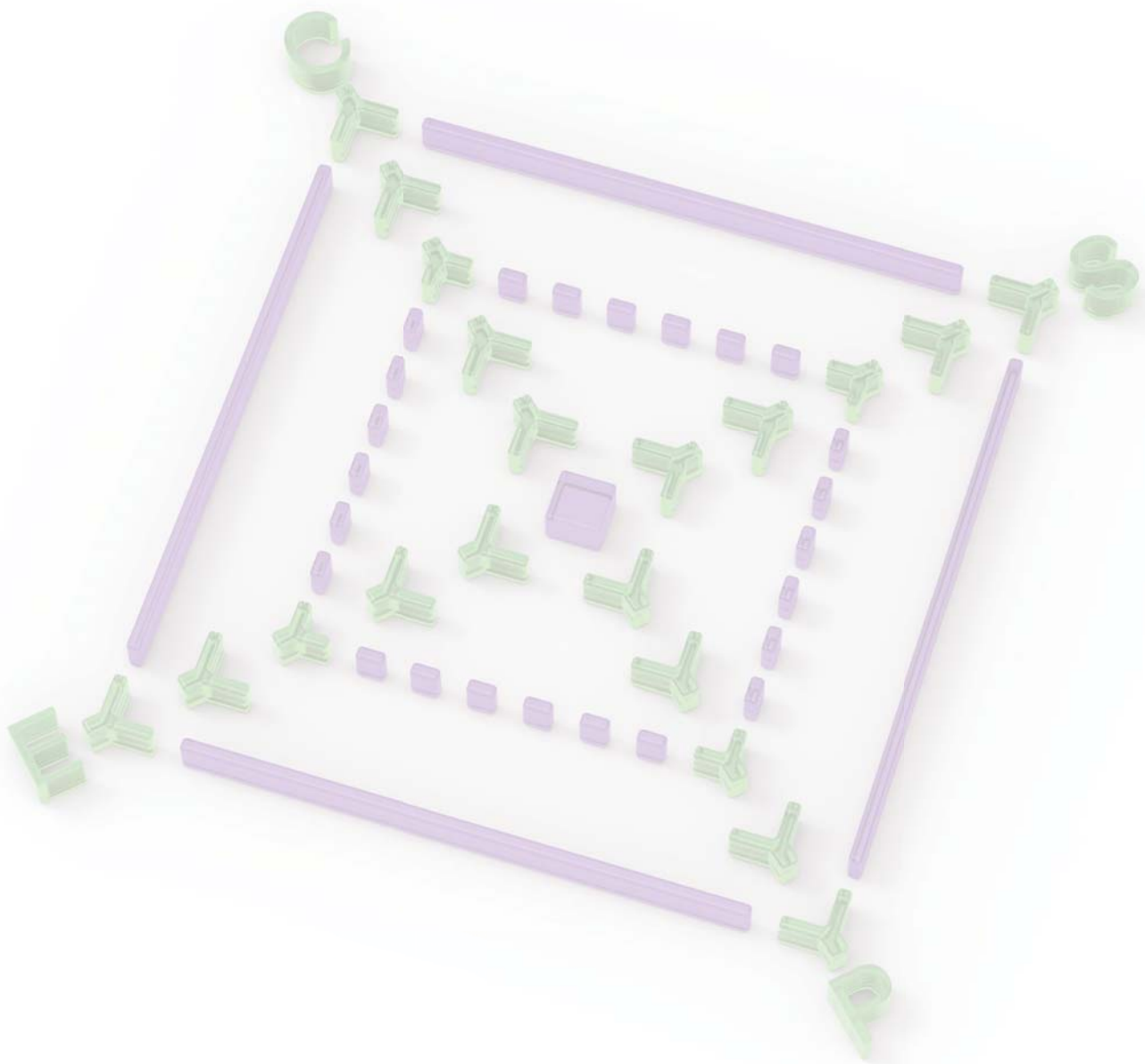
Figure 52: Persona image one: Girl playing piano. Retrieved from: <https://i.ytimg.com/vi/apAduEAofKw/maxresdefault.jpg>

Figure 53: Persona image two: Boy eating sausage.
Retrieved from: <http://1.bp.blogspot.com/-D570Lhtx-zY/U7ODYxE1IHI/AAAAAAAAAG9w/E0xrMZhWoo0/s1600/DSC00938.jpg>

Figure 54: Persona Image Three: Tired Dad. Retrieved from: <https://pbs.twimg.com/media/CZftSzHWEAA8GsR.jpg>

Figure 55: Journey mapping images.

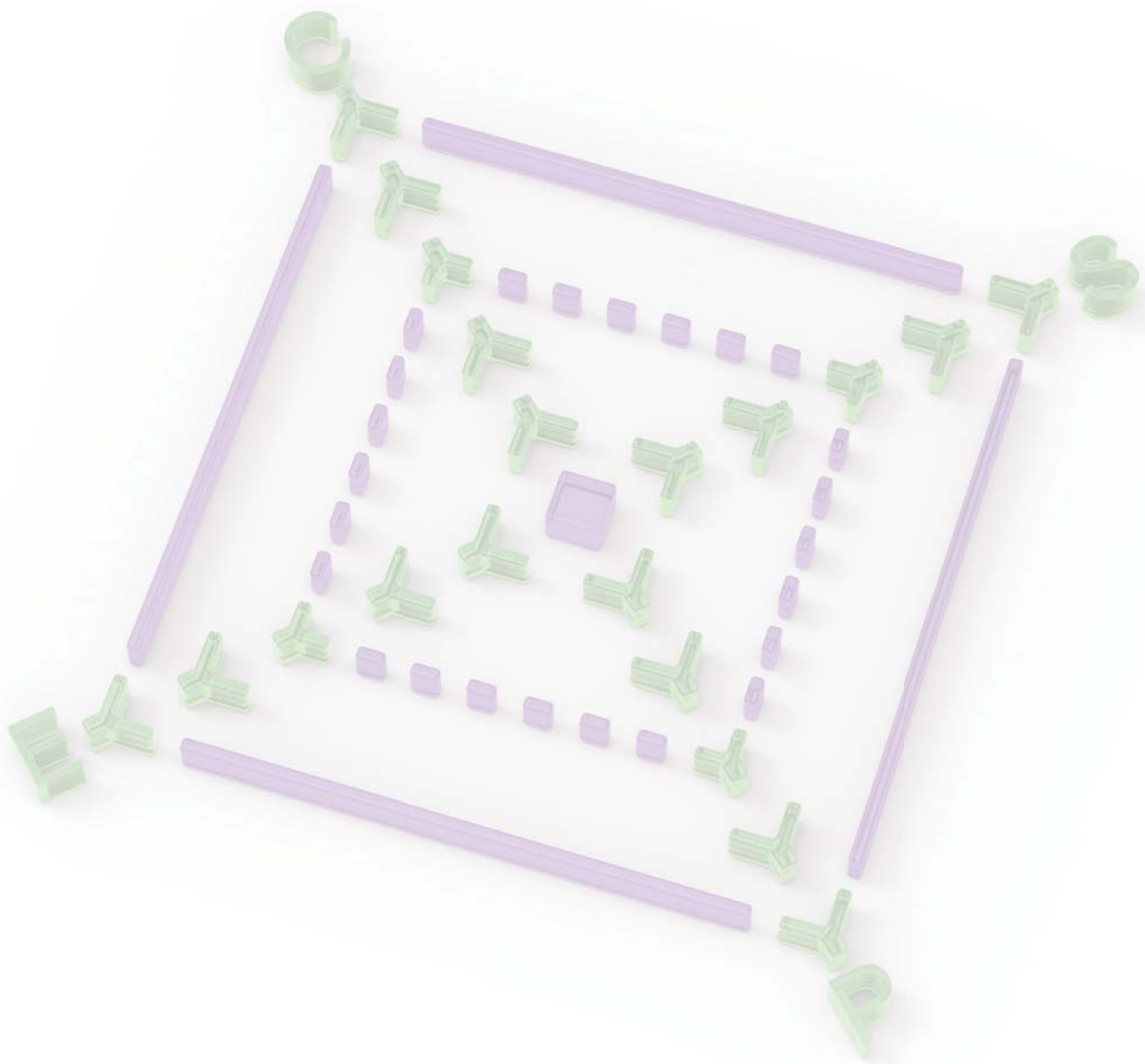
Figure 56: Venn Diagrams I created myself.



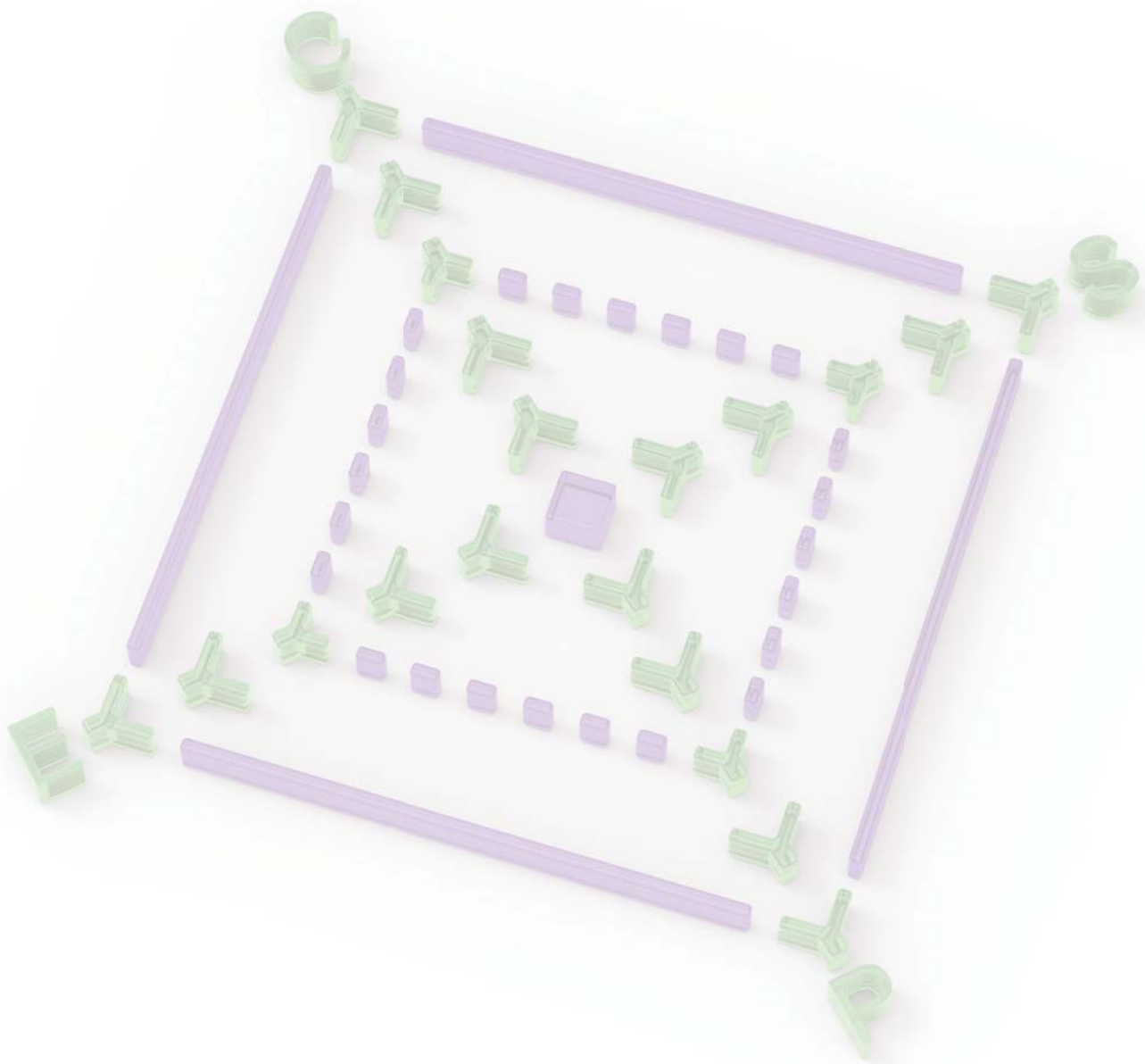
15.8

Bibliography:

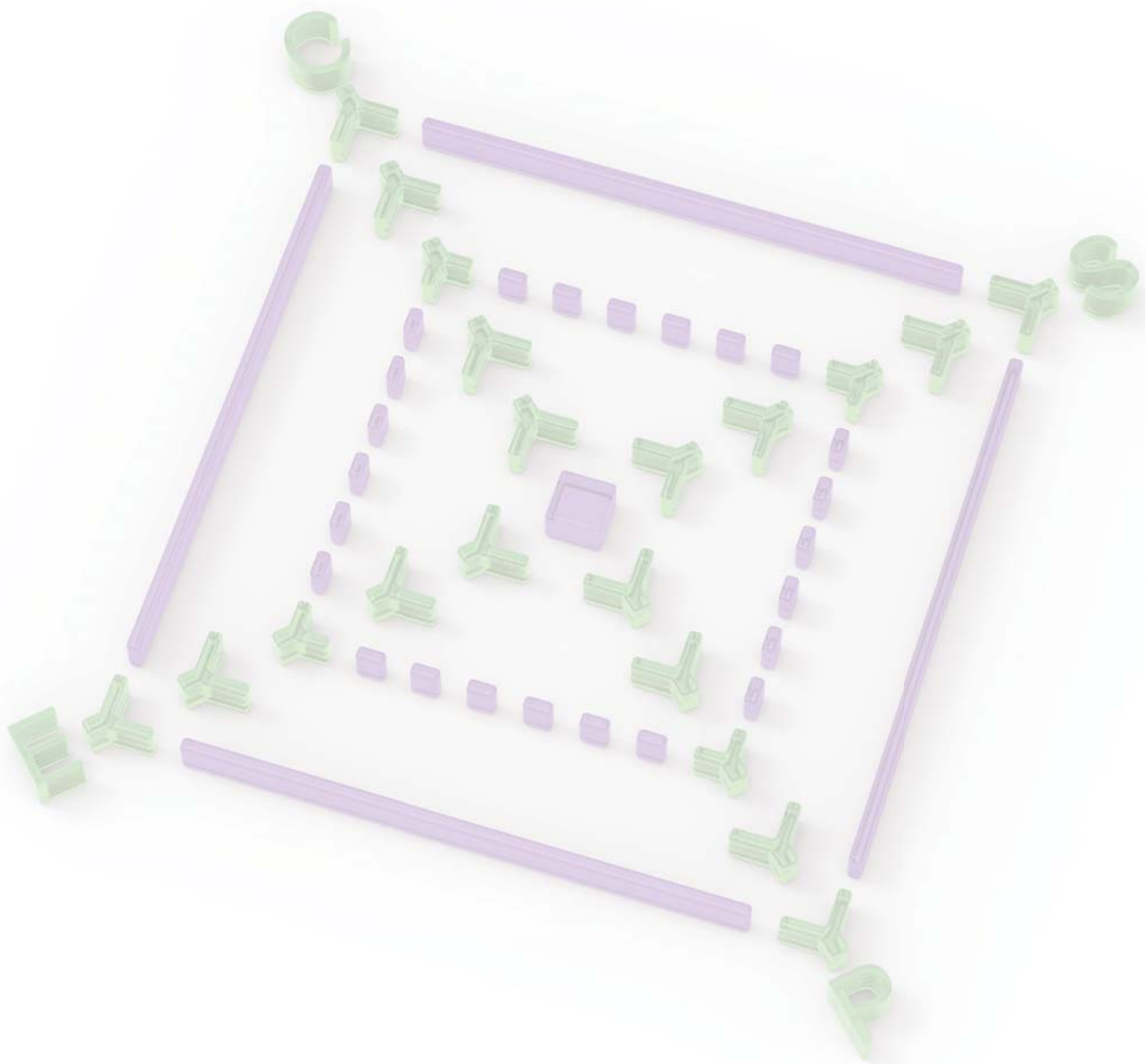
- Allen, M. (2004). *Toys, Games and Media*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Ackerman, J. (2015). Toucha-Toucha-Toucha-Touch Me: Morality, Learning, and the Haptic Origins of Cognition. Retrieved from: <http://www.psychologicalscience.org/observer/toucha-toucha-toucha-touch-me-morality-learning-and-the-haptic-origins-of-cognition#.WKeMb-iYbxA>
- Auerbach, S. (1999). *Toys of a Lifetime: Enhancing Childhood Through Play*. New York, NY: Universe Publishing.
- Auerbach, S. (2004). *Dr Toys: Smart Play Smart Toys*. San Francisco, CA: Educational Sights.
- Auerbach, S. (2012). Marinations 32 Interview: Dr Toy. Retrieved from: <https://youtu.be/49pIEeR2f2A>
- Baichtal, J., & Meno, J. (2011) *The Cult of LEGO*. San Francisco, California: No Starch Press, Inc.
- Başkale, Hatice, Bahar, Zuhale, Başer, Günsel, & Ari, Meziyet. (2009). Use of Piaget's theory in preschool nutrition education. *Revista de Nutrição*, 22(6), 905-917. <https://dx.doi.org/10.1590/S1415-52732009000600012>
- Bergen, D. (2002). The Role of Pretend Play in Children's Cognitive Development. *Journal of Early Childhood Research and Practice*, 4(1).
- Bird, J., Edwards, S. (2015). Children Learning to Use Technologies Through Play: A Digital Play Framework. *Journal of Educational Technology*. 46(6), 1149-1160.
- Blythe, D. (2011). *Gadgets & Games: From the 1950's-90's*. South Yorkshire, England: Replika Press Pvt. Ltd.



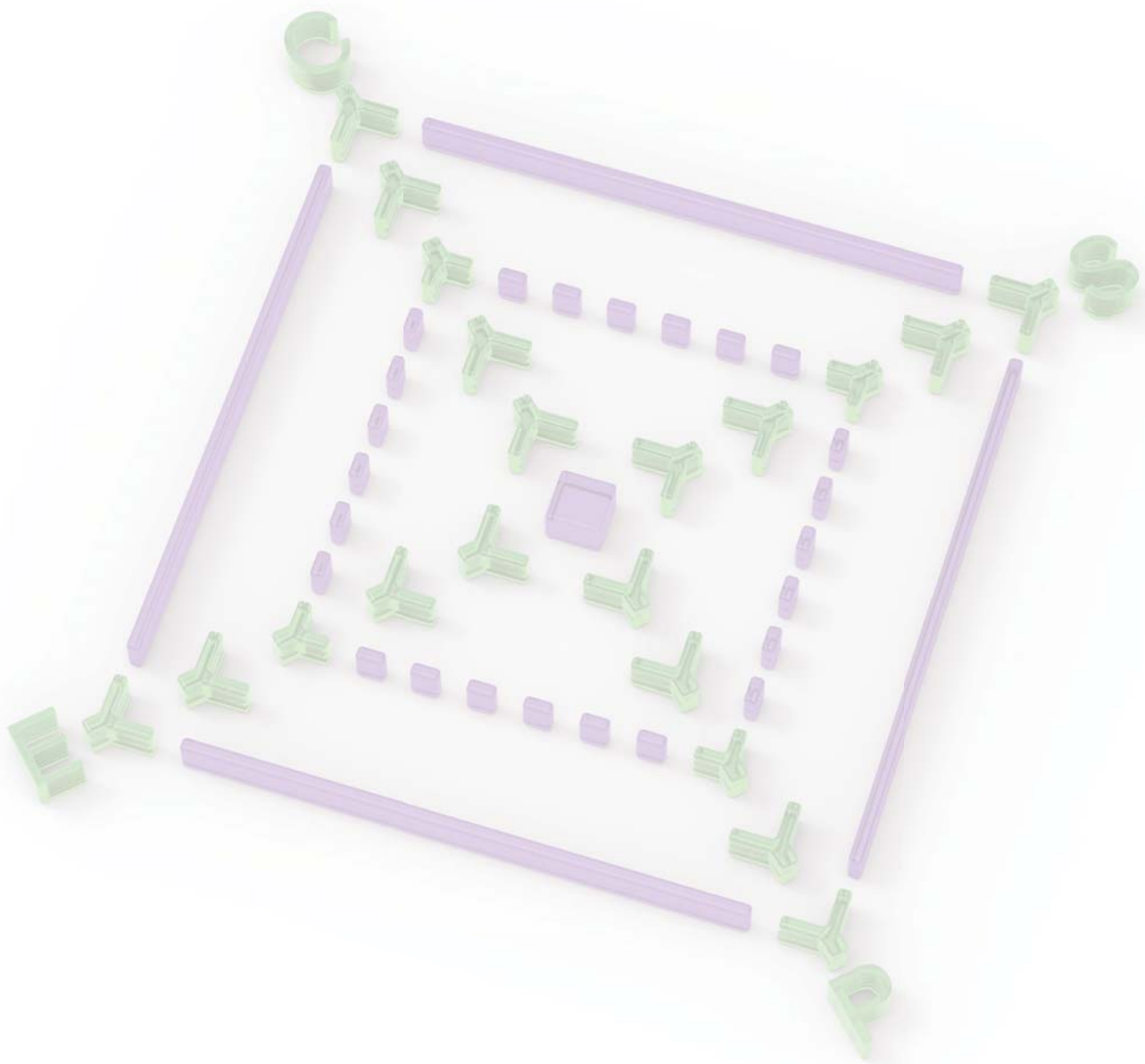
- Bradford, H., & Moyles, J. (2015) *The Excellence of Play* (4th Ed.). Berkshire, England: Open University Press.
- Broto, C. (2012). *The Complete Book of Playground Design*. Barcelona, Spain: Links Books.
- Burdette, H. L., Whitaker, R. C. (2006). *Resurrecting Free Play in Young Children*. The American Medical Association. 159: 46-50.
- Callaghan, S. (2017). *Poli: Film Day* [Video File]. Shadow Alley Films. Wellington, NZ.
- Carr, V., Luken, E. (2014). *Playscapes: A Pedagogical Paradigm for Play and Learning*. *International Journal of Play*. dx.doi.org/10.1080/21594937.2013.871965
- Dictionary. (2017). Retrieved from: <http://www.dictionary.com/browse/criteria>
- Downey, S., & Hayes, N., & O'Neill, B. (2004). *Play and Technology for Children Aged 4-12*. Dublin, Ireland: Centre for Social and Educational Research.
- Elkind, D. (1993) *Concrete Operations* [Video file]. Davidson Films. Retrieved March 23, 2017, from *Education in Video: Volume I*.
- Elkind, D. (2003). *Technologies Impact on Child Growth and Development*. Retrieved from: <https://www.cio.com/article/2441936/it-organization/david>
- ECSIP Consortium (2013). *Study on the Competitiveness of the Toy Industry*. Rotterdam, Netherlands.
- Fisher, P. A. (2016). *InBrief: Executive Function: Skills for Life and Learning*. Retrieved from: <http://developingchild.harvard.edu/science/key-concepts/executive-function/>
- Fernandes, S. A., Coelho, D. A. (2013). *Toy Design: A Methodological Perspective*. *Journal of Designed Objects*, 7(1).



- Gaudiosi, J. (2015). This billion dollar market didn't even exist five years ago. Retrieved from: <http://fortune.com/2015/07/24/toys-to-life-market/>
- Gielen, A. (2009). Essential Concepts in Toy Design Education: Aimlessness, Empathy and Play Value. Retrieved from: <https://repository.tudelft.nl/islandora/object/uuid:238fb5cb-5610-4ec0.../download>
- Goldstein, J. H. (1994). *Toys, Play and Child Development*. New York, NY: University of Cambridge Press.
- Goldstein, J. (2012). *Play in Children's Development, Health and Wellbeing*, Brussels, Fuel Design.
- Gottlieb, R. (2014). About Global Toy Experts. Retrieved from <http://www.globaltoyexperts.com/>
- Gray, P. (2011). The Decline in Play and the Rise in Psychopathology in Child and Adolescents. *American Journal of Play*, 3(4), 443-463.
- Guyton, G. (2011). Young Children: Using Toys to Support Infant-Toddler Learning and Development. *Exchange Magazine*. September, 50-56.
- Hanks, T. (1995). Tom Hanks: 67th Academy Awards Speech. Retrieved from: <https://youtu.be/Vd420MYpGek>
- Hendrick, J., Weissman, P. (1986). *The Whole Child: Developmental Education for the Early Years*. New Jersey, NJ. Edwards Brothers.
- Hinske, S. Langheinrich, M. Lampe, M. (2008). Towards Guidelines for Designing Augmented Toy Environments. Retrieved from: <https://www.vs.inf.ethz.ch/publ/papers/hinske2008dis.pdf>
- J. S. Rycus, & R. C. Hughes, (1998). Developmental Milestones Chart. Retrieved from: http://www.rsd.k12.pa.us/Downloads/Development_Chart_for_Booklet.pdf



- Kidspot, (2017), Six to Nine: Social and emotional development. Retrieved from: <http://www.kidspot.com.au/parenting/child/child-development/6-9-social-and-emotional-development-2>
- Learning works. (2012). Creating a Healthy Play Diet and Child Development: Ages 6-9. Retrieved from: <http://learningworksforkids.com/2012/03/digital-play-and-child-developmental-ages-6-9/>
- Lillard, A. (2013). Playful Learning and Montessori Education. *American Journal of Play*, 5(2), 157-186.
- Lillian, A.,Griffore, R. J. (2013). The Importance of Object Memories for Older Adults, 39(10), 741-749.
- Madson, H. (2016). How Nintendo Changed Video Games. Retrieved from: <http://twinfinite.net/2016/10/nintendo-changed-game-video-games>
- Marketline (2016) Company Profile: *Nintendo Co.*
- McMonagle, A. (2012).Professional Pedagogy for Early Childhood Education. DCCC Publishing.
- Mertala, P., & Sarenius, V. M. (2016). The Value of Toys: 6-8-Year-Old Children's Toy Preferences and the Functional Analysis of Popular Toys.
- Moyles, J. (2015). *The Excellence of Play* (4th Ed.). Berkshire, England: Open University Press.
- Parent further. Ages 6-9: Developmental Overview. Retrieved from: <http://www.parentfurther.com/content/ages-3-5-developmental-overview>
- Pope, G. (2015). The Modern Child: Biology, Culture and Society - and Play. Retrieved from: <http://linkedin.com/article/the-gen-z-division/>



- RaisingChildren.net (2016) Retrieved from: http://m.raisingchildren.net.au/articles/child_development_6-8_years.html
- Reeves, B. (2011). <http://www.gameinformer.com/b/features/archive/2011/04/26/the-nintendo-difference-nintendo-s-impact-on-the-gaming-landscape.aspx>
- Santer, J. (2007). Free Play in Early Childhood: A Literature Review. London, England: National Children's Bureau.
- The Toy Man. (2012). The Toy Man: Product Guide. Retrieved from: www.thetoyman.com/guidelines.html
- Trautman, T. (2014). The Trouble with Toys. Retrieved from: https://nytimes.com/2014/11/27/business/tech-toys-that-can-make-the-video-screen-passe.html?_r=0
- Unantenne, N. (2014). Mobile Usage Among Young Kids: A Southeast Asia Study. Singapore: Tickled Media.
- Van Uffelen, C. (2010). Toy Design. Netherlands: Braun Publishing
- Whitebread, D. (2012). The Importance of Play: A report on the value of children's play with a series of policy recommendations. Brussels, Belgium: University of Cambridge.
- Yelland, N., & Moyles, J. (2015). The Excellence of Play (4th Ed.). Berkshire, England: Open University Press.
- Zelazo, P. D. (2013). Executive Function and the Developing Brain: Implications for Education. Retrieved from: <https://youtu.be/r2-j7pqOfoU>



Declaration:

Student ID: 10952007

Surname: McManus

First Name: Chaz

Submission Title:

Exploring The Phygital:
An Assessment of Modern Play-objects

Declaration:

I declare that this is an original assignment and is entirely my own work.

Where I have made use of the ideas of other writers, I have acknowledged (Referenced) the sources in every instance.

Where I have made use any diagrams or visuals, I have acknowledged (Referenced) the sources in every instance.

This assignment has been prepared exclusively for this paper and has not been and will not be submitted as assessed work in any other academic courses. I am aware of the penalties for plagiarism as laid down by Massey University.

A copy of the Assessment and Examination Regulations can be found under the 'Statutes and Regulations' section on the Massey University website (<http://calendar.massey.ac.nz/>).

Signed: