Comprehending Chronic Pain through Evocative Mediums

Project 2

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Approval Sheet

The Interaction Design Project two titled “Comprehending Chronic Pain through Evocative Mediums.” by Jonathan Joseph Mathew (Roll Number 176330003), is approved, in partial fulfilment of the ‘Master in Design’ Degree in Interaction Design at the Industrial Design Centre, Indian Institute of Technology Bombay.

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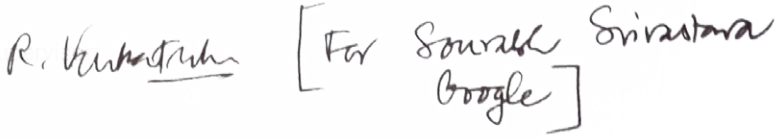
External Examiner: 

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November 2018

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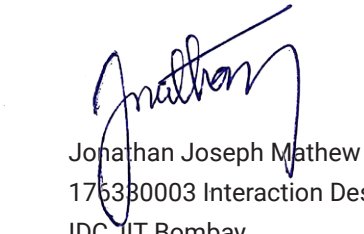

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November 2018

Acknowledgements

I am sincerely grateful to my guide Prof. Vivek Kant for his valuable guidance and support throughout the project.

I thank the IDC Interaction Design faculty Prof. Venkatesh Rajamanickam, Prof. Ravi Poovaiah, Prof. Pramod Khambete, Prof. Girish Dalvi, Prof. Jayesh Pillai and Prof. Anirudha Joshi for all their inputs and feedback.

To my batchmates, for their continuous feedback, support, and all the help when needed. Thank you.

Abstract

This design exploration beings to address the idea or the notion of evoking thought and provoking action through evocative objects. This centered around chronic pain; revolves around two challenges: first, to express chronic pain where the interaction is pliable through evocation and second, the possibility to communicate the same to a caregiver through embodiment. This exploration seeks to probe into these questions, can we design objects to evoke thought? Or even provoke action? What might the characteristics of these be? How do we design for evocation? Could evocative objects be used as a medium to better understand, communicate and express chronic pain? While we start to experience these objects, we realize that there is a certain level of intensity and similarity that we share with them; in-turn they could offer us a way to relate our connections to the world through them. This experimental approach does not seek to validate the use of these objects as substitutes for any medical purpose, but to shed light on new possibilities to approach chronic pain.

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01
Introduction

Aim: Comprehend Chronic Pain through Evocative Mediums.

Most research in the field of evocation and embodiment are mostly theoretical, few researchers touch upon the notion of evocation through embodiment in an abstract sense. This project is a design exploration that beings to address the idea or the notion of evoking thought and provoking action through evocative objects. Most existing applications and devices do evoke a thought, this is done primarily through information that conveys a state of being, like the percentage of battery on a mobile device. This exploration seeks to probe into these questions, can we design objects to evoke thought? Or even provoke action? What might the characteristics of these be? How do we design for evocation?

To do so, we look at chronic pain as it is recognised as a serious public health problem as it leads to issues regarding depression, fatigue, decreased cognitive and physical abilities to name a few. A large portion of the population within India have been diagnosed with diseases that lead to chronic pain. Studies have indicated that chronic pain affects the patients quality of life and social well-being which eventually would lead to disability [1,2,29]. While there may exist ways to address chronic pain and the issues of pain management through the mhealth approach, they fall short. But, there isn't an alternative for the same.

Could evocative objects be used as a medium to better understand, communicate and express chronic pain? While we start to experience these objects, we realize that there is a certain level of intensity and similarity that we share with them; in-turn they could offer us a way to relate our connections to the world through them. This in my case could be achieved by working with embodied interactions in the objects we designed. This approach identifies three aspects to design for evocation. First, what makes an object evocative? Second, what are the design challenges identified while designing these objects and third, utilizing the concepts of embodied interactions. The final idea revolves around two challenges: first, to express chronic pain where the interaction is pliable through evocation and second, the possibility to communicate the same to a caregiver through embodiment. This experimental approach does not seek to validate the use of these objects as substitutes for any medical purpose, but to shed light on new possibilities to approach chronic pain.

This report consists of these sections as follows. First, we look at some existing methods or tools that are used to express or convey pain, traditional as well as technology that aids the process. Second, the background research into the evocation and embodiment, what do they mean? And how do we design objects with these properties? This is followed by some background literature regarding areas of concern while expressing chronic pain. Fourth, we look into design methods and explorations employed while working with evocation and embodiment. We finally conclude the report by looking at some findings from our evaluation and what limitations or future possibilities of the same would hold.

02
Why Chronic Pain

Why Chronic Pain though?

Chronic pain is a highly subjective experience due to its nature of being unpredictable and constant over a longer period of time. Self-reporting measures are used to assess and treat it, as seen in the field of pediatric oncology. Most hospitals adopt patient recall for the progression of the treatment and its side effects using either the pen-paper scales or through other self-reporting measures like verbal expression or a monitoring device. Some of the reporting methods have low test-retest reliability and face the problem of patient recall bias [4,3]. They do not consider the fluctuating nature of chronic pain over time, as it varies and changes with the context of activities a patient undertakes. Here lies an opportunity for a new approach or a medium to express chronic pain where it evokes itself to be public in nature while it exists in the context of use that is private. This could enable people to solicit social support towards these individuals. Currently most of the traditional pain apps and scales address pain management or expression towards an individual and subjective level, but a very few of these methods approach chronic pain by soliciting social support.In the following section we would take a look at both the traditional as well as the applications that support patients living with chronic pain.

03
Background Research

3.1 Traditional Pain Scales

A pain scale is a visual method that aids doctors and other caregivers asses your pain. They're often visual or numeric based . The other variants of the pain scales help by observation and behavior (for differently abled patients and children). They are also used to track certain aspects but not limited to duration, severity, and type. Below are a few pain scales that are in use by practitioners.

3.1.1 Numeric Pain scale 1-10

This common scale consists of numbers from 1-10 and the patient points out what is his current pain intensity level. While it is simple there are patients who relate to the numeric number and their pain. The interpretation of the scale is subjective in nature and differs from patients as well as doctors.

3.1.2 Faces pain scale

This scale consists of facial expressions next to the numeric number to help patients, especially children report their pain level. Patients with autism do not find it helpful. The scale helps patients report a more reliable pain intensity.

3.1.3 Visual analog pain scale

Many patients don't experience pain in fixed units like numbers, but with a lot of variations like that on a sliding scale. A patient can mark the pain intensity anywhere along the slider. Some variants of the scale have fixed points along the edge of the slider.

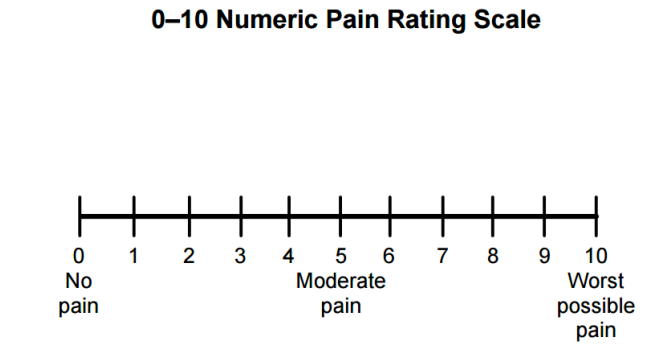


Figure 1: Numeric Pain scale

Figure 2: Face Pain Scale

3.1.4 McGill pain scale

The Mcgill pain index provides a better pain scale compared to most. It considers the sensory, affective and evaluative issues with pain to help pinpoint the intensity. The index was first created in 1971. It compares the reported pain to other related injuries or types of pain, this helps the overall reliability of the scale especially for severe chronic pain patients.

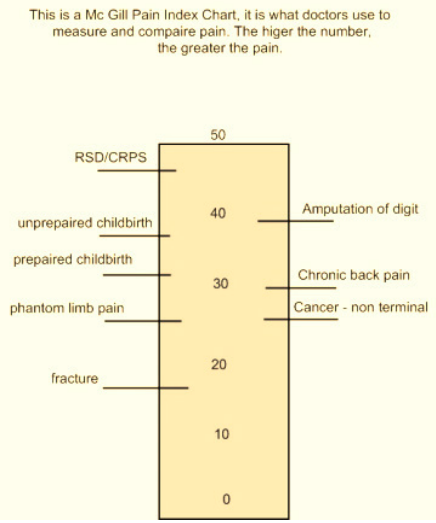


Figure 3: McGill Pain scale

3.1.5 Color scale for pain

Color pain scales were meant to help children express their pain, they showcase a strong association to pain representation and help them understand their progress. They also designed in different shapes for the kids like for eg. A thermometer.

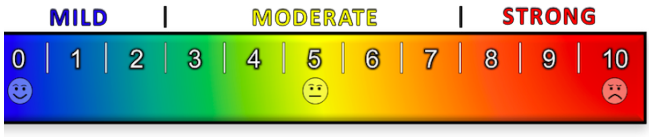


Figure 4: Color Pain scale

3.1.6 Care Pain Observation Tool

This tool is based on observation by caregivers and doctors to help patients who are unable to report their pain themselves. They look into factors like facial expression, body movements and muscle tension.

3.1.7 Personalized scale

These pain scales are designed by patients to help track the pain themselves by using their own expressive words or images, similar to a randall pain scale.

3.2 Why do Traditional Pain ScalesFall Short?

> *"Ultimately, it isn't really about pain — though that is the root. The problem is suffering. All of the personal, cultural and other factors that make us unique make it almost impossible to convey our inner experiences with other people."* [33]

Though the study was short and qualitative with semi structured interviews and observations, it did bring out people and their perspective about engaging their chronic pain set in a given context. And looking further into related literature and other sources available, the unidimensional nature of pain reporting proves to be problematic and might fail because pain is in-fact multidimensional in nature.

Numeric analog scales – some patients are unable to relate to the numbers and what exactly would a specific number convey to the doctor; the relationship of the number to the seriousness of the pain.

"Would a lower number reported, mean that i'm not in pain?"

(Note: some doctors consider scores to be very relative and subjective in nature based on the patient's reaction to the seriousness of the disease.)

Visual analog scales and face scales – most patients can not relate their pain to certain facial expressions or plain colors (this works for kids who are unable to express their pain, but these are not always reliable).

"If I can't cry, is my pain not severe or would they even take me seriously?"

3.3 Technology in the Measurement of pain: mHealth Age

The healthcare sector has also adapted to the use of mobile technologies within their monitoring systems for patient healthcare management, this also termed as “mhealth”. These applications are affordable as well as accessible to most users as it provides them with services that can aid their pain management process [8].

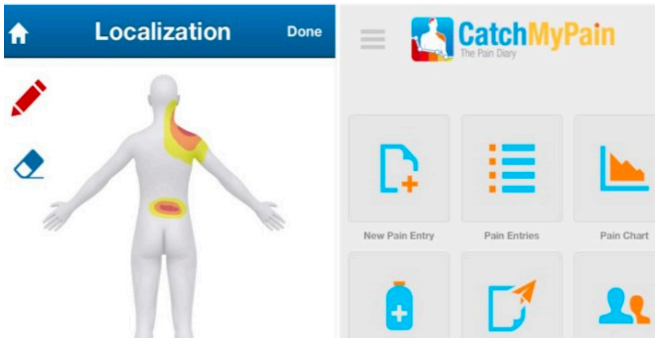


Figure 5: Catch My Pain app

Looking at Pain management mHealth Apps:

3.3.1 CatchMyPain

This app is known not only for features like tracking the pain, fatigue and treatment but also solicits social support through their online pain community forum. Additional features include
Pain location tracker and access to your physician.

3.3.2 My Pain Diary

Apart from continue pain reporting the app makes links to reports and events. While sending across the details to their physician they have the option to keep certain reports private. It acts like a pain calendar with reminders for treatment and appointments with the clinic.

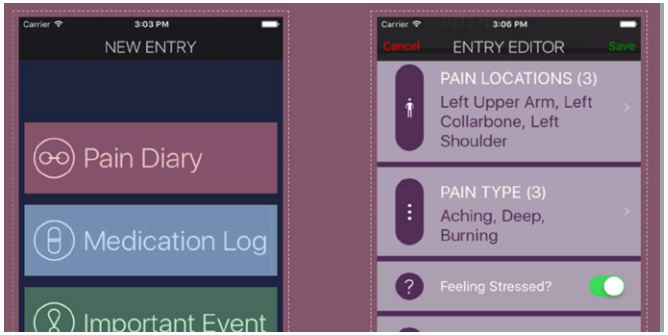


Figure 6: My pain diary app

3.3.3 Pain Scale App

Pain scale is an app specifically for patients living with chronic pain. While reporting pain and their symptoms, they also help you share the same with your doctor. They provide educational content for patients like good health tips and better management plans.

Figure 7: Pain scale app

3.3.4 Manage My Pain

Manage my pain is a generic pain app that lets you do the same as the above apps but you can share your reports with your family and friends. The applications also gives the patient proper data to help explain their condition and the treatment effects.

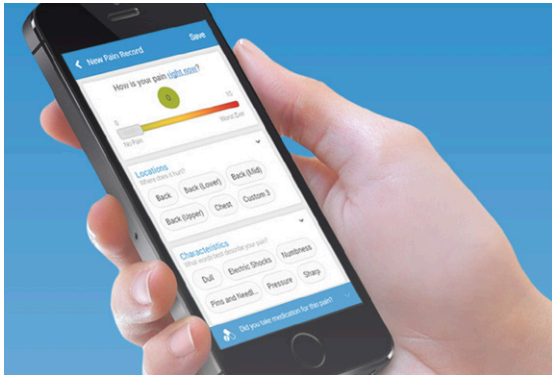


Figure 8: Manage my Pain app

There are numerous other pain applications that are very similar in terms of function but they aren't very developed and the applications still do not meet the criteria for a good pain management app. Appendix a contains a short heuristic study on a few apps.

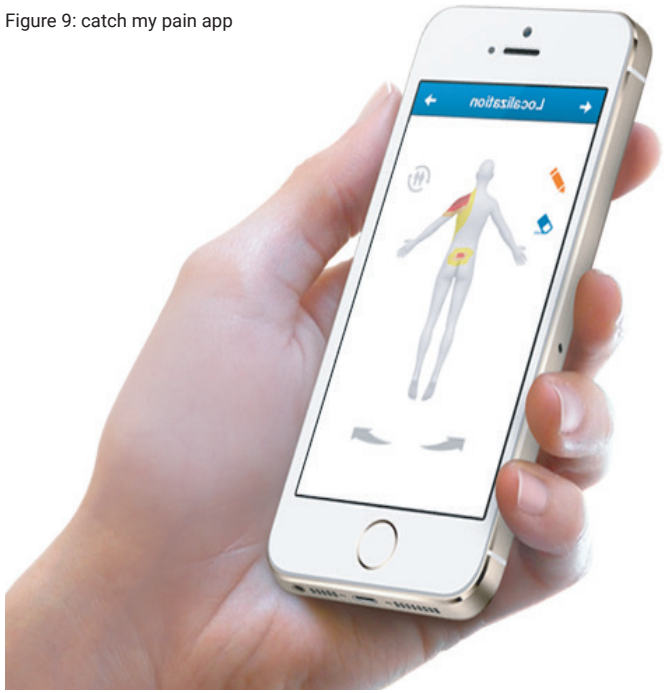
3.4 Why do these applications fall short?

Previous studies in pain management applications showcases that most applications lack proper content and the involvement of healthcare professionals in their design and planning, these apps do not show any effectiveness of pain management with regards to chronic pain [13]. There is a need to develop and test applications to support patients with affordable healthcare solutions for self-management of chronic pain [13]. Taking a few available apps found on the app store both on android and ios, a short heuristic study on the pain management apps in appendix A was undertaken based on the applications content and functionality. This study did not look into the aesthetic and visual aspects but considered the following:

-Chronic pain education/tips and skills
-Monitoring system for pain/treatment
-Patient goals
-Soliciting social support groups

While most applications in appendix a did meet 2 of the 4 criterias, only 2 out of the 11 applications have content or features that allowed patients to be a part of a help community or a support group. This indicates a gap where the need for support groups for patients that could enhance the adherence to positive outcomes during the treatment phases.But a closer look at the applications and the surrounding literature studies showcases that a very few pain self-management apps have content that is moderate and useful to the patients in terms of tracking and reporting.

Figure 9: catch my pain app



One of the major reason for this could be the unregulated list of requirements and prerequisites for pain self-management applications. However, there could exist a need to probe further into multi-modal programming and new mediums to focus on chronic pain and patient health management with regards to treatment tracking over infrequent visits.

While there may exist ways to address chronic pain and the issues of pain management through the mhealth approach, they fall short. But, there isn't an alternative for the same. One aspect maybe the lack of motivation of the user to engage with these applications as chronic pain leads to mental health related issues. While the solution may lie within alternative treatments for the same, there is a need to find new mediums to translate chronic pain to help patients better express themselves.

This new medium should help these patients evoke a thought (positive reaction) and provoke action from loved ones or caregivers. Hence, the area of evocation through embodiment of interactive objects could be the beginning for designers to design objects with a different approach, where one seeks to better comprehend the aspects of evocation.

04
Evocative Objects

4.1 Evocative Objects

We live our lives in the middle of everyday things and we are constantly surrounded by them. This culture of material possession carries both emotions and ideas, with this culture spreading over the years only a handful of these objects receive attention to their existence as part of our lives. While studying the idea of an object that could be evocative through Sherry Turkle's work, "Evocative objects: Things we think with" [23]. It brought out certain underlying implications these objects have in our lives. There is no fixed definition of the same, it is a way we experience the objects we love and in turn start to think with them. Her work

> *"Offers us a language to interpret the intensity of our connections to the world of things, which in recent past have been termed as material culture. Through different narratives, we take and make objects part of ourselves and discover the simple, yet powerful similarities in our relationship between the animate and inanimate." [23]*

But how do we design such objects? There are no set guidelines or parameters that one could set, (as experience is always subjective). These objects in her book have evolved over time and understood at a later stage on their implications of being an evocative object. As the project duration is short, testing the end object on the basis of whether or not it becomes evocative is still in question.

My exploration to design evocative objects has led to designing objects with the embodied approach. Embodied interactions are a way for us to evoke these objects and their intentions. This is not the only way, while they may not exist approaches to design these objects this approach is highly experimental.

4.2 What makes an Object Evocative?

This section would highlight certain key features or more so, challenges, these objects should address. Listed below are only an approach to design these objects.
Our approach towards these objects are usually looked upon as either useful or vain indulgences. There exists no familiarity with the object when we start to consider them as counter parts to mediums that are used as a form of expression to evoke a notion.

This brings about the bricolage of ideas, two to be specific. First, inseparability of thought and secondly, our relationship to the material culture of things. When we look closer at these objects, we find a rich connection to

the context of use in our daily lives. So, an object could be called evocative if it finds associations with the following questions:

Where does it take you?
What do you feel?
What do you understand?
Do you trust the object?
Do you have a sense of control over these objects?
Conflicts between meaning and the objects.

Most objects claim to have a sense of control because of the context in which they come into contact with us. But, on the other hand some of the objects that are not designed but evolved a period of time with respect to its context of being, the seem to be intrinsically evocative, this is a quality sherry turkle refers to as uncanny.

"Uncanny objects are substitutes for thoughts that cannot be expressed; they take the place of what cannot be spoken." [23]

The uncanny feature of the object is always warped around the bounds of the context of use. The boundary that exists here, with time would lead to times of transition (liminal or threshold) which could lead to new creative possibilities. This influences the design, as we probe further into designing these objects we will end up with two aspects of the objects. First, the notion of drawing us in towards them and second, repelling us. This is the balance that always remains uncertain as the design decisions we make tip the scales in favour of one over the other. Thus, these complex relationships evolve objects that seem to be intrinsic and unobtrusive. There is significant amount of influence these objects have semantically over our relationship with other things around us and exploring the notion of embodiment through the object could help us design these artefacts.

05
Embodied Interactions

"we act in a world that is suffused with social meaning which both makes our activities meaning full and itself transformed by them. Our actions cannot be separated form meaning that we and others ascribe to them." [22]

Embodied interaction explores the possibility to unify the experience of the physical and tangible worlds to a new medium of interpretation that relates to our daily experiences with the objects around us. This offers us a perspective on the relationship between people, objects and systems they are part of. This type of interaction is not a set of rules, it is an approach to understand embodiment. Most of my study related to this field is primarily explored through the work, of Paul Dourish [22] the author in this book leaves with us opened ended questions on how it could be developed and explored.

There are multiple frameworks that the book offers us as we start to look into embodiment of objects. I have specifically looked into three aspects for this project; one is the relationship between action and meaning, their usually direct and have little or few means to be separated within the context of their existence or the nature of the communication with each other. The second is a later or a more refined approach towards bricolage, referred to as coupling in his work. The relationship that evolves or that is created between the different intended actions of object's and their purpose to the activity in context. While they exist in the same context, how suitable and sustainable is this relationship? Are questions we look into. Finally, we look at these objects as artifacts of a larger system and the technology we embedded in them to be part of the socio-cultural aspects of their interaction.

The approach towards embodiment in this design exploration is guided by few perspectives that are brought up in Dourish work. Following are few considerations on an abstract level that could be looked into if an object is to be embodied and evocative.

As designers,
We explore and create new mediums that translate the meaning and action of the intended activity within a socio-cultural context.
Translating meaning of an action could result into ambiguous relationships between the environment, user and the designed artefact. Do not discard these relationships as they give rise to new meanings that evolve with time. Consider, the hierarchy of meanings evolved through actions.

The designed artefact should participate in translation of meaning through action between the environment and the user, not just as a

state of being. This could be achieved through artefact- artefact interactions within the world they exist in.

Do existing design systems entertain these few aspects of embodiment? They might. But in most cases they not consider to look at the artefact as a participant in these systems of interaction. They are rather seen as a tool of conveyance. The challenge here as a designer is to answer the question, how can we include the artefacts we design as an active participant into the context of the environments we design for? What are the other socio-cultural challenges? Or can it lead to negative experiences between them?

Dourish's framework of applied embodiment was later enhanced by other researchers who looked into the areas of reasoning by action, uncertainty in a framework and familiarity through repetition of actions, to probe into embodiment as a medium of interaction [24].

Dourish had begun to highlight certain aspects towards embodiment, but what exactly constitutes a body in the environment of its interaction was still unclear. Merleau-ponty and his work around phenomenological (the study of consciousness and the object experience) was brought about towards the field of embodiment by svanaes, where the idea of embodiment was further extended to bring more meaning from the subject as a lived experience. This could be understood by the very idea of recognition towards the things around us and the innovative action that follows. This is the nature of being human, where we understand and act accordingly with the context we perceive ourselves to be in. (In this case, the context of artefacts, interaction and interpretation of the same) [25].

What I hope to achieve through this approach is to seek insights on how will we be able to understand, control and incorporate them into our lives.

"The embodied interaction perspective highlights the role of meaning in action; it sets out a relationship between representation, action, and the production and reproduction of meaning within communities of practice." [22]

06
Literature Insights

6.1 Socio-Cultural Factors

Related literature points out, chronic pain related conditions lead to severe problems in closed loop relationships, which in-turn portrays the perception of patients in self-management of their pain through the influence of social factors. Healthcare should always be private and personal, with varying degree of relationships people have with towards caregivers or loved ones [18, 17]. A majority of people would prefer to hide; as their perception of their condition is treated as a stigma in certain social contexts.

The impact of coping strategies among patients who adopt help from caregivers have a serious residual effect on their treatment compared to self-management of their condition, as it gives them a sense of control [15,16].

This puts forward a challenge to designers. “Showcasing vs. Concealing” should the new medium we design offer us a new language to communicate with others by being unobtrusive to their sociocultural context of use. This should be considered as a prominent feature of the objects that we attempt to create.
But, how do we understand the perception of people towards these objects or mediums through the above challenge: showcasing vs. Concealing? Approaching this through goffman’s theatrical metaphor would help us better understand people and how they set themselves within their social setting.

6.2 Goffman's Theatrical Metaphor

> *"Sometimes the individual will act in a thoroughly calculating manner, expressing himself in a given way solely in order to give the kind of impression to others that is likely to evoke from them a specific response he is concerned to obtain" [19].*

Goffman's conceptual theatrical metaphor helps us to better understand people when they try to control the impression of themselves within a social setting. In his work, we look at these specific interactions of the theatrical framework : on-stage, off-stage and backstage.

On-stage: people are actors and the construct the entire performance to every detail for their audiences.
Off-stage: no performance and maintain the image they portray to the audience while maintaining their social context.
Backstage: actors become real people or their true identity is revealed then.

> *"In most social contexts, people choose to be either offstage or onstage" [19].*

As designers we should take back this approach to understanding people within socio-cultural contexts and be sensitive to their performance they would like to put-up. This is key in new mediums as people would fail to have recurrent use for these objects if they do not fit their onstage or offstage performance.The objects also lead individuals to make decisions that are of a preconceived notion around the stigma of chronic pain. This would lead to certain areas of concern and the uncertainty in these situations of onstage and offstage performances.

6.3 Uncertainty Leads to Hiding

In older generations the perception of chronic pain to other audiences was carefully thought off, as the impressions they gave depicted their current state of being and the response they needed to evoke from the caregivers or others [20].The notion of showcasing vs. Revealing depends on each participants social context to different audiences and how supportive they are during treatment or therapy [21].

6.4 Areas of concern

The designer should always consider contextual factors and the activity that a patient would undergo. This is usually difficult as the ethics in pervasive healthcare is more complex due to the systems in place to protect patient information like privacy. So, observing patients within the clinical setup may not be possible unless the study is longitudinal. We should look at other methods to collect relevant data for patient living with chronic pain as they would choose to hide and not reveal [22]. How would these patients relate to objects that might sound obtrusive? What could be the expected outcome if we design these objects? Expressing pain through new mediums always leads to conflicting views of responsiveness.

6.5 Is There Evidence of Responsiveness?

The literature review puts forward a question to us, considering both ends; what would be the result of repeated reporting of chronic pain? Is the nature of the response positive or negative? [39,24, 25]. While some studies do indicate a more positive approach, having a sense of control over the pain [39,26]. Other related literature points out that repeated assessment draws more negative experiences of the patient's condition and their perception of being in pain, this reduces their quality of life by serving as a constant reminder [39,27].

Section 6 sheds light on the pitfalls one would fail to consider while designing evocative objects through embodiment. While we proceed to design these artefacts with the socio-cultural context in mind, it is essential to understand the local context of expressing pain. Hence, field observation is necessary while we begin to consider aspects or features these objects would have or the design decisions one can make that may help or prove to be inappropriate to the designed artefact. The following section would help us better understand this through an approach to design such artifacts.

07
Design Probe and Field Observation

7.1 Field observation

The observation was unstructured , but looked into the people and objects that the patient interacts, while dealing with pain (i.e doctors and caregivers). This field Observation seeks to probe into the field with the question, how do doctors assess pain In practise? These visits were carried out in local hospitals where the patient was accompanied to regular appointments in one case and another was an emergency case. Now, these patients were not currently suffering with chronic pain but their approach to expressing their pain towards individuals or caregivers was noted. This observation did not seek to conduct any inquiry as patient health information is highly sensitive and gaining access to them is difficult. This project seeks to design artefacts that help these individuals, but designing these artefacts prove to be a hassle due to the subjective nature of chronic pain. Hence, a design artefact probe was conducted via the wizard of oz method.

Note: my role was clearly to accompany a patient and observe the interaction between Patient and doctor. No questions were asked to either of them.

7.2 Design artefact probe : wizard of oz study

This initial probe seeks to answer the following questions:

1. What characteristics, or features that are critical for users to express their pain levels?
2. What is appropriate to express pain, based on their context of use?

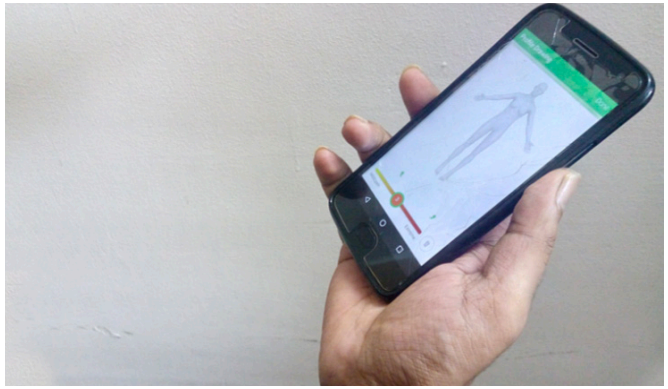
As in the above study with pain applications it is evident that they were all simple, so Prototyping a new application may not help answer the above questions. So, using Existing applications along with other *ideas of interactive objects* helps us understand The choices they make along with the rationale behind them.

With regards to chronic pain, gaining access to patients becomes relatively complex due to ethical concerns as well as privacy. It is very difficult to approach participants that live with chronic conditions as the nature of their pain is highly based on each individual and their unwillingness to be apart of the study. But on the contrary most of us have a high possibility of ending up with chronic pain due to certain incidents or lifestyle characteristics. Hence, recruiting participants for the study is an act, where they are given three or four scenarios that they would place themselves in. We then observe the choices they make. Followed by a semi-structured interview. The method followed in this approach is similar to that of an earlier work where they compared devices and mobile interfaces [34].

Note: this study is an explorative study, no observation made here is to validate or prove The preference or choice of objects or interactions. It is merely to help guide the project.

Figure 10: Object Interaction

Figure 12: Interface Interaction



Method:
Used qualitative methodology for observation:
Each session lasted about 30 min (max.).
What kind type of information did we collect?
-Results regarding competency with the interface.
-Areas of concern regarding usability of possible interactive objects.
-Context of the use.
-Observations from post study interview.
-Followed by a short interview q&a session.

Participation
The participants were randomized young adults, no of participants : 6
What are the constraints of this study? They are given three or four scenarios that they Would place themselves in. We then observe the choices they make.

Design probe
Applied semi-structured interviews with participant. To avoid biases of novelty, the participants interacted with different objects and the number of participants in each group are counterbalanced for better results.

Each interview had the following structure:
-The participants were introduced to the study.
-They are given a scene to enact and then they start describing the pain they feel.
(The participant chooses an object or interface to report pain.)

Figure 11: Object Interaction

-Before each object or interface is given, a short description is read.
-They interact with the objects at hand and observations are noted.
-Follow up questions about the interface that was semi-structured.
-The above steps are repeated for the other objects.

Participants are asked questions comparing the two mediums they interacted with. Finally, followed up with end questions regarding the two questions that the study seeks to address.

08
Insights for Design

Figure 13: Theme Board for analysis

After gathering the observations from the initial probe and the literature study, a thematic analysis of the same resulted in the theme board; where ideas, problems and insights are further structured and sorted out to identify existing patterns and contexts of use.

Sorting the initial set of observations to understand the brief overview of how pain can be expressed. This was followed by grouping them according to their affinity to a certain area or domain within expressing pain.

Key points that emerged from the mapping:

Unobtrusive expression
Pliable interactivity
Confirmation and feedback
Cognitive impairments
Translation of pain to interpretation
Discretion
Disclosure

The most import factor would be the context of use. Participants reported that while using at different situations they would want something that meets that need. This, drives the project to look at interventions that could meet a few, if not most of the situations by which a person could express his pain.

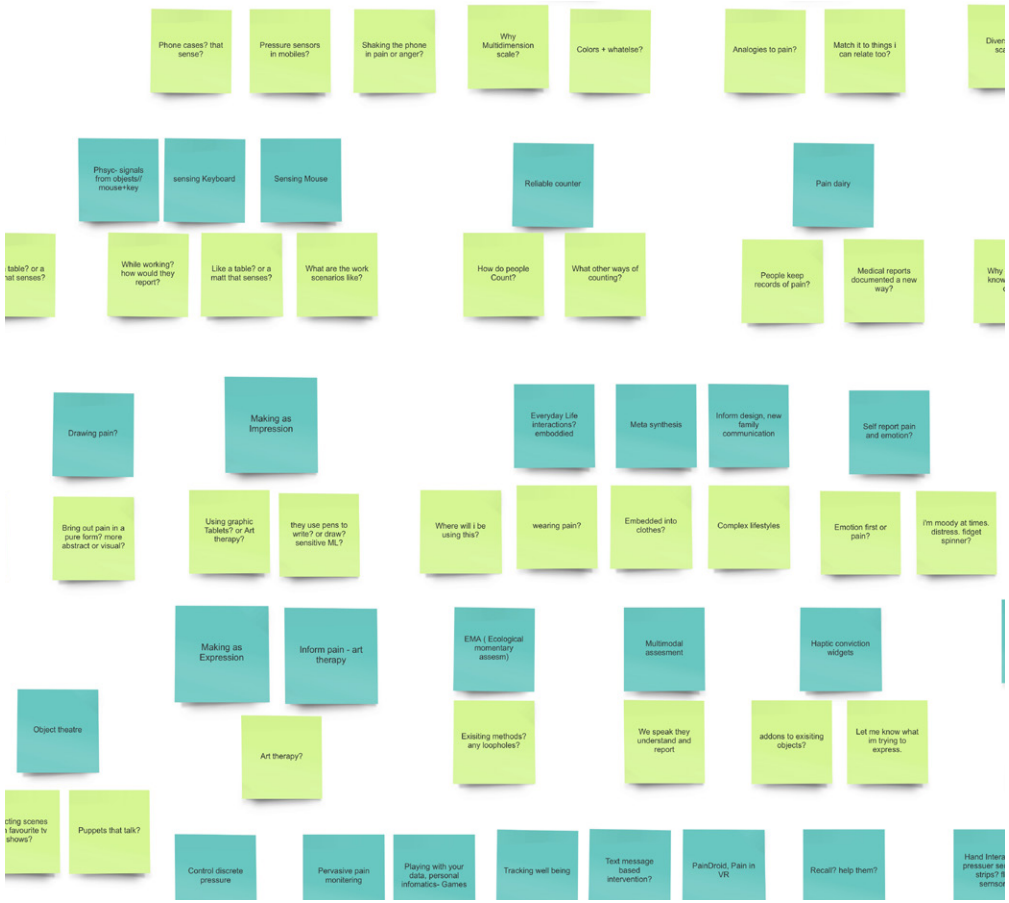


Figure 14: Insights Mapping

8.1 Design Criteria

There are a few challenges that one would face while working with expressing pain, through there are multiple options out there. This project sees to express pain through a medium that considers the multi-dimensions of pain. Looking at this task it is necessary to consider the following aspects of pain intensity while reporting or expressing the same. Here are a few constraints the study has brought about while creating prototypes for future work.

Design criteria to consider:

Medium to express intended pain level
Mediums resolution : doubts about accuracy
Discretion and disclosure
Continuous tracking task
Form factor affordance
Intuitive
Confirmation and feedback
Possibilities of unintentional reporting
Portability
Embodied interaction
Insensitive to participant
Repeated use
Cognitive translation/difficulty interpreting
Pliable interactivity
Unobtrusive reporting
Sharing with a doctor/caregiver during visits
Impractical or socially inappropriate
Time consuming
Cognitive impairments
Low-to-little digital competency
Functional limitations (vision, motor skills)
Uncomfortable reactions

Note: these challenges are not listed in the order of importance. But will follow up by creating groups within this list. These might be the least number of items that one should consider while working with and designing mediums to express pain.

8.2 Evaluating Ideas : Harris Profile

Ideas that evolved from the sessions, results in multiple directions that a designer would want to take up. But this leads to the biases that might emerge. While looking at pain it is essential to place yourself away.

To counter this, the harris profile provides a good framework to evaluate and assess ideas that come
Up after a brainstorming session. We list down the constraints that we would consider and rate them visually, as shown in the figure on the right. This allows multiple people to participate and evaluate ideas. Thus, helping the project to move in the intended direction [28].

Note: the hierarchy of the list depends on the importance of the constraint. This process is lengthy while evaluating each key idea, but it covers most aspects of the design considerations.

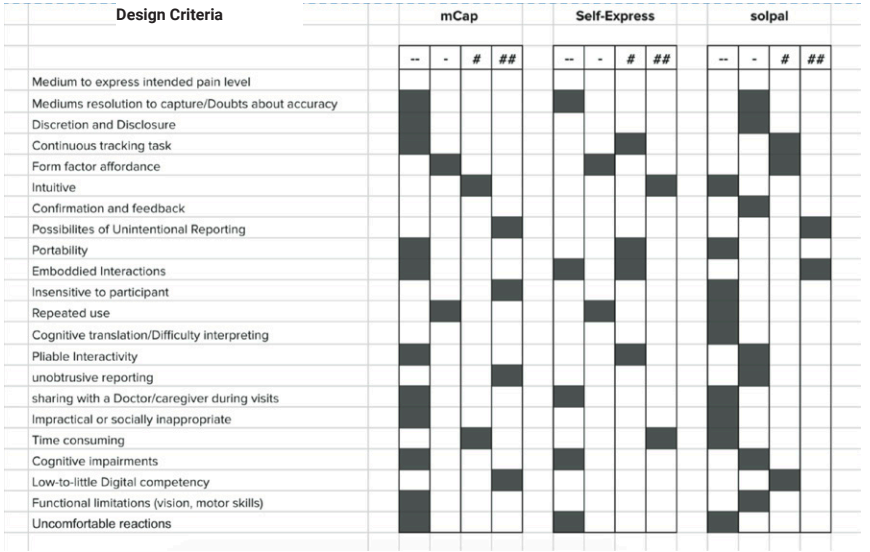


Figure 15: Harris Profile

8.3 How Harris profile helped structure design concepts?

To begin with, the initial ideas are clustered or grouped based on their affinity towards a particular design approach. After we have these groups we then try to break them down into the core aspect of the design idea. After which we are left we a very limited set of ideas. These are then evaluated. For this project the following procedure was followed to make sure the core aspect of evocative and embodiment are considered [28].

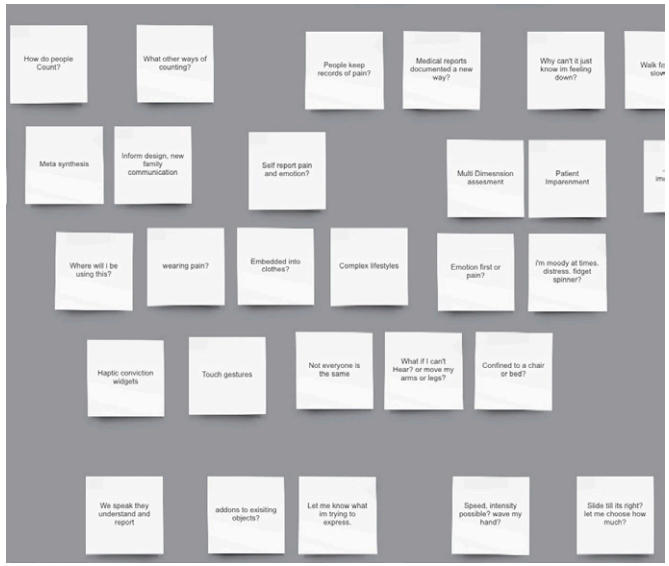


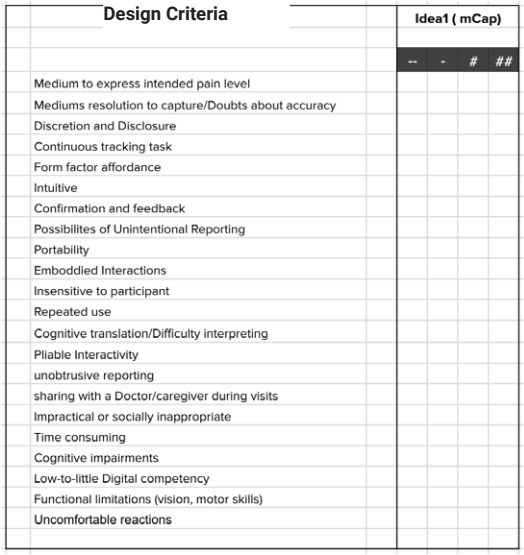
Figure 16: Harris Profile, Sorting ideas

Design Criteria
Medium to express intended pain level
Mediums resolution to capture/Doubts about accuracy
Discretion and Disclosure
Continuous tracking task
Form factor affordance
Intuitive
Confirmation and feedback
Possibilites of Unintentional Reporting
Portability
Emboddied Interactions
Insensitive to participant
Repeated use
Cognitive translation/Difficulty interpreting
Pliable Interactivity
unobtrusive reporting
sharing with a Doctor/caregiver during visits
Impractical or socially inappropriate
Time consuming
Cognitive impairments
Low-to-little Digital competency
Functional limitations (vision, motor skills)
Uncomfortable reactions

Figure 17: Harris Profile, Listing Design Criteria

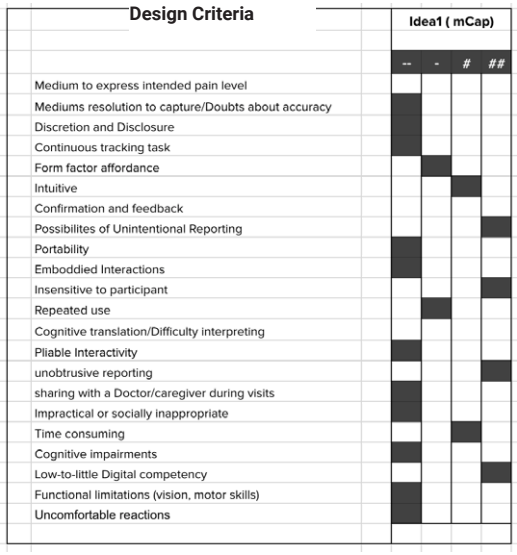
First , to create an evocative object where the interactions are embodied the main focus was to create a criteria or a list of challenges that most ideas should look into. This was done earlier through a thematic analysis of the literature review and other findings using affinity tools.

Second, we take these as a criteria and create a four point scale from -2 to 0 to +2. And we begin to score them to create the profile for each idea (Figure 18). Here we color the score. This helps to visually understand and compare the design ideas for quick iterations.



Design Criteria	Idea1 (mCap)			
	--	-	#	##
Medium to express intended pain level				
Mediums resolution to capture/Doubts about accuracy				
Discretion and Disclosure				
Continuous tracking task				
Form factor affordance				
Intuitive				
Confirmation and feedback				
Possibilites of Unintentional Reporting				
Portability				
Emboddied Interactions				
Insensitive to participant				
Repeated use				
Cognitive translation/Difficulty interpreting				
Pliable Interactivity				
unobtrusive reporting				
sharing with a Doctor/caregiver during visits				
Impractical or socially inappropriate				
Time consuming				
Cognitive impairments				
Low-to-little Digital competency				
Functional limitations (vision, motor skills)				
Uncomfortable reactions				

Figure 18: Harris Profile, Four point scale



Design Criteria	Idea1 (mCap)			
	--	-	#	##
Medium to express intended pain level				
Mediums resolution to capture/Doubts about accuracy	■			
Discretion and Disclosure	■			
Continuous tracking task	■			
Form factor affordance		■		
Intuitive			■	
Confirmation and feedback				
Possibilites of Unintentional Reporting				■
Portability	■			
Emboddied Interactions	■			
Insensitive to participant				■
Repeated use		■		
Cognitive translation/Difficulty interpreting				
Pliable Interactivity	■			
unobtrusive reporting				■
sharing with a Doctor/caregiver during visits	■			
Impractical or socially inappropriate	■			
Time consuming			■	
Cognitive impairments	■			
Low-to-little Digital competency				■
Functional limitations (vision, motor skills)	■			
Uncomfortable reactions	■			

Figure 19: Harris Profile, scoring

Third, these individual scoring are then compared with each other and the decision of the design direction is taken either by an individual or a group. It is good practise to involve more people in this stage. Fourth, consider the tradeoffs of each idea and pick a direction that aligns with the project goal through profile, it is good to consider reframing criteria to get an efficient list that covers most aspects of the prerequisite. Finally, the final design is not the design with the best score alone, though people would prefer it. In my case it is used to look at the directions that one could take and end up with a good challenge list to further evaluate the ideas. Hence, the preference here is to select a design approach that meets most of the criteria rather than just a few good ones.

Harris profile helps the designer in two aspects; one, looking at the pros and cons of our design ideas with respect to the design object. Two, helps the designer gain a better understanding of the problem space and the challenges ahead that should be considered at later design stages (form finding etc...).

Harris profile helped me to narrowed down the explorations of embodiment and evocation through concepts specific to chronic pain related ideas; as this was part of the direction of the project. From here we take it forward by using the filtered ideas, their pros and cons after evaluating them and we followed the bricolage of prominent recurrent themes within them. While deciding product approaches one should have a systematic way to tackle the design of such products, a good option is the fish trap model.

09
Design Method: Fish Trap Model

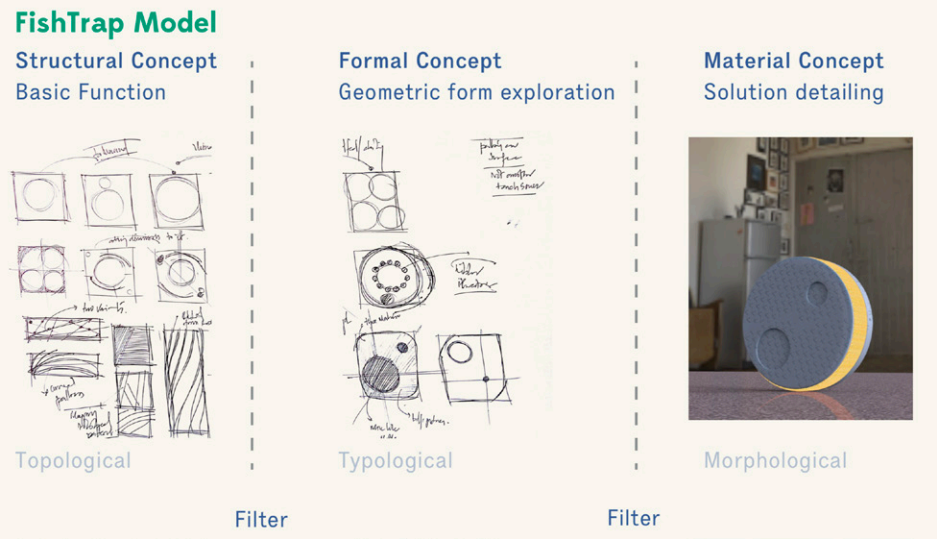


Figure 20: Fish Trap Model

The fish-trap model is a systematic process of designing a product form. The model was chosen as an experimental approach to help guide the product form by forcing the designer to explore alternatives on three subsequent levels of increasing detail and meaning [27]:

(1) Topological level
(2) Typological level
(3) Morphological level.

Following which the ideas are clustered based on a fixed notion of design expectation and they are looked at with the context of use in mind. It is generally good practise to narrow down the number of clusters and decide on a particular design typology that one would like to proceed with. This would be one of the converging stages of the fishtrap model. In this particular exploration, only two clusters were narrowed down.

Exploring alternatives on each of these levels yields three types of concepts:

9.1 Typological level: the formal concept

This stage is to generate geometric forms from the initial stage. Here, the design has no cap and explorations are not limited to existing constraints set by earlier process or general norms. A designer can adopt any inspiration he would need to direct his form exploration.

One of the above structural concepts are chosen to further develop them into more formal or geometric concepts.The selection of the structural concept

The entire process is iterative in nature and this is not the only exploration method, as design is subject using a systematic method helps us to quickly narrow down design ideas and avoid biases.

9.2 Topological level: the structural concept

We work out the basic block functions of the forms of the objects we design for. This is also a bare-bone design where all the component parts are laid out first and ideation happens around them.

The design components of the entire system should be listed and prepared, this helps guide the design exploration to stay within the expected deliverables/outcomes.The components are the bare minimum or the bare bone structure that is essential for the product. While we consider the technical limitations while designing the product, the components can also be hypothetical or in other cases a new feature or an attribute of the design. The design considerations of the early stages of the development in fig.21 showcases the ordering of the components based on their functional and structural properties. With the barebone components the design would lead to multiple variants of the same by articulating their relationship to the given space constraints. In fig.21, the basic components considered where the two sensors and the housing unit of the nodemcu board.

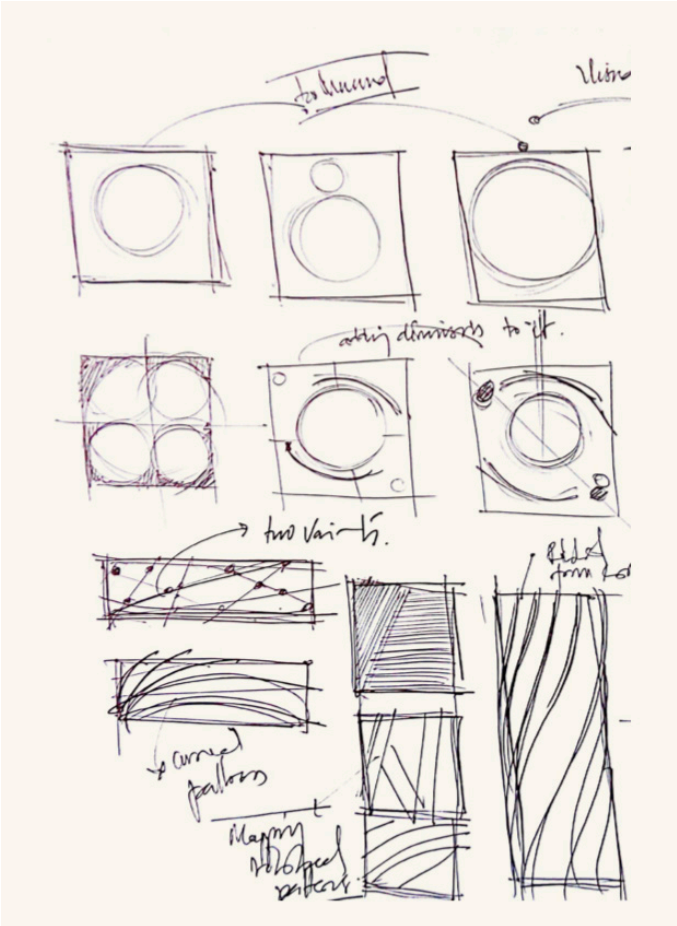


Figure 21: Structural concept

is not final, the designer goes through multiple iterations between the two stages of formal concept and structural concept. Since this stage revolves around the geometric form explorations this part should diverge and multiple ideas for a structural concept should be developed as this stage will eventually converge into defined product outcomes based on later technical constraints.

Exploration could be through a 3d modelling software or basic hand sketches for the same.At this point, the designer considers the emotion or the design aesthetics that he would want the product to evoke by being in its innate form. Following which the ideas are clustered and further refined to showcase a feature particular to the intended context of use. In my case, intended to provoke or evoke an emotion. This is further evaluated to see if the outcome of the intended interaction is delivered. If not, re-iteration around the same model of divergence and convergence takes place.

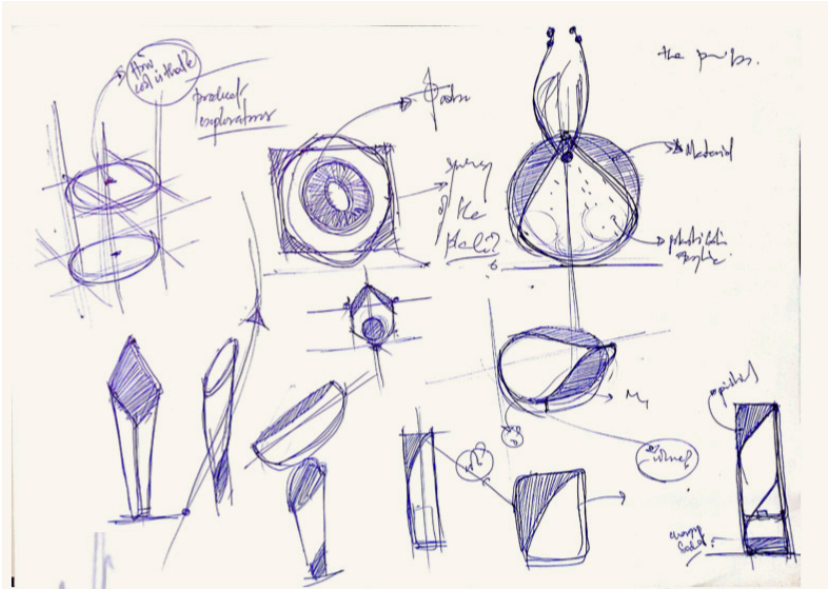


Figure 22: Two formal concepts

9.3 Morphological level: the material concept

The constraints are in place now and the convergent part of the design phase would occur here. The designer selects and develops detailed concepts and forms looking into multiple aspects of the design requirement.

This stage fits all the clustered pieces left after iterations where the design exploration of the same occurs at a more detailed level to seek solutions for the intended design outcomes. For this stage material properties as well texture of the same with respect to its context is explored to achieve a finished product concept. This is given out to get feedback from peers as well as the intended target users. Followed by the re iteration of the material concepts to seek out an efficient design outcome of the model.

This section helped us to decide the place of embodiment and evocation in a product. Through the systematic approach we understood that embodiment should be at a structural level while evocation is primarily through the topological level and we utilize the morphological level to add value and support the other levels as this is key in deciding ambiguity in meanings and provoking action. Following sections talk about thedesigned artefacts, their explaration of its materiality and details.

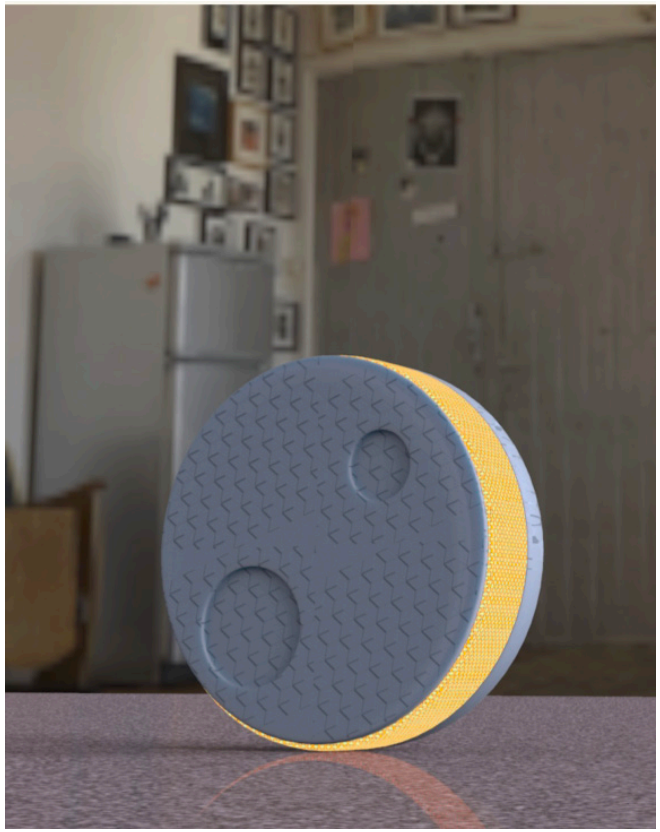


Figure 23: material concept

10
Design Artefact

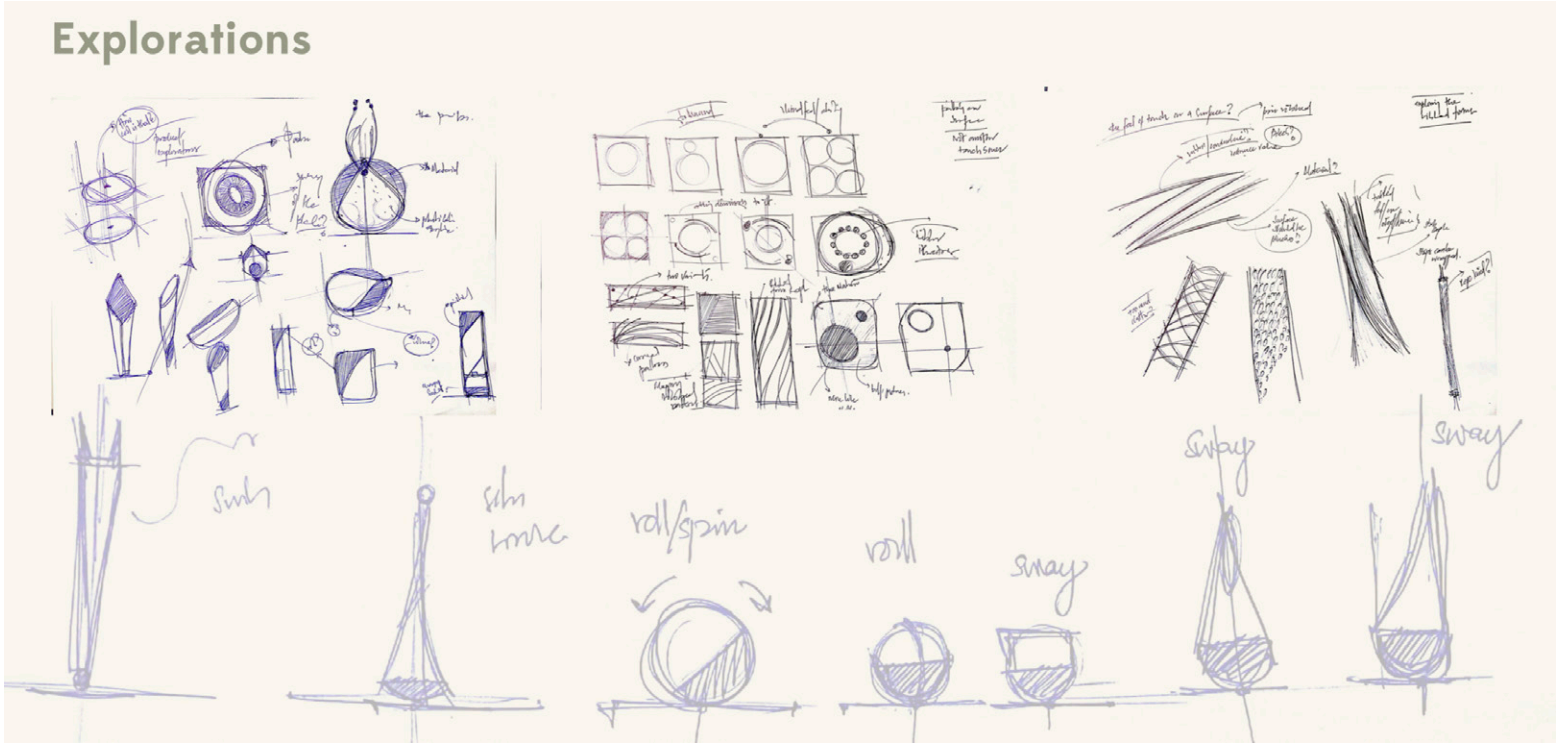


Figure 24: Design concept Explorations

Iterative cycles of discussions and brainstorming with people (using the wizard of oz) the final concept evolved was an object that people could use to express or communicate their pain. While other ideas were eliminated using the list of challenges identified in earlier sections, the

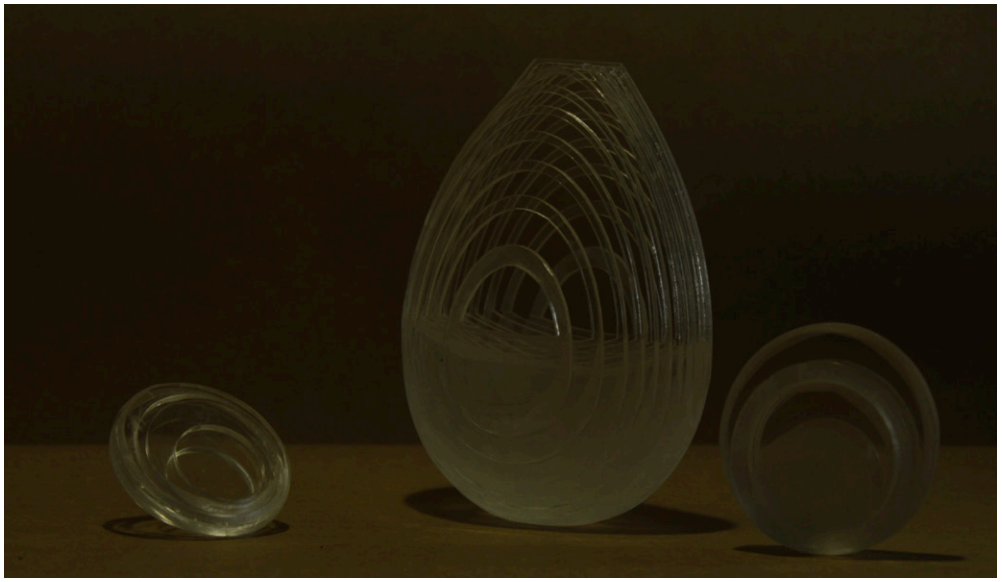
Figure 25: Design object Explorations

final concept is only a stage that multiple iterations would follow to improve existing features of the design.

The designed interactions would be uncanny as it puts these users in an unfamiliar environment where this unfamiliarity provokes and evokes intentions in them. In the design of such objects, the interaction here we explore is to evoke thought through the interaction of the medium and the object. This is extended to provoke action through the communication of the same between objects. The form, the material, the object properties are very crucial as they play a part of our daily interaction with these objects. These are essential aspects while designing for evocation and embodiment as they in turn will relate to the socio-cultural factors that encompass the environment in which we design them in. While being in the context of use these forms bring about interactions between objects that provoke thought. Failing to do so will lead to ambiguity between action and meaning.

While addressing the key challenges using evocative objects, the main factor to consider is the context of use. While this project is exploratory

Figure 26: Design concept



in nature, the context of use that this object would seek would be a person going through treatment for chronic pain related diseases and a caregiver or a relative of the user.

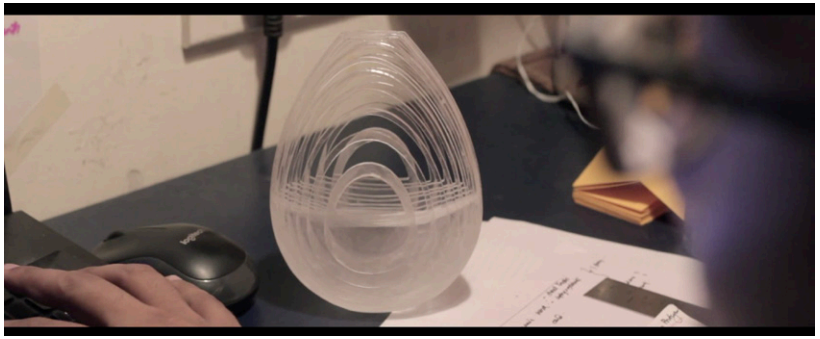
The final idea revolves around two challenges: first, to express chronic pain where the interaction is pliable through evocation and second, the possibility to communicate the same to a caregiver through embodiment.

In order to address the first challenge we start addressing the second. If an object is to be evocative, the object should communicate efficiently. This is possible only if the object is smart, one that relates and one that understands. While pain is subject in nature it is essential to self report pain. The treatment for the same is altered based on the progress of the medication; understood through the intensity of pain a patient would feel. Inability to report pain throughout the course of the treatment proves to be fatal. Thus, the object designed is to help the user report pain to the caregivers or loved ones and help them understand the progress.

The proposed final prototype is a device that communicates pain by collecting pain intensity data and mapping the same on a color scale. The data received helps caregivers and doctors or therapists address issues that persist.

10.2 Final Concept Video Narrative (Screenshots of the video story boarding)

The final concept was difficult to elaborate using mediums such as 3d modeling renders and sketches that depicted the intricacy of the relationship that these objects would hold in the environment and the context of their use. The video narrative was used as a medium to better capture the relationship that we would share with these objects and the meaning we would derive from them along with the action that it provokes. Earlier findings in the literature showcases an inherent need of patients that act in social situations according to goffman's theory, we put it to the test through this video narrative to seek insights on the reactions that people would have regarding these objects, their interactions and the levels of intimacy they would carry.



The video narrative talks about a user who's going through chronic pain. And brings up the what if? We had objects that can express myself to and inturn expresses itself to others.

10.3 Prototype Details/Design decisions

For the prototype, iot based board esp8266. The esp8266 wifi module gives any microcontroller access to your wifi network and the ws2812b addressable leds. The pressure input was based of a force sensor (force resistive sensor). An additional part that is integrated is the use of micro motors (micro vibrators).

Embodied interactions are properties of interaction (there might be other terminologies for the same), it is more related to the approach one would take while designing these properties.

While a users are interacting with the device there is no direct end indication of the scale or the intensity. Such problems give the user an unfamiliar approach to communicating their pain as they are unaware; is it really high or medium? While using the color scale to map out the intensity for visual cue to the user as colors tend to evoke a nostalgic meaning. Considerations on cognitive impairments are also considered. The embodied interaction that is narrowed down for this object is the use of micro vibrators that are relatively triggered based of the intensity of the pain coupled with the visual indicator. The question here is can the device resonate with the intensity an individual is feeling. As the animated device is triggered, do individuals react different intensity levels for the same? Vs. One that is plain?

> *"The key property essential for an embodied interaction, is the ability to take meaning from action." [22]*

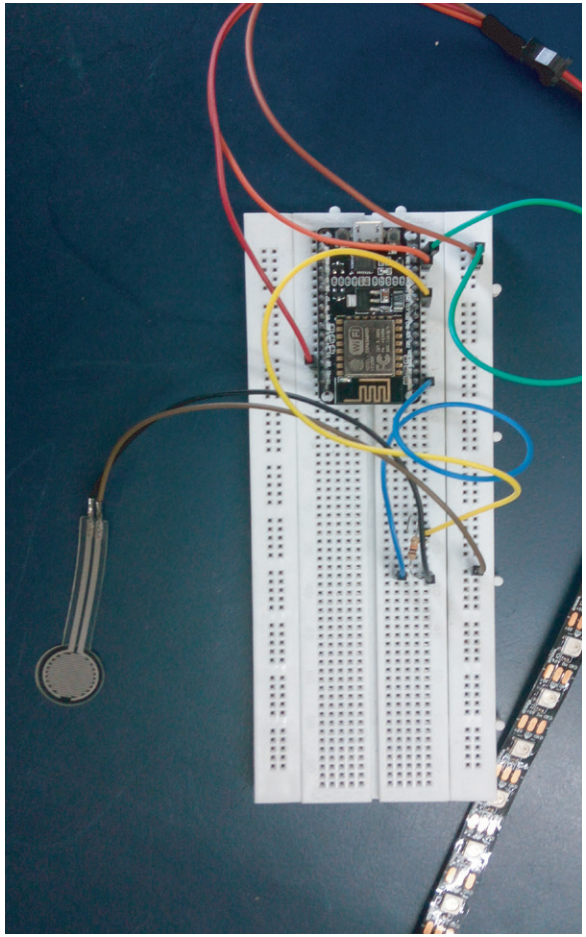
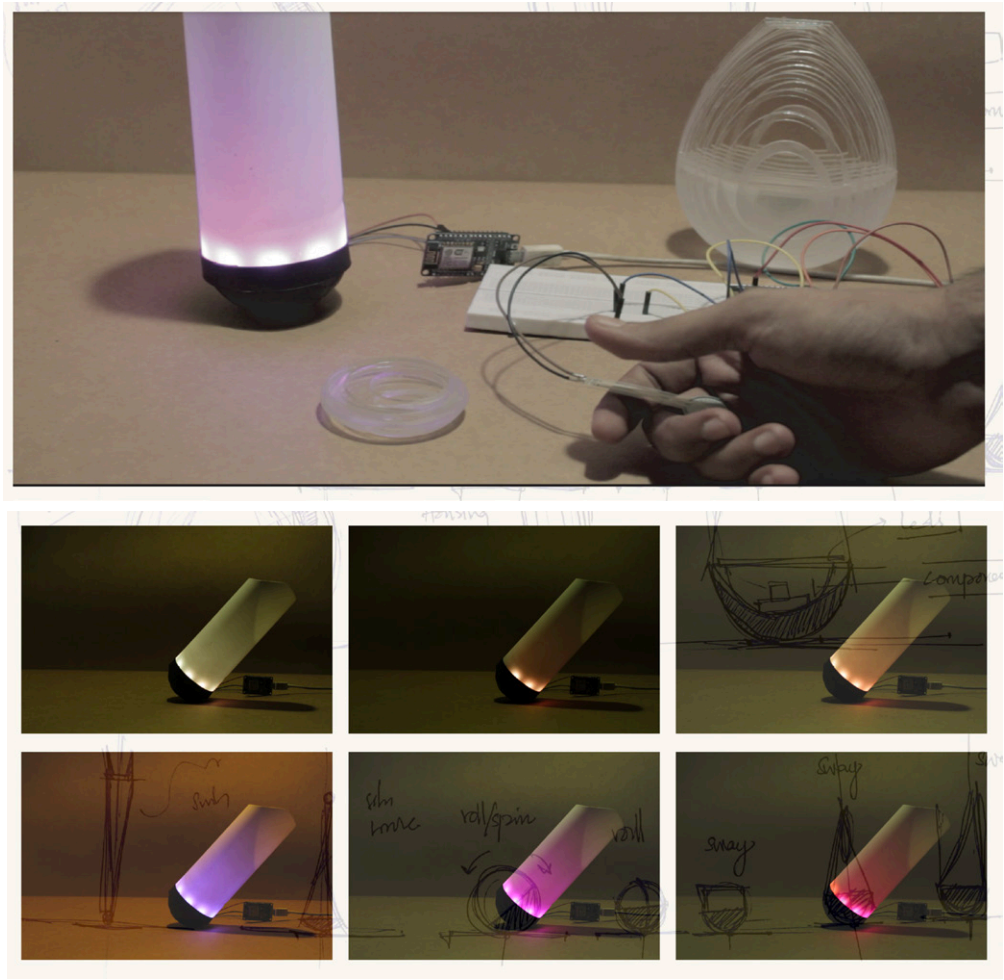


Figure 27: Design prototype details

The devices are meant for both the patient and the support group as a subtle indicator of the intensity of expression over a period of time. Here, the evocation and the embodied interaction is designed to trigger interactions between groups or users. Where they can rely on each other to communicate the same. These objects could offer a way to help a person express himself to the object and in turn the object translates that expression to other objects that are part of an individuals connected social support group. Later iterations of these objects resulted in more dynamic behaviour that draws one's attention in a more subtle way. In this the object showcased three states as being active (upright) and discomfort communicated through an off center position with varying gradient of colors to indicate intensity as seen in fig.28.The final stage is the subtle movement to showcase growing aversion or disinterest. Further probe into the designed artefacts as seen in section 10.4 is evaluated on certain aspects of the designed outcomes, found in section 11.

Figure 28: Prototype Final



10.3 Prototype Details

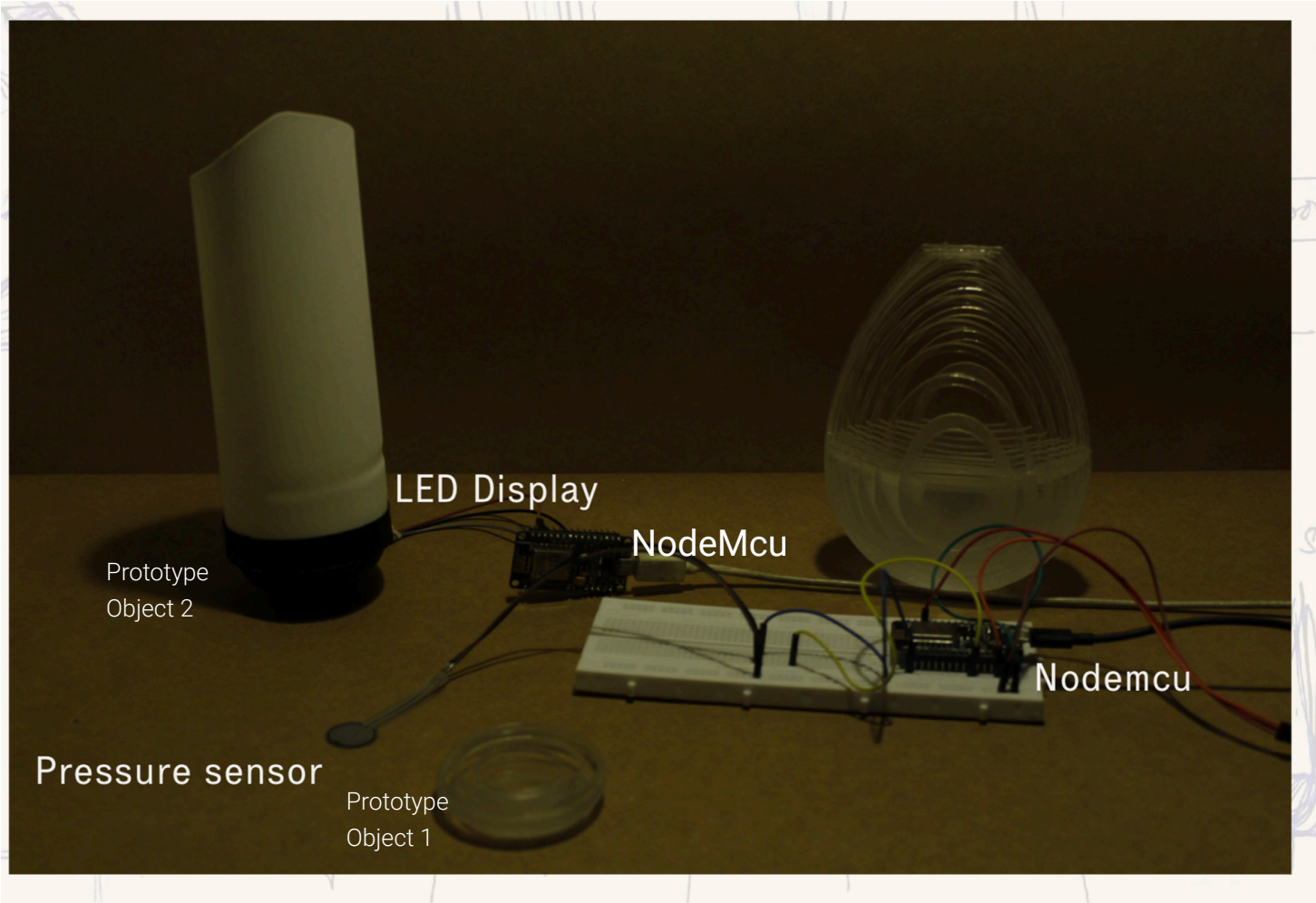
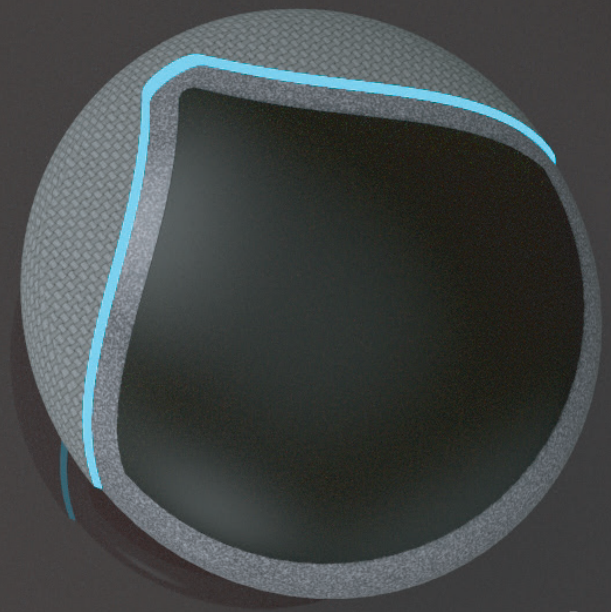


Figure 29: Prototype detail

10.4 Final Design Concept

Object one

The Embodided Interaction of this object animates itself when pressed. The Object Vibrates as if it resonates with your pain. Giving a user a sense of familiarity while reporting pain.

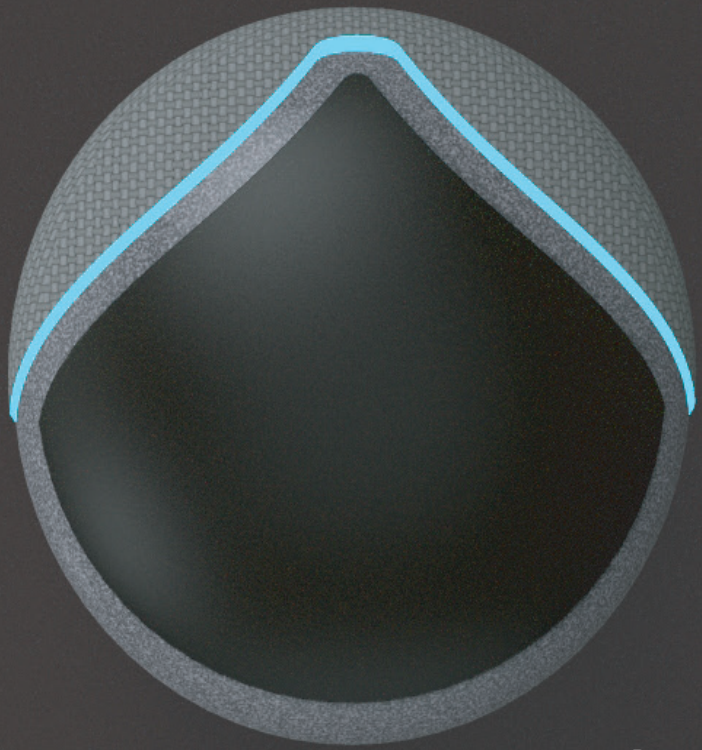


Prototype
Object 1

10.4 Final Design Concept

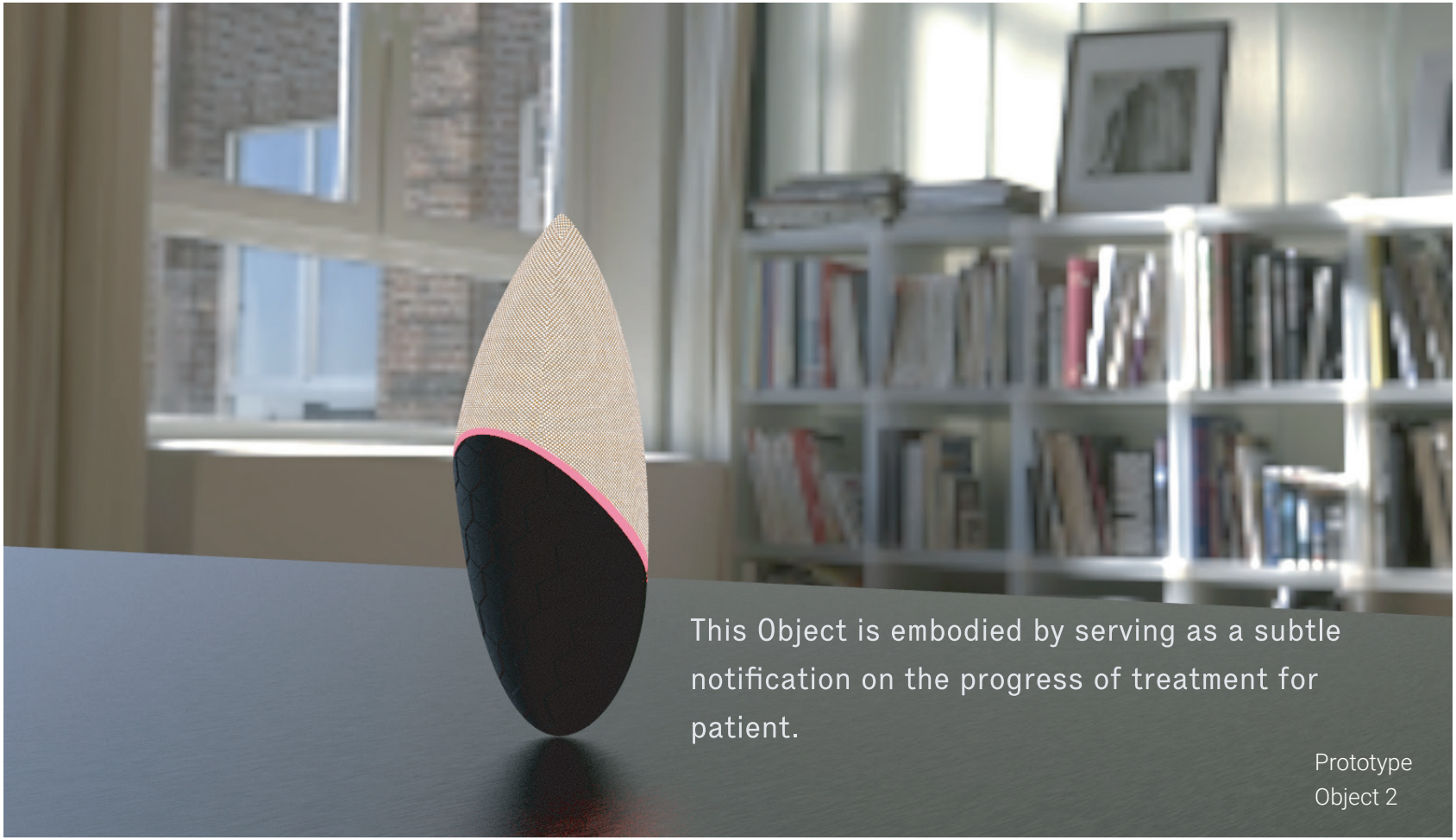
The LED Difusser is Mapped to the pain intensity input by the user.

1. Force Resistive sensor coupled with U-foam.
2. Housing Part, LED Diffuser , PCB and the Micro Vibrators.
3. Indicator LED Strip.

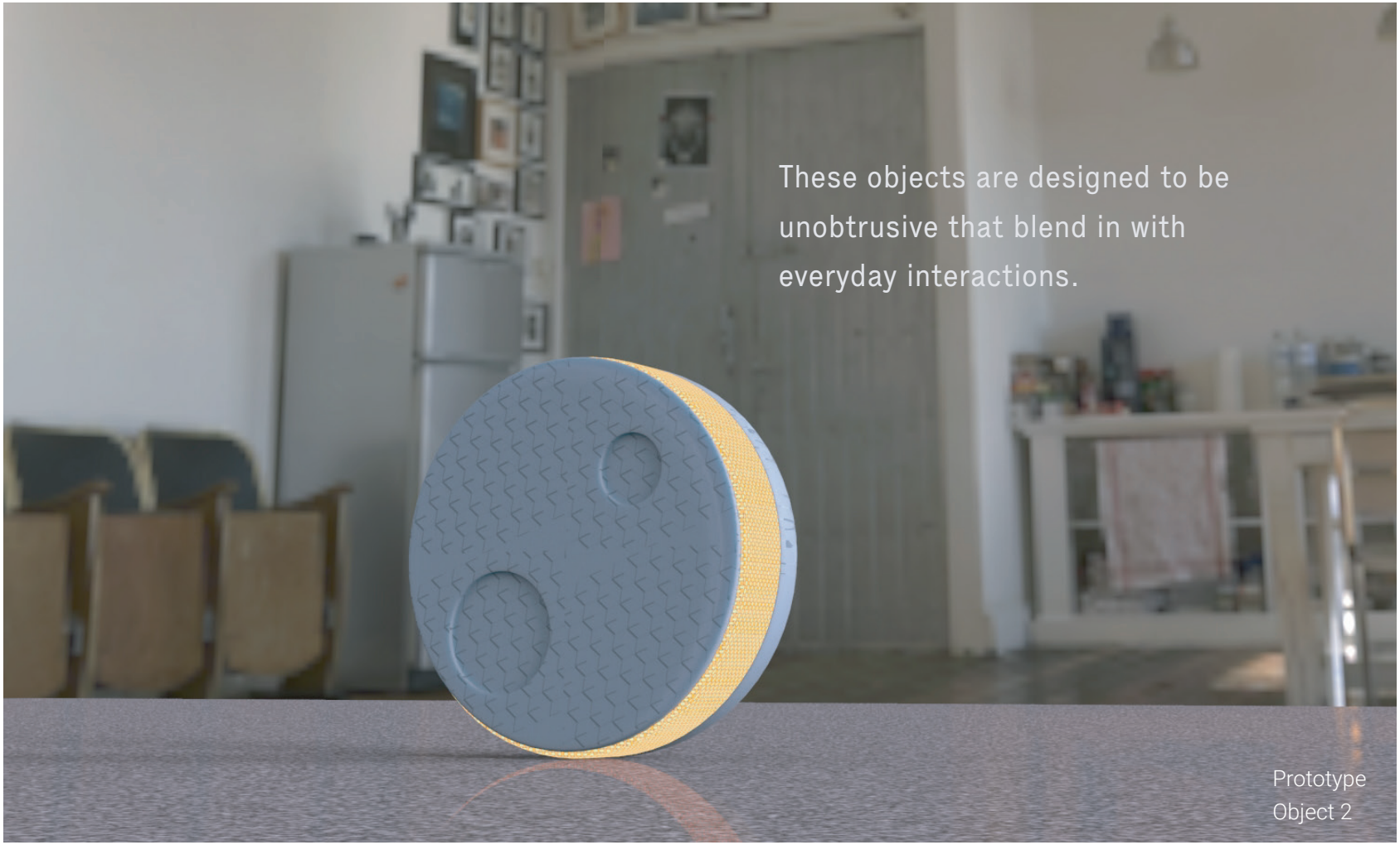


Prototype
Object 1

10.4 Final Design Concept



10.4 Final Design Concept



Prototype
Object 2

11
Evaluation

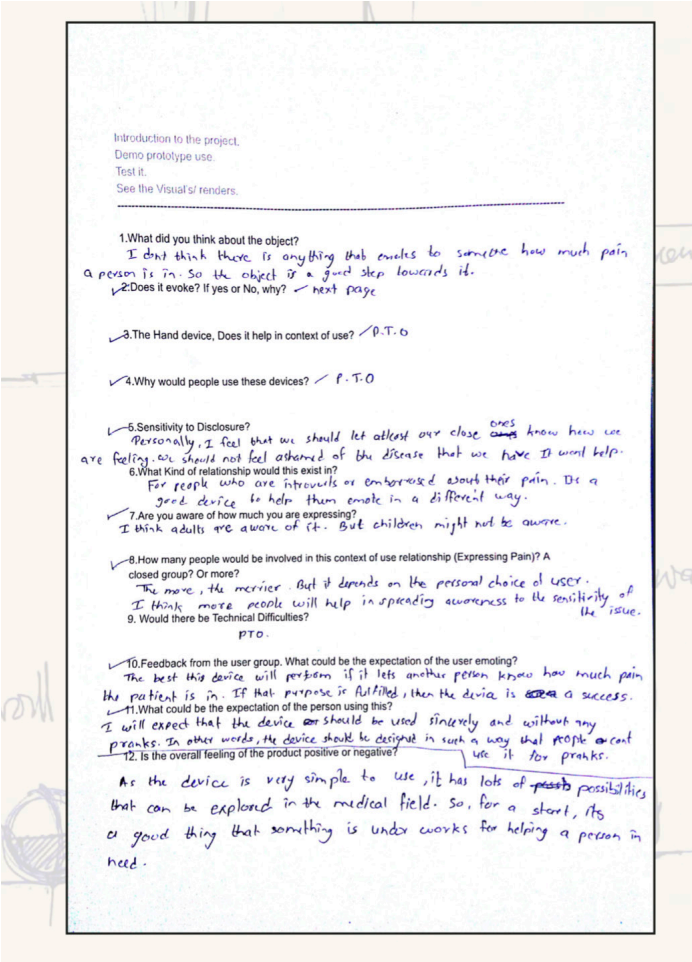
11.1 Evaluation: wizard of oz method

The purpose of this evaluation method was not to justify the use of these objects as substitutes for another, but to help us understand how people would respond to uncanny or unfamiliar interactions. This is structured by introducing them to the object and then we narrate an instance of its context of use. This is followed by observing them interact with these objects.
This seeks to answer the following key questions:

1. Do these objects become evocative?
2. What kind of relationship would they exist in?
3. Would there be recurrent use?

Method:

Used qualitative methodology for observation:
Each session lasted about 30 min (max.).
What kind type of information did we collect?
-Results regarding competency with the interface.
-Areas of concern regarding usability of possible interactive objects.
-Context of the use.
-Observations from post study interview.
-Followed by a short interview q&a session.



Introduction to the project.
Demo prototype use.
Test it.
See the Visual's/ renders.

1.What did you think about the object?
I don't think there is anything that enables to someone how much pain a person is in. So the object is a good step towards it.
2:Does it evoke? If yes or No, why? ✓ next page

3.The Hand device, Does it help in context of use? ✓ P.T.O

4.Why would people use these devices? ✓ P.T.O

5.Sensitivity to Disclosure?
Personally, I feel that we should let atleast our close ones know how we are feeling. We should not feel ashamed of the disease that we have It would help.
6.What Kind of relationship would this exist in?
For people who are introverts or embarrassed about their pain. It's a good device to help them emote in a different way.
7.Are you aware of how much you are expressing?
I think adults are aware of it. But children might not be aware.

8.How many people would be involved in this context of use relationship (Expressing Pain)? A closed group? Or more?
The more, the merrier But it depends on the personal choice of user. I think more people will help in spreading awareness to the sensitivity of the issue.
9. Would there be Technical Difficulties?
PTO.

10.Feedback from the user group. What could be the expectation of the user emoting?
The best this device will perform if it lets another person known how much pain the patient is in. If that purpose is fulfilled, then the device is a success.
11.What could be the expectation of the person using this?
I will expect that the device should be used sincerely and without any pranks. In other words, the device should be designed in such a way that people cant use it for pranks.
12. Is the overall feeling of the product positive or negative?
As the device is very simple to use, it has lots of possibilities that can be explored in the medical field. So, for a start, its a good thing that something is under works for helping a person in need.

Figure 30: Evaluation Sheet of a participant.

Participation
Participants chosen have encountered a close relationship with people living with chronic pain. The participants were randomized young adults, no of participants : 7
What are the constraints of this study?
They are given three or four scenarios that they would place themselves in and express their pain at different times of the day.

Design Artefact Probe
Applied semi-structured interviews with participant. To avoid biases of novelty, the participants interacted with different objects and the number of participants in each group are counterbalanced for better results.

Each interview had the following structure:

-The participants were introduced to the study.
-They are given a scene to enact and then they start describing the pain they feel. (The participant chooses an object or interface to report pain.)
-Before each object or interface is given, a short description is read.
-They interact with the objects at hand and observations are noted.
-Follow up questions about the interface that was semi-structured.
-The above steps are repeated for the other objects.

Participants are asked questions comparing the two objects they interacted with. Finally, followed up with end questions regarding the two questions that the study

11.2 Findings

1. Some participants found the novelty of the object "creepy" by serving as a subtle notification.
2. The objects are not evocative, due to the prototyping constraints.
3. Objects could be used in closed group relationships.
4. Participants did evoke empathy through these objects.
5. The lack of participation from their closed group would lead to less recurrent use.

This test was conducted with a small sample size of 7 users. A more large and diverse sample could lead to different outcomes.

The idea of uncanny as evocation did provoke thought through the users, but they did feel uneasy with these kind of interactions that are embodied within these objects. Unfamiliarity is an area that takes time to comprehend. Should this interaction be instantaneous that the users adapt within a short period of time? Or should they grow along with the object? Evocative objects evolve with time within their context of use, a longitudinal study might shed more light on this aspect. The recurrent use of these objects would fail if the participants from their closed group avoid interacting with them. This might provoke thought in these participants of the closed group to take up responsibility for the users or it would break the social support system. Designing these systems as a self sustaining would be difficult as active participation is need from both groups. But with the recent advancement in technology self support systems that use of artificial intelligence would turn to be a natural support system for these users. Limitations did occur due to the prototyping constraints as this could have been a major contributor to recognizing these objects as evocative mediums. The objects did evoke thought and provoke action through its interactions, but were they the meaning we intended to share? These are questions that future work in the field should answer .

11.3 Limitations

Chronic pain is subjective and the differences in their experiences can vary dramatically, as mentioned. A more diverse group of individuals would therefore be desirable (socio-cultural context). To probe further in this area, the designer must offer a range of mediums (for expressing pain) from which we understand choice and further evaluate their choices. This was an exploration into evocation through embodiment, while social factors and general stigma around the sensitivity of chronic pain will be difficult to tackle. This offers a new approach to chronic pain, to go beyond the screen and enrich patient interactions with these objects.

12
Conclusion

Evocative objects are designed to evoke thought and provoke action, but as a designer do we impose or design a particular thought? And can these thoughts or actions have ambiguity in the meaning that is communicated back to the user? The project exploration resulted in these new unfamiliar interactions that users did relate, as it did provoke thought and action. However, there were limitations in recognising these objects as an evocative object. This is primarily due to fact that, these objects evolve with time. In this short duration we did however find out key characteristics of these objects and the embodiment perspective a designer could take towards these objects.

We started this project as probe into these questions, can we design objects to evoke thought? Or even provoke action? What might the characteristics of these be? How do we design for evocation? And while looking at evocation through the issues of chronic pain, literature suggests the patients quality of life and social well-being is severely influenced by the same. We set out to explore new mediums for patients to express themself and in turn caregivers could comprehend the same. But, how do we understand the perception of people towards these objects or mediums? Approaching this through goffman's theatrical metaphor would help us better understand people and how they set themselves within their social setting. Later we realised the other areas of concern that surround evocation and embodiment through literature review.

Could these objects be used as a medium to better understand, communicate and express chronic pain? Evocation does offer us a perspective towards designing theses objects as there is a certain level of intensity and similarity that we share with them as they could show us a way to relate our connections to the world through them. Embodied interaction explores the possibility to unify the experience of the physical and tangible worlds to a new medium of interpretation that relates to our daily experiences with the objects around us. This offers us a perspective on the relationship between people, objects and systems they are part of. While we proceed to design these artefacts with the socio-cultural context in mind, it is essential to understand the local context of expressing pain. After the initial field observation, we begin to consider aspects or features these objects would have. The design decisions one can make that may help or prove to be inappropriate to the designed artefact by conducting a small probe into these artefacts.

Following which we gathered the observations from the initial probe and the literature study, a thematic analysis of the same resulted in the theme board; where ideas, problems and insights are further structured and sorted out to identify existing patterns and contexts of use. We identified challenges that are necessary to guide the design of these objects. This drives the project to look at interventions that

could meet a few, if not most of the situations by which a person could express his pain. Harris profile and the fish trap model was used to help structure the design prototype process where we identified the levels at which evocation and embodiment could be imparted into the design of these objects. After repeated iterations, the final designed objects address two areas. First, to express, where the interaction is pliable; through evocation and second, the possibility to communicate; through embodiment. A short video narrative was explored where it talks about a user who's going through chronic pain. And brings up the what if? We had objects that i can express myself to and in turn expresses itself to others. Later these objects were evaluated to seek further insights into whether these objects could evoke thought and provoke action.

This area is relatively unexplored and probes further into the possibilities these objects have in the interactions to the world around us. Exploring these unfamiliar or uncanny interactions would lead to new mediums or approaches that could help us enrich our existing interactions. This project does not seek to validate any of these findings but to serve as an exploration into the field of embodiment and evocation through interactive objects.

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Resources

Figure 1. https://static1.squarespace.com/
static/56843f7d40667a476247ba9f/5c08916070a6ad40348eb629/5c08916003ce6456d0c66858/1544065378498/Numeric-Pain-Scale.png?format=500w

Figure 2. https://whyy.org/wp-content/uploads/2017/07/painscale-768x432.jpg

Figure 3. https://mccoymccoy.com/app/uploads/2018/08/779951.jpg

Figure 4. https://cdn.paindoctor.com/wp-content/uploads/2017/02/color-scale-for-pain.png

Figure 5. https://www.healthnavigator.org.nz/media/3568/pain-diary-catch-my-pain-screenshots.jpg

Figure 6. https://is4-ssl.mzstatic.com/image/thumb/Purple122/v4/88/b1/98/88b19804-5bfb-7034-a2cb-bb66524d08ba/mzl.xcfmwkcu.png/750x750bb.jpeg
Figure 7. https://www.painscale.com/assets/img/home/report-ipad-desktop@2x.jpg

Figure 8. http://a360-wp-uploads.s3.amazonaws.com/wp-content/uploads/ptproduc/2018/11/ManagingLife-466x350.jpg

Figure 9. https://www.catchmypain.com/catchmypain-for-professionals/

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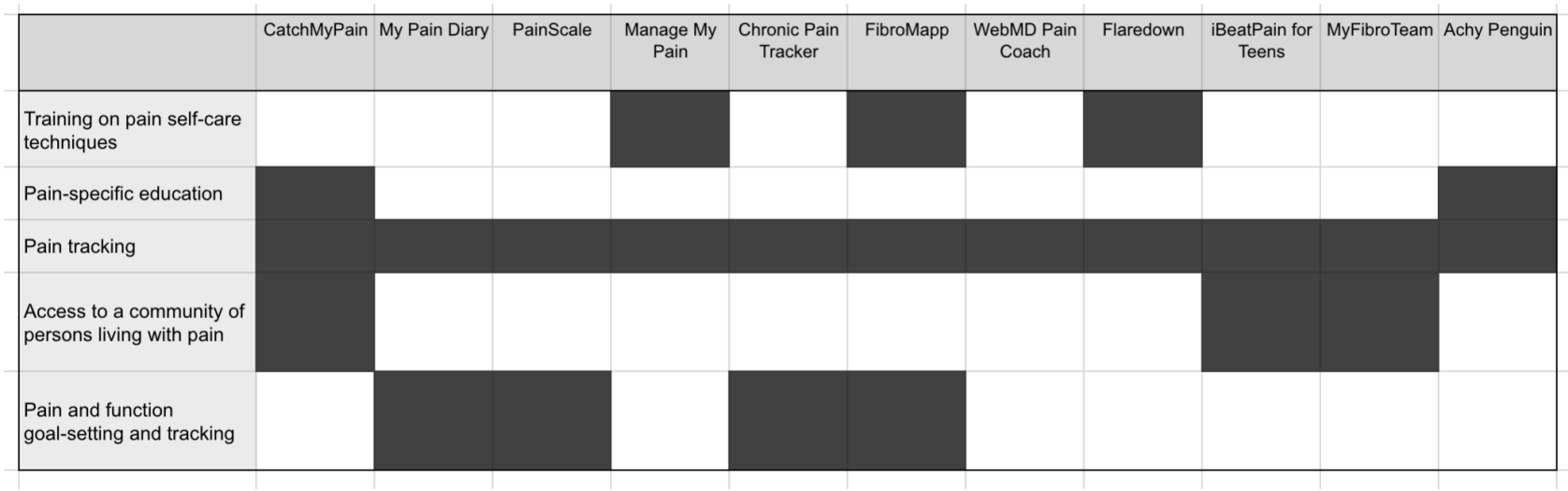
Appendix A



	CatchMyPain	My Pain Diary	PainScale	Manage My Pain	Chronic Pain Tracker	FibroMapp	WebMD Pain Coach	Flaredown	iBeatPain for Teens	MyFibroTeam	Achy Penguin
Training on pain self-care techniques				■		■		■			
Pain-specific education	■										■
Pain tracking	■	■	■	■	■	■	■	■	■	■	■
Access to a community of persons living with pain	■								■	■	
Pain and function goal-setting and tracking		■	■		■	■					

The Dark Fill Indicates the presence of the features listed above in that application and Light/No fill Indicates absence of the same.

Pain Management Applications short study considering the following:

-Chronic Pain Education/Tips and skills
-Monitoring system for Pain/treatment
-Patient Goals
-Soliciting Social Support groups