THE ALLUSORY

Damola Rufai . IM May 2020

PART I

In this project I aim to explore how pattern recognition plays an essential role to our visual and spatial perceptive abilities as humans. I intend for the project to be a physical embodiment of the ideas I have gathered through my research process that had to deal with pattern, as it relates to people and their perceptions not just of space, but also of their social experiences.

Pattern on all levels (regardless of semantics) deals with the interconnectivity of separate items with common relational elements. I am interested in how we as humans have an innate ability to recognize patterns and restructure them to suit our own perspectives.

Author Michael Shermer describes human brains as "evolved pattern-recognition machines that connect the dots and create meaning out of the patterns we think we see in nature", this idea is also reinforced by Marshall McLuhan who wrote "Faced with information overload, we have no alternative but pattern-recognition."

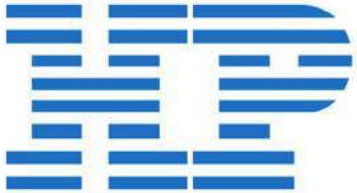
Echoing the observations of McLuhan and Shermer, Diane Ackerman notes "Pattern pleases us, rewards a mind seduced and yet exhausted by complexity. We crave pattern, and find it all around us, in petals, sand dunes, pine cones, contrails. Our buildings, our symphonies, our clothing, our societies — all declare patterns."

This ability of humans to seek out patterns and interpret them in different ways is one that is also governed by the subjectivity of each person. An example of this can be seen in the naming of Dutch produced wax print fabrics by African consumers. According to the Dutch fabric manufacturing company Vlisco, the patterns they design are not named in-house, the names they end up bearing are as a result of African patrons' interpretations

"Homosapiens are about pattern recognition. Both a gift and a trap."

These words are said by a character in the 2003 novel, "Pattern Recognition" by acclaimed scifi writer, William Gibson to illustrate how humans are generally attuned to seeking out patterns around them sometimes to a fault, such as in cases of apophenia where people see patterns in random occurences where there are none.

Figure 1a. *Rival logos* by printsome, 2016, https://blog.printsome.com/brand-logo-swap/



Rival Logos imagined by printsome

Rival Logos imagined by printsome

Figure 1b. *Rival logos* by printsome, 2016, https://blog.printsome.com/brand-logo-swap/

If you merely glanced at the logos presented on the previous two pages, they might seem accurate but if you took more than a moment to regard them I'm sure you would have realized that the assets for each brand logo in the images have been swapped.

If you were able to identify that before you read this page, you have pattern recognition to thank for that. This is because you were able to recall from your long term memory, your past impressions of each brand's visual identity and then compare them with the information being presented to your short term memory.

This is one of the many ways in which pattern recognition helps us navigate and understand the world around us.

To further explore this concept of pattern recognition I undertook a couple of tests to determine for myself just how evident and potent this ability is in most people. The objective of these tests was to observe if people could perceive things (based on their internal references) in my pattern designs that I actually hadn't included when I was designing them.

In the first test I asked a couple of my colleagues if they could find and point out to me the image of a dog hidden in a pattern I presented to them. Unbeknownst to them, I hadn't hidden a dog in this pattern but sure enough, a couple of them were able to find dogs and a variety of other things in the pattern that I hadn't included in the original design (Figure 2a & 2b).

Figure 2a. Pattern with outlines of dogs and hearts identified by a colleague

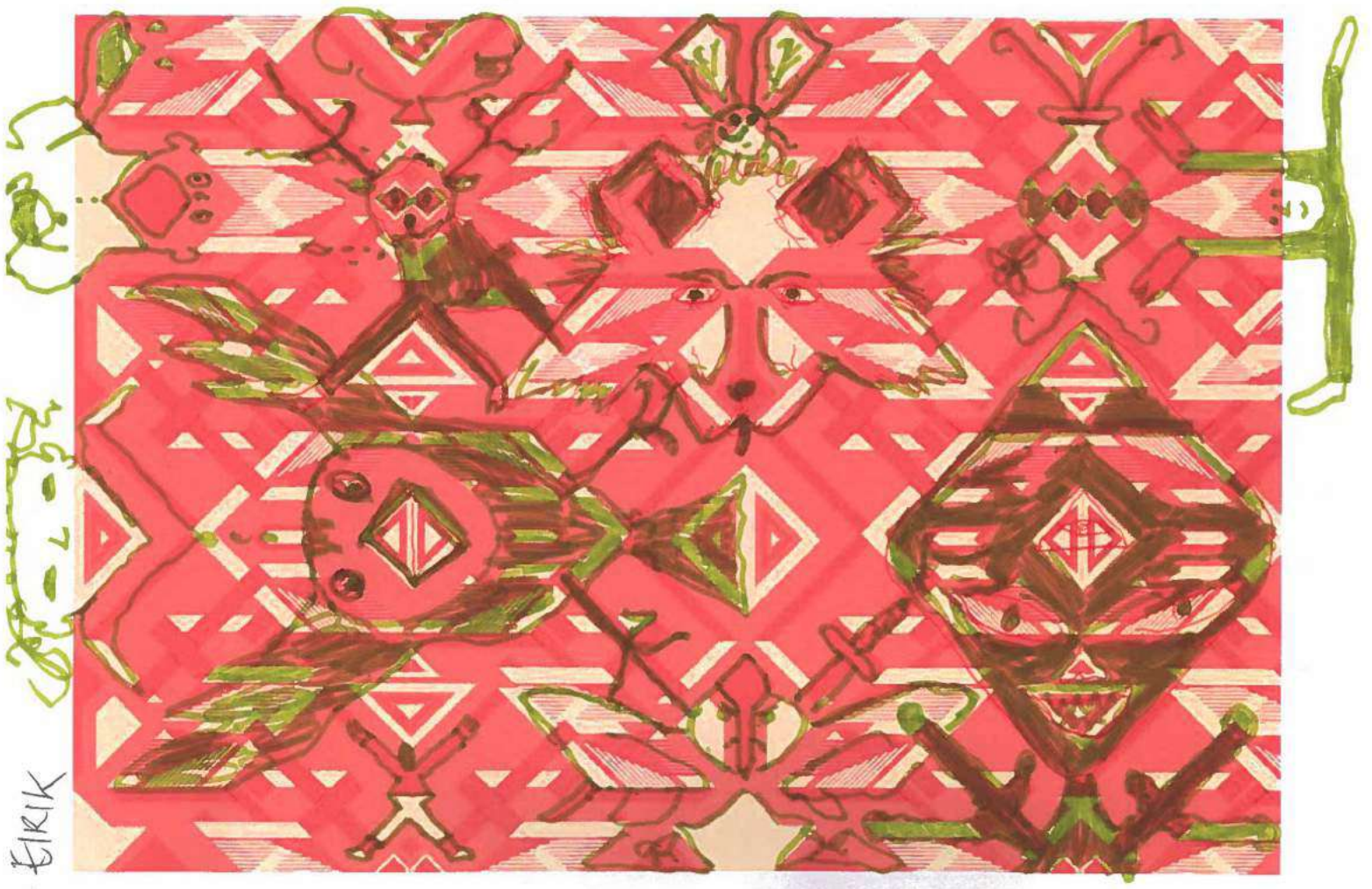


Figure 2b. Pattern with outlines of a dog and other creatures identified by another colleague

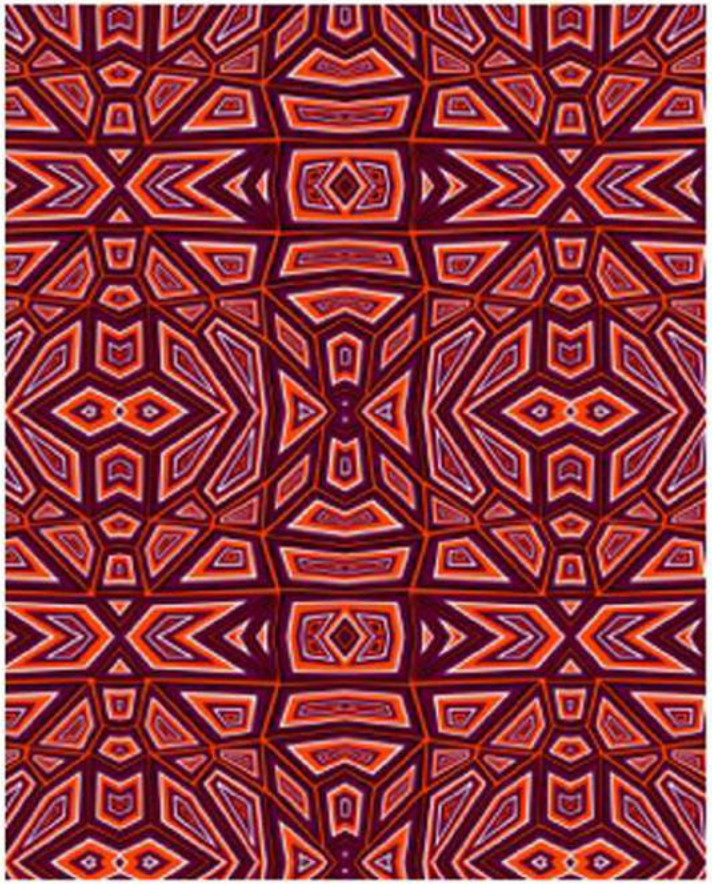
KARINE

EIRIK

Figure 2c. Side by side comparison of dogs identified by colleagues in test

This is due to the brain's penchant for connecting the dots through pattern recognition. In both cases they were able to construct abstract images of dogs with shapes in the pattern that matched with their ideas of what a dog looks like based on their memories (Figure 2c).

The next tests I conducted were through social media. I designed abstract patterns and posted them with no captions, instructions or tasks just to see the feedback I would get. What I got back were a couple of comments that showed that where I hadn't provided a title or theme for these patterns, people had began to see their own narratives based on their own memories in them (Figure 3a & 3b).



These look like
panamanian molas. Google em.

Figure 3a. Pattern designed by me alongside the interepretation a German Panamanian friend of mine had of the pattern. Illustrating an example of how pattern recognition relies on peoples' memories and internal references.

They look like mussels. ❤️
And now I'm hungry! 😩😂🤣

Figure 3b. Another pattern designed by me alongside the interepretation a "foodie" friend of mine had of the pattern. Yet another example of how pattern recognition relies on peoples' memories and internal references.

I also tried to carry out a variation of the last two tests in a more spatial setting to see if the same occurence I had witnessed in the previous two tests would manifest again. I pasted a pattern design I made on the doors of an elevator on campus and left a mini questionnaire asking people if they could perceive any underlying images in the pattern.

Unfortunately the test wasn't succesful as it couldn't even commence due to the fact that the pattern was taken down by an unknown person before anyone could see it. A short video of the pattern on the elevator doors can be found here: https://youtu.be/lGs5SjMINDk

Through these tests I was able to observe firsthand how pattern recognition relied on recalling stored memory and internal references to make sense of the stimuli that was being presented in the patterns I had made. This began to assist me in framing my project and encouraged me to delve deeper into the links between pattern and the mind.

PART II

"On a pattern like this, by daylight, there is a lack of sequence, a defiance of law, that is a constant irritant to a normal mind. The color is hideous enough, and unreliable enough, and infuriating enough, but the pattern is torturing. You think you have mastered it, but just as you get well underway in following, it turns a back-somersault and there you are. It slaps you in the face, knocks you down, and tramples upon you. It is like a bad dream."

This excerpt from Charlotte Perkins Gilman's seminal work "The Yellow Wallpaper" is one of the instances the author clues us into the mental state of the main character of the novel who just cant seem to grasp the pattern of the titular yellow wallpaper. It is interesting that this is used as a literary device to showcase her slow mental decline because as I will soon show, pattern recognition is a recurring form of assessment in psychological cognitive tests.

As established in the previous section, pattern recognition is a skill that is key to how we as humans make our way through the world. It stands to reason that it's decline in a person would be a major signifier of mental impairment.

As such cognitive assessment tests and tools that utilize themes of pattern recognition have been developed by psychologists to help detect cognitive impairment and stimulate cognition in at risk people. It is in this space that I have chosen to situate my project.

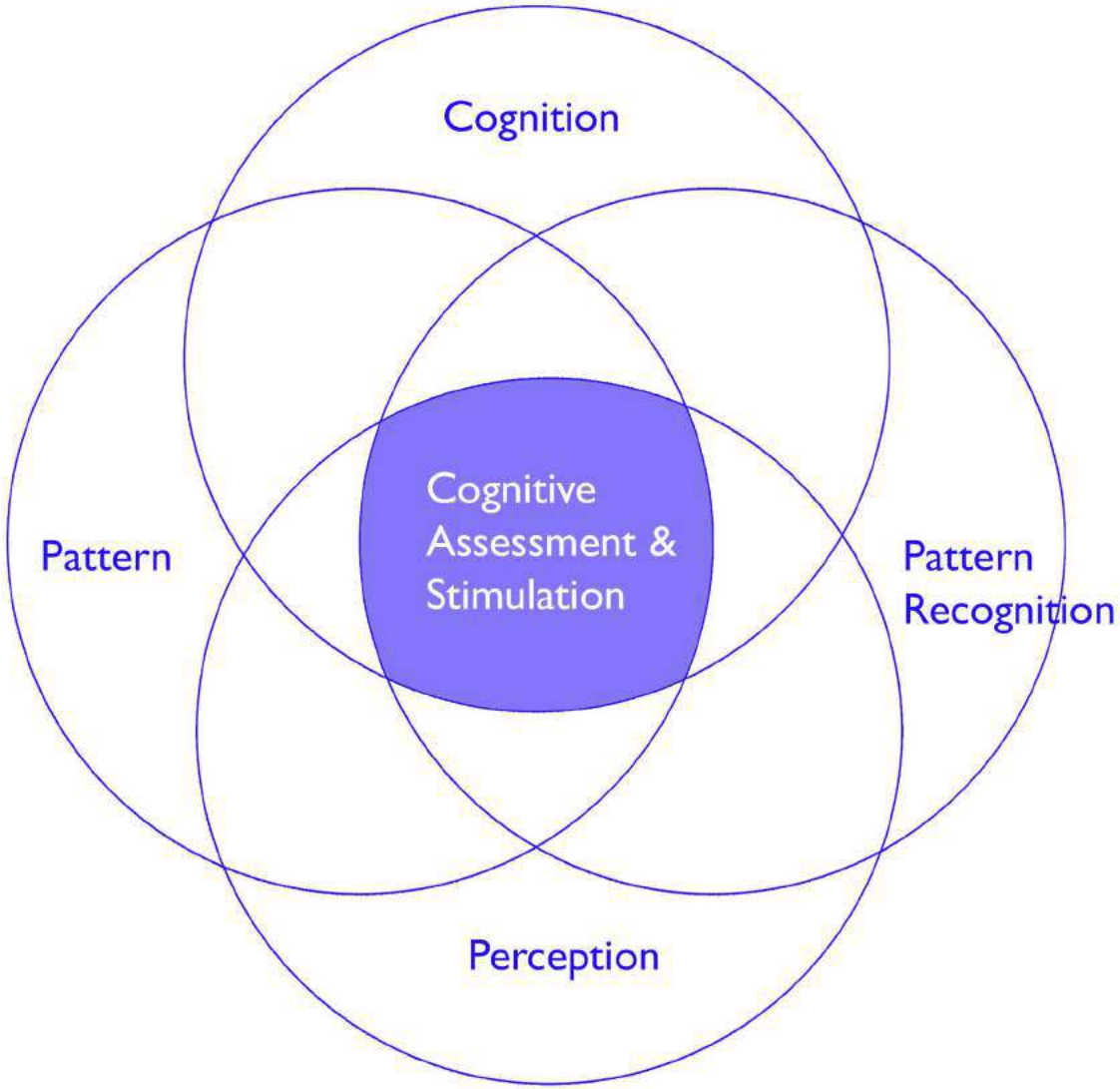


Figure 4. Venn diagram depicting crossection of concepts in my project.

To understand this area of cognitive assessment and stimulation better, I researched some established tests within the field of psychology that have been used in the early detection of dementia and Alzheimers. Although there are quite alot of tests out there I have chosen to look at a couple that I noticed reoccuring in my research, that also skewed closer to themes that were relevant to my project.

Montreal Cognitive Assessment Test (MoCA) This is a popular assessment tool used to detect mental impairment in at risk patients. It is a short one page test with excersises that test cognitive abilities like memory recall and visuospatial abilities in test takers. An example of the type of tasks you will find on the test is the Clock Drawing Test, where a patient is asked to draw a clock with its hands depicting the requsted time. This is used to test pattern recognition and visuospatial abilities in patients by challenging them to mentally recall how a clock works, what it looks like and to visually represent that two dimensionally (Figure 5).

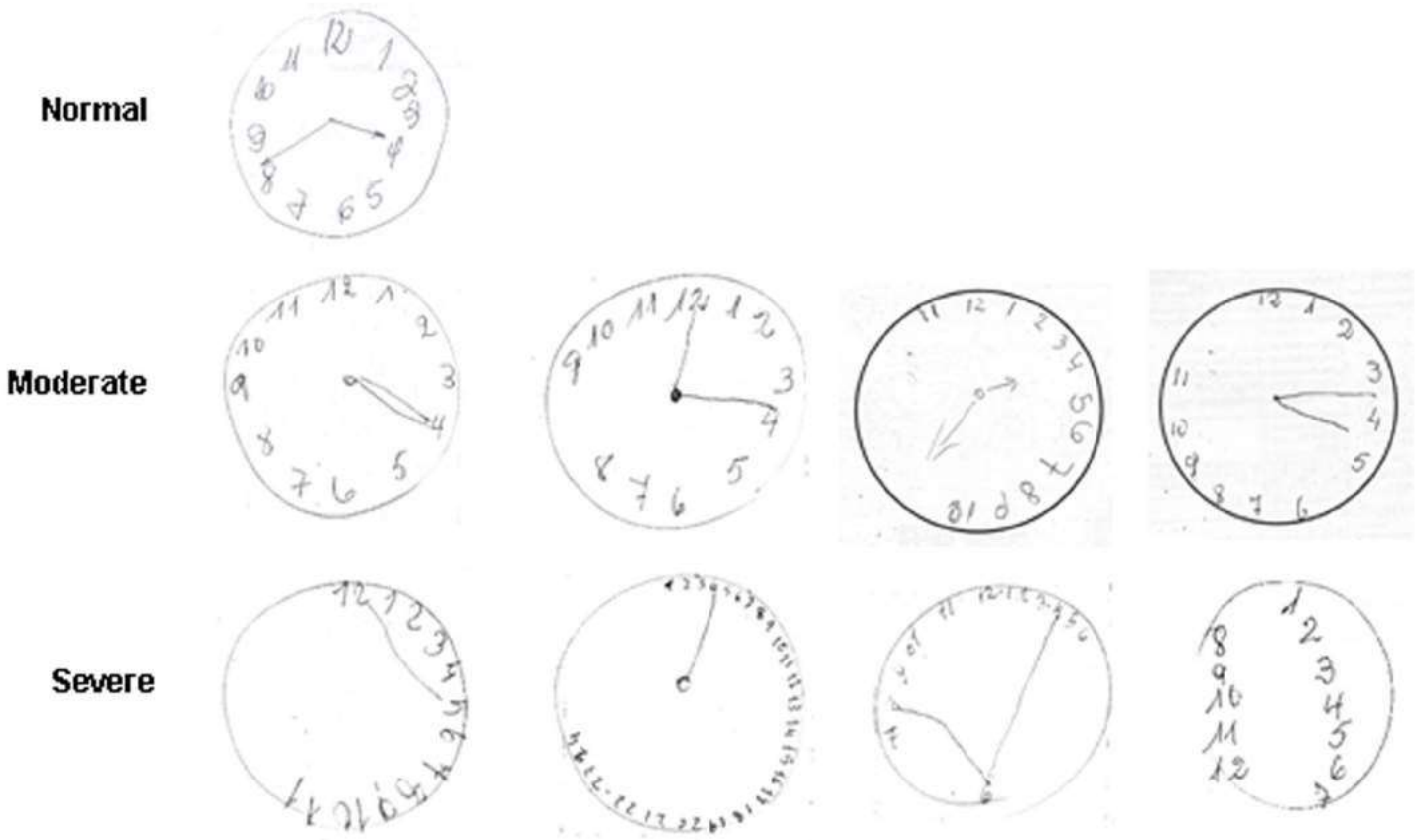


Figure 5. Image depicting clock drawing test examples from different patients. Ranging from someone with a normal mental state to people with moderate and severe mental impairment.

Kohs Block Design Test Named after its creator Samuel Kohs who developed the test in 1920, is mostly used as an IQ test but over the years has been used in research assessing the effects of aging on cognition. Coloured cubes (each cube's side with a single color or two colours divided by a diagonal) are used in the test (Figure 6). Test takers' visuospatial abilities are challenged by presenting them with a series of preset patterns on cards and then having them replicate these patterns using the cubes. The test is then scored according to how quickly and accurately test takers replicate the patterns.

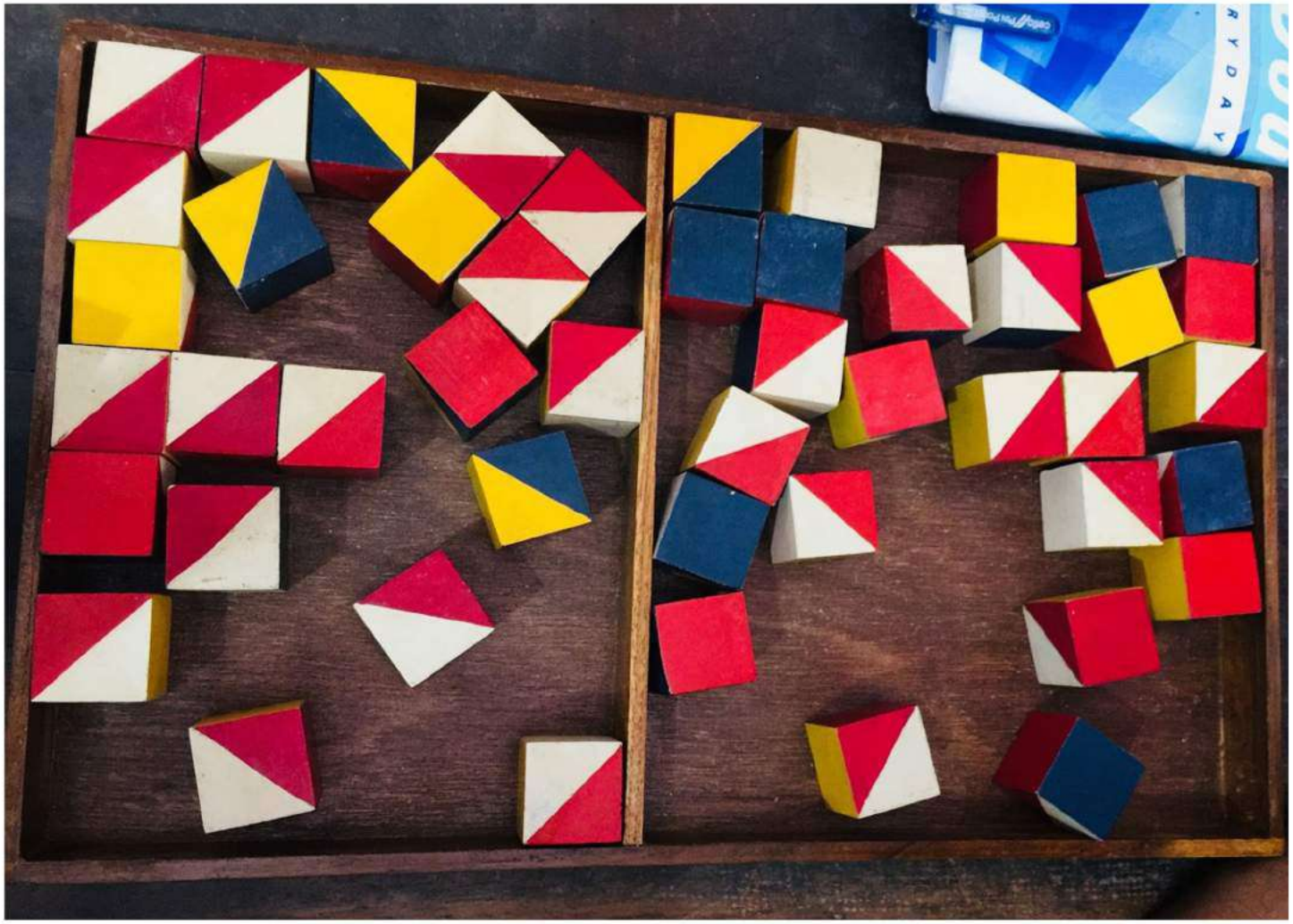
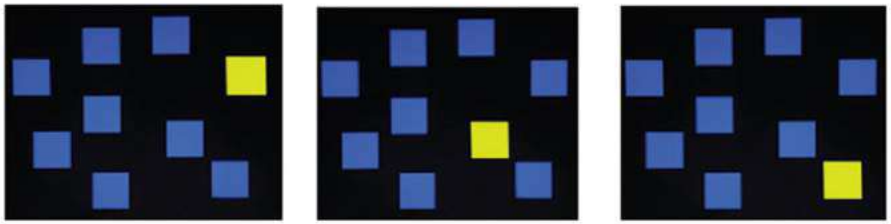


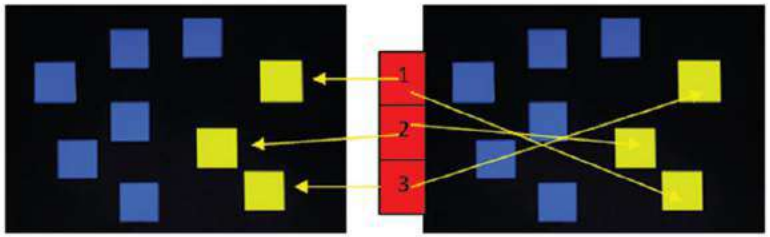
Figure 6. Coloured cubes used in Kohs Block Design Test

Corsi Block-Tapping Test This is a psychological test used to assess visuospatial short term memory. In the test, an examiner taps the tops of up to nine identically spaced blocks (in digital versions of the test the blocks light up) in a specific sequence, and then asks the test taker to repeat the same action they have just done. The test can start with a simple sequence involving two blocks and eventually get more complex with the other seven blocks, with tasks that also involve the test taker tapping the reverse order of the sequence performed by an examiner.

Nine blue squares which are shown at the starting point of the Corsi block test



Sequence of the squares light up as yellow



Forward tapping, i.e., click on the same order

Backward tapping, i.e., click on the reverse order

Figure 7. Diagram depicting the process of the Corsi Block-Tapping Test

Benton Visual Retention Test This test is typically used to assess a person's visual perception and visual memory. It is administered by presenting test takers with a batch of cards with unique motif designs on them and then asking them to recall or reproduce them. A stage of the test asks test takers to reproduce the designs from memory after viewing them for 10 seconds, while another stage asks them to reproduce them while they are in view. The participants' performances are then rated against average scores in six different categories, namely omissions, distortions, preservations, rotations, misplacements and sizing errors.

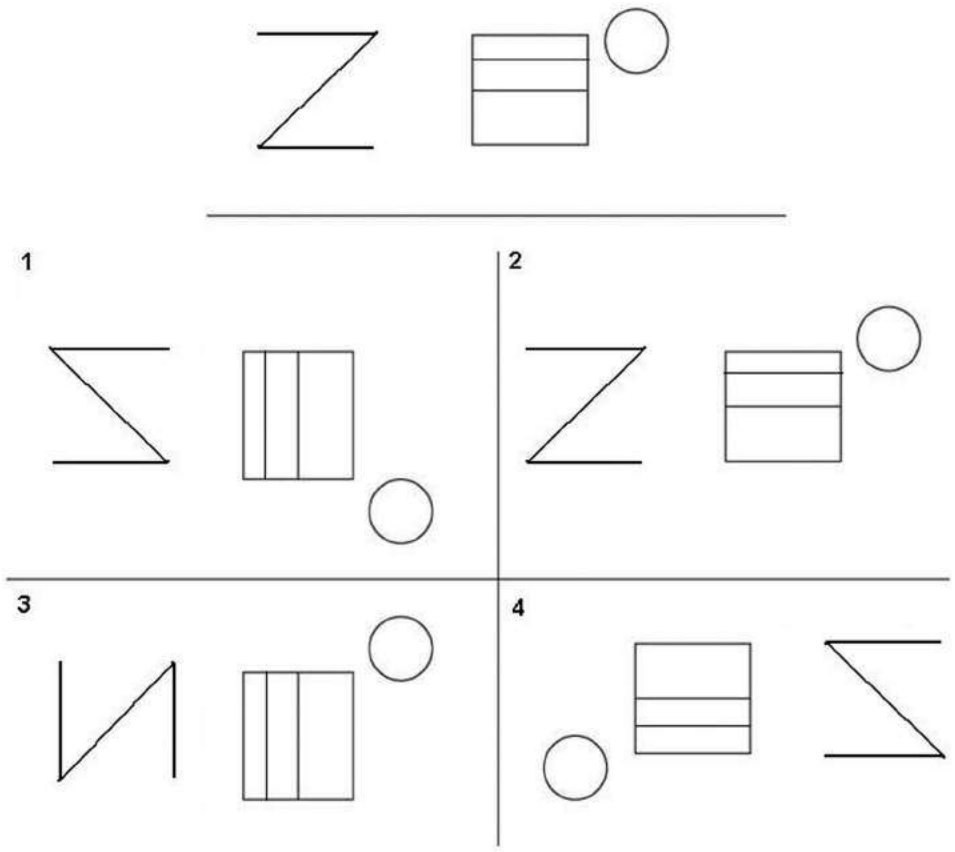


Figure 8. An example of the Benton Visual Retention Test showing the target motif design at the top and a selection of options below it for the test taker to match it with

From these cognitive assessment and stimulation exercises I noticed how much a number of them utilized memeory recall and-pattern recognition as methods.

It was also fascinating how these methods were used to challenge participants' perception and spatial understandings (visuo-spatial abilities). Engaging them in a way that required them to reproduce images in their mind's eye by corroborating the stimuli presented by the tests with their own stored memories.

Researching these various tests further solidified some of the ideas inherent in my project and made me want to discover what other methods or innovations had been made in relation to mental impairment/memory care.

In researching other methods and innovations in memory care I discovered that play (puzzles, crossword, building blocks etc.) and sensory experiences are also recommended as positive ways of cognitive stimulation and mitigating the circumstances of mental impairment. They aren't prescribed as a cure but as a sort of salve to help ease patients' lives.

I have included in the next few pages a couple of play tools and sensory concepts I found that had qualities I aimed to have in my project. Some of them aren't geared specifically to cognitive assessment or stimulation but are still applicable in those scenarios due to their modular nature.

Smartkuber This is a cognitive assessment tool that arose from the PHD research project of two students (Costas Boletsis and Simon McCallum) from NTNU's Faculty of Computer Science and Media Technology. For their project they used principles of the Montreal Cognitive Assessment test as a reference point for development.

They created an interactive tool that uses virtual and physical means to assess participants' pattern recognition and visuospatial skills. It is made up of an augmented reality (AR) mobile app and physical cubes that users correlate with tasks issued by the app. After each task is completed, the AR component of the app is then used to assess the users' performance by hovering the phone's camera over the cubes.

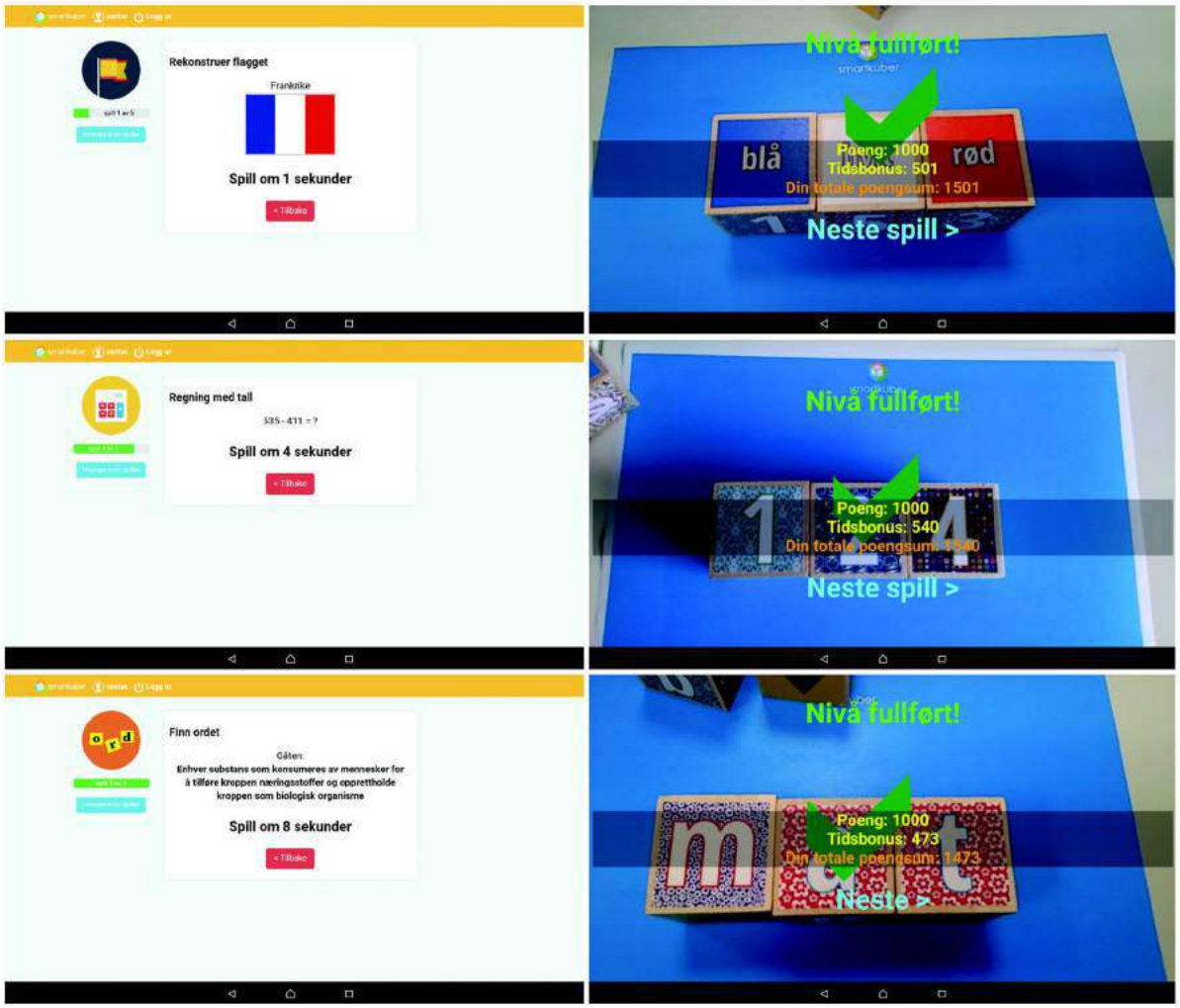


Figure 9. Smartkuber in use. On the left the mobile app user interface is shown issuing instructions to users. On the right the corresponding tasks are shown executed with the cubes along with the AR interface confirming correct answers.

Tiletoy This is an interactive game prototype made of modular square tiles developed in 2004 by Tuomo Tammenpää and Daniel Blackburn. Each tile has an LED dot matrix display that can be reprogrammed to display different numbers and shapes.

The tiles can also communicate in such a way that wirelessly transmits their position in relation to each other. The prototype was mostly developed as a learning aid not for cognitive assessment but due to its modular, adaptable nature I can see its possible application in visuospatial tests that rely on recalling shapes and sequences.

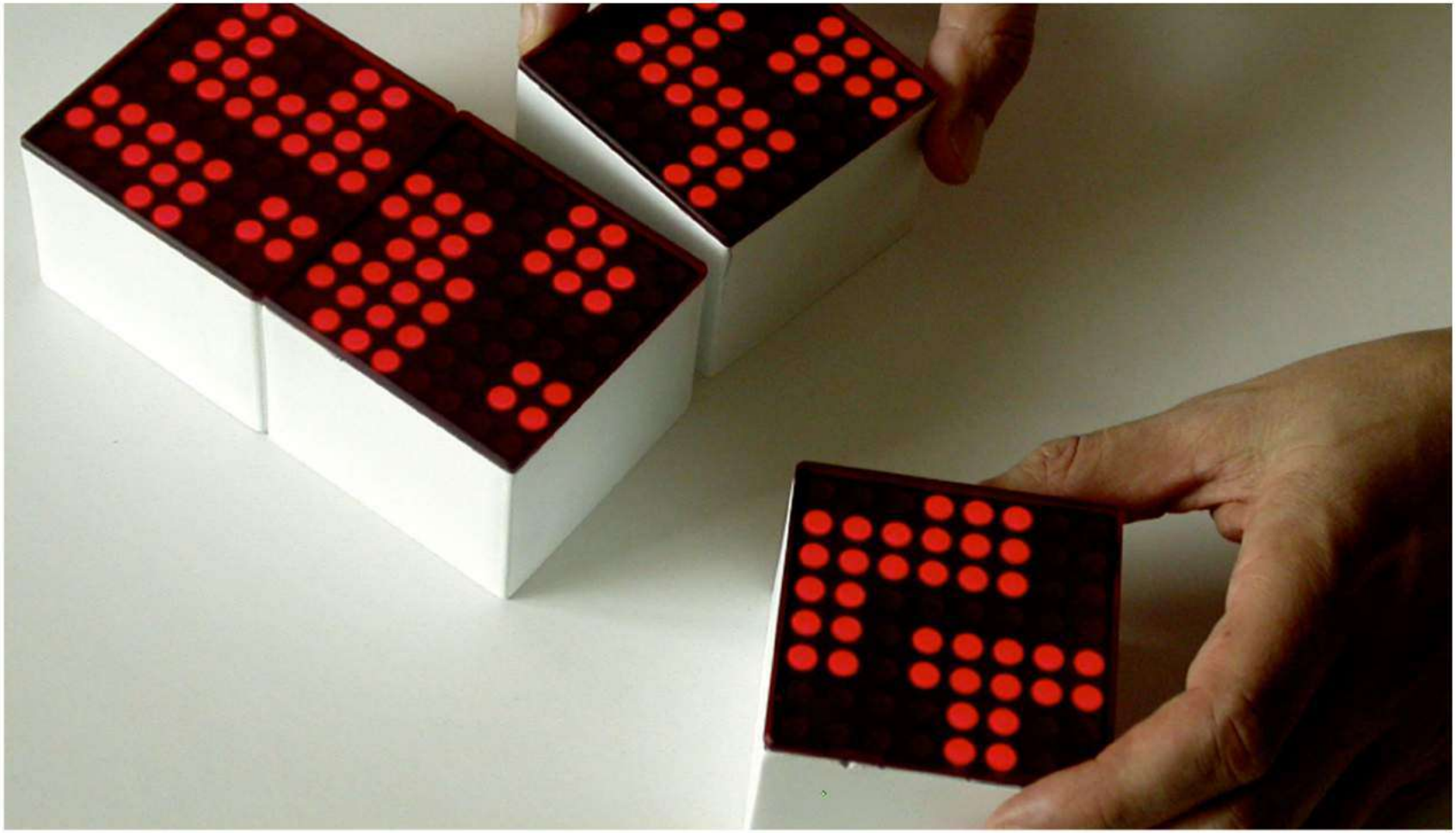


Figure 10. Tiletoy prototype

Siftables These toys (which are no longer in production) are similar to the Tiletoy prototype, in that they are made up of modular square tiles with screens that are adaptable and customizable. Where they differ is in the range of images they can display and how they interact with each other.

Unlike the tiletoy that used a dot matrix display, siftables use a full colour graphic display which allows for more complex images. Siftables also work with infrared transmitters at the tile edges to communicate with one another unlike the tiletoy tiles that use wireless radio through a host computer.

Figure 11. Siftables

Interactive Tiles These are sensory toys developed by the company TFH Special Needs Toys. They are 50 x 50cm discs that light up with vibrant colours in response to the pressure users apply on the surface of each disc. These types of toys aren't developed for cognitive assessment but are more for stimulation. Improving the wellbeing of people with mental impairment, helping them combat agitation, apathy and anxiety by having them engage in a tactile sensory experience.

Figure 12. Pressure sensitive Interactive Tiles

Multi Sensory Environments / Snoezelen This is a form of therapy developed in the Netherlands in the 1970s by Jan Hulsegge and Ad Verheul. It is an approach that uses sensory experiences such as sound, music, colour, lighting, and scent to deliver stimuli to patients with mental impairment.

The therapy usually involves a health aide bringing a patient to a "Snoezelen room" that has been equipped with various sensory tools that aid in creating a soothing eperience that can be tailored to the patients' liking and having them interact with the environment. These experiences are usually centered around the patients and aren't led by the health practitioner so as to promote free will and agency which in turn promotes communication.

Figure 13a. A Snoezelen room located in Francis House Hospice, Manchester. https://www.snoezelen.info/europe/francis-house-hospice/

Figure 13b. Another example of a Snoezelen room. http://www.ludovico.it/stanze-polisensoriali/

By researching these various cognitive assessment and stimulation tools I gained a better sense of the scope of my project and the boundaries I was aiming to explore.

From the cognitive assessment tests it can be seen just how essential pattern recognition is to memory and learning. It was helpful to see the different ways each of these tests probe recollection and mental imaging. It also hepled to further understand how pattern recognition informs visuospatial abilities.

It was also fascinating to explore cognitive stimulation tools and the positive effects they have on the wellbeing of people living with incurable mental impairment, especially the soothing effects that sensory experiences can have.

PART III

Coupled with my initial research and tests around pattern recognition, my research into cognitive assessment and stimulation gave me a better idea of the kinds of qualities I wanted to infuse my final project with. I had also began to see my project as a tool centered around elder care that could be used in homes or assisted living facilities in service of people with mental impairment.

It was important to me that whatever I ended up with had the potential to not only facilitate assessment tests but also stimulate cognition through sensory experience. What I arrived at was an adaptive, modular sensory tool that can be used either as a means of cognitive stimulation or a means to conduct cognitive assessment tests that utilize pattern recognition as a way of assessing visuospatial abilities and short term working memory.

As a guide I outlined goals for my project based on observations in my research to assist me as I progressed with the production phase of the project. Here they are listed below:

- Should be accomodating of frameworks of established cognitive assessment and stimulation exercises.
- Must be modular
- Must be scalable
- Must be adaptable
- Should have easy user experience. No instruction manual needed
- Should have the potential to encourage creativity
- Should be able to accomodate multiple users
- Should be able to be used by different age groups but more specifically older people (65-90) at risk of mental deterioration.
- Interaction should reward engagement whether a set task is involved or not

In some of the earlier stages of my project I had already began to explore modularity and different ways I could tesselate square motifs to generate forms through pattern. Although they garnered interesting visual expressions they didn't quite give me the degree of flexibility and adaptability I would require for my project. They did however provide me with leads for material exploration and gave me ideas of how light could activate pattern to aid the sensory aspect of my project.

Figure 14a. Early model tests exploring modular capabilities of square motif tiles using silkboard modeling paper and printed patterns designed by me.

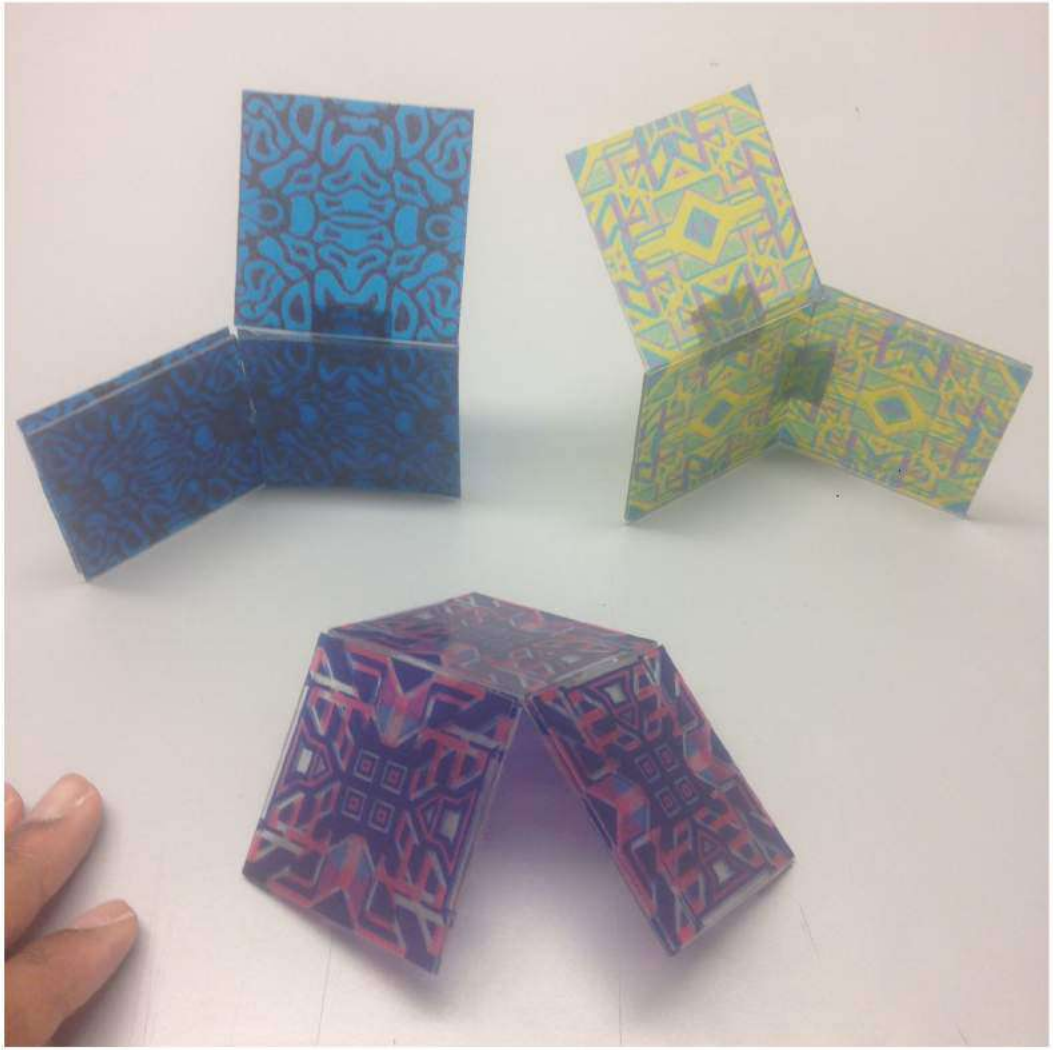


Figure 14b. Early model tests exploring modular capabilities of square motif tiles using acrylic sheets, OHP (Overhead Projector) film and printed patterns designed by me.

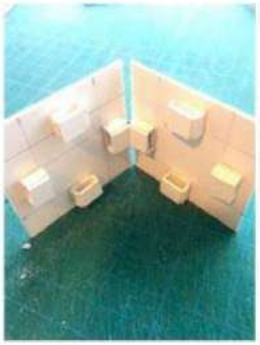
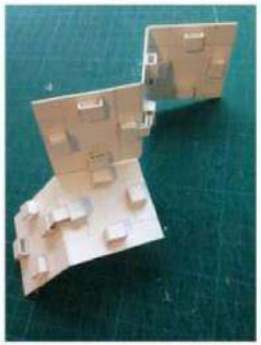
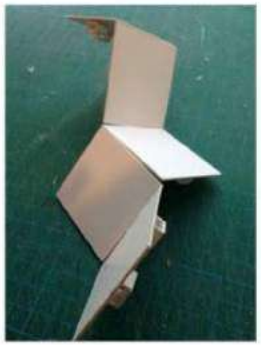





Figure 14c. Early model tests exploring modular capabilities of square motif tiles and how light can activate pattern using silkboard modeling paper (l) and acrylic sheets, OHP (Overhead Projector) film and printed patterns designed by me (r).

After identifying qualities I wanted in the project I went a little further to identify potential functions of the tool and their corresponding requirements. In doing this, the form of the project began to take shape because I began to see what would be needed to accomplish these functions. The following are some of the potential functions I listed:

Memory Recall Tests

- Should be able to display an examiner's pattern configuration which can then be erased and replicated by a test taker to assess their memory recall abilities.
- Should work almost like a chalkboard in principle

Visuospatial Tests

- Should allow users be able to match, motifs, colors or shapes to each other

- Should allow users be able to manipulate, and rotate displayed motifs so as to affect pattern outcome
- Should have the ability to showcase pattern sequences

Creativity

- Should give users the ability to create their own pattern configurations with motifs of their own choosing
- Should give users the ability to develop their own custom motifs that they can use to create their own pattern configurations

Sensory Capabilities

- Should allow for interactivity
- Should be tactile and responsive to gestures made
- Should incorporate lighting and colour thereby providing visual stimulation

Once I identified these functions and requirements I realized that it would be a good idea to make the tool consist of modular blank canvases that could take on whatever pattern was displayed on them like the toys I researched in Part II.

For the form of these modular blank canvases I decided to stick to the square, due to the shape's history with pattern and the fact that it is the most commonly identified form of tiles and building block toys.

Each module needed to house a lighting source and have some sort of screen that patterns could be displayed on. So for my final project prototype I decided to create 30 x 30 cm boxes out of chipboard with screens made out of vellum paper (stand ins for polycarbonate sheets)

Figure 15. 30 x 30 cm boxes made out of chipboard with screens made out of vellum paper

I also brought back the OHP film from my initial tests with light and pattern, as a means of projecting patterns on the screens. I printed patterns I designed digitally on them and folded them into cylinders (Figure 16) so they could be rotated 360 degrees like a safe dial.

This would allow the patterns they projected to also be rotated 360 degrees clockwise or counter-clockwise. Their cylindrical shape also just happened to fit the circular light sources I had decided to use.

For the light sources I went with motion sensor battery operated puck lights (Figure 17) for their versatility and portability. In initial tests I had been using the white LED from my phone which gave an effect that I liked so I made sure the lights I used were also white LED lights.

Figure 16. OHP (Overhead Projector) film with digitally printed patterns by me.

Figure 17. Motion sensor battery-powered LED puck lights

One of the challenges I faced with the lights was the fact that each one came with a diffuser which made the LED lights less bright and thus made the initial projections on the light box screens unintelligible. So I manually removed the housing around the lights that held their diffusers and tested how the projections looked without the diffusers and there again I found another challenge.

I discovered that each puck light contained 6 LED lights (Figure 18) which meant the projections I'd be getting would be from 6 different light sources, therefore making them once again unintelligible (Figure 19). To circumvent this problem I had to fashion a makeshift "lightblocker" (Figure 20) that would block 5 out of the 6 LED lights so I could get more focused intelligible projections from a single light source (Figure 21).

Figure 18. "Unhoused" puck light with 6 LED lights exposed

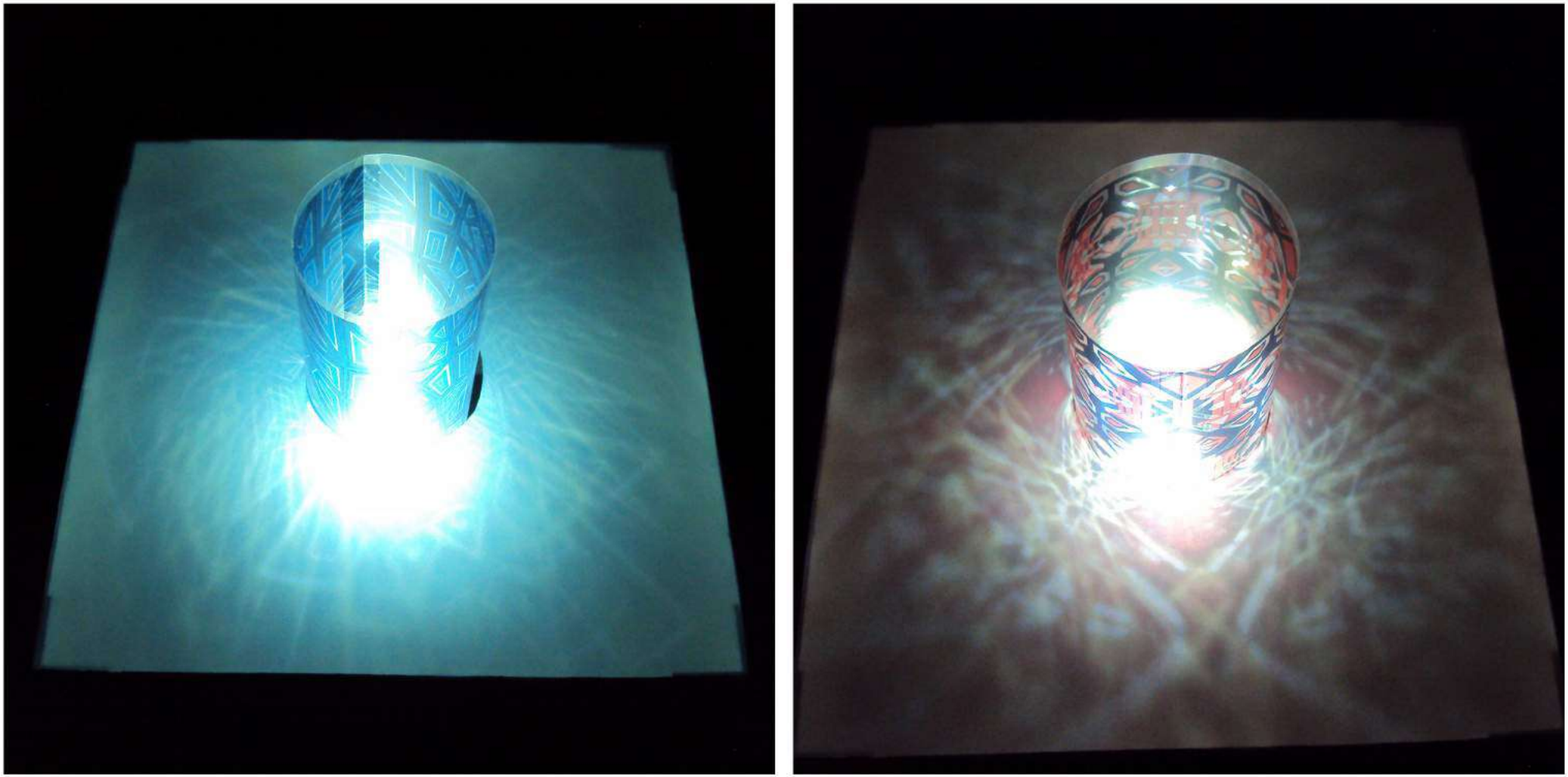


Figure 19. Unintelligible projections made with 6 LED light sources

Figure 20. "Unhoused" puck light with makeshift "lightblocker" concealing 5 LED lights and exposing only one single light source.

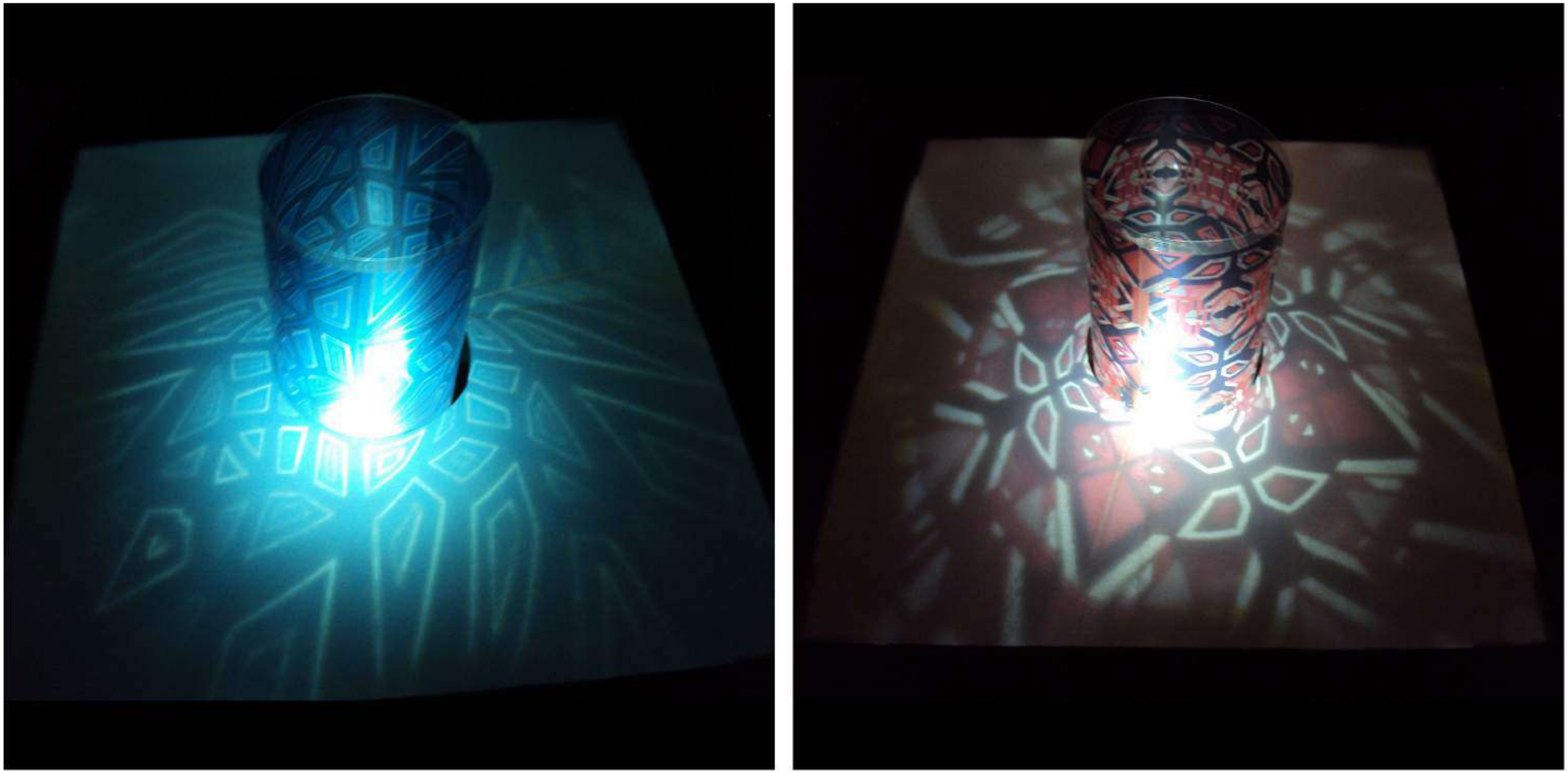


Figure 21. Intelligible projections made with single LED light source

To determine the pattern motifs that would work best I digitally designed a couple of patterns and then tested them with the light boxes. I grouped them into basic motifs and complex motifs. Basic motifs being those made up of one or two colours with no shapes in their design. While complex motifs are those with multiple shapes and colours in their design. My criteria for both groups of motifs were their legibility when projected and their ability to generate numerous permutations when rotated in relation to other similar patterns.

In terms of legibility I found that basic motifs were easily legible since the designs only had one or two elements that were being projected. For complex motifs I found that designs I made that contained elements coloured white were the most legible. This was due to the fact that in the printing process these parts of the design were usually omitted by the printer thereby leaving spaces in the OHP film that allowed light to pass through unfiltered creating stronger, more outlined, and legible projections.

To create motifs that allowed for flexible and varied permutations I took inspiration from Truchet tiles and the coloured-blocks in the Kohs block design test where colours are split by a diagonal. This creates a situation where each tile rotation has the potential to generate a new pattern permutation with tiles of the same kind.

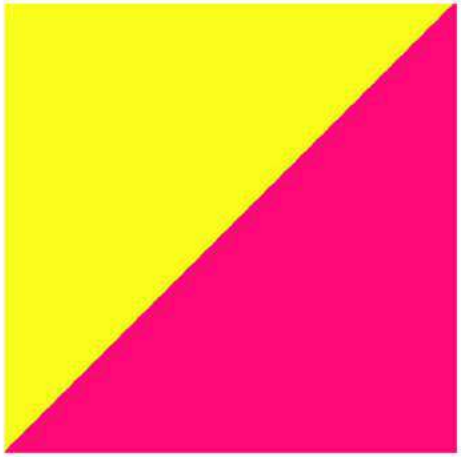


Figure 22a. Truchet tile

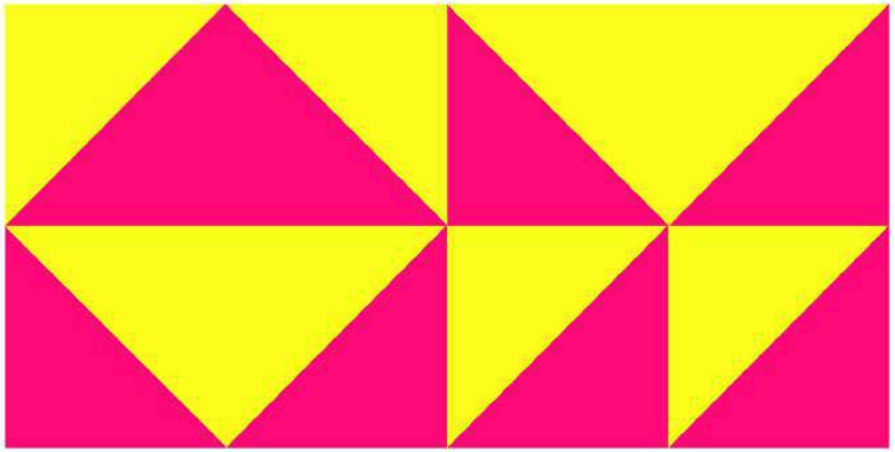


Figure 22b. Pattern generated by repeating and rotating Truchet tile

Upon figuring out the design parameters for the project I then went on to do some tessellation tests to see how a set of 6 light boxes worked with different pattern motifs. You can find these tests at the links below:
Tessellation Test 1 - https://youtu.be/wc7lwLEOsrY
Tessellation Test 2 - https://youtu.be/nLh4wAa5mso

From the tests I saw the qualities I had aimed for in my project. The pieces were modular, adaptable and had enough capability to either be used in a cognitive assessment or cognitive stimulation capacity. Although this project is based on established research and practices in the psychological field, I still see the potential for further development, testing, probing and consultation with professionals in the psychological field. In the next couple of pages I have included images and mockups that show my project in use to further contextualize it.

Figure 23a. An example of how the light boxes could be used in a space similar to a Snoezelen (without pattern cylinders)

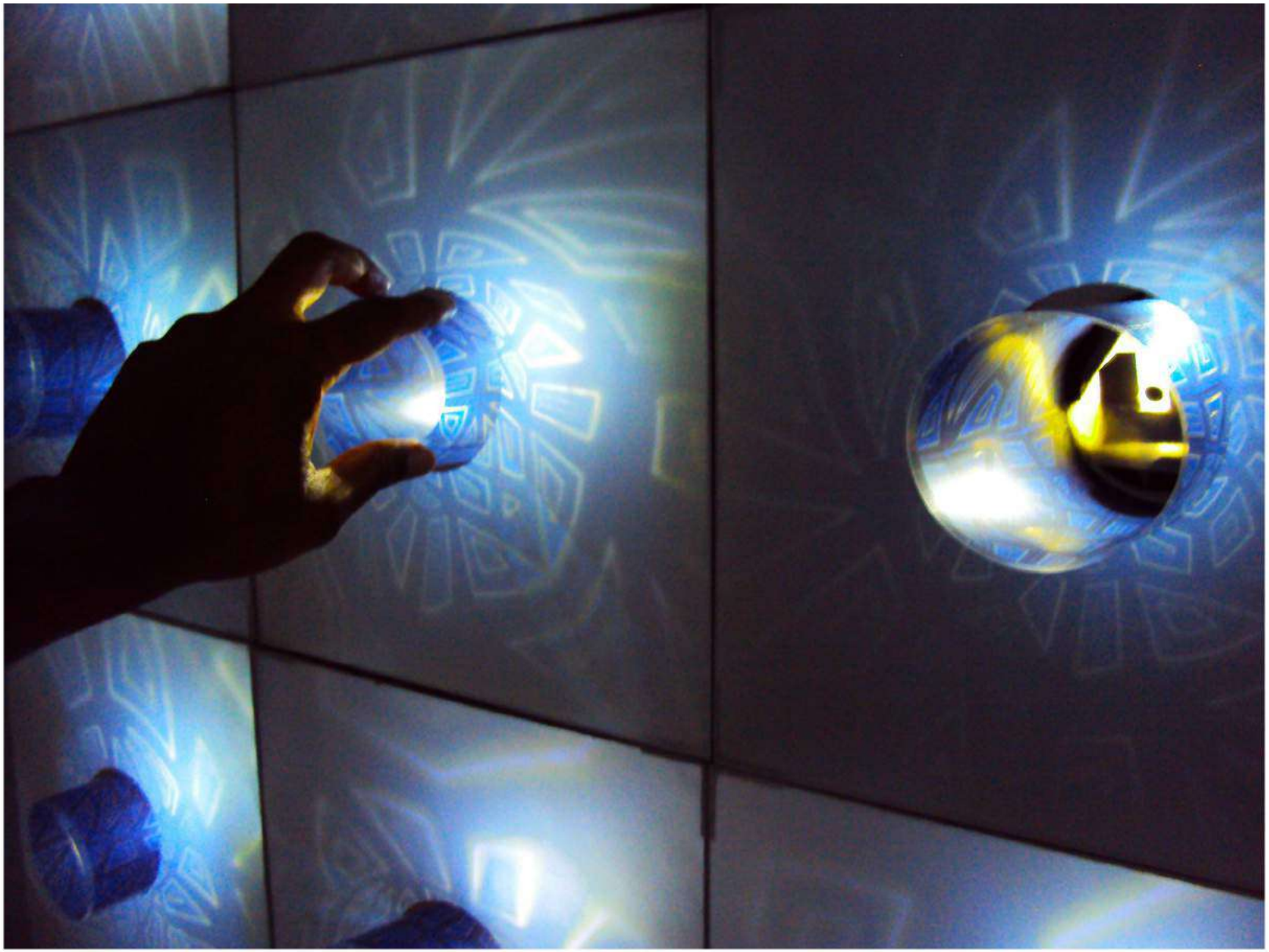


Figure 23b. An example of how the light boxes could be used in a space similar to a Snoezelen (with pattern cylinders)

Figure 23c. An example of how the light boxes could be used in a space similar to a Snoezelen (with pattern cylinders)

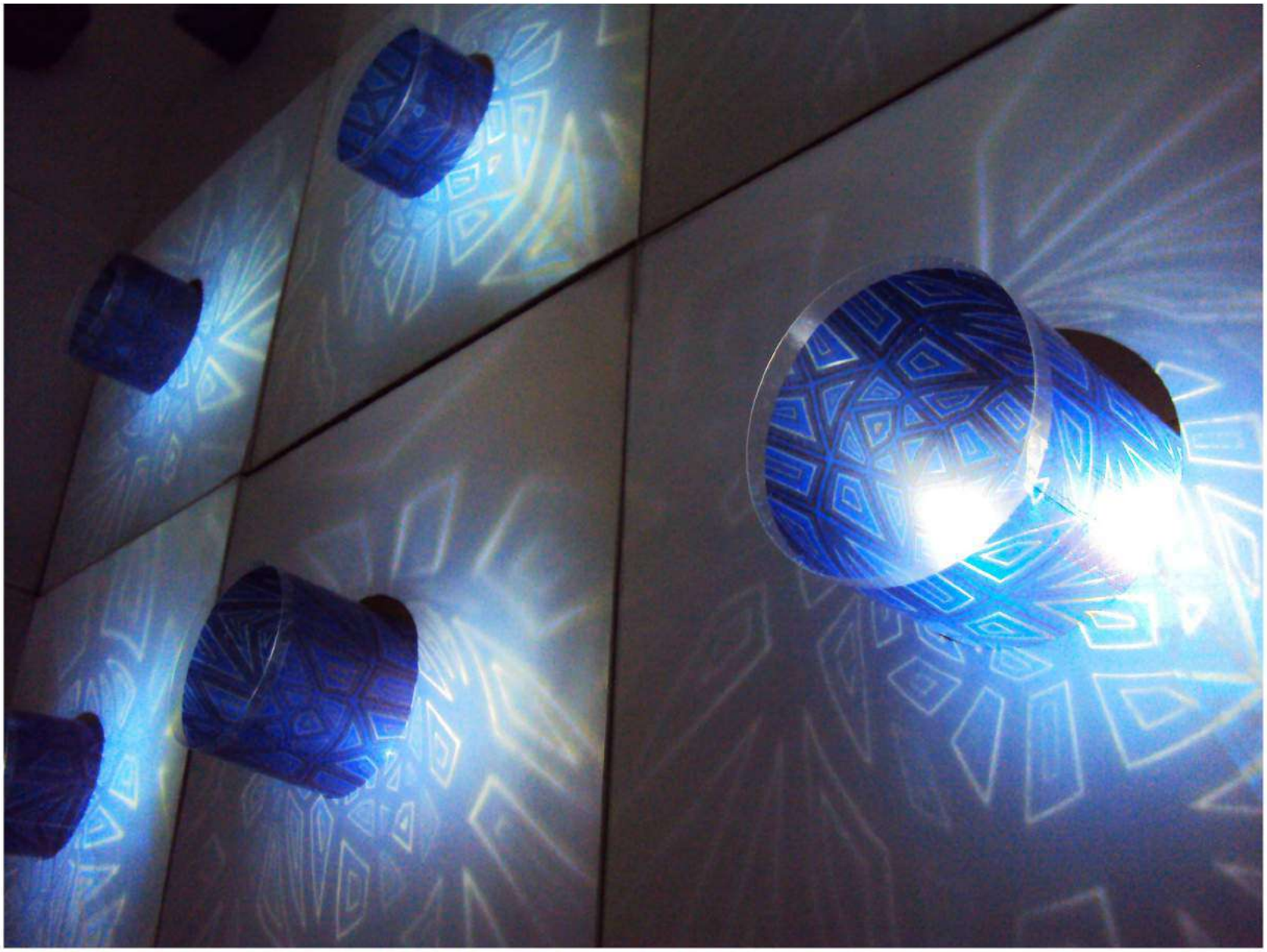


Figure 23d. Detail showing how the light boxes could be used in a space similar to a Snoezelen (with pattern cylinders)

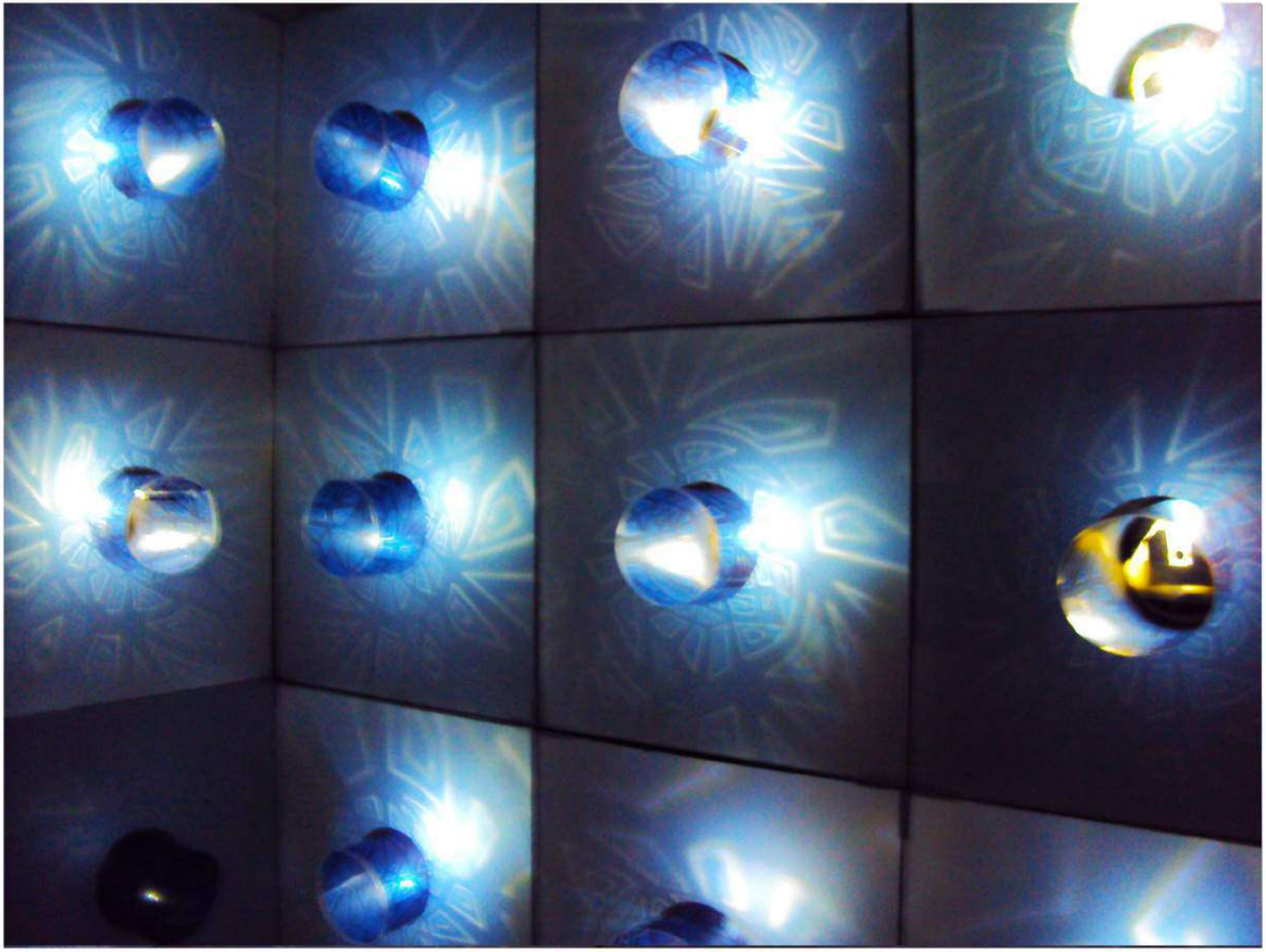


Figure 23e. An example of how the light boxes could be used in a space similar to a Snoezelen (with pattern cylinders)

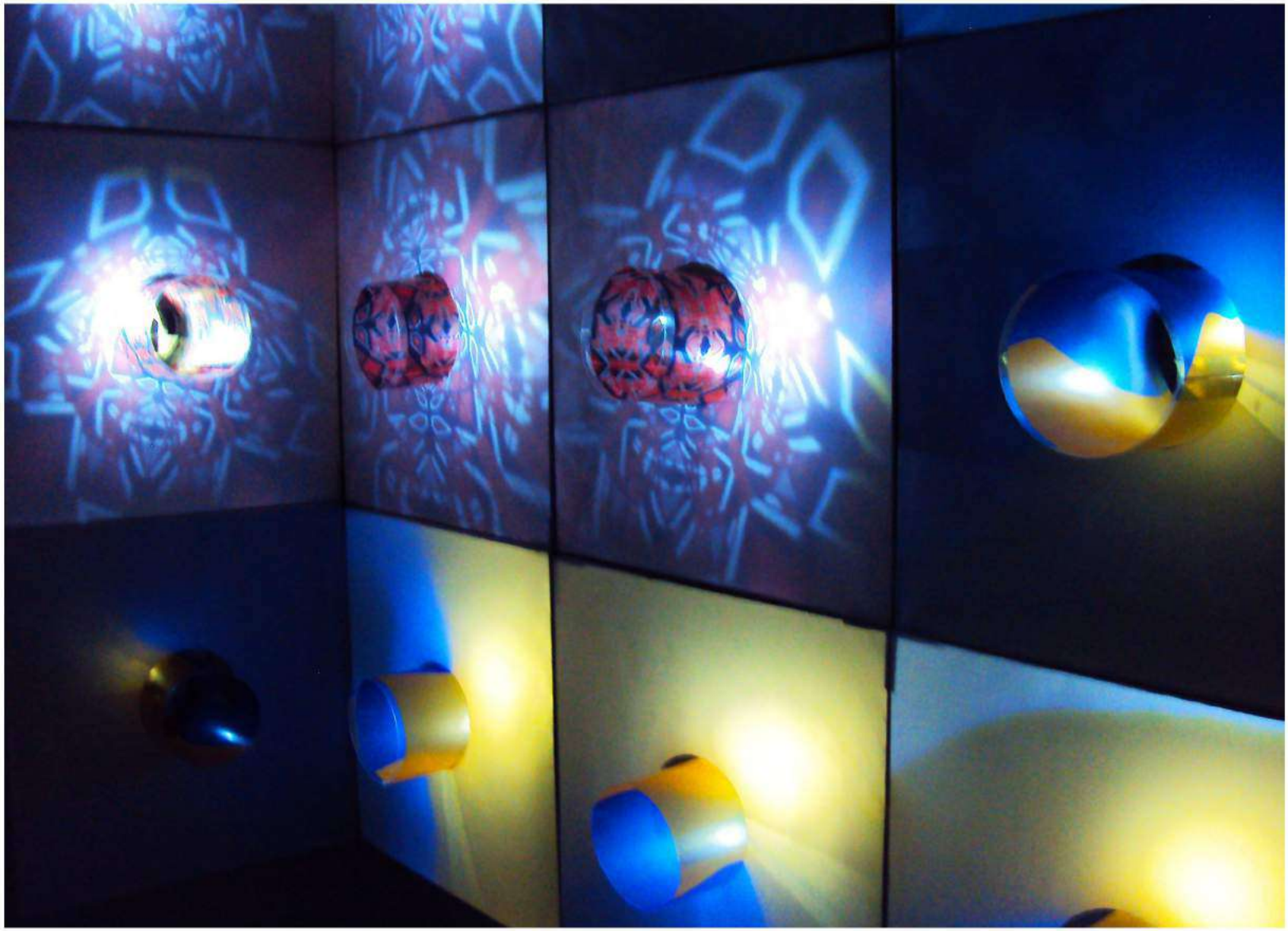


Figure 24. A scenario where a complex pattern motif and a basic pattern motif are used with the light boxes

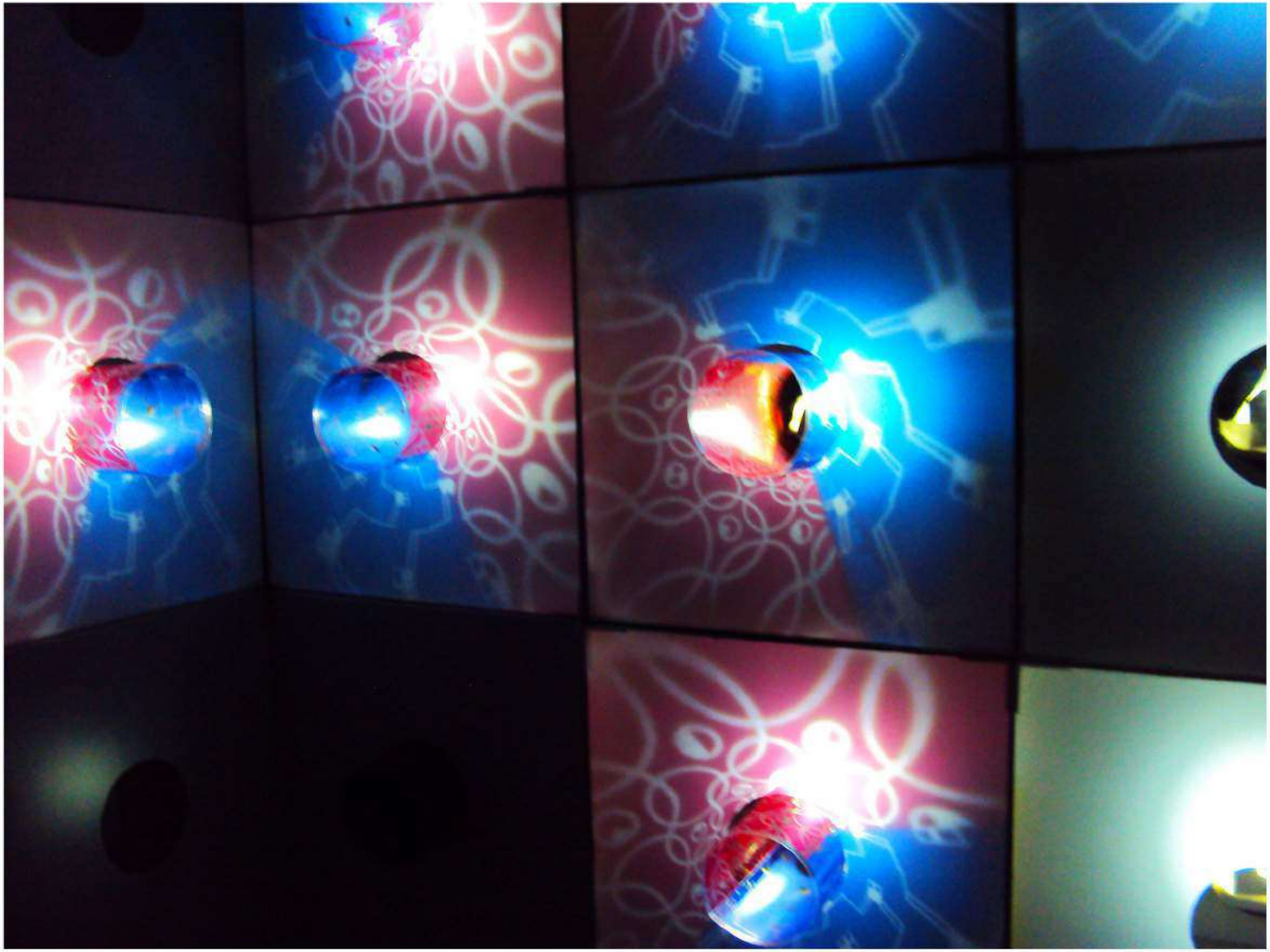


Figure 25. A scenario where two complex pattern motifs occupy each tile in the style of a truchet tile.

Figure 26a. Users can also create their own handdrawn custom designs by drawing on a blank OHP film

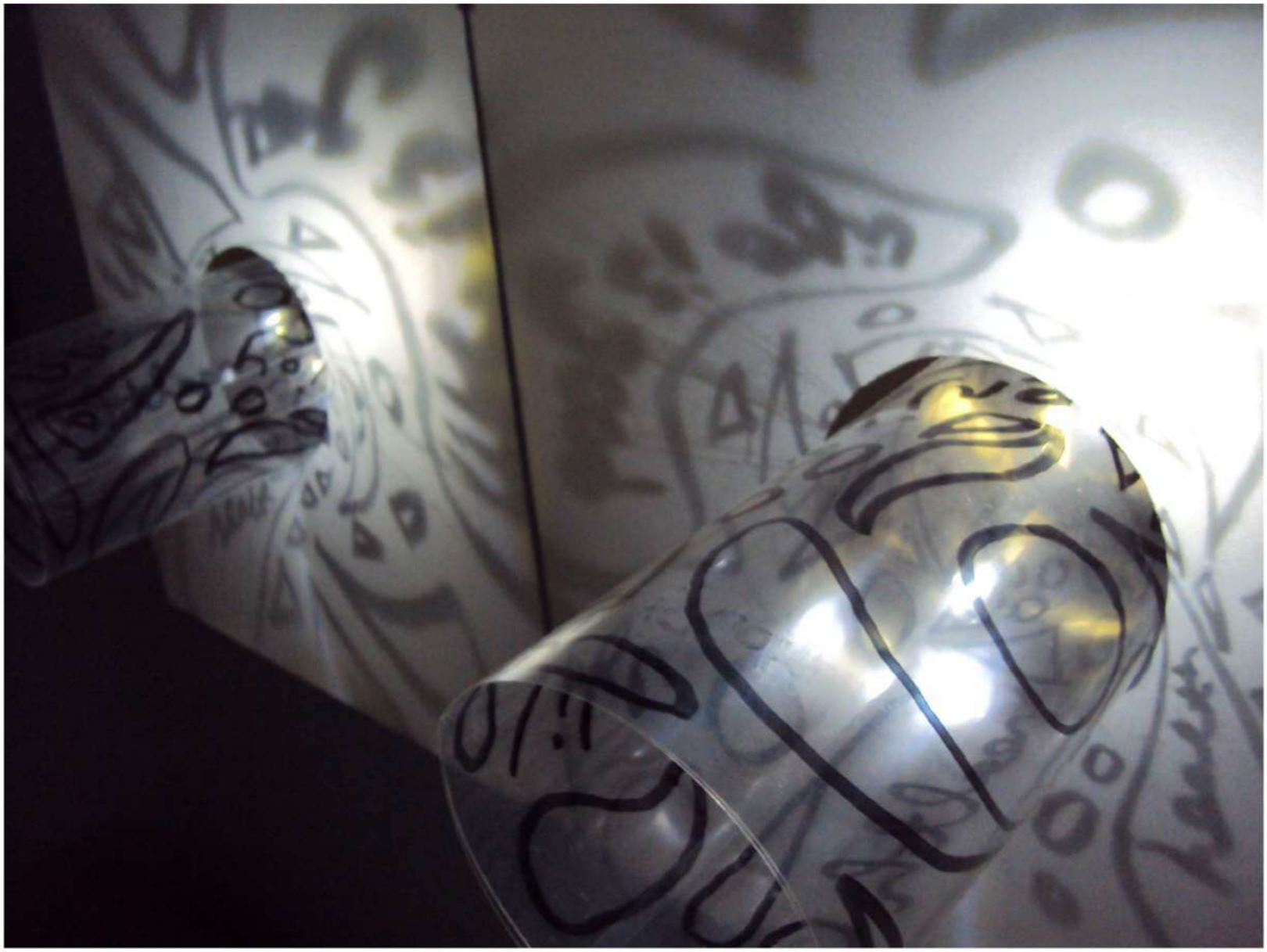


Figure 26b. An example of projections made from hand drawn pattern motifs.

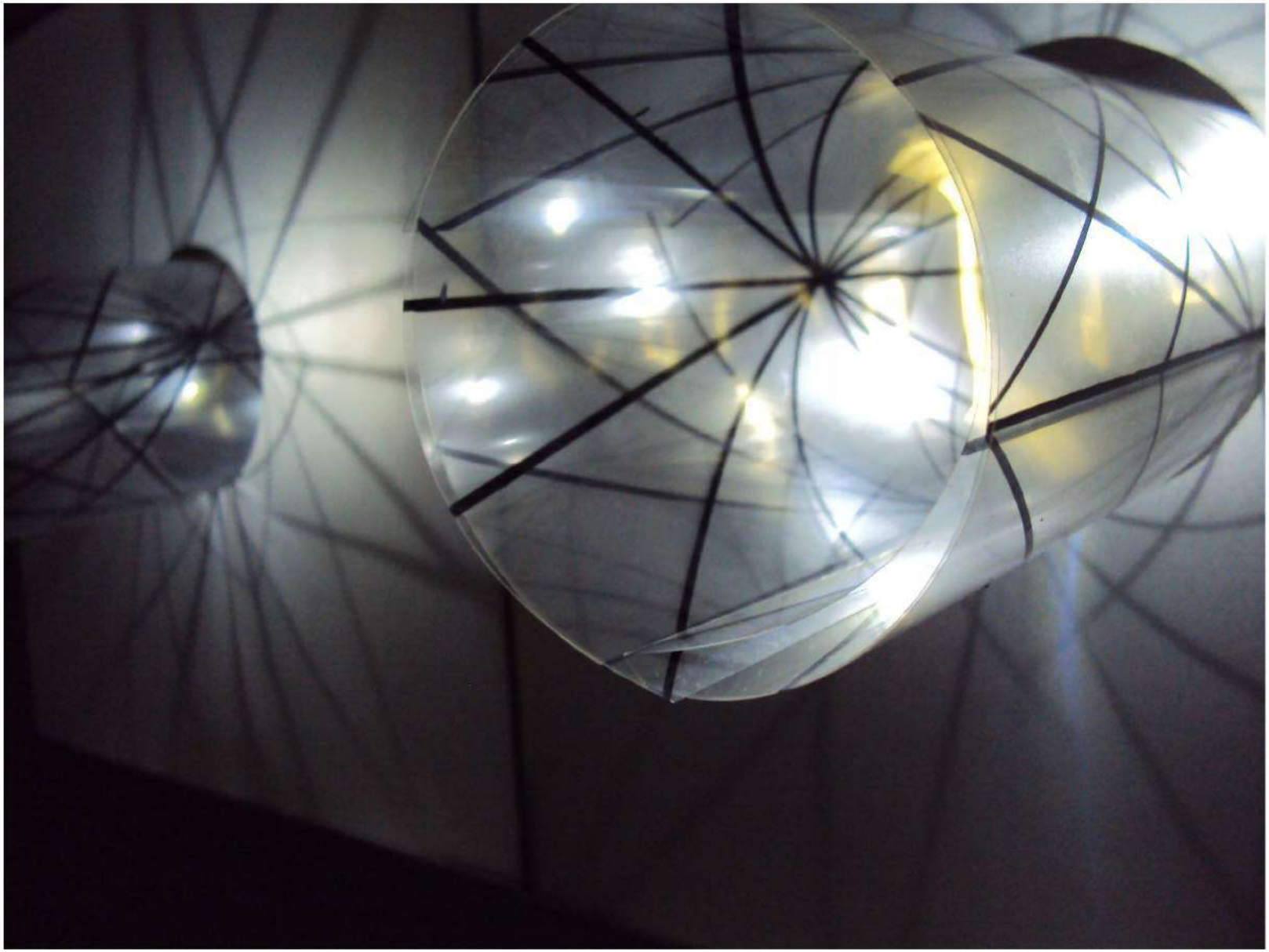


Figure 26c. An example of projections made from hand drawn pattern motifs.

Figure 27. Mockup depicting a scenario where the light boxes are being used as a cognitive assessment and stimulation tool.

Figure 28. Mockup depicting a scenario where some light boxes are mounted on the wall of a psychologist's office while the rest are on the table in front of a patient being used as a cognitive assessment tool.

Figure 29. Mockup depicting a scenario where light boxes are being used independently as a cognitive stimulation tool

Figure 30. Mockup depicting a scenario where light boxes are being used in group activities at an assisted living facility

Figure 31. Mockup depicting a scenario where light boxes are mounted on the wall of a room of a resident at an assisted living facility for thepurpose of cognitive stimulation through sensory activity.