Designing Tangible Interaction Methods for Digital News Management

An object-based media approach to modern journalism through design research, user experience and prototyping

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Academic Year 2018/2019

ACKNOWLEDGMENTS

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Master of Science Thesis in the Master Degree Design&Engineering
Tesi di Laurea Magistrale di Progetto e Ingegnerizzazione del Prodotto Industriale

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Milan, Italy, 6 June 2020

ABSTRACT

(EN)

This master thesis explores how user-centered approach to journalism can be used to design screen-free products for creating new engagement methods for news audiences and how digital news can be deconstructed to enable object-based tangible interaction. As the increasing digitalization of news media enables a more democratic distribution of information through fast and cheap online platforms, the amount of digital content becomes overwhelming to navigate through using the traditional screen-based interaction methods. Thus, the aim of the research is to better equip news audiences with tools for navigating large volumes of instant and constantly updated news media. The research starts with an extensive study of news in digitalization context and its cognitive consequences on the user. Subsequently,product case studies and user survey methods are used to construct the design brief. Through prototyping and simultaneous user testing, various versions of the design concept has been developed along with a final product design. The outcome is a physical device that enables users to pre-select the source and amount of news they will receive on their news access tools (e.g. Smartphone, tablet, PC). The device offers a tangible interaction to manage digital contents in a more engaging way. This solution, here designed for news feed, might apply as well to other digital contents.

(IT)

Questa tesi di laurea esplora con approccio di user centred-design il tema dell' interazione con le notizie digitali attraverso l'utilizzo di prodotti senza schermo. Lo scopo è creare nuovi metodi di coinvolgimento per il pubblico nella fruizione delle notizie digitali e su come esse possano essere decostruite e integrate per consentire l'interazione tangibile basata sugli oggetti. Data la crescente digitalizzazione dei mezzi di informazione attraverso piattaforme online, la quantità di informazioni è di conseguenza aumentata e difficile da selezionare. Pertanto, lo scopo della ricerca è quello di fornire all'utente degli strumenti semplificati per navigare attraverso una grande quantità di informazioni costantemente aggiornata. La ricerca inizia con un ampio studio sulla digitalizzazione delle notizie e delle sue conseguenze cognitive sull'utente. Successivamente, vengono utilizzati casi studio con lo scopo di sviluppare il brief di progettazione. Attraverso la prototipazione e il verifica simultanea del prodotto da parte dell'utente, sono state sviluppate varie versioni che hanno contribuito al design del prodotto finale. Il risultato è un dispositivo fisico che consente agli utenti di preselezionare la fonte e la quantità di notizie che l'utente riceverà sul proprio device (ad es. Smartphone, tablet, PC). Il dispositivo offre un'interazione tangibile per gestire i contenuti digitali in un modo più coinvolgente. Questa soluzione, qui progettata per la selezione di notizie, potrebbe essere applicata anche ad altri contenuti digitali.

Keywords: Interaction Design, Journalism, Design Research, Object-based Media, HCI

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INTRODUCTION

The news is an integral part of daily modern life, as it provides the fundamental facts about a recently happening or happened event(s) (Campbell & Kwak, 2010). This information effects the decisions we make everyday, which can be simple as deciding to take an umbrella before going out or it can be more complicated such as taking a political side of a social discussion effecting the future of the living environment. Thus, the definition for news is a very broad term and it is difficult to come up with a single definition as the interest and preferences of each person differs from another, and also from context to context. Nonetheless, the fundamental conditions for an information to be considered as newsworthy are defined for the purpose of this research paper as: "being new" indicating its recentness, "being accessible" indicating its reachability by the public and "being relevant" to the news audience.

Traditional news media have been informing the public for decades and enriching democratic citizenship (Graber & Dunaway, 2017). The ever-growing use of digital platforms for accessing news, has been changing the traditional ways of news consumption among society. Internet has drastically changed not only the amount and speed of information that can be accessible by an ordinary citizen, but it also created private and public many-to-many communication channels. Nowadays, news are more accessible to greater part of the world and instantly dissipated online. The increase in news accessibility is directly connected to uninterrupted online connection provided through mobile connected devices, and the abundance of online information sources (Schmitt, Debbelt, and Schneider 2018). In a sense, it can be said that news engagement became more democratized and participatory allowing greater parts of the population, especially the ones that have been undervalued or oppressed by authorities for many centuries, to join in the political decision-making process (Boulianne 2015). Especially, the civil obedience acts and organized protests of the past decade, couldn't have happened without the instantaneous distribution of news to unlimited number of people and accessibility opportunities provided by the online services based on connected products.

Arab Spring is the first and the one of the biggest examples how the new journalism dynamics, tools and structure can influence the public in massive scales. Smartphones made an undeniable effect on the coverage of the 2011 Mideast-wide Arab Spring revolutions.

MASSIVE RISE IN NEWS ENGAGEMENT
News readers are not only passive consumers, they are becoming their own editor and publisher.

2018

2019

49

28 **The Disengaged**
Consume news less than weekly

24

26 **Consumers**
Consume news about weekly or more

26

40 **Amplifiers**
Consume news about weekly or more AND share or post content several times a month or more
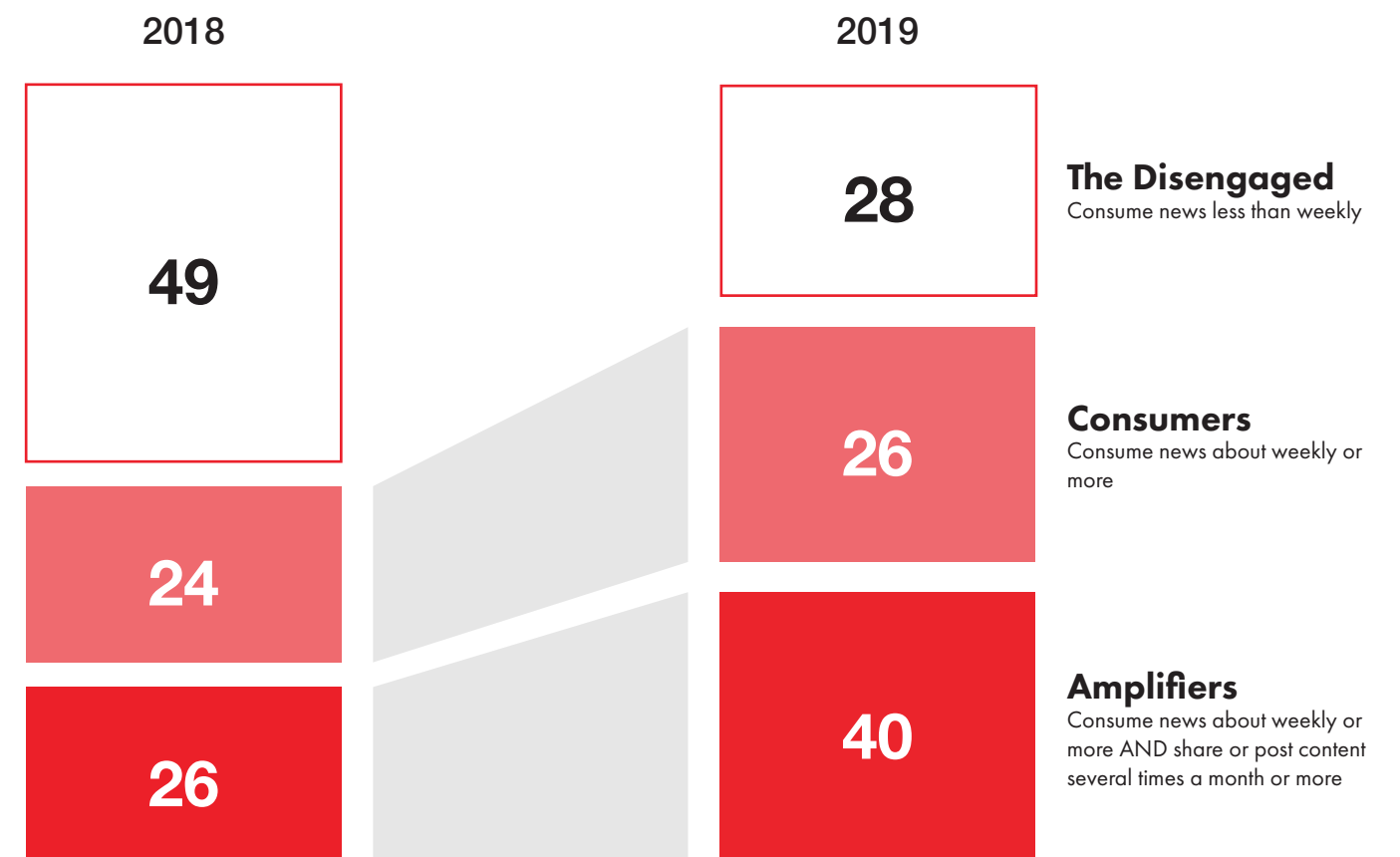
Fig 0.1: How often do you engage in the following activities related to news and information? (Edelman Trust 2019)

What happens when there is too much news?

Although, the high distribution speed and ever-growing news information availability provided advantages on a societal level, their effect on personal level is not so clear. The continuous influx of news from numerous connected devices (smartphone, PC, tablet,…) and Online information sources (Search engines, social networking services,….) are triggering a sense of overwhelm in news consumers which potentially can lead to negative psychological and emotional consequences (Lee and Kim 2016). This situation is conceptualized as "news overload", when the consumers are surrounded with large amount of news information that overcomes their mental processing capacity. Which results in decreased cognitive ability to fully understand the whole news context, weaken their decision-making capabilities. Just to give an example for comparing how the news information availability changed during the last centuries, the quantity of information available on a single Sunday issue of New York Times, is larger that of an average 17th century reader faced during their lifespan (Wurman 1989). According to the latest Reuters Digital News Report, around the globe almost one third of the population (%32) is actively trying to avoid news. This ratio is higher in countries with already existing political, economic or social turmoil (Newman et al. 2019).

The concept of News Overload has already started being a popular new research field in the scientific literature. However, as it will be explained in the latter parts, most of the research done on the topic is based on the organizational aspects of information management and communication areas. Moreover, they offer statistical results about the phenomena. Since the digital information is communicated to the users through physical products, such as a smartphone or a Laptop, a perspective from product design could provide alternative communication possibilities instead of the alphanumeric language based on digital screens.

The main research question of this thesis is:

How can users navigate large volumes of instant and constantly updated digital news information through a physical product interaction?

This research thesis consists of three main parts:

The first chapter, Understanding the Problem, explains Digital News in a user-product context and News Overload from scientific perspective.

The second chapter, Design Research, brings together the results of User Habit Survey and Communicative Product Analysis.

The third chapter, Design&Test, sets out the characteristics of the physical interaction solution along with simultaneous prototyping and user testing processes.

The fourth chapter, Conclusion, synthesizes the outcomes of research.

This Master Thesis has an interdisciplinary structure as it combines various fields from Design, Engineering and Humanities in order to research a multi-level problem from all its relevant perspectives.

RESEARCH METHODOLOGY

The research methodology of this thesis is divided into three parts and carried out from both product and user perspective separately. Product perspective represents all the tools and platforms that are used for engaging with digital news. The user perspective represent the relation of user with digital news in terms of information, daily habits and use experiences.

First part of the research is carried out as a literature review for understanding digital news and the notion of news overload. This part provided the factual qualitative and quantitative data for constructing the problem statement and organizing the research methodology.

Second part of the research is divided into two methods: analyzing products that communicates digital information without using verbal language of digital screens and understanding user engagement habits of news audiences. The organization and construction of case studies are inspired from the sensory mapping methods of the research "Dynamic Products: Shaping Information to Engage and Persuade" by Sara Colombo (Colombo 2016). However, the scope of this thesis regards a specific type of information, the news. Therefore, unique case study models are designed for the purpose of for constructing the information flow of news from digital sphere into the physical world.

Third part of the research consists of the experimental data that has been generated by prototyping and user testing for designing a final version of the concept derived from the design brief. The iterative design process based on user feedback resulted in a final product design.

Fig 0.2: The flow of research methodology
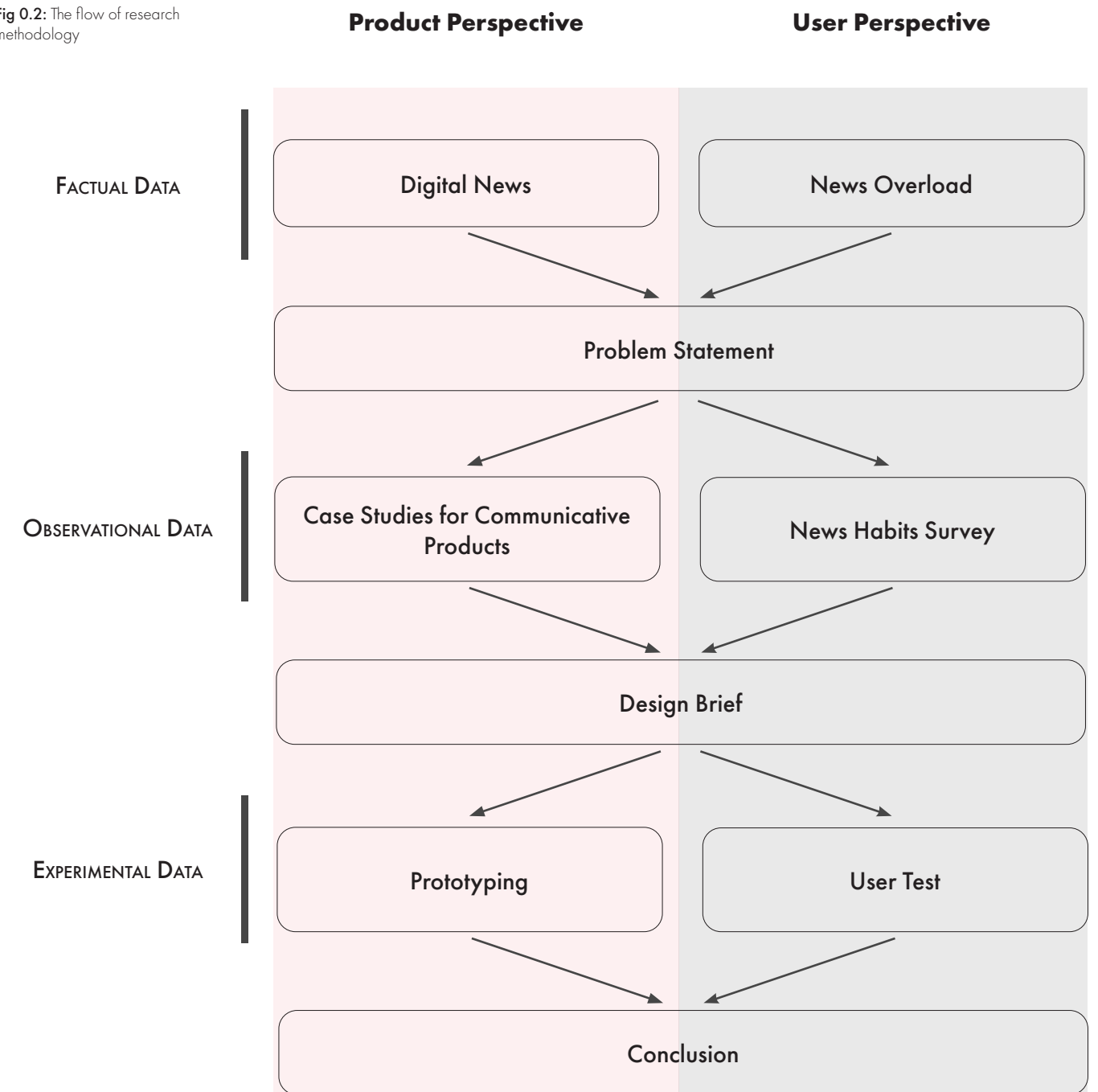
Chapter 1 /
Understanding the Problem

1/Description of Phenomena:
The news in the Internet Age

The role of traditional journalism is under a great change and the conventional journalistic values are becoming irrelevant to the digital news. Not only disruptive technologies are offering great deal of innovative news engagement methods, but also through the connected products users are becoming directly influential in their own news filtration, creation and distribution processes. From print to radio, TV, PC and mobile, news media have led media transitions in the past 100 years by helping to provide the content that attracted audiences to each channel. As we rapidly move toward a mobile-first internet, there's been a corresponding shift in where and how people consume the news. This part of the design research will discuss how digital news engagement is changing through the investigation of changing news sources, changing news products, changing news habits.

1.1/ News through time

News is something that is new or current, and it must mean something to people. News is what people want to know about or need to know about. Gathering and conveying information is the heart of journalism, which has existed since almost the beginning of time. (Arte n.d.) In antiquity, town criers announced the news in square of large cities. The ancestor of newspapers appeared in the Roman Empire: handwritten pages appeared in posted in public spaces, mainly featuring political decisions. Things accelerated with the invention of printing press. The first weekly newspaper was created in England in the early 16th century. But it was only in the late 1800s, during the industrial era, that newspaper become democratic. In the early 20th century transformed the profession conveying information in real time. Filmed coverage came just before The World War 1. For a long time, it was not seen at home but in cinemas. The latest technological progress is the Internet, which grants access to the news everywhere, all the time. News had been distributed comparatively slow before the Broadcasting era of journalism due to the transportation need of the physical newspaper from the printing press to the shops and to the final reader finally. Whereas, broadcasting allowed instantaneous distribution of news from a single source to millions of TVs and Radios on a both global and local scale.

News Reach   Speed of distribution

Pre-Industrial

59 B.C
Acta Diurna, a gazette published daily at Rome by the authority of the government during the later times of the republic, and under the empire, corresponding in some measure to our newspapers

Printing Press

1639
Di Genoa is the first published Italian newspaper, issued weekly on Fridays with information about political and military of Italy and foreign countries. Its oldest issue is still preserved

Newspaper
Book
Magazines

1831
The first newspaper that is in fully Turkish language was Takvim-i Vekayi, which means "the calender of the facts".

Broadcasting

1920
First radio news broadcasting took place in Michigan,USA.
Radio has been the most influential news communication tool for decades , since it was the first mass broadcasting tool for informing the public instantly.

Radio
TV

1940
The National Broadcasting Company (NBC) broadcasted the first-ever regularly scheduled news program in New York, USA. From then on, TV became the primary product for getting the news among society.

Internet

+

1995
CNN has launched its first news website, which has been followed by many other news agencies around the world, such as La Reppublica and BBC News on 1997.

Smartphone
PC
Tablet

2010
Flipboard has been released as one of the first personal news application allowing readers to create their own customized digital newsstand. It can also notify the user in case there is a new information based on their preferences. Although it is primarily designed for phones and tablets, it is also accessible on PC.

Fig 1.1: Representational News Distribution and Access Timeline through time

However, a news TV or Radio show still needs be produced, prepared and handled by the professional journalists, which takes time and requires planning. Also there is a limited number of places available for news stations or channels on the broadcasting network, which requires regular payments and permission from the authorities. Thus, through the broadcasting technology news are provided to the audiences based on a schedule prepared by the channel, which is also common among others in order to establish a universal news habit. A great example is the daily evening news, presented by the head-commentator of the channel at the same time everyday, which doesn't only provide the factual information of the news but it also engages audiences emotionally based on the personality, subjective comments and gestures of the host. Here, the news presenter plays a great role by positioning itself between the audiences and professional journalistic practice.

However, a new type of journalistic media content has born with the Internet, which does not require any intermediary or time-taking production processes. It is called the Digital News, providing unlimited speed of distribution and news audience.

1.2/ Digital news

The Internet has transformed journalism not only through increased speed of distribution but also it lifted the time-taking and costly requirements of professional journalism. The Digital News can be accessed continuously from a variety of platforms, and also can be edited by the news agencies without undergoing costly and time-taking production processes. Digital news is the latest form of journalism, where the content is provided to the readers via the Internet, as opposed to the conventional mass broadcasting tools of printing, Radio or TV. The news content is communicated through a combination of media formats including text, audio, video or innovative forms like interactive data visualizations (Franklin 2013).

According to the latest Reuters Institute's Digital News Report, based on a survey including more than 75.000 participants from 38 different countries, the use of Internet as a source for news has expanded to almost all of the population (82%) surpassing the conventional News Sources that has been used for decades such as Radio, Print and TV (Newman et al. 2019). The use of Digital News is inversely proportional with the age, as younger generations (86% for 18-34) tend to prefer Digital News over the conventional broadcasting news sources, compared the older generations. Nevertheless, even the oldest generations (55+) are actively using the Internet for news with a ratio of 77%.

Fig 1.2: News access methods in Europe. (Newman et al. 2019)
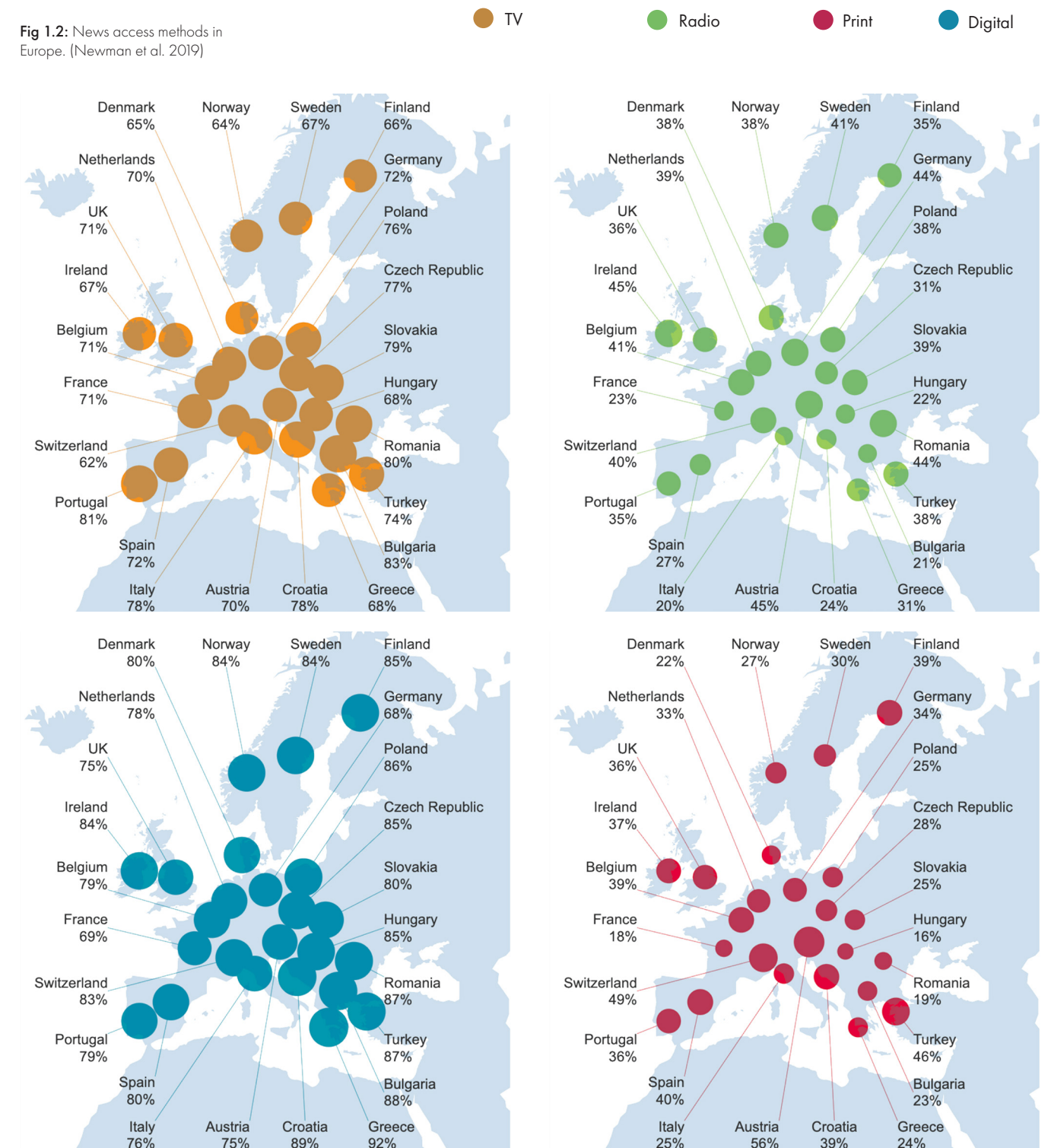
The Digital News has been growing throughout the globe unevenly, with some countries having higher digital news penetration than others. This is mainly due to the changing cultural, political, economic or social dynamics from one country to the another. As trust towards conventional media decreases in a country, due to censorship applied by governments or biased approach of mass media corporations, the use of digital news increases allowing the creation of unrestricted communication channels. An example can be drawn by comparing the digital news penetration between two countries: Germany (68%) and Turkey (87%). According to the World Press Freedom Index, Germany is ranked 13th among other 180 countries making it one of the freest, whereas Turkey ranks at the 157th position (Newman et al. 2019).

1.3/ Digital News Products

Digital News Products are the physical tools that enable users to interact with the Online journalistic content. The change of news access platforms has been one of the most physically visible transformation in the field of journalism. It is significant that, not only there is a shift from conventional paper-based news platforms (such as newspaper, magazines, ... etc.) to digital platforms, but also there is a shift from the static devices to mobile ones. The main physical products, that communicates digital news information, can be listed as: Personal Computers, Smartphone and Tablet. However, it should be noted that those products not only used for digital news, they are also used for accessing all available information on the Internet and used for many other computational purposes. They both differ in size and the way of interacting with the digital world, leading to two different product use patterns, active and passive. **Active** news access happens when the news audiences consciously seeks for a news information during an allocated time. Whereas, **passive** news access depends on the push notifications, that provides an omnipresent ambient information delivery (OFCOM 2018).

1.3.1 Personal Computers

Personal Computers or specifically their portable counterparts, Laptops, have become the indispensable and omni-present tool of our daily lives throughout the last decades. Even before the dissemination of Internet to the larger part of the population, computers were being used to undertake various computational tasks from highly sophisticated mathematical calculations to the modeling of physical phenomena. Even though the size of an ordinary computer drastically shrank from the its antecedents, it still has the same design elements: a screen used as an interface for visualization, a keyboard and a mouse used for interacting with the processing. This is mainly that computers were not primarily designed to communicate digital information, rather they were designed as processing tools.

Accessing the news through computers or tablets was often more purpose-driven (e.g. for school or university studies), or out of necessity (e.g. because phones weren't socially acceptable at work).

1.3.2 Tablets

A tablet, shortened from tablet computer, is a handheld device fitted with a display touchscreen, fitted with or without a cellular connection. Tablets allow one to do many the same things that a conventional computer does. It is able to browse the internet, link to social network applications and view HD videos. They are intermediary tools between PC and Smartphones. On one hand, the size of their screen is more similar to a PC screen. On the other hand, the interaction happens through the touch screen just like a smartphone.

1.3.3 Smartphones

A smartphone is a mobile phone allowing one to do much more than making phone calls and sending text messages. Smartphones can surf the Internet and run computer-like software programs. Smartphones use a touch-screen to communicate with users. There are plenty of smartphone apps that can all run on the phone, including sports, personal-use programs and business-use applications. Smartphone app design and development promotes passive news consumption, favoring scrolling, swiping, and viewing habits rather than constructive search and discovery. Some even argue that the smartphone could prove to be the most significant breakthrough for journalism since satellite uplinks were created, since they are not used only as a tool for engaging with news, but also as for all type of digital information.

● Interested in news   ● All

| Any device | Mobile | PC / Laptop | Tablet |
| 92% / 84% | 76% / 67% | 58% / 47% | 20% / 15% |
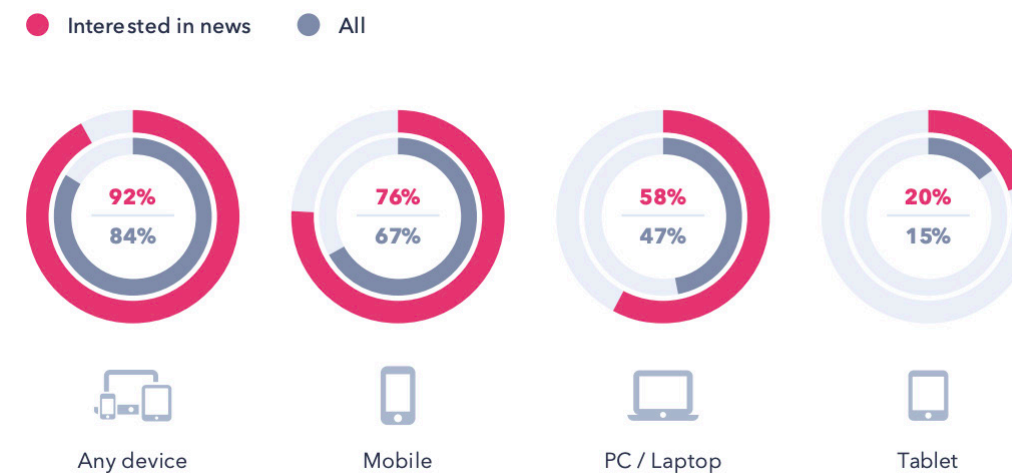
Fig 1.3: Reading the news Online, % who encountered news content online, by device
(Nisa and Paisley 2019)

Although smartphones are the most used product for news access, people tend to use also other devices, they need something more than one solution to choose the way to read news in the most convenient way.

1.4/ Digital News Sources

Traditionally, news has been an information that one received passively or browsed for. One might read over a newspaper and pause on articles that were important or listen to the evening news on the radio or television learning the shared stories, but without any influence over what was transmitted. The Internet has brought many new ways of finding information in the press. People can now search the news on a news website or portal, similar to a newspaper browser. But via social media posts, site search, email links, and other online outlets like Reddit, YouTube, or Wikipedia, they can also get to articles too (Bentley et al. 2019). In the figure below, the generational news source preference is found to be changing across different generations. Especially among younger generations, it is observed that the main sources for getting daily news is shifting from official news agencies to social media (Nadel and Goldstein 2018). There are a range of sources and platforms for consuming digital news, including social media, news aggregators or other news-specific apps and website, but the "newsfeed" format was present across almost all. Newsfeed is a continuous stream of news, which is generally navigated by scrolling through the web interface enabling user to explore.
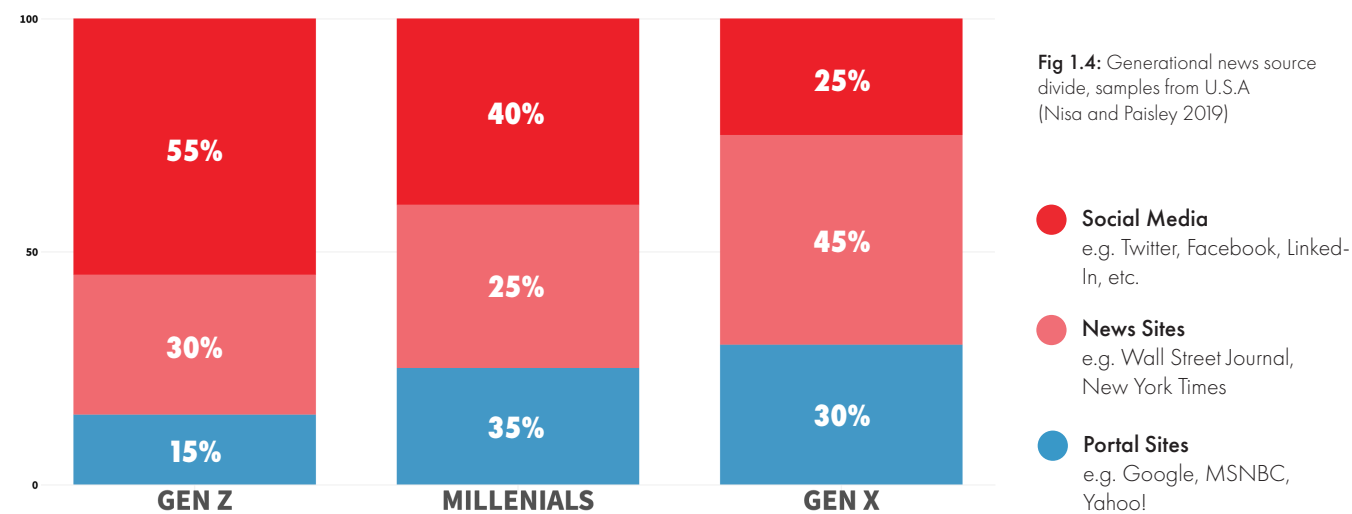
This type of news delivery often makes evaluating and understanding news content difficult, since news become more and more indistinguishable from other non-news content such as social media.

1.4.1 News Websites
News Websites are the online versions of a physical newspaper, which are graphically designed to look like an actual newspaper. They are generally used to take dedicated time to read news, skim the homepage for an update or in an intercept moment when a link is shared.

+Pros: All there in one spot, variety of formats, long-form articles, short summaries of the day, images, explainers and expanders, videos at the top of article for being shared on social media.
-Cons: Website UX or adverts that disrupt seamless online experience, laptop/PC experience often interrupted by other media

1.4.2 News Applications
News Applications are mobile news access softwares of the official news agencies. As opposed to the News Aggregators, they are single sourced news sources. They are easy to use, giving the feeling of timeline and provide daily/weekly summaries. However, the interface is mimics the layout of the physical news paper, which is difficult to navigate with available tools.

+Pros: Credible source of news information through push notifications, subscription for synchronizing among digital platforms.
-Cons: High number of applications, UX quality varies according to the news source finances.

1.4.3 News Aggregators
News Aggregators are web applications that give users efficient access to a breadth of news from wide range of sources. Users can actively curate and access the news they are most interested in from the sources they want or passively get notified for keeping up to date with news. However, the diversity of the available news content can get narrowed down with the increasing user preferences. Moreover, their constant push notifications, increases the news intake of the audiences.

+Pros: Option to fully tailer news 'pipeline' or completely effortless overview
-Cons: Diversity can narrow with usage (for active users), too much news (for passive users)

Fig 1.4: Generational news source divide, samples from U.S.A (Nisa and Paisley 2019)

Social Media
e.g. Twitter, Facebook, Linked-In, etc.

News Sites
e.g. Wall Street Journal, New York Times

Portal Sites
e.g. Google, MSNBC, Yahoo!

1.4.4 Social Media

Social Media is the most used sources among younger generations as the primary news source, as it provides a less mediated experience and many-to-many communication among users. It allows users to control and create their own unique news experiences. Moreover, a wide range of views can be found from professional journalists to an ordinary citizen through direct engagement tools, such as liking, commenting, reposting or direct messaging. Social Media's biggest advantage over the other news sources is that in Social Media the news are given to the user integrated into the wider group of personal information sphere, which makes the news consumption more entertaining.

+Pros: Very fast distribution of information, uncensored or unregulated communication
-Cons: Susceptible to fake/corrupt news, Large amount of information to navigate, News is mixed up with other media content (e.g. games, messaging) that can be distracting.

1.5/ Digital News Habits

The Internet brought new ways for people to get their news, changing the paradigm of broadcast and print to include on-demand access to individual articles. The technological advances not only transformed the time and space of news interaction but also changed the consumption behavior between the news and its audiences.

A digital news habit of a user covers the time people spend consuming news content, the way they interact with it and how the come across it. Consumption of information has drastically changed compared to the pre-web space and time dimension. A person's dedicated time for consuming news is divided among various platforms and topics based on everyday habits and lifestyles. The way people consume news is rapidly evolving, getting increasingly private and timeless in the direction that anyone can reach the news anywhere, any moment of the day (Franchi 2013).

A new type of news reader has emerged, which doesn't not only consume news through a passive one-way interaction, but also contributes to the news media by producing their own content in a continuous two-way interaction. The traditional news media, based on mass broadcasting mediums (such as TV, newspaper, magazine... etc), has been only allowing readers to receive information without allowing any kind of input or feed-back from their audiences. This has been altered by the integration of new technologies and services into contemporary news media.

News consumers now take the role of news mediators or producers themselves as they participate directly (or indirectly) in the process of collecting, distributing, and discovering news (Robinson 2011), which increases the information availability to even higher levels due to the lower costs of publishing and increased speed of distribution. People's engagement with news is based on their preferences on different news topics, that are generally grouped into standard categories such as Sports, Politics, Global News.

Desktop devices have more visual display area thanks to their larger screens as opposed to mobile devices having limited space but are accessed often and on-the-go. This difference in news engagement also represents a different diversification of news categories that are followed through mobile or desktop devices (Comscore 2019). As it can be seen from the figure below, weather category is overwhelmingly accessed by mobile devices. It is a very simple type of information that is part of our daily life routine, and subject to change any moment, thus mobile devices are more preferred for being updated. Thus, it can be concluded that mobile and desktop devices are not only different based on their use of time and space, but also differ on news category preference.
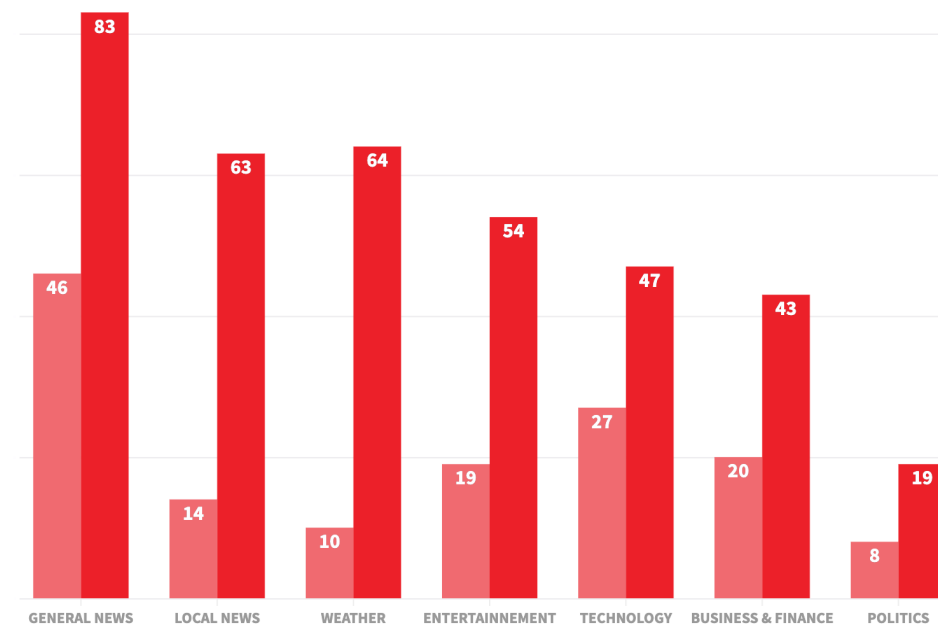
Fig 1.5: % news reach of UK digital population, July 2019 *(Comscore 2019)*

● Mobile
● Desktop

People's interest and preferences in news also changes with time. The popularity of an event can trigger reactions in the news audiences for diverging from their standard news topics in order to stay up-to-date with the events that are effecting the whole society. This public reaction can be observed in situations where the severity of the news is very high that it communications vital information about the daily life.

The graph below represents the popularity of Coronavirus as a news search keyword among Italy, Turkey and Worldwide users. The first thing to notice, is that each user group has a different popularity timeline. For example, the peak of the Coronavirus search popularity happens on the 24ᵗʰ February in Italy, where as at the same time the popularity is very low in Turkey and globally.

Moreover, the popularity trend seems to start decreasing after reaching its peak point for each of the user groups. At the end of 29ᵗʰ April, the popularity of Coronavirus almost dropped down to the values before the outbreak. This might be related to that Corona and Quarantine becoming the new normals of the life, and therefore they are not considered news anymore. Or simply the news audiences might have been overwhelmed by the amount of information and the emotional distress.

In either cases it is evident that the news topics people follow diverge based on platforms they use, the time and the severity of the events.

24 February 2020
First quarantine measures take place in Codongo, highest popularity for Corona search.

11 March 2020
The first positive Coronavirus case in Turkey

12 March 2020
WHO declares Coronovisrus a pandemic

Fig **1.6:** Comparing news keyword search trends of Coronavirus, for Italy, Turkey and Worldwide source: Google Trends

Worldwide

Turkey

Italy

4 February   29 April

2/Literature Review

This section of the thesis consists of a scientific literature review about the phenomena of News Overload which news audiences describe as being overwhelmed by the large amount of information being communicated to them continuously. The reasons leading to the this feeling, the symptomatic consequences of the News Overload experience and the countermeasures are highlighted.

2.1/ Information Overload

From the daily communication aspect, the information overload basically is the experience of receiving information, that is too much to rationally process all of it during our free time period. People express this experience as flooded by various information, based on communication services such as e-mails, text messages, phone calls, social media feeds, reports, newsletters.This exposure to large amount of information also results in negative (cognitive) consequences (Schmitt, Debbelt, and Schneider 2018). A popular term called FOMO (Feeling of missing out) is used widely in public for describing this situation as a feeling that there is always another information to know, social experience to be a part of in order not to be left out.

Although, this situation has been conceptualized by many different names and constructs in the scientific literature, such as cognitive overload, sensory overload, communication overload, knowledge overload, or information fatigue syndrome, the most dominant and persistent definition is the Information Overload (IO) (Eppler 2015). It is a considerably new field of research since it is closely related to the post-modern societal dynamics of the late 20th century and the development of internet-based communication technologies.

The concept of information overload (IO) dates back to the book "Future shock" of Alvin Toffler who describes IO as "the distress, both physical and psychological, that arises from an overload of the human organism's physical adaptive systems and its decision-making processes" (Toffler 1984, p.326). According to Toffler, the rapid technological developments and social changes of the industrial society resulted in unprecedented difficulties in human comprehension and decision-making process, due to the availability of the overwhelming amounts of data. His predictions from almost half a century ago, still holds their validity. However, Toffler's approach to the topic was based on his future predictions and he provided neither a framework for understanding the specific reasons causing Information Overload, nor remedies to reduce its negative consequences.

Eppler and Mengis has developed a framework through reviewing the studies that have been done on the field of Information Overload for over the past 40 years (Eppler and Mengis 2004). Their framework conceptualizes the IO as a circular process instead of a single one-way logic, with different inter-reliant factors effecting the whole process. The circular model also underlines the fact that a conclusive solution to information overload cannot be found through a single solution. To resolve this issue, there needs to be a continuous improvement and refinement process including causes, symptoms and countermeasures.

Fig 1.7: Alvin Toffler

Moreover, they have determined 5 categories as the primary causes of the information overload which is illustrated in the figure below. Those concepts can be applied to the news media environment also for deconstructing news media communication elements and steps.

Their research was based on four business-related scientific disciplines that are mostly interested with organizational management of workflows. Thus, the focus slightly differs from the field of product interaction design, where the personal experience with the physical product is the most important.
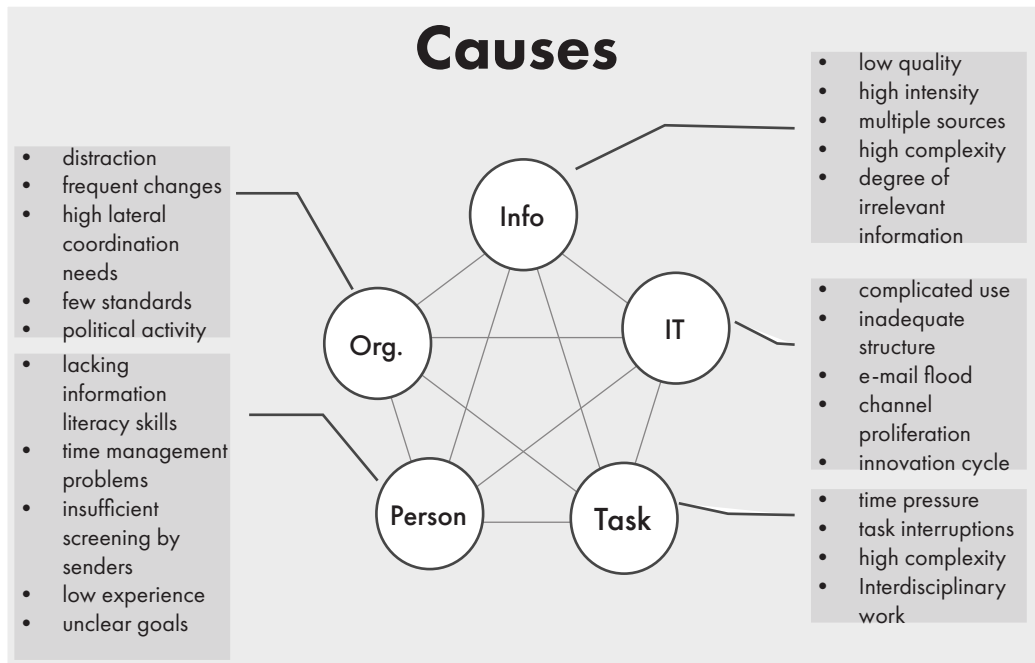
Fig 1.8: Information Overload Diagram

Causes

- distraction
- frequent changes
- high lateral coordination needs
- few standards
- political activity

- lacking information literacy skills
- time management problems
- insufficient screening by senders
- low experience
- unclear goals

Info

Org.   IT

Person   Task

- low quality
- high intensity
- multiple sources
- high complexity
- degree of irrelevant information

- complicated use
- inadequate structure
- e-mail flood
- channel proliferation
- innovation cycle

- time pressure
- task interruptions
- high complexity
- Interdisciplinary work

Countermeasures ← Symptoms

2.2/ News Overload

This section focuses on the news aspect of the information overload, which is faced by news audiences on a daily basis. Previous studies on this field mostly explores the levels of news overload perception and personal characteristics affecting it. Given the amount of news content available today, it should come as no surprise that news audiences, even the younger, are overwhelmed with the available information quantity and never-ending updates. Today's news media producers are not only competing among themselves for consumer interest and user attention, but they are also faced with the rising number of independent content creators such as bloggers or social media users (Holton 2012). The competition creates a flood of news content and channels that can lead to what communications experts have called the information overload, as discussed in the previous chapter with the general outlines (Mizerski 1977). According to a recent research conducted by the Pew Research Center during the first quarter of 2018, 68% of Americans express their inability to cope up with the increasing news availability these days (Gottfried and Barthel 2018). This case is not isolated for United States but across the globe people are sharing the feeling of information overload.

In order to better understand the dynamics of news overload, the circular Information Overload model is applied to the News context for determining the common triggering reasons and resulting mechanism for coping up. It should be noted that, the symptoms and countermeasures of News Overload are overlapping in many instances, meaning that people are naturally taking countermeasures themselves to prevent and reduce their feeling of news overload.

AROUND TWO-THIRDS OF AMERICANS FEEL WORN OUT BY THE NEWS

	Like the amount of news	Are worn out by the amount of news
2019	32%	66%
2018	30%	68%
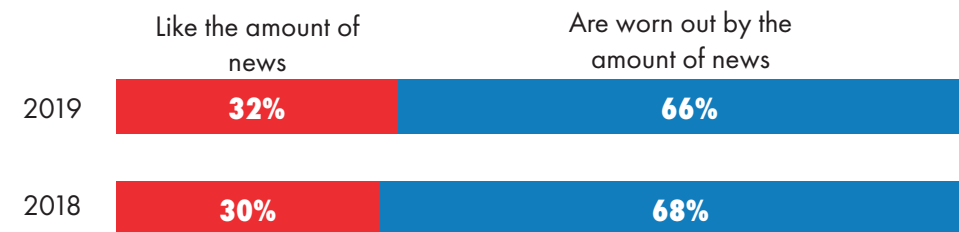
Fig 1.9: % of U.S. adult ... these days Source: Survey of U.S adults conducted Oct.29-Nov.11,2019, PewResearch Center

2.2.1 News Overload Causes

The triggers of news overload ranges from personal and social characteristics of the news audiences to technological interaction methods of news information management systems and the used products.

2.2.1.1 Demographics

Demographics is a very frequent and popular area for understanding the personal dynamics of a problem by comparing them with others based on statistical results. It consists of social characteristics of such as education level and household income, or physical characteristics such as gender and age. However, there exists many contradicting results for structuring news overload based solely on demographic characteristics, especially through gender. For example, Lee et Al. determined through their extensive news consumption study that the females are less susceptible to news overload (Lee and Kim 2016), whereas (York 2013), (Song, Jung, and Kim 2017) and (Holton and Chyi 2012) showed women are more likely to feel overloaded by news.

Fig 1.10: What is the first way you typically come across news in the morning?

Data from US, UK, France, Italy, Spain,Ireland, Norway, Finland, Netherlands, Japan.

Reuters
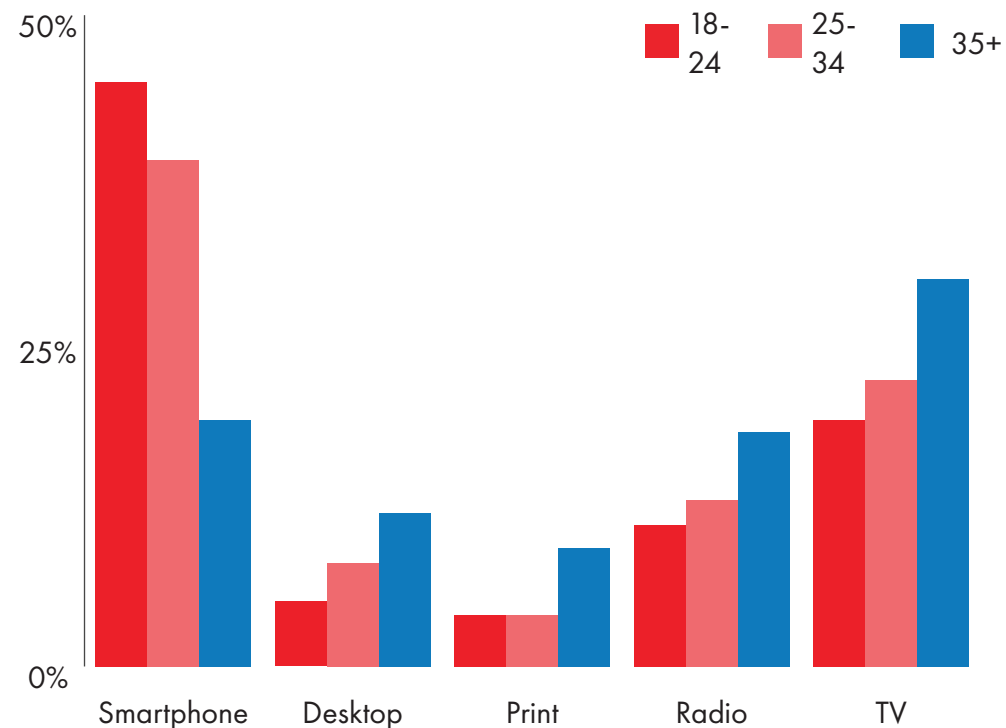
Moreover, their common explanation for women having more difficulties in processing news content, is the possible lower cognitive processing efficiency compared to their male counterparts. This argument not only fails due to contradicting study results, but also it overlooks other factors influencing cognitive abilities other than gender, such as education level.

However, there is one main demographic driver of News overload, which is consistent throughout all of the aforementioned studies, the age of the news audiences. Older people are repeatedly found to experience less news overload (Lee and Kim 2016) compered to younger generations, as they spend less time online and less exposed to non-news content. Moreover, it is found that older generations still tend to prefer conventional news tools such as TV, newspaper and magazines, which in turn lowers the speed and the amount of news information they receive.

2.2.1.2 Digital Devices

One of the main reasons that increases the feeling of news overload on the user, is the growing use of screen-based digital products for accessing news such smartphones, PC and tablets. As discussed previously, the digital devices have replaced the traditional media platforms in terms of being the primary means of news access. A research done by Lee et al. demonwstrated that use of digital news media platforms is associated with higher levels of news overload, which is also amplified by the higher attention levels to news through the aforementioned new media channels (Lee and Kim 2016). Another research conducted by Holton and Chi also determined the same results that the new digital news platforms induce higher news overload experiences on the user, as opposed to the traditional media outlets, such as newspapers, TV and magazines (Holton and Chyi 2012).

The fundamental reason for this result is that the digital devices are in a constant connection with online services through their daily use and they communicate various information to the user continuously. When users interact with news through new digital platforms, they are generally not only exposed to news, but they are also bombarded by a variety of distracting information irrelevant to the news context. On one hand, a part of the distracting information such as social media feeds are accessed by the users voluntarily, meaning that they distract themselves consciously from the news content. On the other hand, another part of the distracting information such as online advertisements are involuntarily given to the users.

2.2.1.3 Lack of Filtration Systems

As discussed in the chapter of changing news habits, the traditional journalistic approach for news distribution has been transformed immensely from the top-down hierarchical system, where news consumers are presented a set of daily news curated by professionals, into an horizontal sharing network, which makes the consumer their own news curators. System of news information filters have shifted from before publication (ex-ante) to after publication (ex-post) (Franchi 2013). The cultural and professional filters, that have worked in the past, now seems to have been made obsolete by the course of event and by increasing complexity. As Clay Shirky suggests: "Thinking about news overload isn't accurately describing the problem; thinking about filter failure is (Shirky 2010).

2.2.2 News Overload Symptoms

Song et Al. determined (Song, Jung, and Kim 2017) three main consequences of news overload effecting the daily lives of the news audiences: the news fatigue, cognitive strain and the incorrect information processing.

2.2.2.1 News Fatigue

The feeling of news fatigue can be described as simply being tired of receiving and processing information. It can be compared to the noise pollution, when it passes a certain threshold level, it begins causing anxiety, distraction and redundancy (Savolainen 2007). The signs include extreme stress and powerlessness, pessimism and anxiety.

2.2.2.1 Analysis Paralysis

The processing of large amounts of news could increase the cognitive load which could lead to paralysis or arbitrary analysis of information. There is broad consensus among researched on this field that a heavy load of information will negatively affect the productivity of a person, whether measured in terms of accuracy or speed (Eppler and Mengis 2004). People are likely to suffer from poor decision making or mistakes because their cognitive load prevents them from processing given information to understand the entire event.

2.2.2 News Overload Countermeasures

News Overload coping strategies can be divided into two categories according to the nature of the information handling process. First, the withdrawal strategy is driven primarily by affective factors which highlight the personal need to protect oneself from information bombardment. Second, the filtering strategy is based on the need to concentrate on the most useful information by systematically scrapping irrelevant content from sources.

2.2.2.1 News Avoidance

Avoiding or completely ignoring news is a withdrawal strategy for encountering the excessive supply of information. Many news audiences talked about feeling over-loaded, exhausted and desensitized by the amount of news before deciding to avoid news. In Reuters data this year it is found that almost a third (32%) of the global population say they actively avoid the news, which is 3 points more than 2017. This may be because the world has become a more depressing place or because the media overage tends to be relentlessly negative – or a mix of the two (Newman et al. 2019).

According to a recent research of OFCOM, the news audiences that attempted news "detoxes" to reduce their intake, returned to previous levels of consumption because they feared they were missing out (OFCOM 2018). Furthermore, this study finds evidence that news consumers are willing to use news curation services to alleviate news avoidance and thus stay informed (Song, Jung, and Kim 2017).

2.2.2.1 News Curation

News can now be filtered through a variety of networks and reaches consumers via a variety of platforms that can be called news curation services. News Curation services that deliver customized news is a way for consumers who avoid news consumption because of overload, to resume their news consumption. Flipboard is an interactive news aggregator built for phones and tablets that aggregates news from a variety of publishers into thematic collections and groups it together. Readers can then follow lists, subject matter, or publications. Consumers curate news for their social networks, selecting and sharing those items most worthy of attention and filtering out irrelevant stories (Pentina and Tarafdar 2014).
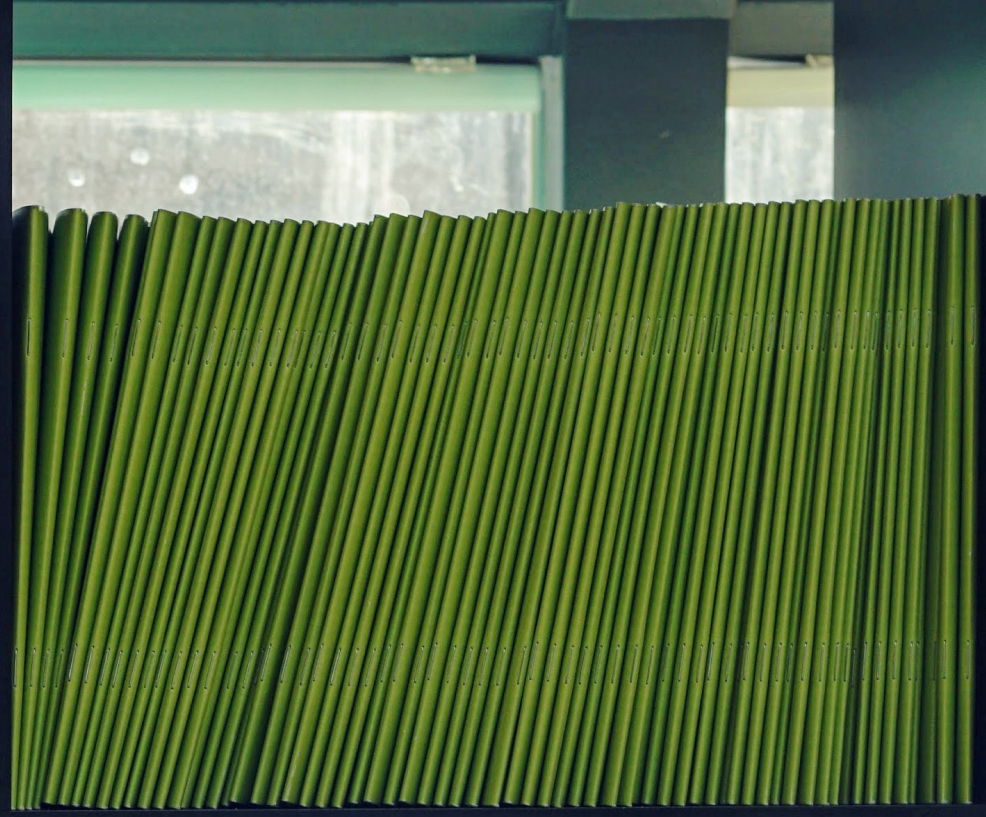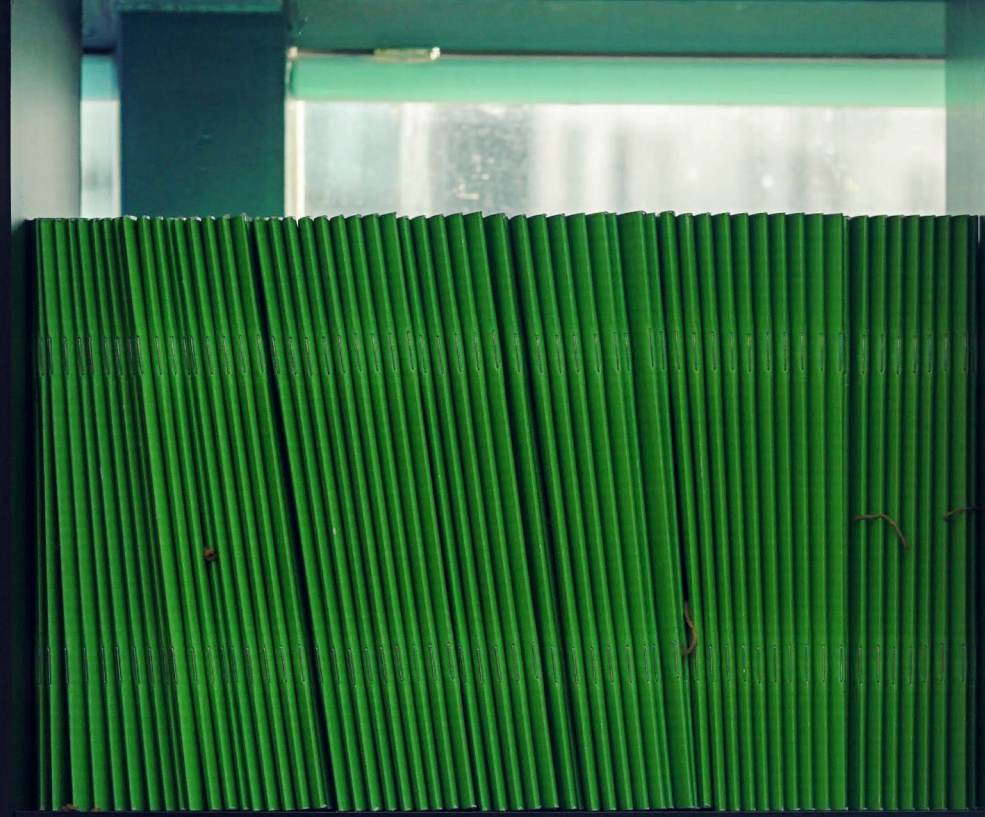
Chapter 2/
Design Research

1/ Case Studies for Communicative Products

Design of a physical product can be facilitated by exploring already existing creative solutions. It shouldn't come as a surprise to investigate different vacuum cleaners when designing a new floor cleaning product or benchmarking wide range of headphones to establish a cost analysis that can be the defining criteria for a low-cost personal audio products.

However, the topic of this thesis goes far beyond than the standard products that exists in our daily lives. Thus, it is imperative to find conceptual solutions that might give an overall idea for managing news overload through physical interactions. This chapter will investigate some products that are designed to facilitate the communication process between the digital information sphere and the physical world that we live in through tangible media.

1.1/ Product Selection

In order to define the product selection into a reasonable search query for narrowing down and shortening the exploration process , a criteria is set to define the required qualities. The desirable products are defined as:

"Products that communicate **dynamic digital information**, that is external to the product itself, through **reversible changes in sensory outputs**, without using digital screens based on alphanumeric language. They should be able to **gather data using API services**, since it is a widely used method by digital news sources.

News are dynamic digital information, which refers to any kind of digital information that is accessible from Online sources and subjected to change continuously (e.g. currency exchange ratios, weather or traffic conditions). This is the most important product selection criteria as it defines the fundamental characteristic of news being contemporaneous.

Reversible changes in sensory outputs are the physical tangible responses that products generate for communicating with the user about the changes, that are defined in the operating system of a product. The recoverability of the output is crucial to provide sustainable response generation of a product.

Application Programming Interface (API) is a widely used computational interface for requesting specific information from online sources. It consists of customized set of search queries and communicates with a web server for receiving the updated digital information. Many major web services provides free of charge developer licensing for the use of their API libraries such as Twitter, Google Maps, YouTube, AccuWeather and so on.

Designing tangible product interactions in the field of digital communication, is an innovative design practice without any established product characteristics, forms nor defined user-product interactions. Consequently, those products are not mass-produced and mostly in their prototyping or research phases. Thus, the main sources for gathering products samples are chosen among the product libraries that offer conceptual and open-ended solutions. There two categories of sources that are used for collection the products: contemporary design magazines (e.g. YankoDesign, Designboom) and educational institutions specialized in interaction design (e.g. Copenhagen Institute of Interaction Design, MIT Media Lab). In overall preliminary 50 product examples are found through over a period of four week, then a secondary selection process is conducted for filtering down the quantity for more focused product analysis. Finally, 18 products are selected for deeper focus.

After collecting all the product examples that fit into the criteria set before, they are classified based on the four different categories that are designed to represent the flow of information from digital environment to the physical world. The classification categories are listed as:

    1. The **Topic-based** classification refers to the classification of products through the qualitative meaning of the digital information they communicate with the user.
    2. The **Information-based** classification refers to the classification of products through the quantitative range of information
    3. The **Interaction-based** classification refers to the classification of products through their interaction flows
    4 The **Output-based** classification refers to the classification of products through their sensory output modalities.

Moreover, each product is evaluated on three different performance indexes in order to compare their suitability for digital news interaction through mapping of the results. The three used performance indexes are listed as:

    1. **Adaptability** to diverse news content evaluated from limited to versatile
    2. **Complexity** of adjusting information filters from simple to difficult
    3. **Cognitive load** on the user during the product use from light to heavy.

1.2/ Case Studies

In this section, each product analysis for the design research "Case Studies of Communicative Products" is listed. The page number of each product is listed on the Table of Contents on the right side.

Table of Contents for Case Studies

Design Team
Oli Snoddy
*BERG Design
Consultancy, UK*

#FLOCK

Design Type
Prototype

Description

#FLOCK is a set of four houses, three contain colorful birds which react to Twitter Steps, the fourth is a simple clock. A new follower, a retweet or an @message will Step one of the birds to pop out of its house, each with a different movement and bird sound. The workings of the device are complicated - synchronizing to a twitter account, allowing the process to be controlled through a mobile phone app - yet its output is simple: a toy bird peers out through a hole.

Design Period
2013

Access
*https://www.disegnodaily.
com/article/flock-by-berg*

Fig A.1: Product Images of #FLOCK

● **Simple** ○ Complex
The #FLOCK is designed to deliver three different types of information to the user based on their Twitter activity.
API: *Twitter*

○ General ● **Customized**
The user can change the Twitter account connected to the product, and can also assign different notification types as information input.

● **Passive** ○ Active
#Flock offers an ambient and passive interaction to the user, as it initiates the interaction autonomously according to the information input retrieved from Twitter.

● **Single** ○ Multiple
Once the user linked their twitter account and assigned their preferred notification settings, the products doesn't require any other interaction steps. Thus, #FLOCK is a single step interaction product.

● **Visual** ○ Tactile ● **Auditory**
#Flock provides two different sensory outputs to the user, the movement of the birds as the visual, and the sound of a chipping bird as the auditory.

● **Short** ○ Medium ○ Long
The required attention time is short, since the product outputs two distinct modalities triggering different senses of the user distinctively.

Information — *Type* / *Filter*
Interaction — *Method* / *Step*
Output — *Modality* / *Attention Time*

Fig A.2: Product characteristics classification of #FLOCK

Adaptability to diverse news content
Limited ———————————————— Versatile
Complexity of adjusting information filters
Easy ———————————————— Difficult
Cognitive load on the user
Light ———————————————— Heavy

Fig A.3: Performance Analysis of #FLOCK

Design Team
Varenya Raj, Yuxi Liu,
Surojit Dey
*Copenhag Institute of
Interaction Design (CIID)*

Design Type
Prototype

Design Period
2018

Access
*www.yankodesign.
com/2018/04/05/a-radio-
for-the-open-minded/*

Airo

Description
Airo is an experimental radio that reads tweets out using Arduino and Twitter's API, the Airo fetches tweets and translates text to speech. Built with a vertical volume controller at its base, and a knob that lets user select the type of tweet, user can have a stream of news, tech, or music related tweets. A fan at the back acts as a metaphorical horizon widener, allowing user to access tweets from a wider area. Open the fan out more, and the Airo fetches tweets from a larger radius.

Fig A.4: Product Images of Airo

Information

Type
○ Simple ● Complex
Airo can communicate different information topics, although it uses a single information source for capturing social media feeds.
API: *Twitter,*

Filter
○ General ● Customized
Users can personalize the communicated information on two different basis, the information topic/category (adjusting the knob) and the Geo-location (adjusting the back fan).

Fig A.5: Product characteristics classification of Airo

Interaction

Method
○ Passive ● Active
Airo is a product that operates only during an active interaction with the user, as the interaction should be initiated by the user.

Step
○ Single ● Multiple
User can physically control three functions of the Airo: volume with vertical slider, information category with circular knob and the geo-location of the information with the fan.

Output

Modality
● Visual ● Tactile ● Auditory
Although the main information output of the product is the audible format created by text-to-speech technique, the adjustment of the distance through the fan provides both tactile and visual user experience.

Attention Time
○ Short ● Medium ○ Long
Due to the nature of social media feeds, the communicated information content is generally consists of couple of sentences or words. Thus, the attention time required is on the medium category.

Adaptability to diverse news content
Limited ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Versatile

Complexity of adjusting information filters
Limited ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Versatile

Cognitive load on the user
Light ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Heavy

Fig A.6: Performance Analysis of Airo

Dandelion

Description

Dandelion is a product concept for feeling the weather outside. Soft spores above the body lets your fingers detect the temperature and wind strength by haptic experience. Here's simply how it works. Since weather forecast information is already distributed to smart phone applications, Dandelion receives the temperature and wind strength information by wireless connection and transfers them into tactile feedback.

Fig A.7: Product Images of Dandelion

Information

Type

● Simple　　○ Complex
Dandelion is a single purpose product that communicates the external weather information specifically the temperature and wind conditions.
API: *tide-forecast.com*

Filter

● General　　○ Customized
The weather information displayed on the product, is a general information and can not be customized by or for the user. The product is designed to communicate with the general public instead of a single person

Interaction

Method

● Passive　　○ Active
Dandelion is an interactively passive product that pushes the user interface away from the desktop and into our everyday living environment.

Step

● Single　　○ Multiple
There is only one interaction step during the product use.

Output

Modality

● Visual　　● Tactile　　○ Auditory
When the spores shake broader, it means the wind outside is stronger. The heating/cooling module inside creates certain temperature of the wind along with ambient lighting color effect to visually emphasize it. //Sensory: Rotation

Attention Time

● Short　　○ Medium　　○ Long
The simulation of the weather conditions allows user to easily and instantaneously understand the weather conditions. By letting your hand gently into the spores, you feel the breeze/temperature outside.

Fig A.8: Product characteristics classification of Dandelion

Adaptability to diverse news content
Limited ━━ ━━ ━━ ─ ─ ─ ─ ━━ Versatile
Complexity of adjusting information filters
Easy ━━ ━━ ━━ ─ ─ ─ ─ ━━ Difficult
Cognitive load on the user
Light ━━ ━━ ─ ─ ─ ─ ─ ━━ Heavy

Fig A.9: Performance Analysis of Dandelion

Design Team
John Mills,
Tom Metcalfe
Media Innovation Studio, University of Central Lancashire,UK

Design Type
Prototype

Design Period
2015

Access
http://johnmillsonline.com/ekko/

EKKO

Description
EKKO is connected to the edge of the print like a bookmark, pressing the printed buttons Step online interactions through the use of conductive ink. Users can access audio material, vote or control a web-based game via the print through an accompanying app. Publishers also can manage the content, and generate analytic data from users, via the accompanying content management system This is dynamic so that the content can change over time whilst the print is static.

Fig A.10: Product Images of EKKO

○ Simple   ● Complex
EKKO is designed to communicate different aspects of a single news topic based on a single information source.
API: *BBC*

● General   ○ Customized
Users can't customize their information filter, since the product is designed to work with standardized print content, very similar to an ordinary newspaper.

○ Passive   ● Active
EKKO is a product that operates only during an active interaction with the user. The interaction should be initiated by the user, by placing the product on the printed content.

○ Single   ● Multiple
Users should first connect EKKO with the printed object for starting the interaction. Then they can simply touch on the specific points on the print object for navigating among information.

○ Visual   ○ Tactile   ● Auditory
EKKO uses text-to-speech technology for transforming written news content into audio format for to be listened by the user.

○ Short   ● Medium   ○ Long
Each news interaction with EKKO lasts about the same time reading a magazine page.

Information — Type / Filter
Interaction — Method / Step
Output — Modality / Attention Time

Fig A.11: Product characteristics classification of EKKO

Adaptability to diverse news content
Limited ▬▬▬▬▬ ▬▬▬ Versatile
Complexity of adjusting information filters
Limited ▬▬▬ ▬▬▬▬ Versatile
Cognitive load on the user
Light ▬▬▬▬▬▬ ▬▬▬ Heavy

Fig A.12: Performance Analysis of EKKO

Design Team
Isak Frosta
Sebastion Hunkeler
*Copenhagen Institute of Inter-
action Design (CIID), DK*

Design Type
Prototype

Design Period
2016

Access
https://designawards.core77.
com/Interaction/64487/
The-Internet-Phone

Internet Phone

Description

The Internet Phone makes the intangible processes of the internet tangible. Users can access websites with the nostalgic interface of a rotary phone. Look up the IP address of the website you want to call in a special cyber directory, dial the twelve digit IP address using the rotary, and wait for your website to be read out loud in the receiver. And if you are feeling adventurous, you can enhance your experience with four different mode tokens – article, developer, incognito, and history.

Fig A.13: Product Images of Internet Phone

Information

Type
○ Simple ● Complex
News Rock can communicated different news topics depending on the users choice, however it is connected to a single digital source.
API: *New York Times*

Filter
○ General ● Customized
The user can personalize the needed information by connecting different regions on the physical globe through a physical audio cable.

Fig A.14: Product characteristics classification of Internet Phone

Interaction

Method
○ Passive ● Active
News Globus is an interactively active product, which requires user engagement for functioning.

Step
● Single ○ Multiple
User can physically control three functions of the Airo: volume with vertical slider, information category with circular knob and the geo-location of the information with the fan.

Output

Modality
○ Visual ○ Tactile ● Auditory
The internet phone uses text-to-speech technology for translating written the web page.

Attention Time
○ Short ○ Medium ● Long
This product requires a long attention time for listening until the text-to-speech loop stops translating the web page.

Adaptability to diverse news content
Limited ▬▬▬▬▬▬ ▬▬ ▬▬ ▬▬ Versatile
Complexity of adjusting information filters
Simple ▬▬▬▬▬▬ ▬▬ ▬▬ ▬▬ Difficult
Cognitive load on the user
Light ▬▬▬▬▬▬▬▬▬ ▬▬ ▬▬ Heavy

Fig A.15: Performance Analysis of Internet Phone

Kai

Design Team
Waseem Chothia, Merlin De Almeida, Rüben de Roock
Cape Peninsula University of Technology, SA

Design Type
Prototype

Design Period
2016

Access
https://www.behance.net/gallery/45532007/Kai-Tide-Reader

Description
Complicated tidal charts presents an opportunity for designers to create a product that will clearly relay the tide height and direction of a specific area. The product interaction with the users was developed to occur in the user's periphery rather than constantly at the center of attention, also known as calm technology. KAI only displays the tide heights and direction, unlike information presented on complicated tide charts, by using the principals of Calm technology and ubiquitous computing.

Fig A.16: Product Images of KAI

Low Tide   High Tide   Receding Tide   Rising Tide

Information

Type

● Simple   ○ Complex
KAI is designed to communicate a single data set of information, the tide heights and direction, by simplifying the complicated process of analyzing seasonal charts and daily deviations.
API: *tide-forecast.com*

Filter

● General   ○ Customized
The tide information displayed on KAI is a general information and can not be customized by or for the user. The product is designed to communicate with the general public instead of a single person.

Interaction

Method

● Passive   ○ Active
KAI is an interactively passive product that pushes the user interface away from the desktop and into our everyday environment to create a product that can clearly relay tide heights and direction.

Step

● Single   ○ Multiple
KAI is a very simple and single-purpose product. Since it doesn't have any controlled properties, there exist only a single interaction step, to look at it.

Output

Modality

● Visual   ○ Tactile   ○ Auditory
The information is communicated through regulation of the water level for signifying both the height and the direction of the tide.
Sensory: Rotation

Attention Time

● Short   ○ Medium   ○ Long
The physical representation of the water level allows user to easily and instantaneously understand the upcoming tide properties. A single glance at the product is enough.

Fig A.17: Product characteristics classification of KAI

Adaptability to diverse news content
Limited ▬▬▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Versatile
Complexity of adjusting information filters
Limited ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Versatile
Cognitive load on the user
Light ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Heavy

Fig A.18: Performance Analysis of KAI

Design Team
Bjorn Karmann, Charlie Gede-
on, Mikio Kiura, Sena Partal
*Copenhagen Institute of
Interaction Design (CIID), DK*

News Globus

Design Type
Prototype

Design Period
2016

Access
*https://www.senapartal.
com/news-globus*

Description

The News Globus has a physical interface that piques the curiosity of people and asks them to explore the world not by news of a single place, but by the relationships between places. It has 20 assigned regions, when two regions are connected, the processor selects a country randomly from each region and queries the NY Times API for news containing both locations. A web server then selects a story and converts the headline and byline to a mp3 file which is played either from the headphone jack or the base of the globe.

Fig A.19: Product Images of
News Globus

Information

Type

○ Simple ● Complex
News Globus can communicate inherently relevant news topics by user choice.
API: *New York Times*

Filter

○ General ● Customized
The user can personalize the needed information by connecting different regions on the physical globe through a physical audio cable.

Fig A.20: Product characteristics
classification of News Globus

Interaction

Method

○ Passive ● Active
News Globus is an interactively active product, which requires user engagement for functioning.

Step

● Single ○ Multiple
Users can only control one function of the News Globus, connecting different regions of the world through audio cables.

Output

Modality

○ Visual ○ Tactile ● Auditory
News Globus uses text-to-speech technology for transforming written news content into audio format for to be listened by the user.

Attention Time

○ Short ● Medium ○ Long
This product offers a very short interaction time, as connecting cables are intuitive and fast. However, the text-to-speech technology needs time for user attention.

Adaptability to diverse news content
Limited ▬▬▬▬▬▬ ▭▭ ▭▭ Versatile
Complexity of adjusting information filters
Simple ▬▬▬ ▭▭▭ ▭▭ ▭▭ Difficult
Cognitive load on the user
Light ▬▬▬▬▬ ▭▭ ▭▭ ▭▭ Heavy

Fig A.21: Performance Analysis of
News Globus

Design Team
Ioana Enea, James Williams,
Jodie Anderson
*Oslo School of Architecture
and Design (AHO)*

News Rock

Design Type
Prototype

Design Period
2013

Access
*https://www.behance.net/
gallery/12420419/NewsRock*

Description
NewsRock is a product designed for a school teacher with a busy lifestyle, who finds it difficult to find relevant news topics to discuss with her pupils. It is a non-intrusive product, wall mounted or placed on the desk where user completes lesson plans. The rock-shaped tokens that sit on top of the curved body have RFID tags embedded within them. Each tag corresponds to a category of information from BBC's Newsround website. When placed in the dip, the RFID tags scan and a child's voice starts reading the headlines of the day.

Fig A.22: Product Images of News Rock

Information

Type

○ Simple ● Complex
News Rock can communicate different news topics depending on the users choice, however it is connected to a single digital source.
API: *BBC*

Filter

○ General ● Customized
The users can filter their news by using the predefined physical rock-like object with engraved symbols, that represents the contained news category/topic.

Fig A.23: Product characteristics classification of News Rock

Interaction

Method

○ Passive ● Active
News Rock is an interactively active product, which requires user input for starting the information delivery. However, once its activated the product goes back to the periphery attention space and becomes interactively passive until user changes the topic.

Step

● Single ○ Multiple
User can physically control only a single function of the product, the activation. The rock object is required to be moved from upper to the lower part of the platform for activation of the product, which is also expressed by an LED light.

Output

Modality

○ Visual ○ Tactile ● Auditory
NewsRock uses text-to-speech technology for converting digital news articles into audible formats. Thus, the information delivery method is auditory.

Attention Time

○ Short ● Medium ○ Long
This product has a very short interaction time, moving rocks makes it very fast and easy to choose topics. However, text-to-speech communication requires more attention time.

Adaptability to diverse news content
Limited ▬▬▬▬▬▬ ▬▬ Versatile
Complexity of adjusting information filters
Limited ▬▬ ▬▬ Versatile
Cognitive load on the user
Light ▬▬▬▬▬ Heavy

Fig A.24: Performance Analysis of News Rock

Design Team
John Mills, Tom Metcalfe
Media Innovation Studio,
University of Central Lancashire,
UK

Design Type
Prototype

Design Period
2018

Access
http://www.thomasbuchanan.
uk/news-things/

Printer Thing

Description
PrinterThing provides a personalized and printed daily newspaper at a time that is best for the reader. Throughout the day, users select or 'Pocket' stories they discover on the web but don't have time to read at the time. These articles are stored and laid out automatically into a print newspaper layout. The user is then able to choose when their newspaper is printed, this can be set for 'an hour before bed', 'breakfast' or another time during the day. It encourages users to turn off their devices, avoid blue light and remove distractions.

Fig A.25: Product Images of Printer Thing

Information

Type
○ Simple ● Complex
PrinterThing is designed to communicate various news articles from different news sources. Thus, it is classified as a complex information type product according to the criteria of this analysis.
API: *Googleweather, Twitter,*

Filter
○ General ● Customized
The users can customize their information by saving each news article through a mobile application. Since PrinterThing is not designed with an embedded filtration system, user is the only responsible agent in filtering information.

Fig A.26: Product characteristics classification of Printer Thing

Interaction

Method
● Passive ○ Active
PrinterThing only interacts with the user in a specified daily time slot. As it starts the interaction by itself according to the set time, it is categorized as a passive product.

Step
○ Single ● Multiple
First, the articles should be saved through a mobile application during the day. Next, the product prints out the saved information on the user's preferred time slot. Lastly, user takes out the printed information for reading.

Output

Modality
● Visual ● Tactile ○ Auditory
The digital information is communicated through an output print that represents the idea of reading a newspaper by providing both a visual (reading) and a tactile (feeling the paper) output modality.

Attention Time
○ Short ○ Medium ● Long
User needs to focus and spend time while reading the printed output from the product. Since reading is a time-consuming activity, the required attention time is long.

Adaptability to diverse news content
Limited ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Versatile
Complexity of adjusting information filters
Easy ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Difficult
Cognitive load on the user
Light ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Heavy

Fig A.27: Performance Analysis of Printer Thing

Design Team
Christian Ferrara, John Mac
Taggart
*Rhode Island School of Design,
USA*

Design Type
Prototype

Design Period
2012

Access
*https://cargocollective.com/
Pulse/Pulse*

Pulse

Description
Pulse seeks to visualize information in the simplest and most elegant way possible. By using mathematical processing, a wireless internet connection and six servo motors, Pulse converts online information into **a tangible graph** which is displayed right on a living room wall. A Wi-Fi capable microprocessor obtains information from websites offering an API (such as Google weather) and processes the information so it is displayed by a series of servo motors. A cord is looped between the servo motor arms and forms a physical graph.

Fig A.28: Product Images of Pulse

Information

Type
○ Simple ● Complex
Pulse is capable of communicating different types of digital information, such as weather conditions and social media feeds.
API: *Googleweather, Twitter,*

Filter
○ General ● Customized
By tilting Pulse users are able to switch between 3 different information feeds of their choice, all of which are easily programmed by pairing the device with its online platform.

Interaction

Method
● Passive ○ Active
Pulse is a passive product that functions in an ambient way without requiring user to start the interaction, as it automatically adjusts the plotted graph according to the retrieved information from the digital source.

Step
○ Single ● Multiple
Since the input information input can be changed by rotating the product, there exists more than a single step of interaction during product use.

Output

Modality
● Visual ○ Tactile ○ Auditory
The digital information is communicated through generation of a physical plot having six different axis of inclination.
Sensory: Rotation

Attention Time
○ Short ● Medium ○ Long
The mapping of digital information into physical graph shortens the standard attention time, compared to the interaction with digital screens. However, the extrapolation of the physical plot is not straightforward.

Fig A.29: Product characteristics classification of Pulse

Adaptability to diverse news content
Limited ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Versatile
Complexity of adjusting information filters
Easy ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Difficult
Cognitive load on the user
Light ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Heavy

Fig A.30: Performance Analysis of Pulse

Design Team
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*Media Innovation Studio,
University of Central Lancashire,
Uk*

RadioThing

Design Type
Prototype

Design Period
2018

Access
http://www.thomasbuchanan.
uk/news-things/

Description
Utilizing text-to-speech, RadioThing converts text from any news website into audio. User loads headlines through the use of tangible RFID tags, each representing a different news source. Each time a tag is tapped on RadioThing, a new story is added. In addition to allowing audiences to filter by publisher, user can also choose increasingly positive, increasingly negative or random pieces, by twisting the upper part of the product. When the user presses the top of RadioThing, the object will fetch the audio articles from the server.

Fig A.31: Product Images of RadioThing

Information

Type
○ Simple ● Complex
RadioThing is designed to communicate various news articles from different news sources. Thus, it is classified as a complex information type product according to the criteria of this analysis.
API: *Multiple Sources*

Filter
○ General ● Customized
The user can personalize their information filter by simply using the physical cards with embedded RFID tags. Each of the cards represent an information source. Moreover, the order of the information can be adjusted by the user.

Interaction

Method
○ Passive ● Active
RadioThing is a product that operates only during an active interaction with the user. The interaction should be initiated by the user, by placing a physical object with an embedded RFID tags and pushing the top cone.

Step
○ Single ● Multiple
User can physically control three functions of the product: selecting headlines from news sources (RFID tags), choosing the order of the news (Rotating the upper cone) and starting interaction (Pushing the upper cone)

Output

Modality
○ Visual ○ Tactile ● Auditory
RadioThing uses text-to-speech technology for converting written news content into audio format.

Attention Time
○ Short ○ Medium ● Long
Since the product converts all the text present in a news article into audible format, user needs to make time for listening all the content.   The duration of this attention time is almost the same as the one for reading the news content from the digital screen.

Fig A.32: Product characteristics classification of RadioThing

Adaptability to diverse news content
Limited ▬▬▬▬▬▬▭▭▭▭ Versatile
Complexity of adjusting information filters
Limited ▬▭▭▭▭▭▭▭▭▭ Versatile
Cognitive load on the user
Light ▬▬▬▬▬▬▭▭▭▭ Heavy

Fig A.33: Performance Analysis of RadioThing

Design Team
Thomas Buchanan
*Telephone Avenue Design
Studio, UK*
Design Type
Prototype

Design Period
2016

Access
https://telephoneavenue.art/
selected_works/raincloud/

Raincloud

Description
Raincloud is a project exploring a calmer, more considered integration of technology and data in the home. Raincloud tells you whether it's going to rain in the next few hours near its current location, by changing color. Simply glancing across the room, the user will know what the weather will be, no need to take out the smartphone!

Fig A.34: Product Images of Raincloud

Information

Type
● Simple   ○ Complex
Raincloud only communicates information about the upcoming rain according to the user's location on earth.
API: *Googleweather, Twitter,*

Filter
● General   ○ Customized
The communicated weather information is general and determined only on the location of the user, which can not be customized or changed by the user.

Interaction

Method
● Passive   ○ Active
Instead of requiring active interaction, Raincloud is a single-purpose object providing information as part of the living environment.

Step
● Single   ○ Multiple
Raincloud is a single step interactive product, since it doesn't have any controllable or changeable function. Moreover, it is designed as a mobile device with an embedded power source.

Output

Modality
● Visual   ○ Tactile   ○ Auditory
The information of an upcoming rain is visualized through rain droplets' color change.
Sensory: Rotation

Attention Time
● Short   ○ Medium   ○ Long
User can instantaneously understand if its going to rain or not, by simple looking at the product. Since it has only a single output and a meaning, this is the shortest attention time among other samples.

Fig A.35: Product characteristics classification of Raincloud

Adaptability to diverse news content
Limited ▬▬▬ ▬ ▬ ▬ ▬ ▬ Versatile
Complexity of adjusting information filters
Easy ▬▬ ▬ ▬ ▬ ▬ ▬ ▬ ▬ Difficult
Cognitive load on the user
Light ▬ ▬ ▬ ▬ ▬ ▬ ▬ ▬ ▬ Heavy

Fig A.36: Performance Analysis of Raincloud

Ray

Description

Ray is a desktop ambient information device thay uses light to communicate information in an ambient and beautiful way. The working prototype uses an Arduino in combination with PHP and Processing to pull Information from the computer and visualize it through a high power LED. It can communicate different types of data ranging from available computer RAM to Stock exchange prices and mail notifications.

Fig A.37: Product Images of Ray

Information

Type

○ Simple   ● Complex

RAY is designed to communicate different types of information using a wide range of sources. It can be both internal information about the PC or from an external sources such as Stock Exchange.
API: *Googleweather, Twitter,*

Filter

○ General   ● Customized

The user can determine the information to be displayed by selecting them their PC, among variety of possible choices. The only limitation is that the information should be quantifiable data in order to be compatible with the output light density.

Interaction

Method

● Passive   ○ Active

RAY is an interactively passive product that act as an accessory to the PC, without interrupting the users workflow. Once the product is set up, user can enjoy an ambient informative experience without hassle.

Step

○ Single   ● Multiple

Although RAY is a very simple product in nature, it requires several steps for completing the interaction cycle. Initially, the product should be both connected to a power source and the PC for information flow. Next, the information should be selected each time for display.

Output

Modality

● Visual   ○ Tactile   ○ Auditory

The digital information is communicated through generation of a physical light array that enlarges or decreases according to the data fluctuations.
Sensory: Rotation

Attention Time

○ Short   ● Medium   ○ Long

The physical light array requires a medium attention time, since the communicated information can not be understood directly from a single glance. The user needs to evaluate and compare with their previous experiences with the product.

Fig A.38: Product characteristics classification of Ray

Adaptability to diverse news content
Limited ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Versatile
Complexity of adjusting information filters
Limited ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Versatile
Cognitive load on the user
Light ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Heavy

Fig A.39: Performance Analysis of Ray

Skål

Design Team
Timo Arnall
Oslo School of Architecture and Design (AHO), NO

Design Type
Prototype

Design Period
2009

Access
http://voyoslo.com/projects/skal/

Description

Skål is a playful media-interface designed specifically for the home that lets user to interact with digital media using physical objects. The objects are placed in a wooden bowl to play back related media. For example a physical Moomin character like Little My will play a sequence from the Moomin cartoon where she is featured. Skål lets you control all kinds of digital media; movie-clips, Youtube channels, Flickr photo streams, home videos, online radio etc.

Fig A.40: Product Images of Skal

Sensor

To media player & TV

Play!

Information

Type

○ Simple ● Complex
Skål is able to collect digital information from different sources
API: *Twitter, YouTube,*

Filter

○ General ● Customized
Users can personalize the information through use of different physical objects. Any object with embedded RFID tags can store digital information, providing user with an even better personalization option.

Interaction

Method

○ Passive ● Active
Skål is a product that operates only during an active interaction with the user. The interaction should be initiated by the user, by placing a physical object with an embedded RFID tags.

Step

● Single ○ Multiple
The product has only a single step of interaction. User only needs to place the object on the spherical platform of the product, in order to start the interaction.

Output

Modality

○ Visual ○ Tactile ● Auditory
Skål is an audiovisual media platform.

Attention Time

○ Short ○ Medium ● Long
Since the product converts all the text present in a news article into audible format, user needs to make time for listening all the content. The duration of this attention time is almost the same as the one for reading the news content from the digital screen.

Fig A.41: Product characteristics classification of Skal

Adaptability to diverse news content
Limited ▬▬ ▬▬ ▬▬ ▬▬ ▬ ▬ ▬ Versatile
Complexity of adjusting information filters
Limited ▬▬ ▬▬ ▬▬ ▬ ▬ ▬ ▬ Versatile
Cognitive load on the user
Light ▬▬ ▬ ▬▬ ▬ ▬▬ ▬ ▬ ▬ Heavy

Fig A.42: Performance Analysis of Skal

Tempescope

Design Team
Ken Kawamoto
Kawamoto Design Studio, JP

Design Type
Prototype

Design Period
2014

Access
https://www.tempescope.com/

Description
The tempescope is an ambient physical display that visualizes various weather conditions like rain, clouds, and lightning. It connects to smartphone (iPhone/Android device) by Bluetooth, and receives the latest weather forecast from the internet. All of the data syncing happens in the background, so user doesn't have to open the app everytime.

Fig A.43: Product Images of Tempescope

Information

Type

● Simple   ○ Complex
Tempescopoe can only communicate information about the weather conditions for a selected location.
API: *Opentempescpoe*

Filter

○ General   ● Customized
The location can be selected through a mobile application for experiencing weather conditions in different areas of the world.

Interaction

Method

● Passive   ○ Active
Tempescope is a passive product that functions without requiring an input from the user.

Step

● Single   ○ Multiple
Tempescope has a single step interaction for use, as it is only required plugging the product to power outlet.

Output

Modality

● Visual   ○ Tactile   ○ Auditory
Four different weather conditions of rain, lightning, clouds and sun can be visually created inside the product chamber for mimicking real weather conditions.

Attention Time

● Short   ○ Medium   ○ Long
The simulation of the weather conditions allows user to easily and instantaneously understand the information content. A single glance at the product is enough.

Fig A.44: Product characteristics classification of Tempescope

Adaptability to diverse news content
Limited ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Versatile
Complexity of adjusting information filters
Easy ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Difficult
Cognitive load on the user
Light ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Heavy

Fig A.45: Performance Analysis of Tempescope

Design Team
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Leila Byron, Kate Twomey
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Interaction Design (CIID), DK*

Timely

Design Type
Prototype

Design Period
2016

Access
*http://www.leilabyron.
com/timely*

Description
With Google Calendar being widely used in the workplace, sometimes it can be overwhelming to keep track of how week may look. Timely is a way to visually forecast the upcoming work-week using tension as a way to illustrate possibly tense or stressful days. Timely updates by rotating each day based on how many events are scheduled. The more events scheduled in a day, the more tightly wound the day appears. The visual forecast is used to create awareness, while capacitive sensors in timely make it easy to adjust busy days.

Fig A.46: Product Images of Timely

Information

Type
● Simple   ○ Complex
Timely is designed for representing a single set of data, the weekly meeting and event intensity. It is based on personal digital calender of the user.
API: *Google Calander*

Filter
○ General   ● Customized
The information communicated through Timely is purely personal, as it is connected to user's personal digital calender for capturing the data.

Interaction

Method
● Passive   ○ Active
Timely is an interactively passive product, which is open to interaction continuously while its connected to the power source. It can be treated as a modern interpretation of a clock, which is a naturally passive product that informs user.

Step
○ Single   ● Multiple
Apart from its ambient informative function, Timely can also reorganize the weekly meeting activity. User can press and hold the most stressed day to distribute its load into other days.

Output

Modality
● Visual   ● Tactile   ○ Auditory
The digital information is communicated through generation of five different elastic tension structures representing the five days of the week. Moreover, user can feel the tension by holding a tower.
Sensory: Rotation

Attention Time
● Short   ○ Medium   ○ Long
Timely provides a straightforward information display to the user about their weekly planning, that requires only a small amount of attention time.

Fig A.47: Product characteristics classification of Timely

Adaptability to diverse news content
Limited ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Versatile
Complexity of adjusting information filters
Easy ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Difficult
Cognitive load on the user
Light ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Heavy

Fig A.48: Performance Analysis of Timely

Design Team
Anoushka Garg, Christopher
Bogár, Somayeh Ranjbar, Yee
Mun Ooi
*Copenhagen Institute of
Interaction Design (CIID), DK*

Design Type
Prototype

Design Period
2017

Access
http://christopherbogar.com/
work/tuneyourfeed/

Tune Your Feed

Description
Inspired by the radio, Tune Your Feed gives the user a different experience of social media by making it pure audio. It collects the user's social media feed from the last 24 hours and reads them aloud. The user can personalise what he or she wants to hear by selecting or creating new filters that will play feeds from profiles, groups, pages and more. These filters, which come in the form of coloured acrylic blocks, can be written on and pushed to snap into place.

Fig A.49: Product Images of
Tune Your Feed

Information

Type

○ Simple   ● Complex
Product can communicate different social media feeds, topics depending on the users choice, however it is connected to a single digital source.
API: *Twitter*

Fig A.50: Product characteristics classification of Tune Your Feed

Filter

○ General   ● Customized
User can easily customize their information filter by simply placing the physical word blocks on the product. Moreover, multiple blocks can be used to establish a combined filter. The red blocks are used for profiles and groups, whereas yellow ones are for hashtags.

Interaction

Method

○ Passive   ● Active
Tune Your Feed is a product that operates only during an active interaction with the user. The interaction should be initiated by the user, by placing a physical block on the product.

Step

○ Single   ● Multiple
The interaction process of the product is iterative, meaning that placing and removing of the filter blocks continuously change the communicated information. Thus, theoretically there exists an unlimited interaction step possibilities.

Output

Modality

○ Visual   ○ Tactile   ● Auditory
Product uses text-to-speech technology for transforming written social media feeds into audio format, which is listened by the user through an ambient speaker embedded in the product.

Attention Time

○ Short   ● Medium   ○ Long
Due to the nature of social media feeds, the communicated information content is generally consists of couple of sentences or words. Thus, the attention time required is on the medium category.

Adaptability to diverse news content
Limited ▬▬▬▬▬ ▬▬ ▬▬ Versatile
Complexity of adjusting information filters
Easy ▬▬ ▬▬ ▬▬ ▬▬ ▬▬ Difficult
Cognitive load on the user
Light ▬▬▬▬▬▬▬ ▬▬ ▬▬ ▬▬ Heavy

Fig A.51: Performance Analysis of Tune Your Feed

Design Team
Oli Woods Mandari
Typified, AU

The Weather Poster

Design Type
Prototype

Description
This screen printed poster uses smart ink and a tiny internet connected computer to reflect the day's changing weather. As the weather forecast changes, so will the ink on the paper. The icons take 5-15 minutes to fully activate and will update throughout the day as needed. The poster shows the weather at 8am, 12pm, 4pm and 8pm. It only shows 1 day's weather forecast at a time, so if it's 4pm and the poster displays 8am sunny, this is information about the morning you've already had.
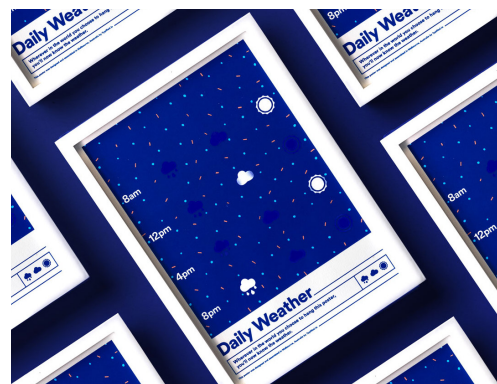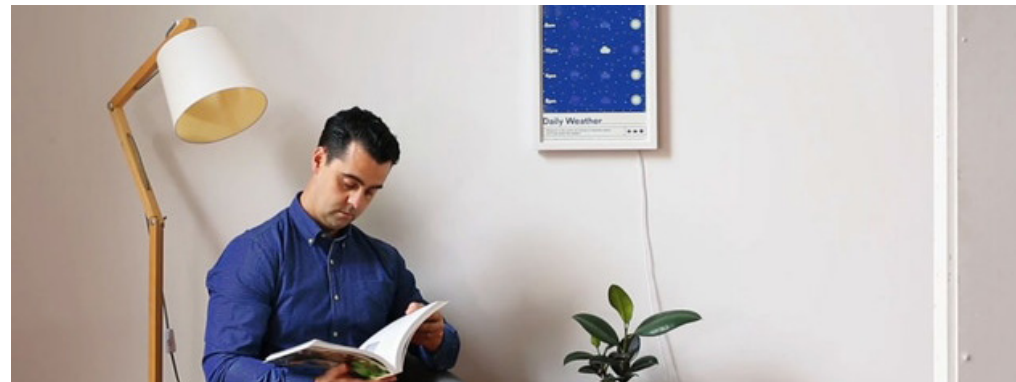
Design Period
2019

Access
http://typified.io/

Rain	Cloudy	Sunny
Showers	Partly Cloudy	Partly Sunny
Fog		Clear
Flurries		Hazy
Thunderstorms		
Snow		

Information

Type
● Simple   ○ Complex
The Weather Poster communicates information solely about the weather conditions of the day, which divided into four time slots.
API: *Typified Weather*
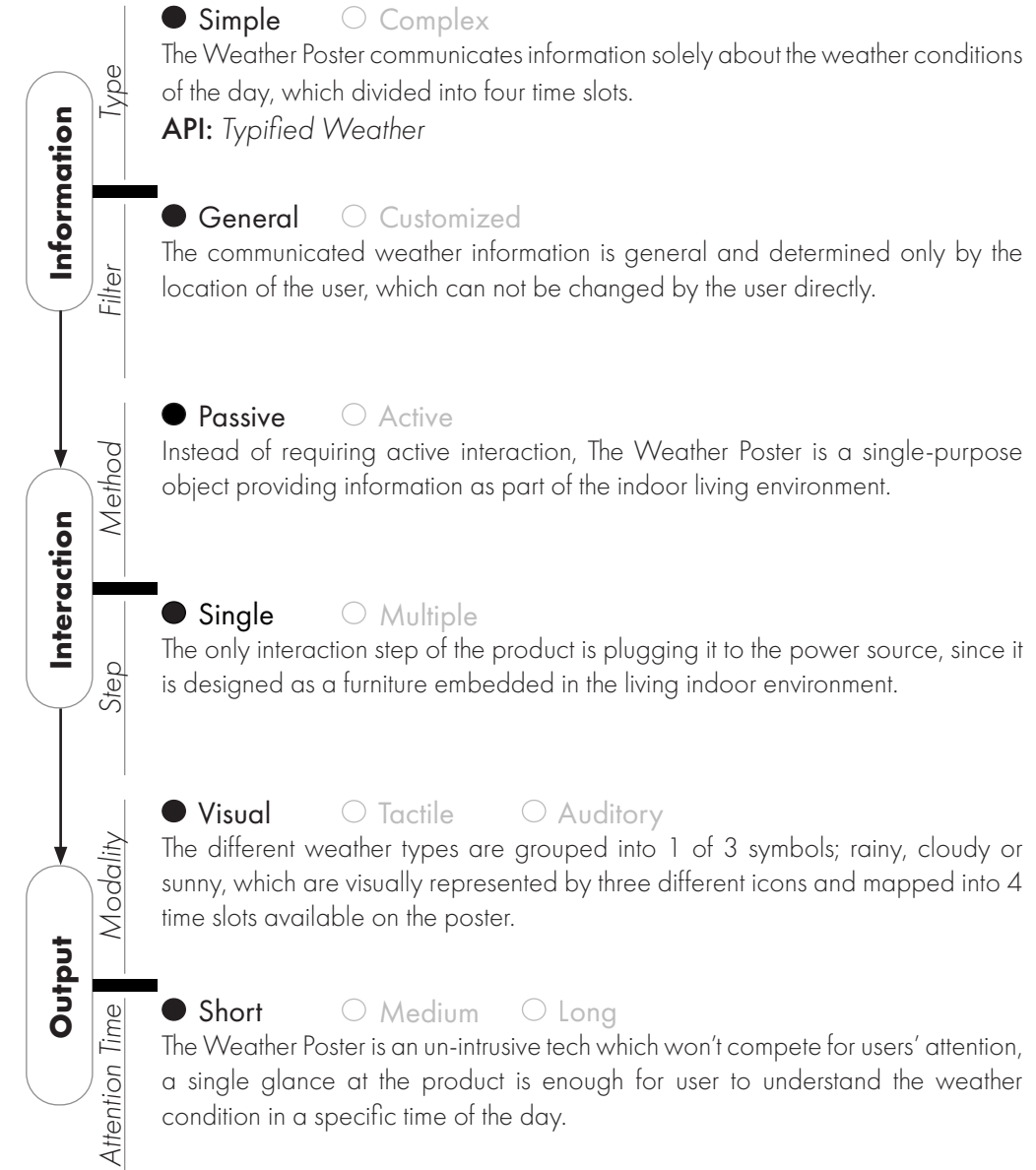
Fig A.53: Product characteristics classification of The Weather Poster

Filter
● General   ○ Customized
The communicated weather information is general and determined only by the location of the user, which can not be changed by the user directly.

Interaction

Method
● Passive   ○ Active
Instead of requiring active interaction, The Weather Poster is a single-purpose object providing information as part of the indoor living environment.

Step
● Single   ○ Multiple
The only interaction step of the product is plugging it to the power source, since it is designed as a furniture embedded in the living indoor environment.

Output

Modality
● Visual   ○ Tactile   ○ Auditory
The different weather types are grouped into 1 of 3 symbols; rainy, cloudy or sunny, which are visually represented by three different icons and mapped into 4 time slots available on the poster.

Attention Time
● Short   ○ Medium   ○ Long
The Weather Poster is an un-intrusive tech which won't compete for users' attention, a single glance at the product is enough for user to understand the weather condition in a specific time of the day.

Adaptability to diverse news content
Limited ━━ ━━ ━━ ━━ ━━ ━━ ━━ Versatile
Complexity of adjusting information filters
Easy ━━ ━━ ━━ ━━ ━━ ━━ ━━ Difficult
Cognitive load on the user
Light ━━ ━━ ━━ ━━ ━━ ━━ ━━ Heavy

Fig A.54: Performance Analysis of The Weather Poster

1.3/ Topic Based Classification

1.3.1 Description of the classification

The initial classification of the products is done based on the qualitative property of their communicated information. The main objective of this classification is to establish a referential foundation for comparing how different information topics, that are conveyed to the user, based on their product-user interaction. The classification process is done through subjective analysis and fitting into widely used information channels. At the end, products are grouped into four main qualitative information categories, that commonly exist in our daily continuous interaction with the information sphere.

1.3.2 Weather

The weather category simply indicates the products that communicate an information related to ambient, outdoor or an another location chosen by the user, which can be about the current (e.g Raincloud simply informs the user about the current rain conditions) or the future status (e.g Weather Poster visualizes all the daily upcoming weather data) of the weather.

1.3.3 Social Media

The products belonging to the Social Media category communicates information about the users' social media feed such as notifications (e.g #Flock informs user about their twitter activity based on retweets, mentions or private messages) or filtration systems (e.g Airo allows users to filter incoming tweets based on their relevant distance to the current location)

1.3.4 News

The News category is the most relevant category for the scope of this research project, since it encompasses products that directly communicates news information to the user. Those products either allow users to access news and/or filter their news reach through physical interaction.

1.3.5 Mixed Media

Mixed media category is probably the most intriguing product class, since the information communicated by this products can not be fitted into a single topic category (e.g Pulse is a multi-functional product for data visualization, that changes topic through tilting)
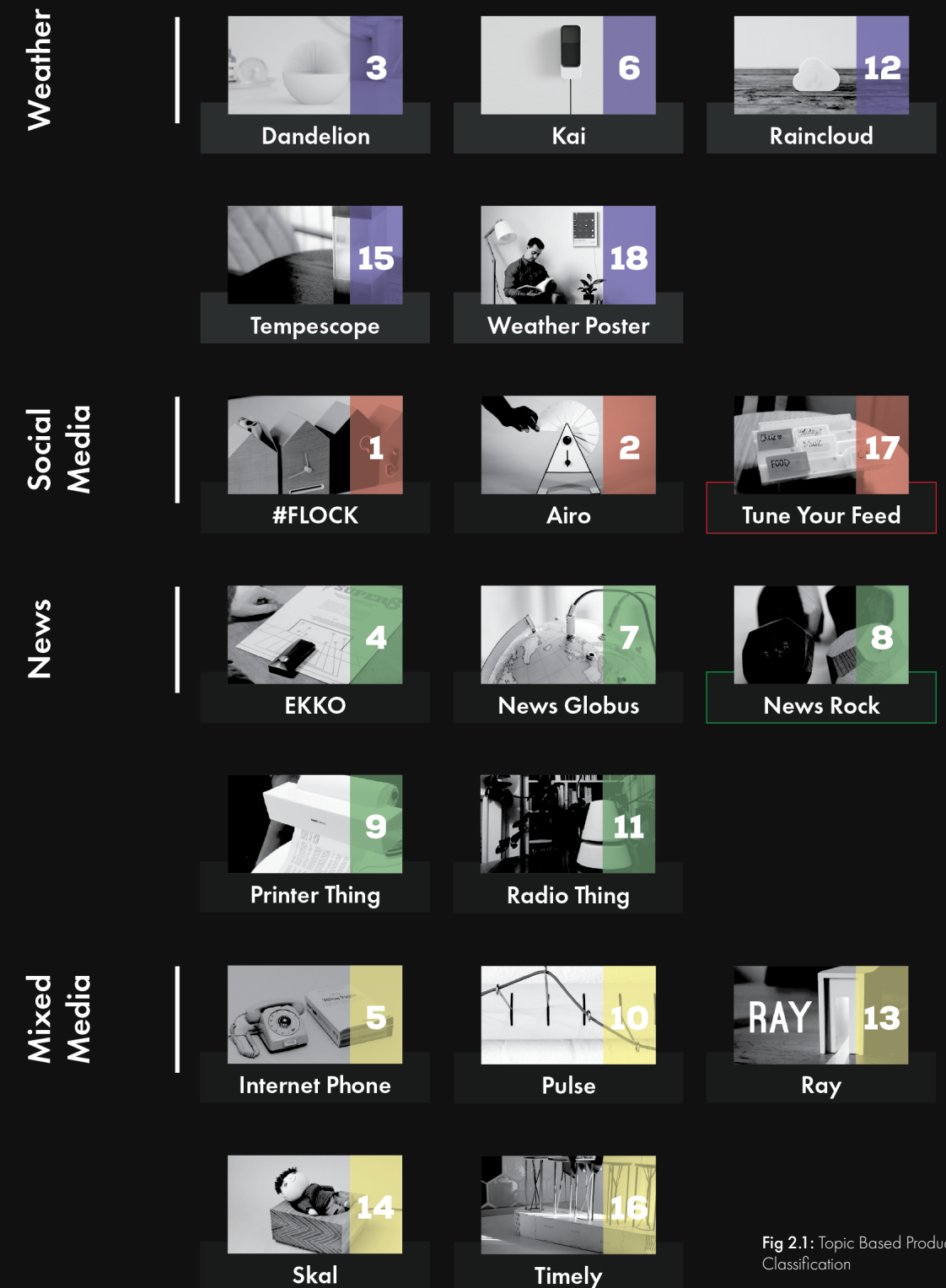
Fig 2.1: Topic Based Product Classification

1.4/ Information Based Classification

1.4.1 Description of the classification

Definition of the digital information is the second step in this product-user interaction analysis. Since each product is designed to communicate a specific digital data set retrieved from the digital sources according to their purpose, the type of the conveyed information differs from product to product.

Comparison of the collected sample products among each other, revealed that the information can be described by two main criteria: **information type** as a criteria representing the level of complexity and the scope, **information filter** as a criteria evaluating its modifiability and/or customization by the user.

1.4.2 Classification Groups

information type

simple
Simple information products are designed to communicate only a single aspect of the information, through simplification of data and concentration of the meaning (e.g. Raincloud only notifies the user about an upcoming rain through a boolean operation of TRUE of FALSE)

complex
Complex information products are designed to communicate multiple levels of information regarding a single or multiple information categories (e.g.). They are defined as complex information type products.

information filter

customized
If the communicated information can be filtered, categorized or changed according to the user needs or interest, it is called a customized information filter.

general
Whereas, if the information delivered by the product is standard and user is not allowed to filter the incoming information, it is called a general information product.

Fig 2.2: Information Based Classification Plot

1.4.3 Discussion of the Results

The news information is generally considered a complex information as it is composed of different parts such as: title, description, author, publication date or references. Moreover, it is a personalized set of information, since for each person there exist different news filters according to their personal interest and needs.

After setting up the classification parameters, a plot is drawn in order to visualize the relation between topic of information and its size and filtering.

As it can be seen from Figure X, the weather category falls under the simple and general information type as expected, since it is a considerably simple information consisting of only temperature and weather conditions.

The majority of the Social Media, News and Mixed Media related products are grouped under the complex and customized type information, which is also expected as those type of information topics consist of multiple parameters.

The main reason for the divide between Weather and the rest of the categories stem from the nature of information that they communicate. On one hand, weather information is an objective and physical real-time data, which can be mapped into predefined tables, lists or scales. On the other hand, social information, which is communicated through other categories, is a subjective gathering of multiple leveled data.

1.5/ Interaction Based Classification

1.5.1 Description of the classification

The second step in the product analysis is the classification based on the nature of the interaction. Once the information is determined based on its size and filtration system, the next step is the designing how product actually will interact with the user.

Through iterative classification studies it is determined that the products can be grouped under two sub categories for defining the user-product relation: **interaction method** as the criteria for defining the initiation of product use and its position in daily life, **interaction step** as the criteria for defining the number of required actions in order to fully benefit from a product's all functions.

1.5.2 Classification Groups

Active products are those that requires user input for initiating, continuing and ending the communication process of the information to the user. (e.g EKKO requires user to plug itself to the newspaper for interaction with digital information)

active

interaction method

As opposed to active products, passive products are those that communicates information to the user continuously or based on a time schedule, without requiring any input from the user. (e.g Pulse continuously visualizes digital information while its connected to a power source.)

passive

Single step interactive products are those that requires only a single action to be performed by the user in order to receive the information. (e.g users only need to move a single item to access news through News Rock)

single

interaction step

On the contrary, rest of the products requires multiple actions to be performed by the user. (e.g users should configure at least 3 settings of Airo or Tune Your Feed allows user to perform unlimited number of actions through changing of tags)

multiple

1.5.3 Discussion of the Results

This plot is more heterogeneous compared to the information plot, this is mainly due to the different techniques used differ widely from product to product.

All of the products belonging to the weather topic class provides passive and single interactions, meaning they constantly communicates with the user during their operation.

Mixed and Social Media products are distributed without a specific pattern along the interaction classification plot.

Passive

Single   **Multiple**
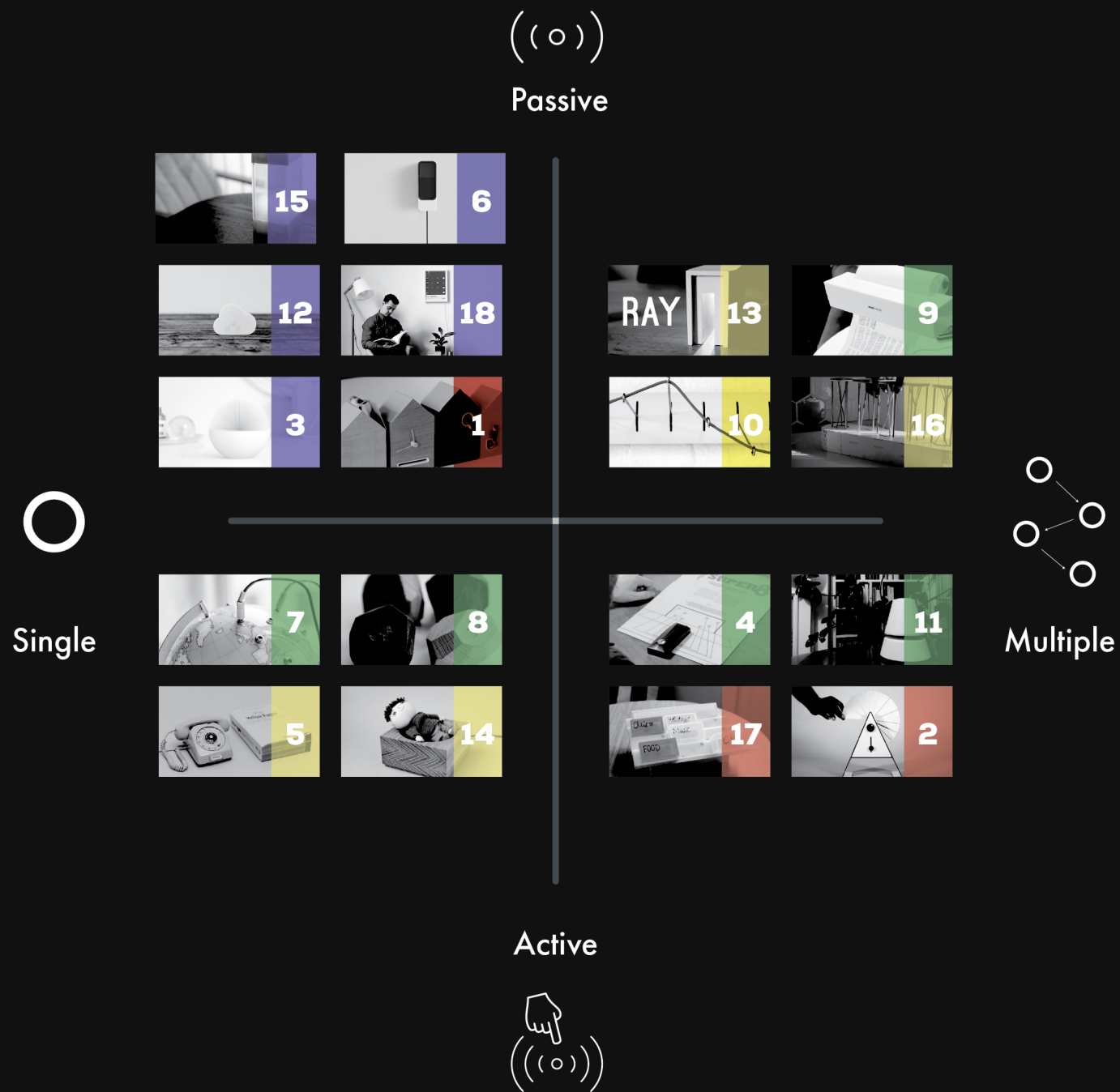
Active

Fig 2.3: Interaction Based Classification Plot

Products that belong to the news category are mostly designed to be more active in terms of user-interaction, meaning they use push technique to deliver information to the user. However, they are heterogeneously distributed between simple and multiple

1.6/ Output Based Classification

1.6.1 Description of the Classification

The final step in the product analysis classification is based on the sensory output of the product for conveying the digital information through physical changes. Output is the direct result of the user interaction process with the product, which defines the product's main character and significance.

Products are grouped under two different sensory output properties: **output modality** as the criteria for defining the type of sensory output for conveying information, **attention time** as the criteria for defining the necessary mental effort expected from user to comprehend the sensory output and the meaning.

1.6.2 Classification Groups

Products with the visual output communicates with the user through visible sensory changes, such as color (e.g. Raincloud becomes blue when there is an upcoming rain), movement (e.g. Pulse has rotating part for visualizing complex digital information)

Auditory output modality refers to the sensory communication method that benefits from the sound. In the case of this product analysis, all of the products use Text-to-speech technique, which is only a single

Tactile output modality can be described as the physical changes that communicates digital information through sense of touch, such as movement.

visual

auditory

tactile

output modality

attention time

short

Short attention time refers to the products with a very low cognitive load on the user for understanding the conveyed information, through almost an instantaneous communication.

medium

Medium attention time refers to the products that require some cognitive processing from the user, ranging maximum to 1 minute.

long

Long attention time refers to the products that ask from user to fully focus on the product and spend more than 1 minute to understand the communicated information in details.

1.6.3 Discussion of the Results

As it has been deducted in the previous sections, products that fall under the weather topic category communicate with the user through simple interactions. It has been observed that visual sensory output method requires shorter attention time span. News products requires longer attention times compared to weather and social media, this can be due to the more complicated nature of news being a multi-leveled information type.

Fig 2.4: Output Based Classification Plot
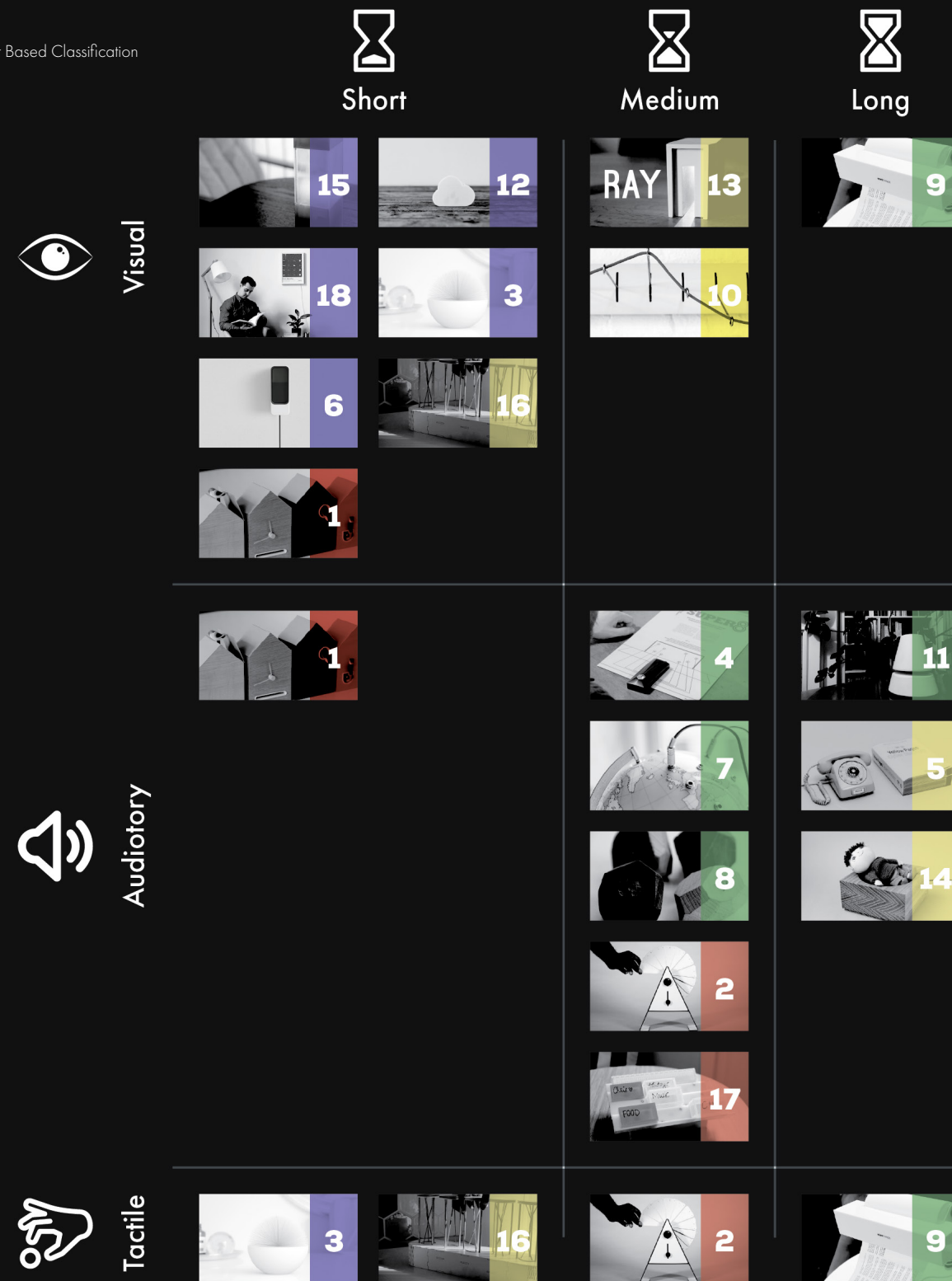
1.7/ Performance Index

Each product has been evaluated for three different performance parameters: **news adaptability**, **filtering difficulty** and **cognitive load** on a scale of 10.

News adaptability index demonstrates how can the product can be redesigned into communicate digital news based on their flexibility. This performance evaluation is mapped from being most versatile to the most limited. Versatile end of the performance evaluation indicates that the product can be easily implemented into the digital news environment without undergoing changes in its interaction system. Whereas, limited end indicates the opposite.

Filtering difficulty index measure products performance in changing their digital information filter through products interactive parts and system. This performance evaluation is mapped from being easiest to most difficult.

Cognitive Load index evaluates products based on the mental effort required by the user to fully understand the communicated digital information through the sensory outputs of the product. This performance index is mapped from requiring the lightest cognitive load to the heaviest.

After evaluating all the products based on their performance indexes, two different plots are mapped for comparing interactively active (Figure Xa) and passive (Figure Xb) products based on all three performance evaluations. The main reason for choosing passive and active products for comparison, stems from the fact that, the method of interaction is the starting point of designing a product. Consequently, this will effect the decision making process for developing conceptual solutions in the upcoming chapters. Furthermore, an hypothetical optimum product performance area has been drawn to point out the most desirable product characteristics.

As it can be seen in Figure Xa and Xb, passive products are more difficult in changing the information filters compared to the active products. This mainly due to the face that passive products inherently have less or sometimes none physically adjustable parts compared to active ones. However, it has been observed that passive products have lighter cognitive load on the user compared the active products. In accordance with the adjustable part hypothesis, when a product is designed to passively communicate with the user, there is less mental effort needed from the user.

When it comes to the news adaptability index, there isn't a conclusive difference between active and passive products compared to the other performance evaluations. Nonetheless, it has been observed that active products can offer more versatile opportunities for adapting to the diverse digital news content.

As a conclusion, products that are active in their interaction method are found to be more suitable candidates for designing for digital news content. This outcome is very important and will be taken into account when developing the conceptual solutions.

1.8/ General Product Diagram

The final step of the product analysis section is concluded with a global mapping of the complete digital information flow from online sources to the resulting sensory output communicated to the user through the product (Figure 2.7). This info-graphic allows observing the overall process from a wider perspective.

Passive products are mostly communicate single Typed information (8 single / 3 Complex) as opposed to active products which all of them communicates Complex information (8 Complex). Most of the products offer some kind of personalization of the communicated information, for passive interactive ones its (7 personal / 4 General) as for the active products (8 Customized). Passive products are triggered mostly by a change in the input data, meaning they will start user interaction on notification (6 products), 2 of them are timed and 3 of them are constantly interactive products. Passive products have the visual output modality as the dominant interaction method with only two products having additional sensory outputs, (1 for tactile and 1 for auditory). On the other hand, interactively all of the active products have auditory properties as the output sensory modality. Passive products have shorter needed attention time during their interaction (6 short/ 5 medium) as opposed to active products that generally have longer attention time average (5 medium / 3 long).

Passive Products
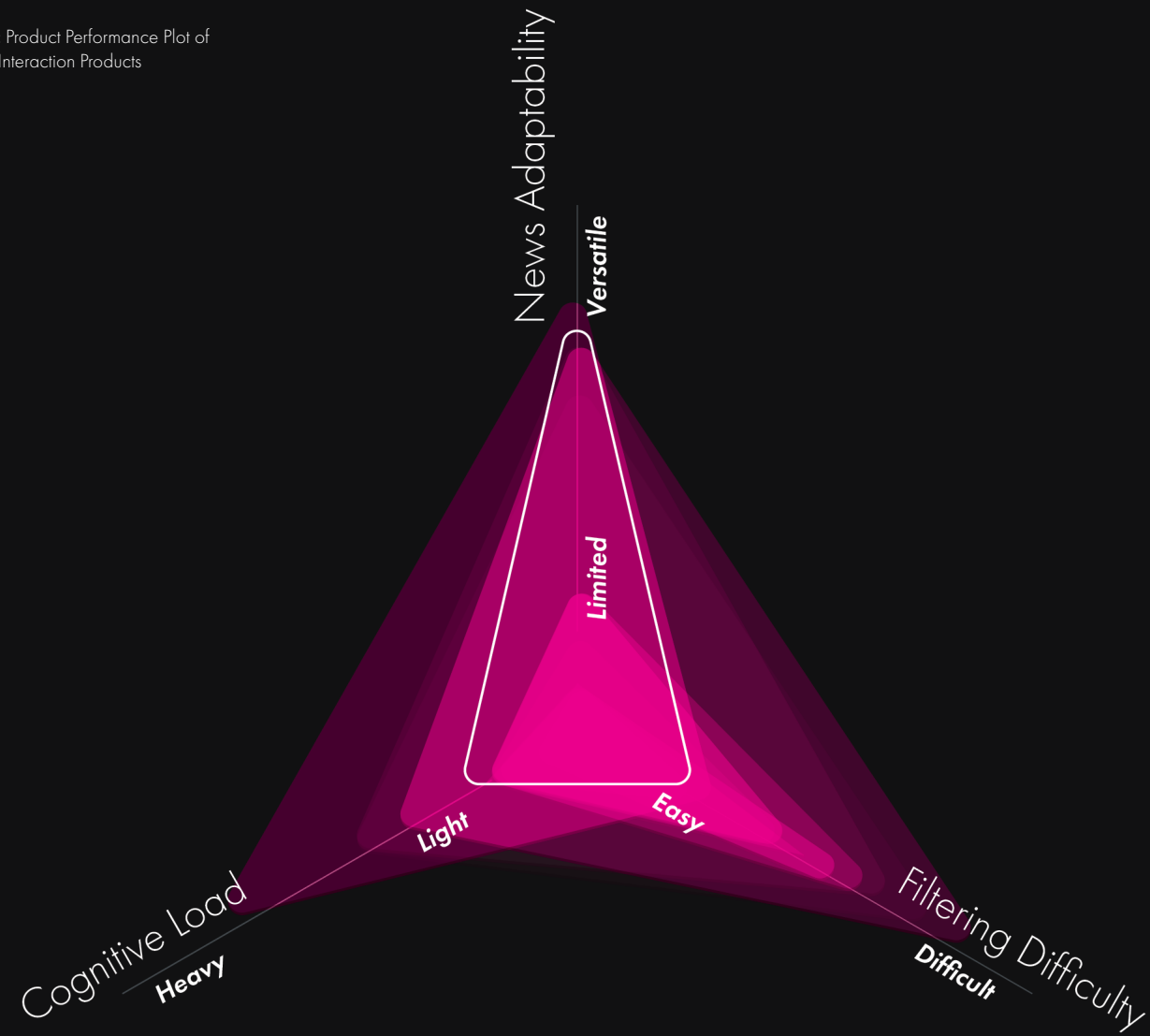
Active Products

News Adaptability

Versatile

Limited

Light

Easy

Cognitive Load

Heavy

Filtering Difficulty

Difficult

Optimum product performance area

News Adaptability

Versatile

Limited

Light

Easy

Cognitive Load

Heavy

Filtering Difficulty

Difficult

Optimum product performance area

Information

Interaction

Output
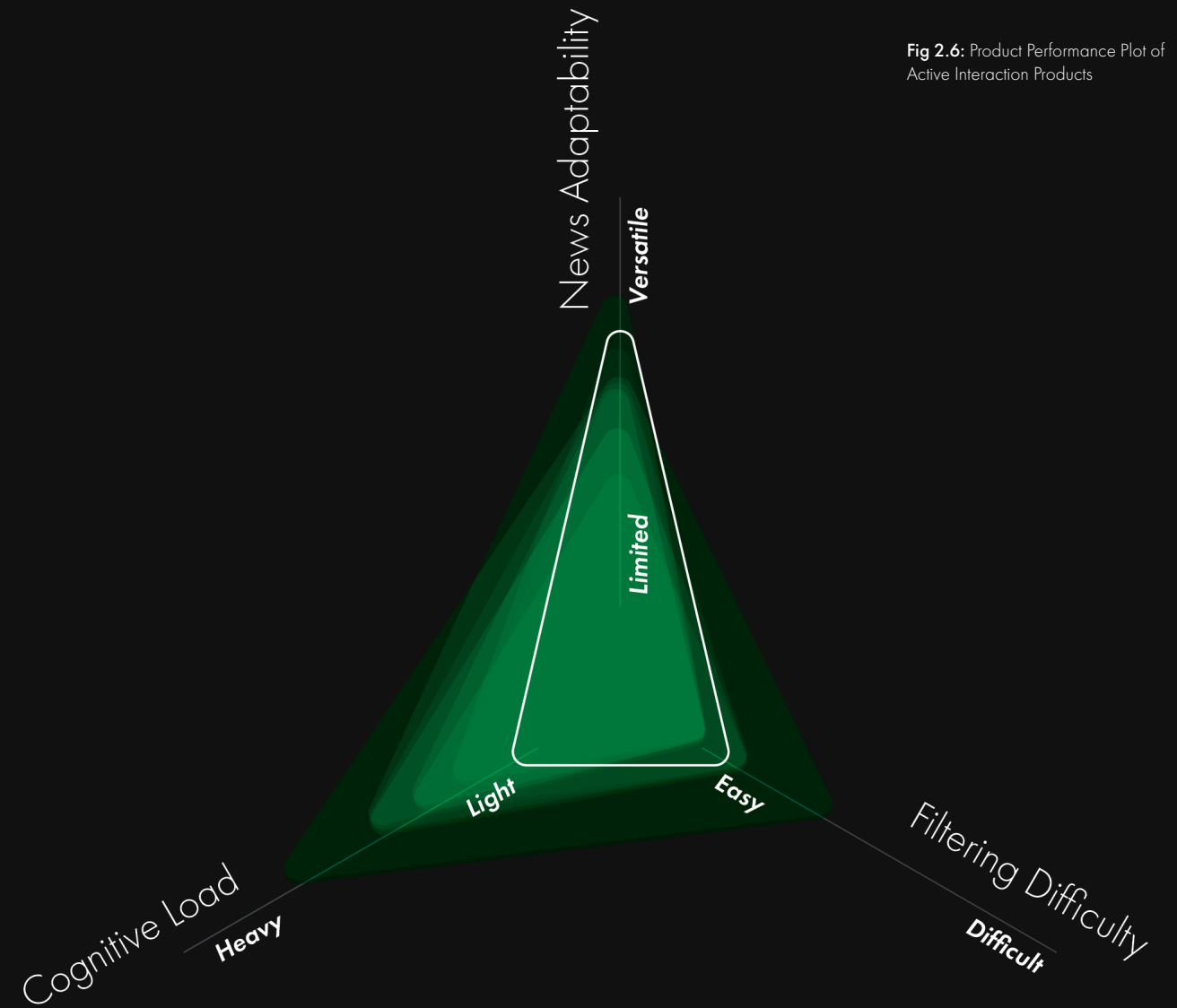
Fig 2.7: The complete information flow analysis of communicative products case studies.

Type

Filter

Method

Step

Modality

Attention

Visual

Short

Multiple

Complex

Customized

Active

Tactile

Medium

Simple

General

Passive

Single

Auditory

Long
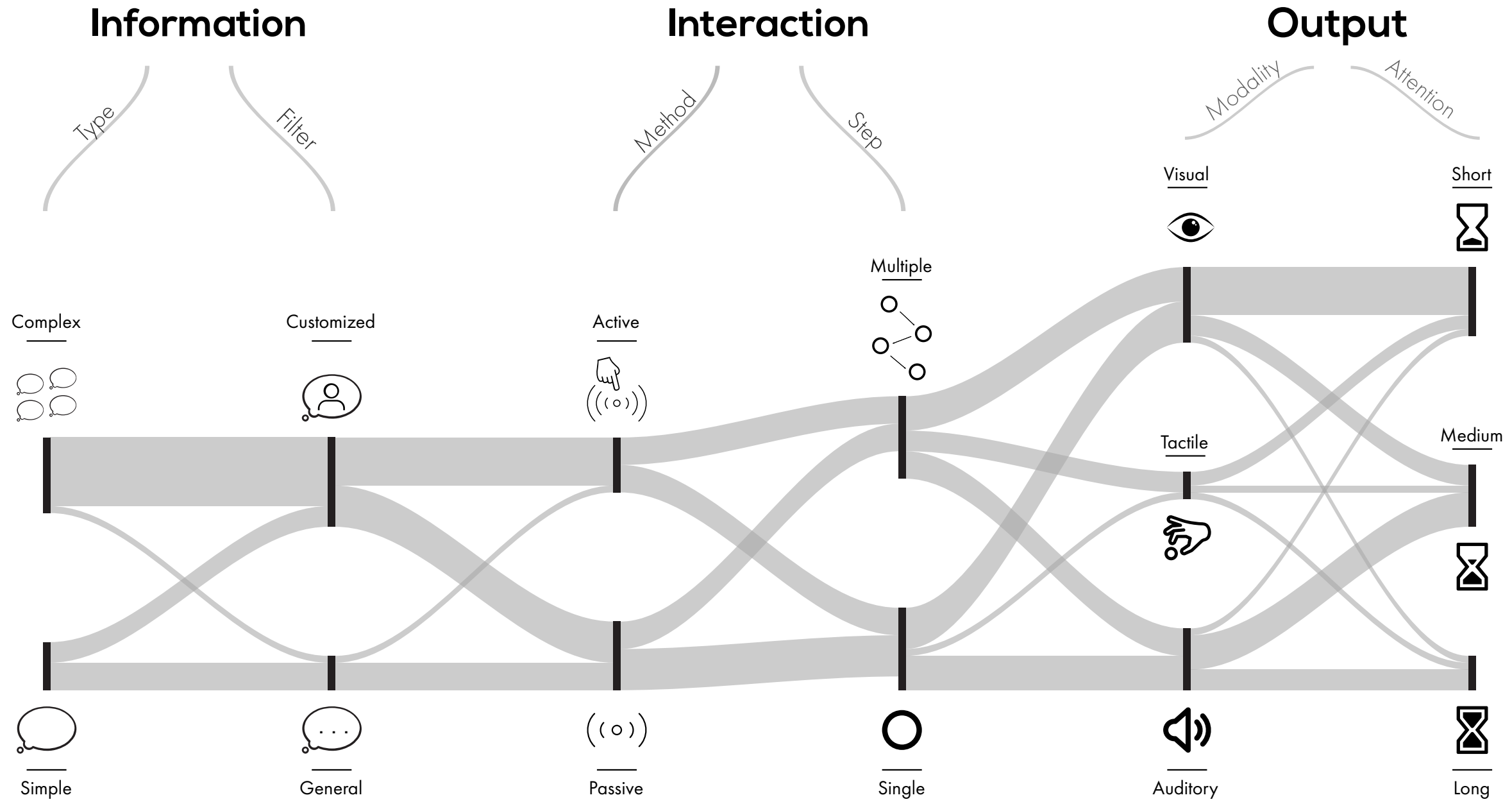
2/ Survey

Survey methodology is a powerful l tool for receiving user insights for a specific problem and it gives an opportunity for better understanding user's perspective. The survey provided a fresh look at how people browse news on their computers and smartphones, how they get to news articles (e.g. via search, social media, or browsing), and how users engage with multiple news sites within a news session.

2.1/ Survey Structure

Survey has four sections, first section of the survey is about the demographic characteristics of the participants, the second section investigates the news engagement habits, the third section goes in deep for understanding if participants face with the news overload and what kind of consequences and countermeasures are resulting, the fourth and final section concludes the survey by post-news interaction experiences.

The general structure of the survey is designed to take as little as time possible from the participant as the high participant number is vital for establishing an outlook for the topic from the news audiences perspective. Furthermore, a more graphically versatile and interactive is survey platform called JotForum is used instead of the standard GoogleForms. It can be accessible from the link : "https://form.jotformeu.com/92942160765361". After the completion of the survey, it has been distributed on social media platforms such as Facebook, and Online academic contribution platforms such as the SurveyCircle.

Fig 2.8: General Survey Characteristics

05:47
Avg. Completion Time

86
Participants

14
Days

Q1.1: How old are you?

Q1.2: What is the highest degree you have completed ?

Q1.3: How much time do you spend on the Internet each day, except from your/studies?

Fig 2.9: Demographic Results of the Survey

2.2/ Survey Results

2.2.1 Demographics of Participants

The first part of the survey is designed to ask questions for understanding the demographic range of the participants through simple and direct question. Participants are asked question regarding their age, education level and their daily internet interaction. Age and education level has already been discussed in the literature review part for being influential factors for news overload. Large part of the participants are young, Gen Z and Millennial but there also participants from older generations. The education level of the participants

2.2.1 News Engagement Habits of Participants

Firstly, participants general outline of news reach is asked in terms of their news engagement pattern by time and topics. It is found that 62% of the participants interact with news on a daily basis and only 7% has a news engagement pattern less frequent than a weekly basis. This indicates that daily news engagement is a widely diffused habit. Furthermore, participants are asked to evaluate 7 commonly used news categories for their engagement frequency ranging from "Always" to "Never". Sometimes is the biggest proportion among the topics except from business. This means that people are following all news categories at a passive level (sometimes). Nonetheless, Global News category is the most followed news category with 30% of the participants always actively interacting. It is followed by Weather, Local News and Politics. Since Art&Culture and Environment categories have more specific and actively involved news audiences, their engagement ratios are lower.

Fig 2.11: Survey Results for the question: "How much time do you spend on the Internet each day, except from your/ studies?"

The second step is to analyses participants widely used platform for their news engagement, where they were asked to choose between physical or digital. As expected, the news engagement is overwhelmingly digital with 97% among the participants, compared to the remaining 3%.

- Hourly
- Daily
- Weekly
- Less than weekly

Fig 2.10: Survey Results for the question: "How frequently do you engage with news?"
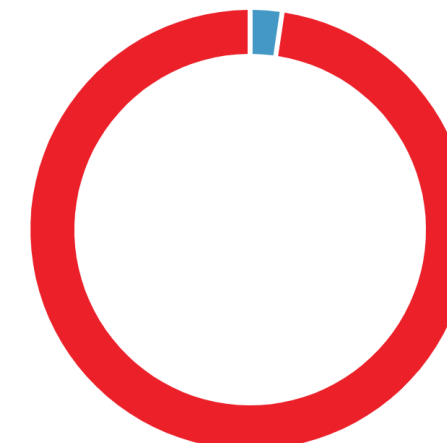
- Digital
- Physical

Fig 2.12: Survey Results for the question: "Does your news engagement happen mostly through digital of physical platforms?"

%72

%15

%13

%10

Smartphone   Laptop   Radio   TV   Tablet

Fig 2.13: Survey Results for the question: *"Which platform do you use for your news engagement?"*
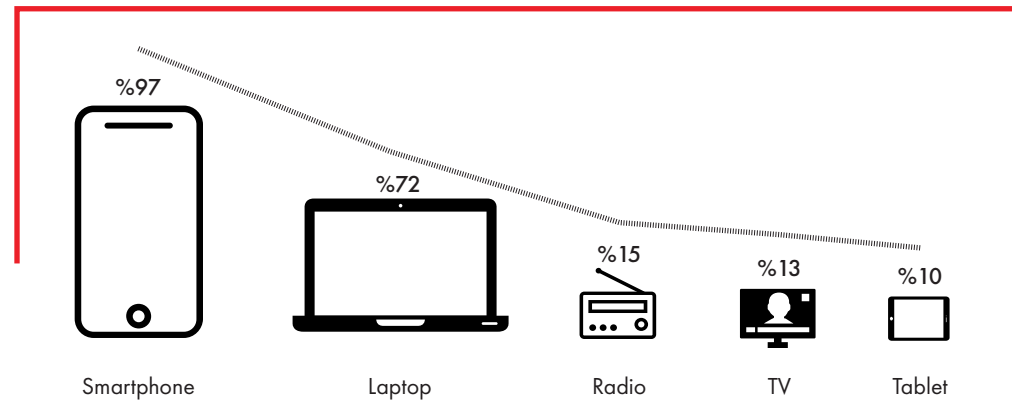
Following, participants are asked which digital platforms they use for engaging with digital news. Smartphone is the leading primary product for news engagement, almost every participant (97%) use phone alone or in combination with other products, which is followed by PC (72%). The other news media platforms Radio, TV and Tablet are preferred far less compared to Smartphone and Laptop. This result doesn't come as a surprise, since Smartphone and Laptop is an integral part of the daily digital interaction with not only news information but also any kind of information accessible online. This results are in accordance with the research part where it has been explained that news engagement is not only becoming digital but also mobile through the use of on the go connected devices.

The next question of the survey is designed to understand the opinion of the participants toward the use of several online tools and their effectiveness for keeping up-to-date with the continuous news flow.

Among the six news access methods, participants found that using keywords for accessing news to be most efficient (70%), followed by social media (67%). The least preferred method is listening news report from radio/podcast (53%), which is in accordance with the previous results indicating the lower use ratios for Radio as a digital news platform.

| In-site References 67% | Advices from friends/family | Motivation for different perspectives |
| Long-term use habits 53% | 38% | 36% |
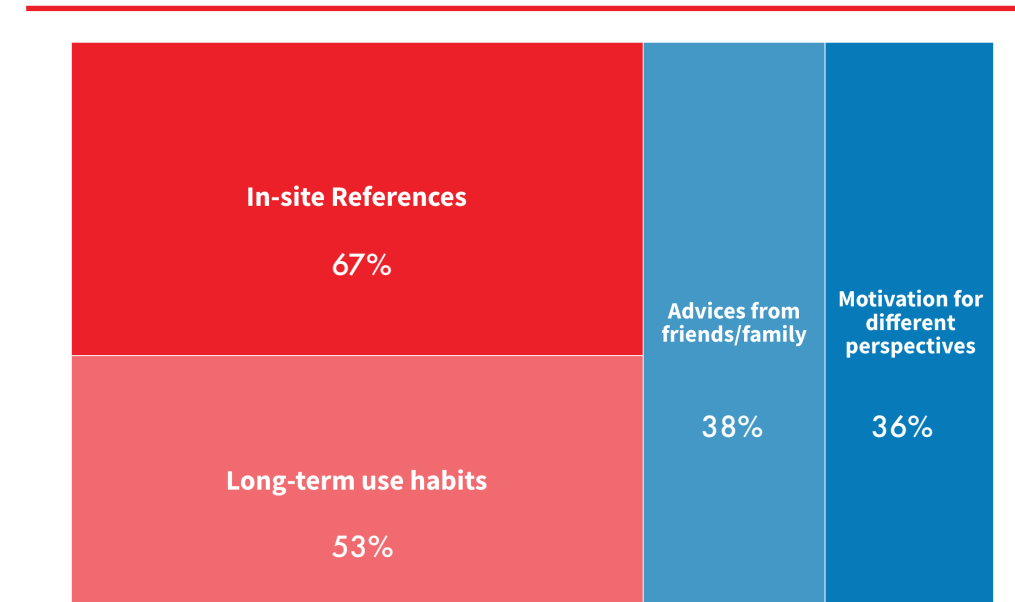
Fig 2.15: Survey Results for the question: *"What does effect your news sources selection?"*

● Useful
● Not Useful

Fig 2.14: Survey Results for the question: *"How much do you find each of the following tools useful for staying up-to-date on the news?"*

Using keywords through search engines (Google, Yahoo!, Yandex ...)

Subscribing to a particular single news source that sends you links to its top news stories for each day.

Getting instant news alerts on your mobile devices.

Listening to news programs on the radio that reports the day's news.

Finding news stories on Facebook, Instagram or other social media platforms.

Subscribing to a website or app that organizes news links for you from a variety of sources.

0   50   100

In the last part of the news engagement habits section of the survey, participants are asked to answer what is the most influential factor effecting their selection of news sources among four options: In-site references from news articles, Long-term use habits of using the same news source over a long period of time, Advices from friends/family as the social influence and Motivation for receiving news from sources that represents different socio-political perspectives.

In-site references is the main choice for many participants, since in-app or in-website links are easy to use and can create continuous interaction when exploring a topic deeper. As also expected, long-habits of using the same sources are also very influential. Motivation to try different sources are low, this might be linked to low trust levels on media, which in turn is making people question the reliability of the new sources and decrease their motivation. Lastly, social influence from friends/family has also very low influence on selecting news sources.

2.2.3 News Overload

This part of the survey is the backbone of this research project. The participants are asked to answer if the digitalization of news made it easier (44%) or harder (56%) for them to be well-informed. Specification of news interaction, through a specific device (60%) or specific topics (36%) is found to be the most chosen countermeasure for getting exposed to too much news. News avoidance is an another preferred method for decreasing the news overload, but its not widely chosen among participants, since it disconnects from news engagement totally.

For participants that found it harder, they were asked two different questions; one question is about how they experience the news overload and the other questions is about what is becoming more difficult in their daily news interaction habits. As discussed previously, participants stated that they encounter the same news (62%). Filtering news according to their personal interests is the biggest problem they encounter (60%), followed by discussing news through real-life conversations (48%). Keeping track of the news of loved ones (21%), as opposed to the expectations were not preferred by the participants. This can be due to their ability to just call or text to check others, through messaging apps, situation directly instead of understanding from news.
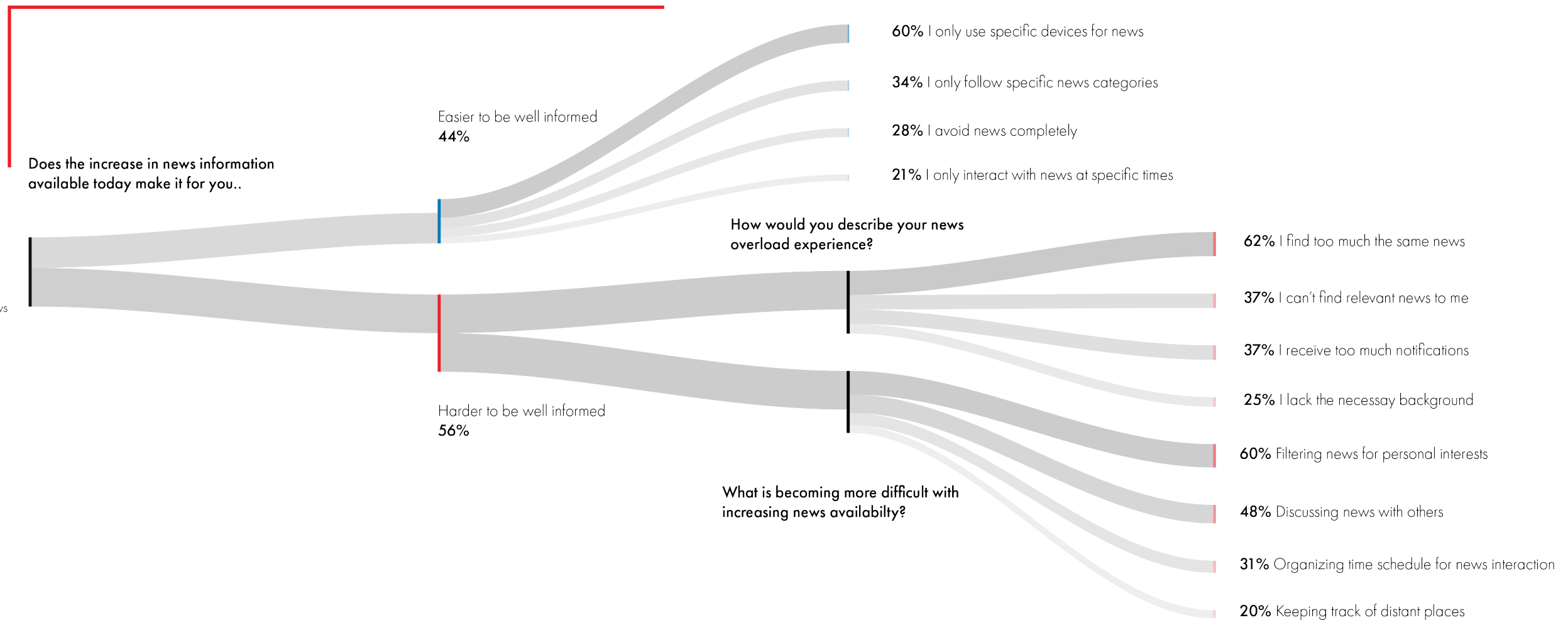
Fig 2.16: Survey Results for the News Overload Questions Combined

Does the increase in news information available today make it for you..

Easier to be well informed
44%

Harder to be well informed
56%

How would you describe your news overload experience?

What is becoming more difficult with increasing news availabilty?

60% I only use specific devices for news

34% I only follow specific news categories

28% I avoid news completely

21% I only interact with news at specific times

62% I find too much the same news

37% I can't find relevant news to me

37% I receive too much notifications

25% I lack the necessay background

60% Filtering news for personal interests

48% Discussing news with others

31% Organizing time schedule for news interaction

20% Keeping track of distant places

2.2.4 Post News Engagement

In the last part of the survey, participants are asked to comment on their post news engagement experiences, feelings and habits.

Firstly, they are asked if they feel any kind of distress when they finish their news session. More than half responded as they don't experience distress (53%) as opposed to 43% of them actively feel distressed. People that feel distress after their news interaction, experiences mostly problems on psychological level with emotional distress being the most (80%) and the cognitive strain being the second (50%). The physical distress is lower than the psychological one.

Fig 2.17: Survey Results for the question: *"Do you feel distressed after your news engagement?"*

- No, I don't
- Yes, I do
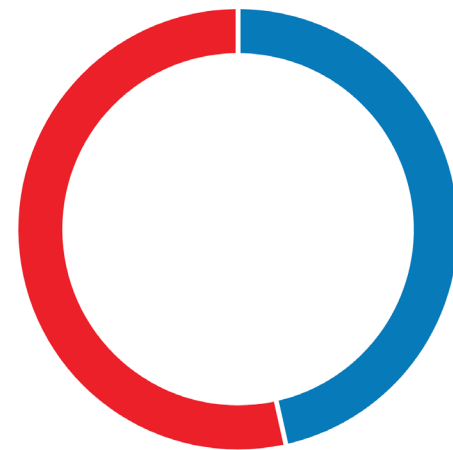
Fig 2.18: Survey Results for the question: *"If yes, what kind of symptoms do you feel?"*

%80 Emotional Distress
%50 Cognitive Strain
%22 Visual Fatigue
%2 Physical Pain
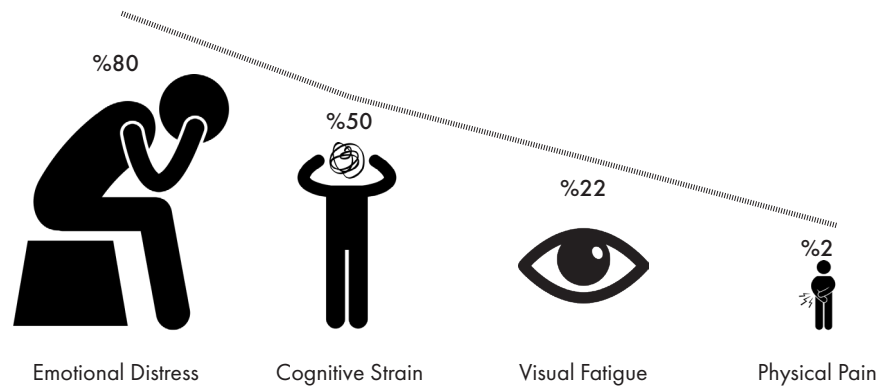
Secondly participants are asked about their news saving habits. As expected people not tend to save news for future reference, this can be related to the nature of news, being recent and consumed on spot. Moreover, this can be also related to the limits of the interaction platform. Digitally bookmarking (80)% is the most preferred method for saving news.

Do you save news?

80% No, I don't

20% Yes, I do

5% Collecting paper-based media

11% Taking physical notes

27% Finding difficult to save

83% Digital Bookmarking

Fig 2.19: Survey Results for the question: *"Do you save news? If yes, how?"*

Thirdly, participants are asked about their news sharing habits, where majority of them responded yes (70%). Moreover, news sharing habits are overwhelmingly happens on a private level either through digital peer-to-peer messaging services or through real-life discussions.
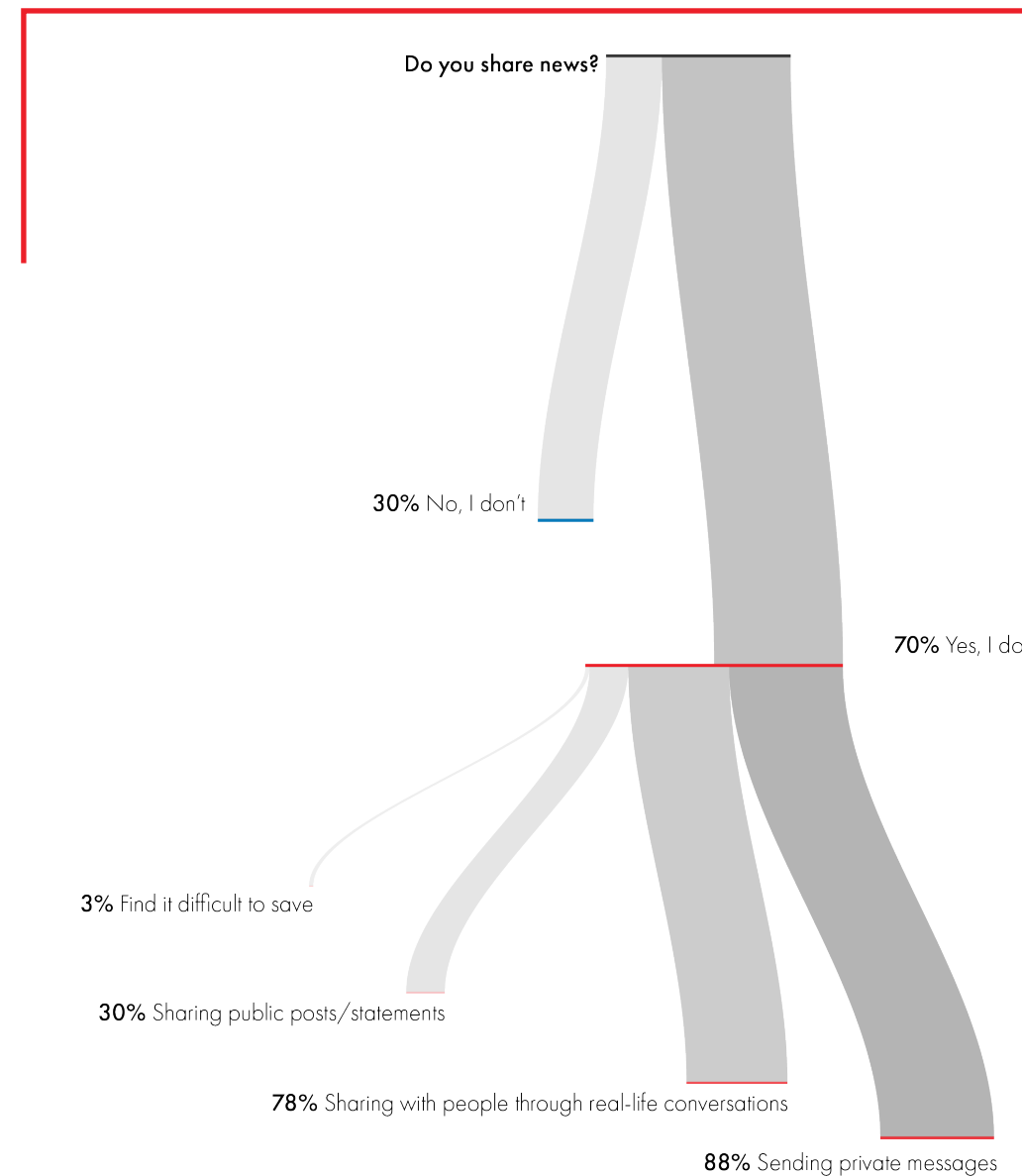
Fig 2.20: Survey Results for the question: *"Do you share news? If yes, how?"*

Do you share news?

30% No, I don't

70% Yes, I do

3% Find it difficult to save

30% Sharing public posts/statements

78% Sharing with people through real-life conversations

88% Sending private messages

2.2.5 Discussion of Survey Results

1.People have different frequencies for interact with different news categories based on their personal interests and preferences. However, they follow other topics on a passive level of checking, big part of sometimes.

2.News engagement is overwhelmingly digital, and especially based on phone as a product of interaction. PC is also a very important product for accessing news. Phone is an indispensable part of any news interaction system.

3.Although trust in social media news is low around the globe, this method is still found to be useful for news access. Direct keyword search through search engines is found to be most useful among other digital news access methods.

4.Participants tend to choose from in-site or in-app sources that is presented by their sources that are already in use. Moreover, habit of using the same source is very influential. The motivation to try different sources is low, which can create bias on the consumers due to use of a single source.

5.Increasing news information availability is found to be making harder to get well-informed by more than half of the participants. The specification of news access (through products or topics) is chosen to be the most effective countermeasure used by people who don't express being overwhelmed by news.

6.Some people experience distress after their news interaction, which is mostly on the psychological level of the consumer. A leading reason is the emotional distress followed by cognitive strain. This doesn't come as a surprise, since the majority of todays news are shocking and bad.

7.People tend not to save news, and when they do so, its mostly through digital bookmarking tools. On the contrary, majority of the participants share news with others and mostly through private messaging and conversations. They tend keep their news in personal sphere.

Chapter 3/
Design & Test
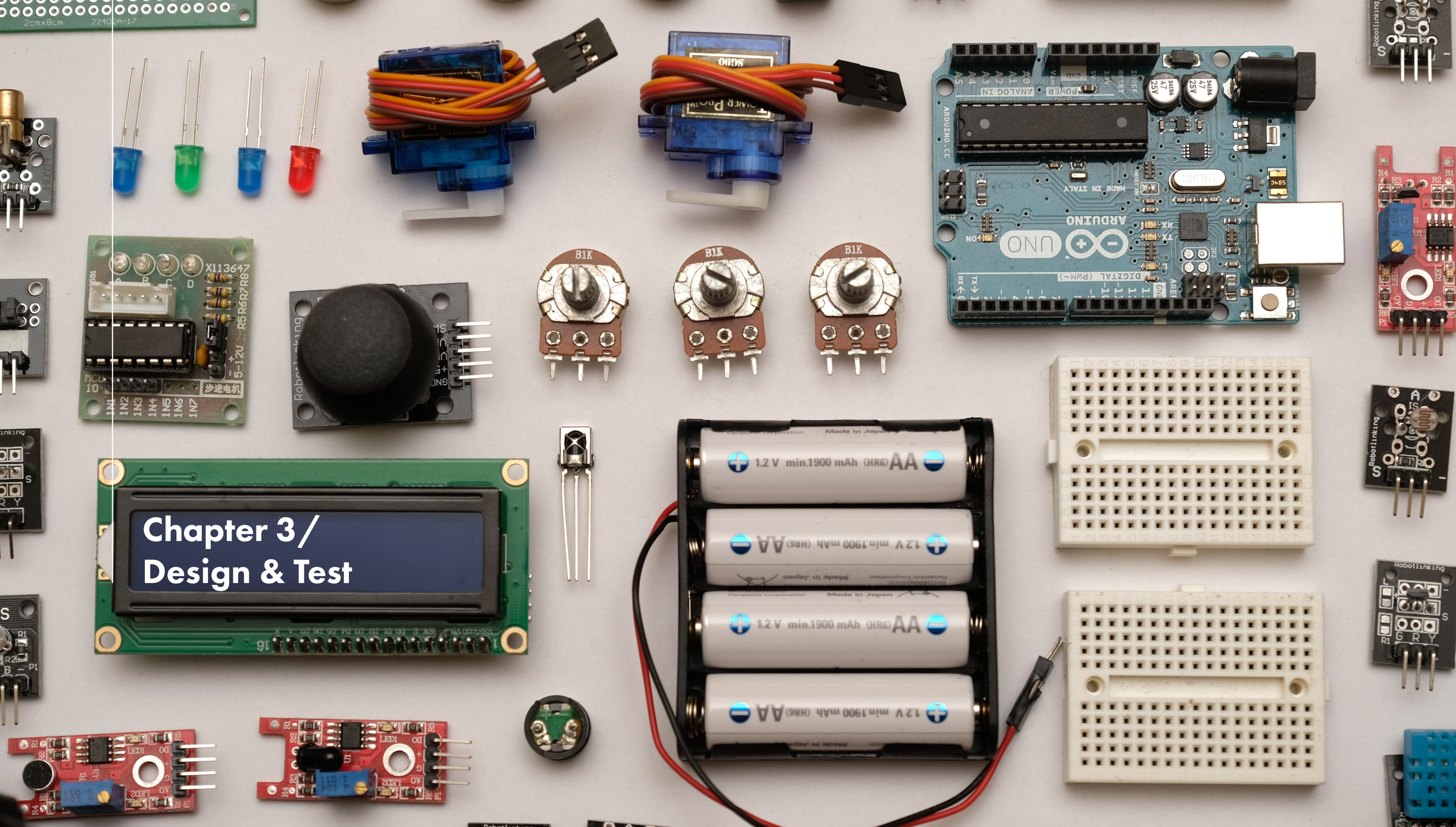
1/ Design Process: from an idea to a concept

The guiding hypothesis of this study is that news engagement through physical products can create more engaging and tangible experiences for users, and this physical involvement can increase user's ability to cope up with the continuous news information flow. In order to test this hypothesis, an interactive physical product for communicating with the digital information sphere is designed through iterative user-testing process.

This chapter includes the design brief where the foundation of product characteristics are laid down, the concept development where the product interaction with the user and the digital news information is defined, and the prototyping of the product with continuous user testing.

1.1/ Design Brief

The design brief is constructed from the intake of three main research methods that are used and explained in the previous chapters: the literature review, the product analysis and the survey.

1.The literature review provided the necessary background for understanding the contemporary news engagement trends around the globe and some problems that are caused by the continuous information flow and digitalization of news. It is found out that the traditional journalism tools and methods are changing, such as the products and sources used for accessing news. Digital news has found to being widely used by all of the age groups and mostly through mobile connected devices. Moreover, people tend to use a mix of sources and topics for personalizing their news reach. On one hand digitalization has democratized news by lifting the accessibility barriers and increased the speed of distribution. On the other hand, the abundance of news information and instantaneous distribution has resulted in overloading of news audiences with irrelevant content for their daily needs. Finally it is concluded that the main drivers of news overload are the screen-based communication devices (e.g. Smartphone, Laptop) and lack of filtration systems for personalization of news content.

2. The product analysis has been conducted to find physical interaction examples in order to have a general idea about communication of digital information from online sources through a physical product medium.

Although most of the products were not directly designed for digital news engagement, they all provided different perspectives for construction an overall information flow including different classifications of information, interaction and sensory outputs. It is concluded that inherently user activated products offer better filter adjustment systems and tactile interaction methods lower the cognitive load on the users if they are coupled with visual indicators.

3. The survey has provided very valuable user insights about their news engagement habits and problems. It is found that big part of the participants were actively engaged with news on a daily basis and through a combination of various news topics. Moreover, the Smartphone dominance on news access has been proven accompanied with social media and search engines being the most efficient online tools. The lack of filtration capabilities is what makes participants feel overloaded by the news, as they find it difficult to personalize their newsfeed according to personal needs and interests.

Combining all of the research outcomes the design brief is constructed as below:

MAIN FUNCTION

A physical product for managing personalized digital news-feed

NECESSARY FUNCTIONS

with **user defined personalized news filters**

with **standalone function**

with **compatibility of digital news tools**

without **alphanumeric language communication**

The design solution should facilitate user's management of their daily news intake, in order to provide more control over their information reach trough a tangible interaction. The brief doesn't specify what type of news filtering system could be user neither the way of interaction for it.

An MIDI (Musical Instrument Digital Interface) controller is widely used hardware by musicians, especially the ones making Electronic Music. This device manages, filters and synthesize different sounds for creating a final song. As it can be seen from the images below, the MIDI controllers can be fitted with various sliders, knobs, pedals or any other sensors.

Since music is an also complicated information type with various parameters such as Pitch, Duration, Dynamics, Tempo, Timbre, Texture and Structure, the tool used for managing it could provide an alternative physical solution for news, an another multi-leveled information.

Thus, a concept of an MIDI controller will be the base for designing the prototypes for user testing. This analogical approach of representing news in the form of music is expected to better skill the users for managing their digital information intake. Moreover, a more playful interaction could negate the emotional and cognitive distress related to the news.

Fig 3.1: Some examples of an MIDI controller used in the music making

1.2/ Prototyping

The prototyping of the concept has been carried out along with user testing at the same time, which started in the second week of February and continued until the second week of May. During this time period, 4 prototypes (2 physical and 2 digital) are prepared and tested with users. The initial aim was to prepare physical interaction experiment for each of the test prototypes. However, the Covid-19 outbreak and resulting social contact limitations during the first half of 2020 has altered the planning of the user tests.

Although designing of the on-line user testing proved to be a challenge, it enabled to communicate and receive feedback from users without needing to be sharing the same physical space. Moreover, the overall Online testing experience made to feel similar to a game which then increased the motivation for user participation.

Fig 3.2: Timeline of Prototypes

1st Prototype

Date:
10 - 20 February 2020

Number of user tests:
8

Test Medium:
Physical

2nd Prototype

Date:
1 - 10 March 2020

Number of user tests:
5

Test Medium:
Physical

3rd Prototype

Date:
15 March - 15 April 2020

Number of user tests:
5

Test Medium:
Digital (Online)

4th Prototype

Date:
1 - 10 May 2020

Number of user tests:
8

Test Medium:
Digital (Online)

1.2.1 The First Prototype

The first prototype is build with very simple interaction tools for having a fast initial test with the user, only using:
-1 Microprocessor (Arduino Nano)
-4 circular potentiometers.

Basically, the digital newsfeed is divided into four different news categories (Global, Local, Politics and Sport) with separate column representing each one. The width of the columns, representing the interest in that specific category, is controlled from the physical prototype.

Analog readings from the potentiometers are captured by the microprocessor (Arduino Nano), which are mapped into digital outputs for sending into Unity software through serial connection. Once the rotation of the potentiometer is delivered to Unity, the corresponding news column is changed. Furthermore, The Guardian's API is used for delivering up to date news content for simulating the real use of the product.

Each user test session took approximately 10 to 15 minutes, since the product had very simple interaction guidelines user testing was short and straightforward. The testing span over two weeks and included 8 participants. Firstly, prototype surprised the users, as none of the them have interacted with digital news through a tangible interaction. After the first encounters, users started to make comments on how well they understand the function of the products and what can be changed or added to increase the use value. The main outcomes of the user test is listed below.

Positive user feedback +

-The feeling of controlling digital information with physical interaction
-Analog interaction makes it easier to adjust news feed
-"Even my grandfather can use it!"

Negative user feedback -

-There is no feedback from the product for understanding the current situation
-Users prefer to designate the news topics instead of standard categories
-Circular motion is weak for interacting with linear change
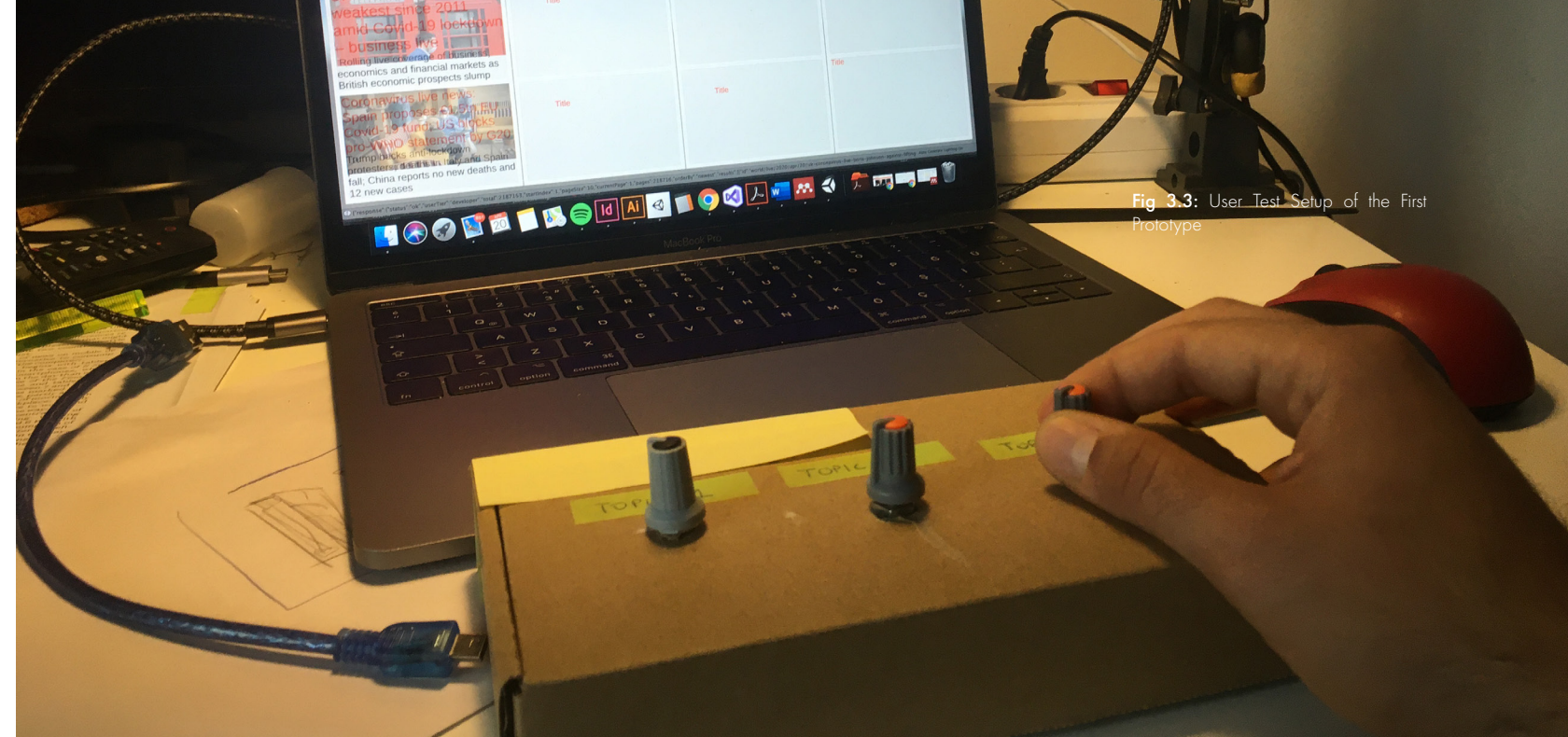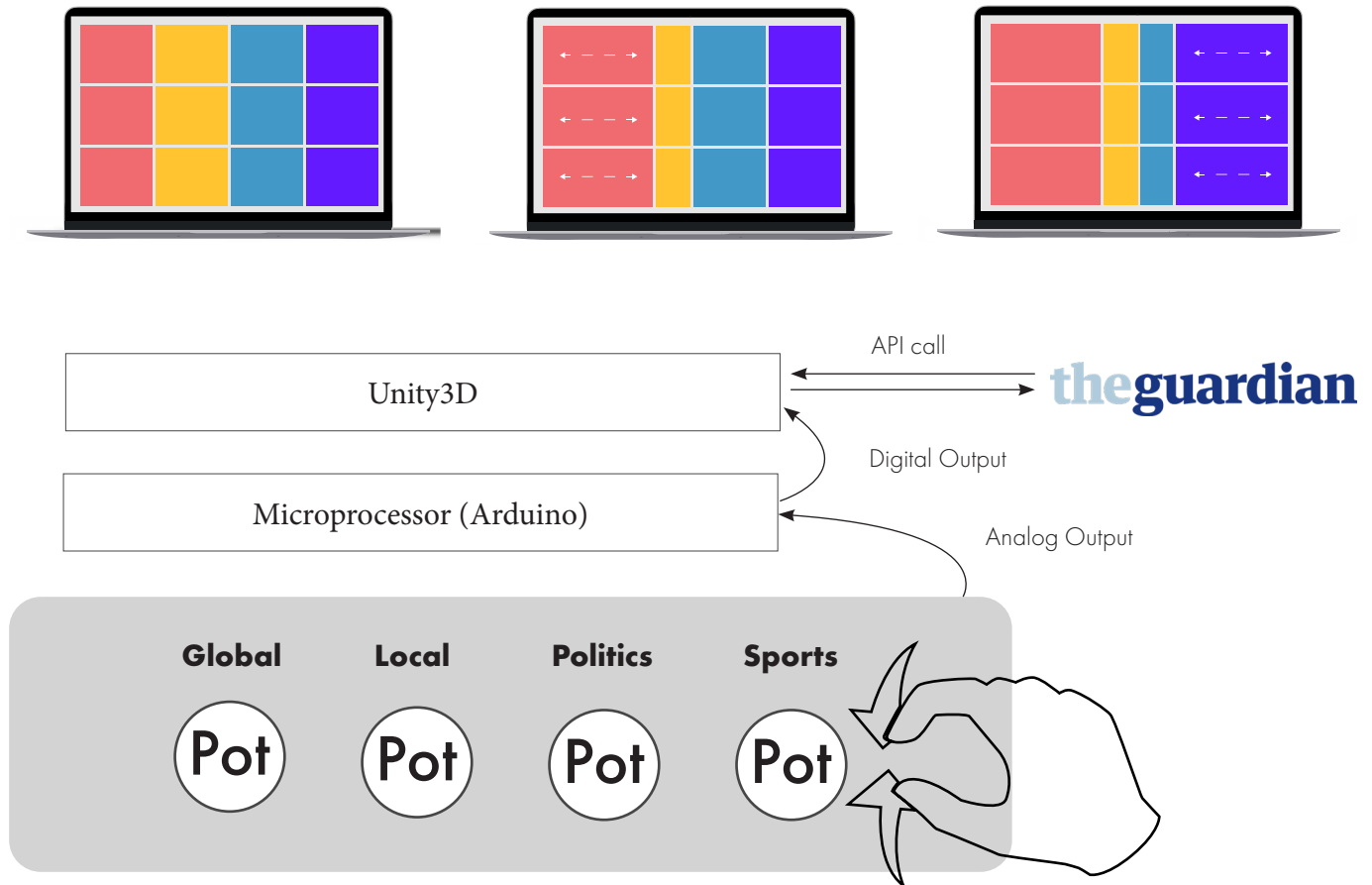
1.2.1 The Second Prototype

The second prototype is redesigned after analyzing the user feedback received during the experimentation of the first prototype. One of the main problems was displaying the current status of the preferred news load, as there wasn't any feedback mechanism on the first prototype. Moreover, the users stated that they prefer more control over topic selection.

Therefore, a more sophisticated prototype is designed using:
-1 Microprocessor (Arduino Nano)
-1 Circular Potentiometer
-2 Slider Potentiometers
-1 Neopixel
-1 TFT LCD Screen

The prototype is controlled by three analog sensors: circular knob connected to the potentiometer for selecting news topic, one slider knob for controlling news load and the other for adjusting selected number of news sources. Upon rotation of the knob, the topic news query is visualized on the LCD screen, the news load is represented by the number of lights that are ON (min 1 to max 8 lights) and the number of news sources are represented by the color of the light ranging from Red (single source) to Blue (multiple sources). This prototype is not connected to the Unity for digital prototyping, since the main aim of this test to better understand user feedback especially about the physical interaction elements.

Each user test session took approximately half hour, since this prototype is more complicated then the previous in terms of learning how to use and understanding the feedback.

positive user feedback +

-Linear motion is better than circle for adjusting
-The dynamic feedback from the product through lights
-Visualizing the chosen news topic on the screen

negative user feedback -

-Difficult to understand using
-There is no standby mode
-Ambiguous how to turn it ON/OFF
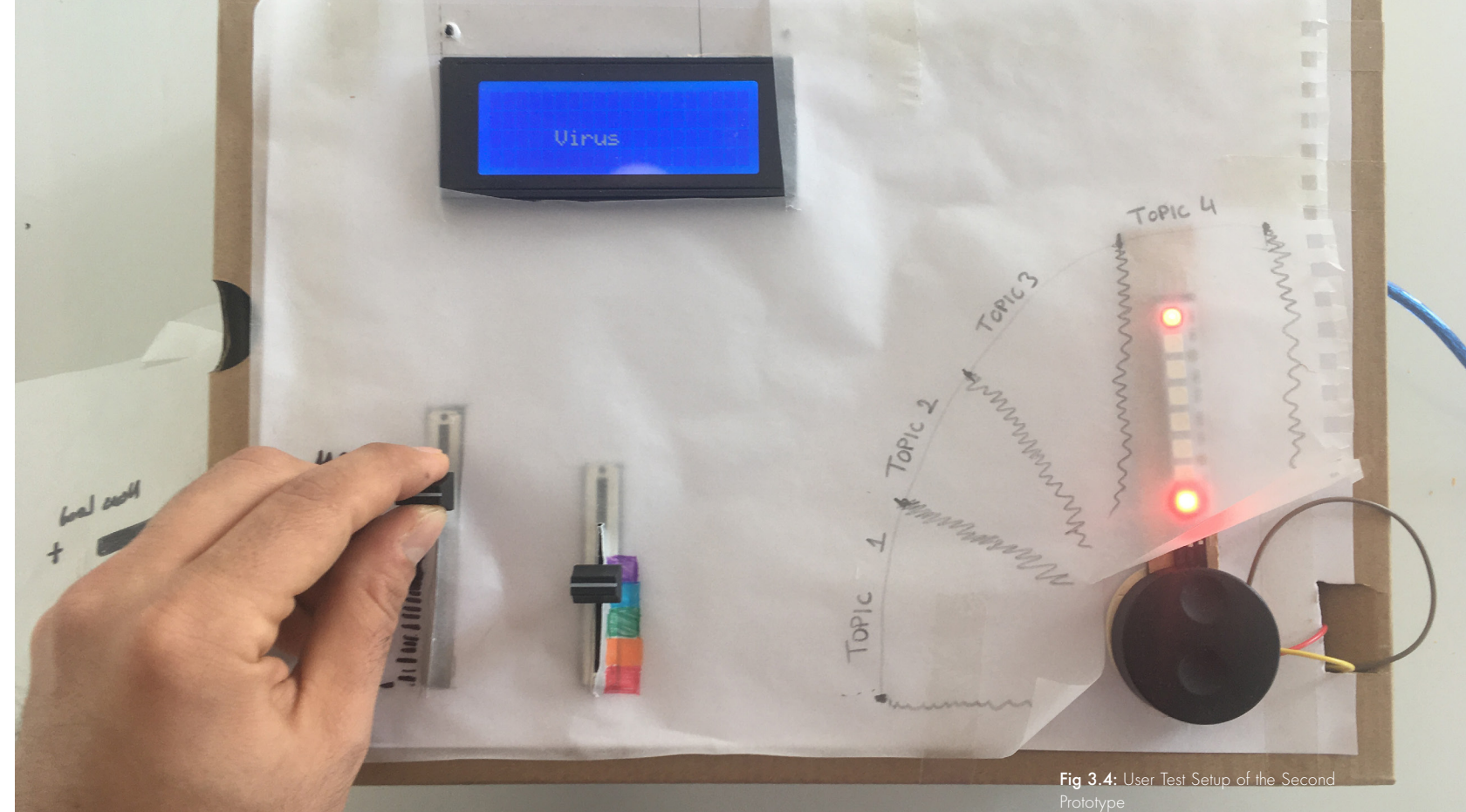
Fig 3.4: User Test Setup of the Second Prototype

Milan

Screen visualizes the chosen topic

Topic 4
Topic 3
Topic 2
Topic 1

The location of the news load slider changes the number of active lights

The location of the source slider changes the color of the lights

Turn for choosing the news topic

Pot

1.2.1 The Third Prototype

The Covid-19 outbreak and the quarantine conditions has changed completely the user testing approach. Since the user testing couldn't be carried through physical prototyping and meeting in person, a completely digital prototype had to be designed for online testing. The development of the third concept took almost a month, since constructing the interaction feedback loop in the digital modeling space is far more time-consuming compared to physical rapid prototyping tools that have been used for the first and second prototypes.

First, a 3D model of the prototype with different interactive components are designed with Fusion 360 software, which is then imported to Unity for building the test application. In the Unity environment, the complete application from start page to description of the product and finally the testing environment is modeled. A third party API service called News API is used for delivering up-to-date news to the participants of the user test. The final version of the Unity application is build for WebGl through exporting into HTML file. Finally, the HTML build file is uploaded to a Github as an open-source repository with a unique online weblink. This user testing development process is also followed during the user testing of the final prototype.

positive user feedback +

-Nice to have a standby mode!
-There are few interactive parts, which makes it easy to understand using
-The size looks very compact.

negative user feedback -

-Communicating two different things with a single light is complicated
-Selection button is not obvious, keep forgetting to press
-Color doesn't fit so well for managing news

Fig 3.5: User Test Setup of the Third Prototype

The news load (width on the digital newsfeed) of the topic is controlled by the slider on the left, as it can be seen from the figure below.

An example of a typical digital newsfeed layout.

An example of a typical digital newsfeed layout.
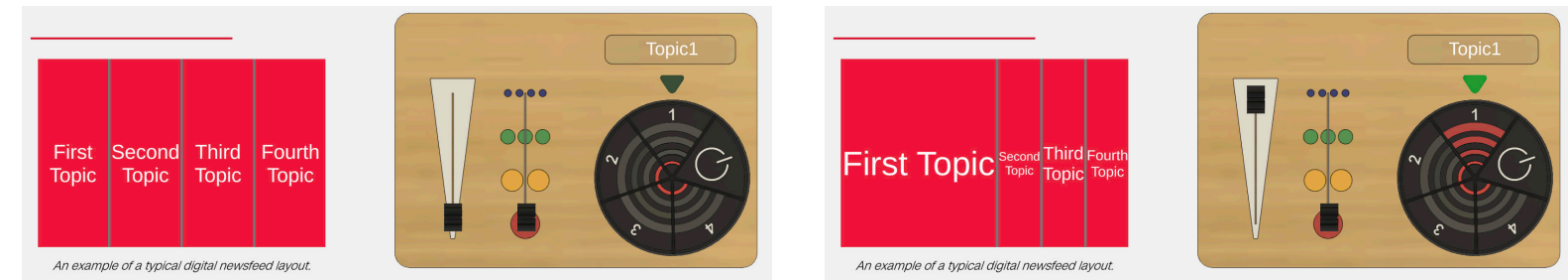
The number of sources for the chosen topic is controlled by the slider on the right, it ranges from a single source (red) to four sources (blue).

An example of a typical digital newsfeed layout.

An example of a typical digital newsfeed layout.

2/ piN Physical Interaction for News

piN is a physical product for managing one's digital newsfeed through tangible product interaction based on four news topics and news sources determined by the user. It is build of simple analog sensors (potentiometers) for capturing user interaction and an electronic display (E-Ink) for visualizing their news preferences.
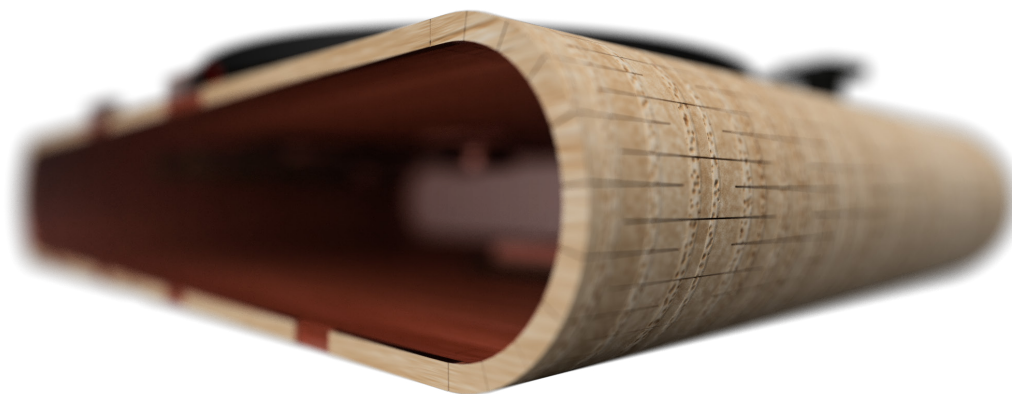
Fig 3.6: Diagonal, front and bottom perspectives of piN

Selection Arm

E-Ink

Topic Turntable

News Focus Controllers

2.1/ How does it work?

piN is a physical product with a unique news application piNews that can be accessed from all of the digital access platforms, such as Phone, Laptop and Tablet.

2.1.1 piNews Application

piNews application has only three different tabs: Topics, Sources and Getnews. From the topic section user determines 4 news topics that can be any keyword for searching news online including city names, events, persons etc. From the sources section user selects four sources among the provided options. The last section is the GetNews, where the personalized digital newsfeed of the user is visualized. The 4 separate columns represent the chosen news topics, and each row on the column represents the sources.
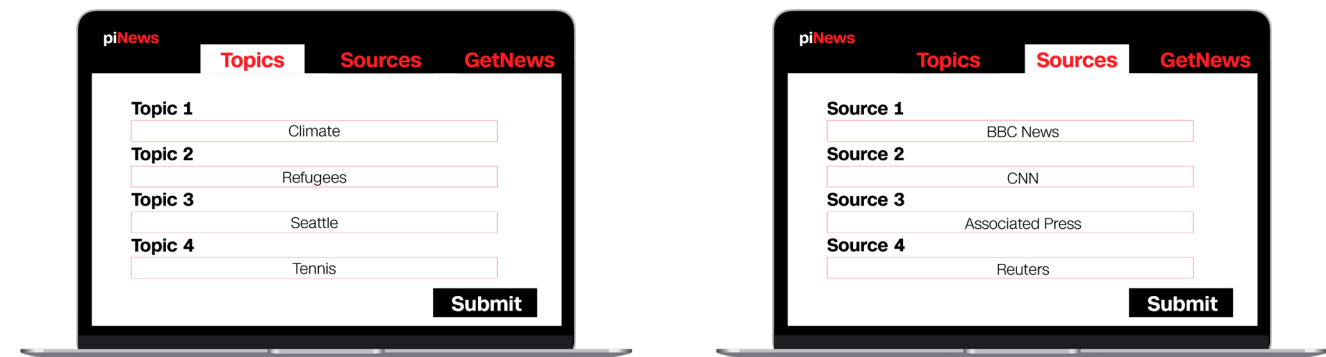
Fig 3.8: The User Interface of the piNews Application

Fig 3.7: piN & piNews

Headline

Description

Source Name

4 rows of news sources

4 columns of news topics
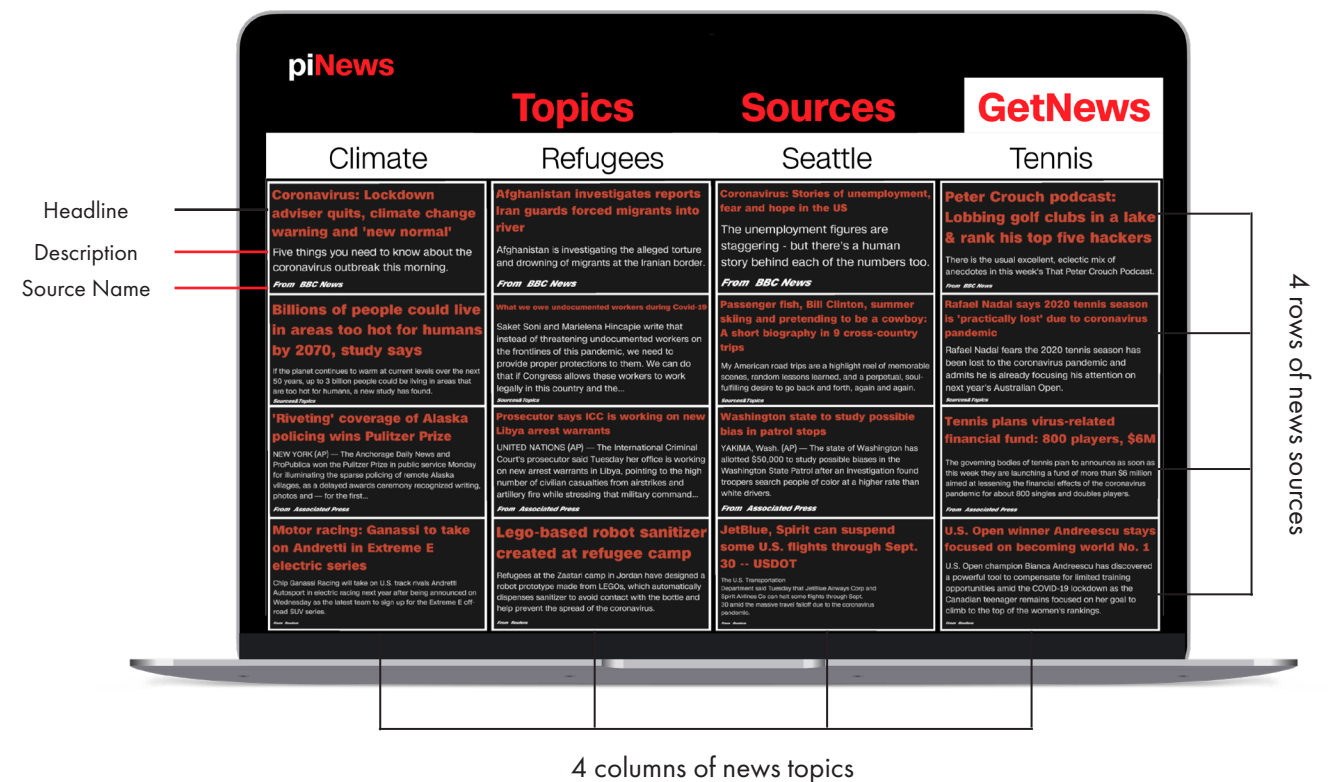
2.1.2 Drag the selection arm

The physical product of piN only connects to the online services when the selection arm is dragged down to the main topic circle. When the product is connected, the power button turns blue and the topic names are updated on the E-Ink.

Fig 3.9: Using the selection arm

power light turns blue when connected

receive the names of the chosen topics

send adjustments to online services
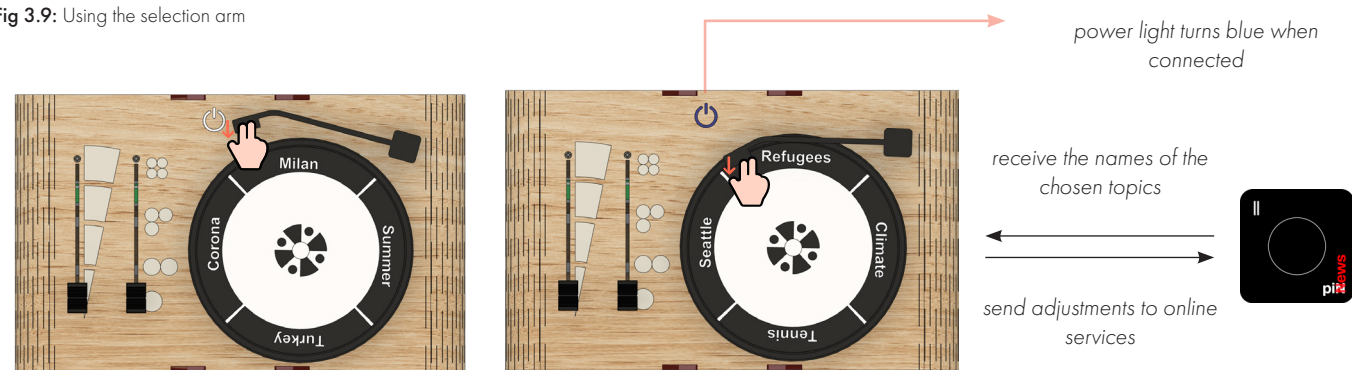
2.1.3 Adjust Topic Focus

Once the piN is connected to the internet, the user can turn the topic circle for selecting the topic that they would like to change news focus. The focus for a specific topic then can be changed by the slider on left.
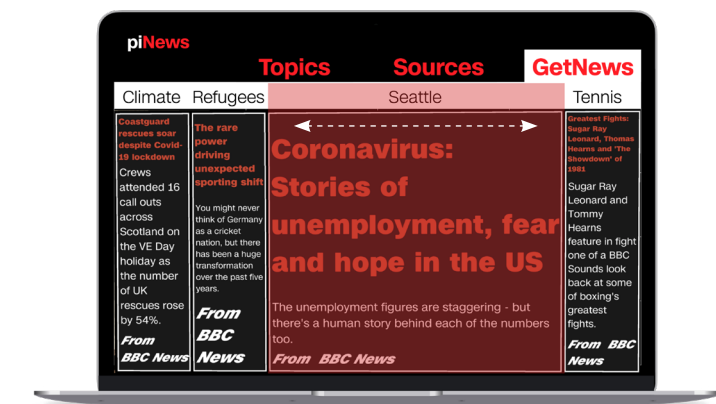
Fig 3.10: Using the news topic focus

the number of radial bars represent the focus of the news topic on the news feed
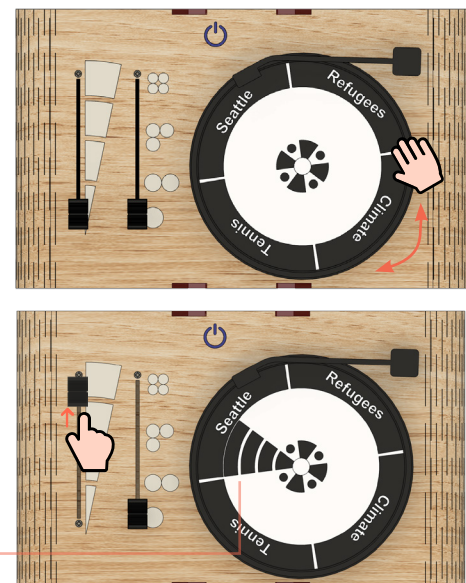
2.1.4 Adjust Source Number

Users can again choose the topic they want to adjust the source number, which can be changed by the slider on the right. The minimum number of news sources for a topic is one, and maximum is four.

Fig 3.11: Using the news source numbers
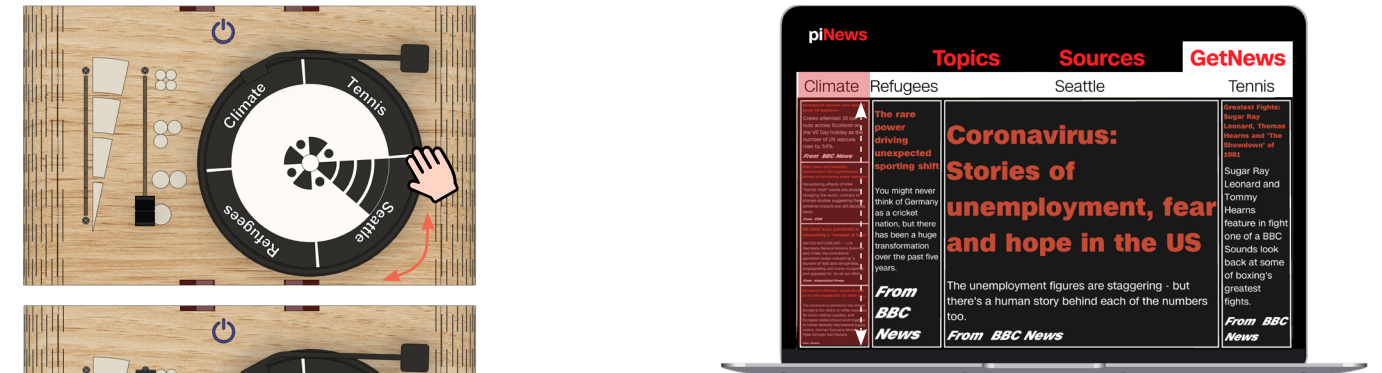
the number of radial bars represent the focus of the news topic on the news feed

2.1.5 Drag the selection arm

When the users finish making changes for their newsfeed, the product can be disconnected by dragging the selector arm upwards. During the disconnected mode, the product visualizes the news preferences through passive display.
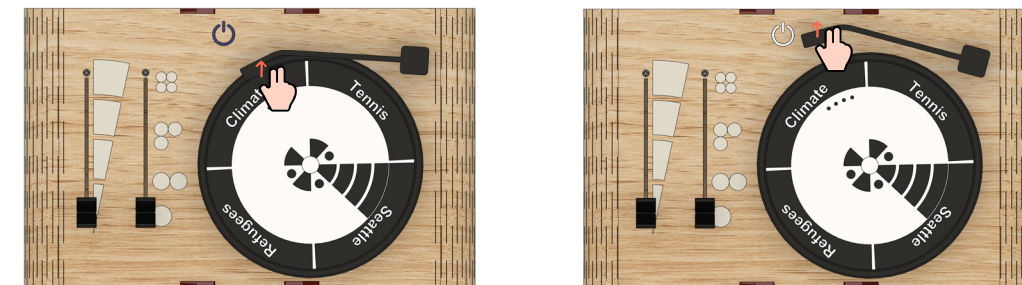
Fig 3.12: Disconnecting piN

2.2/ Assembly

To product is designed to be assembled in just three steps using the advantage of the wood lattice hinges giving main body flexible bends. First, the side panels are mounted to the main body. Then, electronic components are joined from the open bottom face and top face. The last step of the assembly is to bend over the sides of the main body. The overall dimensions of the piN is designed to fit on a bookshelf.

260 mm

160 mm

Fig 3.13: General Dimensions of piN

Fig 3.14: General Assembly of piN

Main Body

Side Panels

Power Assembly
Li-Po Battery
Charge regulator

2 Circular Potentiometers

Processing Assembly
Arduino Nano

ESP4056

2 Slider Potentiometers

E-Ink Base   E-Ink   Selection Arm

2 Slider Caps

Mount the side panels

Fix Bottom Parts

Fix Top Parts
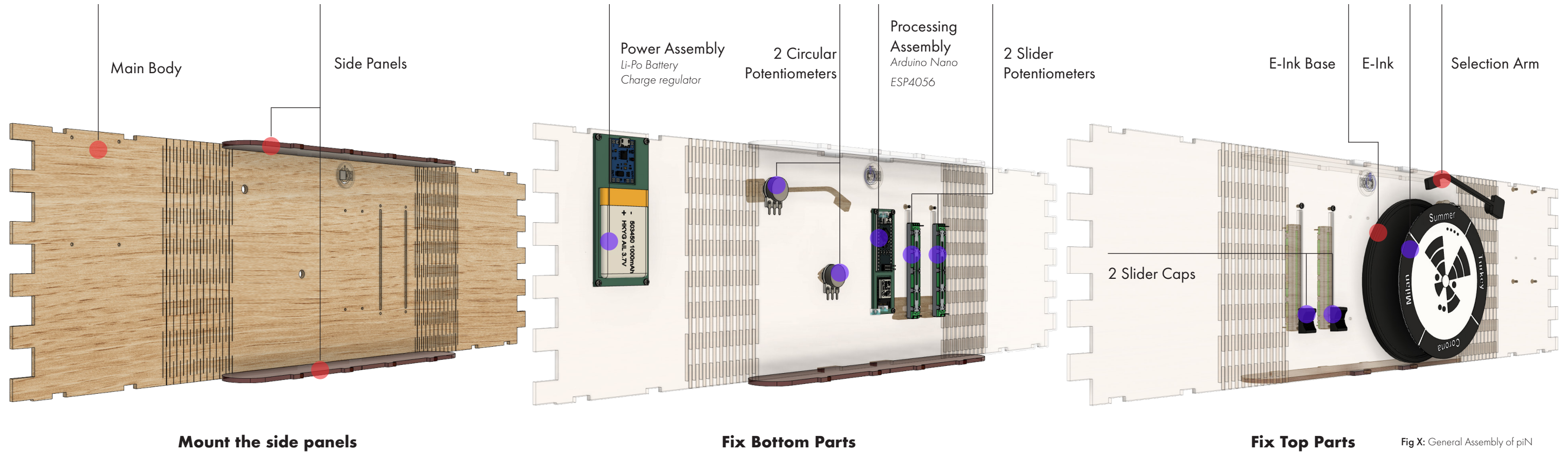
Fig X: General Assembly of piN

2.3/ Make Parts

The product is designed to be manufactured by using the simple rapid prototyping tools, as the batch size is very low and main aim is to provide experimental results. Parts can be categorized under two different manufacturing methods used: Laser Cutting and 3D Printing.

2.3.1 Main Body

Main body of the product is the largest part that carries all the components and provides the structural integrity of the whole. The material for this part is chosen according to the needed manufacturing method, the laser cutting.

Part Material:
3mm Plywood Birch Panel

Manufacturing Method:
Laser Cutting

Plywood is made from softwood, it combines lightweight characteristics with structural stability. The untreated, bright surface is ideally for laser marking or to be painted on.
This material is generally used for model making, cut-out of shapes or as a base material for painting and coating.
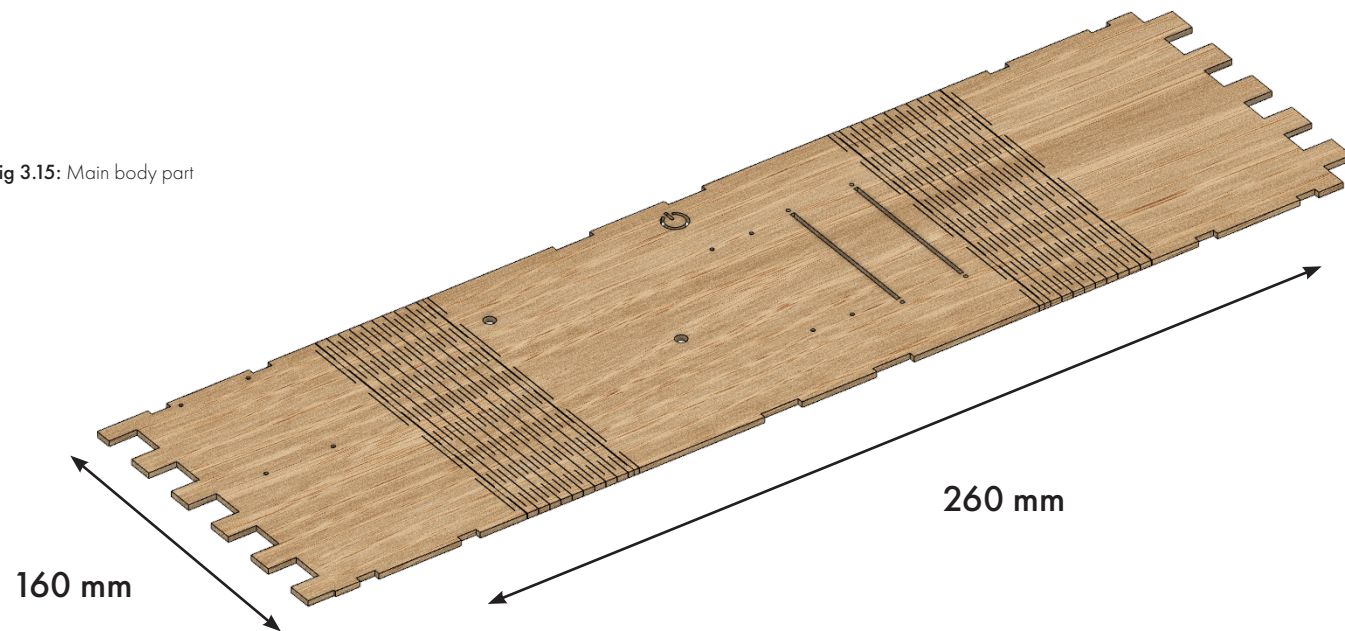
Fig 3.15: Main body part

160 mm

260 mm

2.3.2 Side Panels

Side panels support the product from front and back, again they are designed to be laser cut, since they have a characteristic shape for fitting the main body part. Extruded acrylic is a great choice for laser cutting, as it results in a flame polished edge at the end of the process. The polished edge can then perfectly fit to the opening on the main body. The assembly of the product is very easy, as the main body has flexible sides which are then bend over the mounted side panels.

Part Material:
3mm Extruded Acrylic

Manufacturing Method:
Laser Cutting

220 mm

40 mm
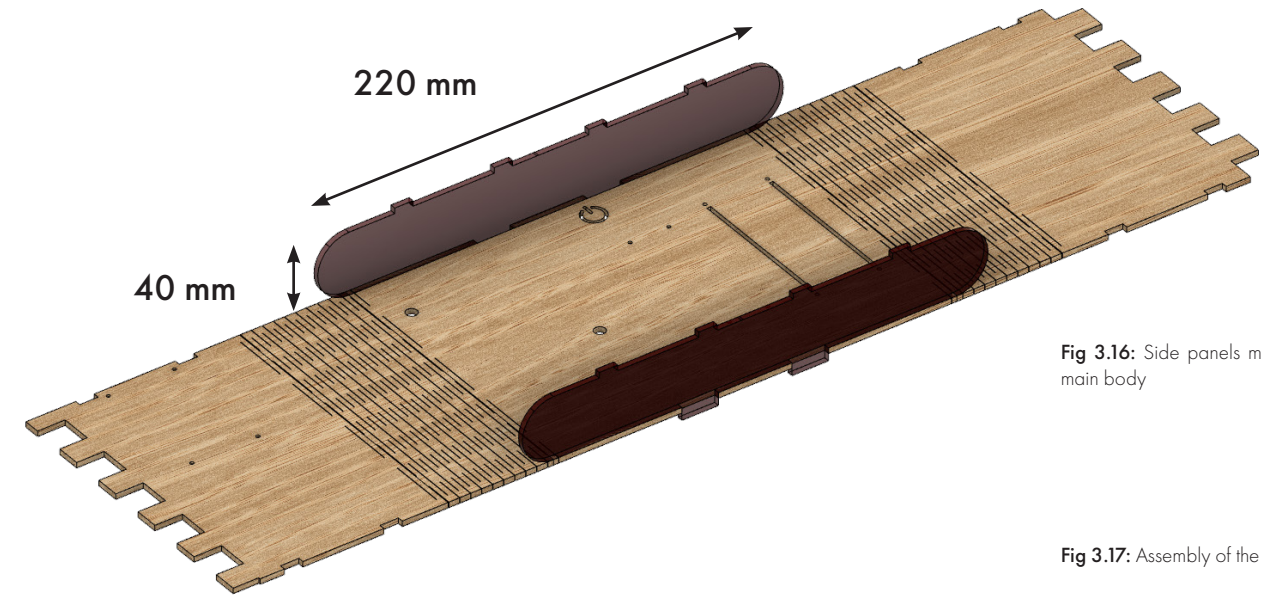
Fig 3.16: Side panels mounted on the main body
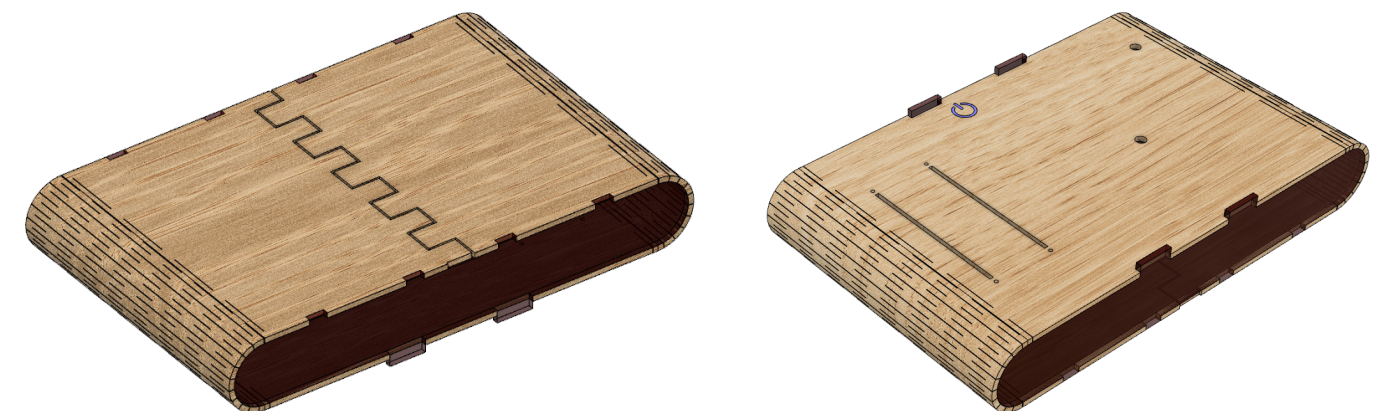
Fig 3.17: Assembly of the main structure

2.3.3 Design for Laser Cutting Lattice Hinges

The laser cutting is the chosen manufacturing method for the main body and side panel parts, as this manufacturing method provides the required precision cutting for the necessary holes and cuts for fixing the other components. Although it is a very standard manufacturing method for low-volume production without limiting design guidelines, the flexible bending of the main body had to be engineered.

The flexible bending of the wood is designed with the lattice hinge method, which is formed by a set of parallel, overlapping cuts dividing a flat sheet into thinner, linked sections. Those sections can then deform easier than that of a solid unprocessed sheet. Each set of parallel columns can rotate around its own length to let the sheet form a flexible bend. A sufficient number of column sets can allow to have a specific angle for the bend.

The minimum number of parallel column sets is calculated through the minimum torsional link equation. In our case the total bend angle is 180^0, as two sides of the main body bend to the center for closing down the product.

Θ = Total bend angle of the piece
k_{laser} = Laser Kerf (m)
n = Number of columns of torsional links
t = Material thickness (m)
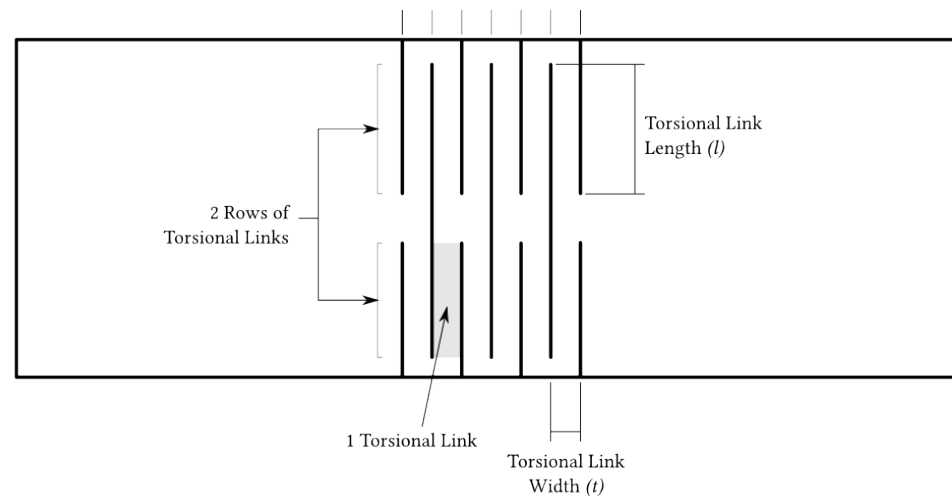
Fig 3.18: Laser cut lattice hinge characteristics

The flexibility of the bend angle is calculated by the material properties of the sheet plate and the geometrical dimensions of the columns. In this case the thickness of the material is kept equal to the Torsional Link Width, which is 3mm.

One other important factor in designing for laser cutting, is the Laser kerf. It is a portion of material that burns away by laser when it cuts through, which ranges from 0.08mm -1mm. Laser kerf varies on the specific cutting machine and is influenced by a variety of factors, including focus change of the laser, cutting speed and the type of material being cut. For the purpose of this design a standard 0.2 mm is taken as the laser kerf value.

$$n \geq \frac{\Theta}{\frac{\pi}{4} - \cos^{-1}\left(\frac{k_{laser}+t}{2\sqrt{\frac{t^2}{2}}}\right)}$$

By inserting all the variables into the equation, minimum number of columns of torsional links is found to be 46. In the design 4 rows of torsional links are used for an array of 20 each side, making in total 80 torsional columns, which is higher than the limiting value.

Part Material:
Acrylonitrile butadiene styrene (ABS)

Manufacturing Method:
3D Printing

2.3.4 Topic Turntable

The E-Ink body is the part responsible for supporting the E-Ink screen and fits on top of the potentiometer that detect the rotation. It is a circular part with a slight thickness. This part is designed for 3D printing by using ABS material. It is mounted on a circular potentiometer for allowing rotation.

2.3.5 Selector

The selector part is designed to look like an ordinary needle part of a record player. As it is designed specific to the purpose and needs to have a high precision manufacturing method in order to fit onto the potentiometer cylinder, 3D printing method is selected for this part. Since it doesn't require any stress related considerations, a general common 3D printing material is chosen, ABS.

Part Material:
Acrylonitrile butadiene styrene (ABS)

Manufacturing Method:
3D Printing

Fig 3.20: The base of the E-Ink and its assembly to the main body

ø 65 mm

4 mm

E-Ink

E-Ink Body

M3 Nut

M3 Washer
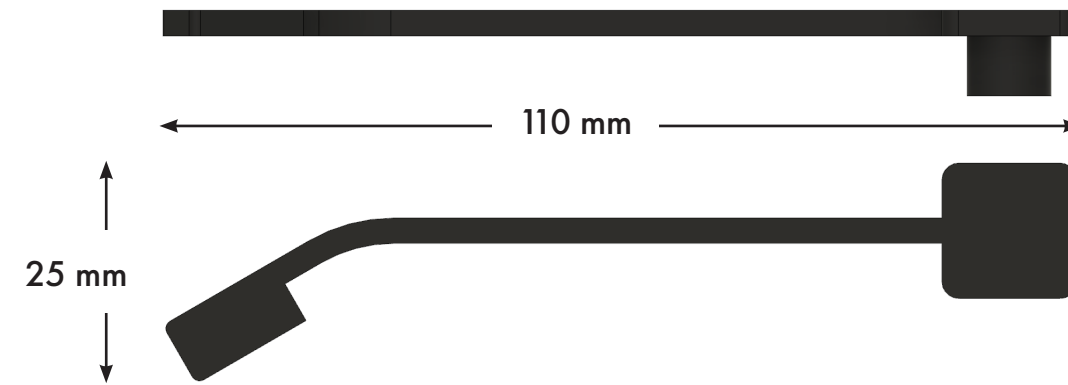
Potentiometer

Fig 3.21: Selector part and its assembly to the main body.

110 mm

25 mm

Selector

M3 Nut

M3 Washer
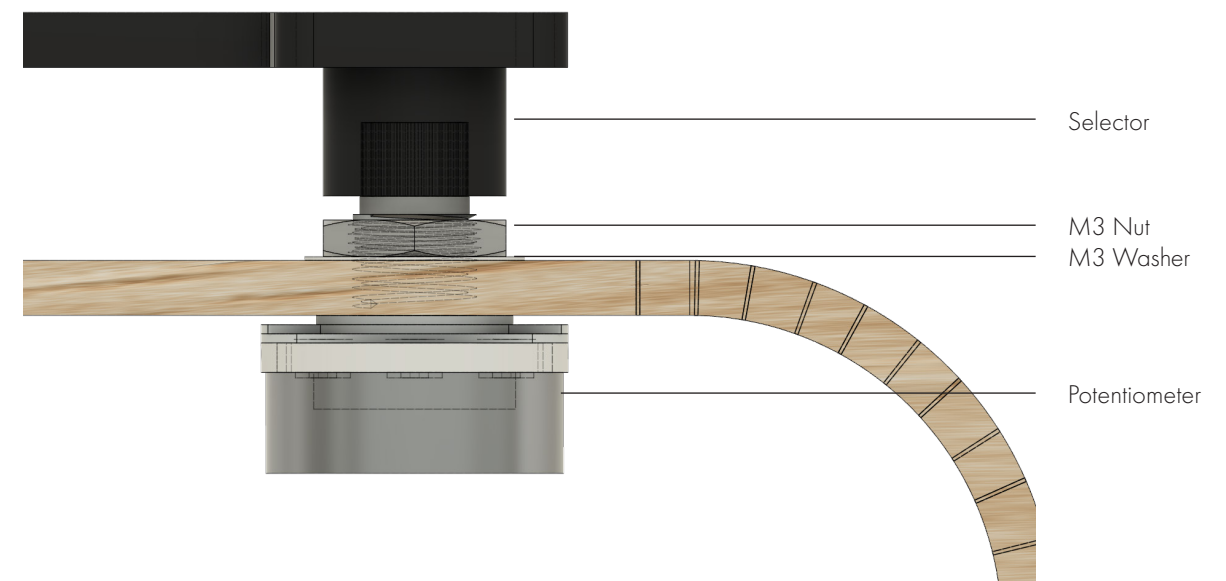
Potentiometer

2.4/ Buy Parts

2.4.1 Microprocessor

Microprocessor is the brain of the system which not only controls the e-ink, reads the analog value sent by the potentiometers, but also communicates with the digital serves through wi-fi processing.

2.4.2 Lithium Battery

Lithium Battery is the power source of the prototype, providing all the necessary energy to the components. It is rated for 3.7 Volt which and has a capacity of 1000mAh.

2.4.3 Charge Adapter

Since the battery is rated for 3.7 volts which is not compatible with Arduino Nano energy and the need for connecting an external power supply to charge the battery, a power adapter is added to the system. Thus, TP-4056 Linear Li Battery Charger is used.

2.4.4 E-Ink

Electronic Ink is a low power consuming display technology that is made from millions of micro-capsules. Each micro-capsule has black particles charged negatively and white particles charged positively, that are suspended in a fluid. When a charged electric field is applied, particles transfer to the visible top part of the micro-capsule. This display mechanism makes the E-Ink display surface black or white on that spot. Furthermore, E-Ink only consumes energy when display elements change, making it the perfect choice.

2.4.5 Wi-Fi Processor

The prototype needs to deliver the analog data captured by the microprocessor to the online services. This communication is provided by a Wi-Fi processor that established a communication channel with the digital environment. ESP8266

2.4.6 Potentiometers

Two slider and one circular potentiometers are used for this design. They are simple rapid prototyping tools that can easily be found.

2.4.7 NeoPixel LED Segment

In order to provide the light effect on the power symbol, two NeoPixel LED segments are used. The reason of this choice is the this type of lightning blocks consume lower energy compared to their conventional counterparts and also from a single digital pin of the Arduino multiple segments can be controlled for their light color and intensity.
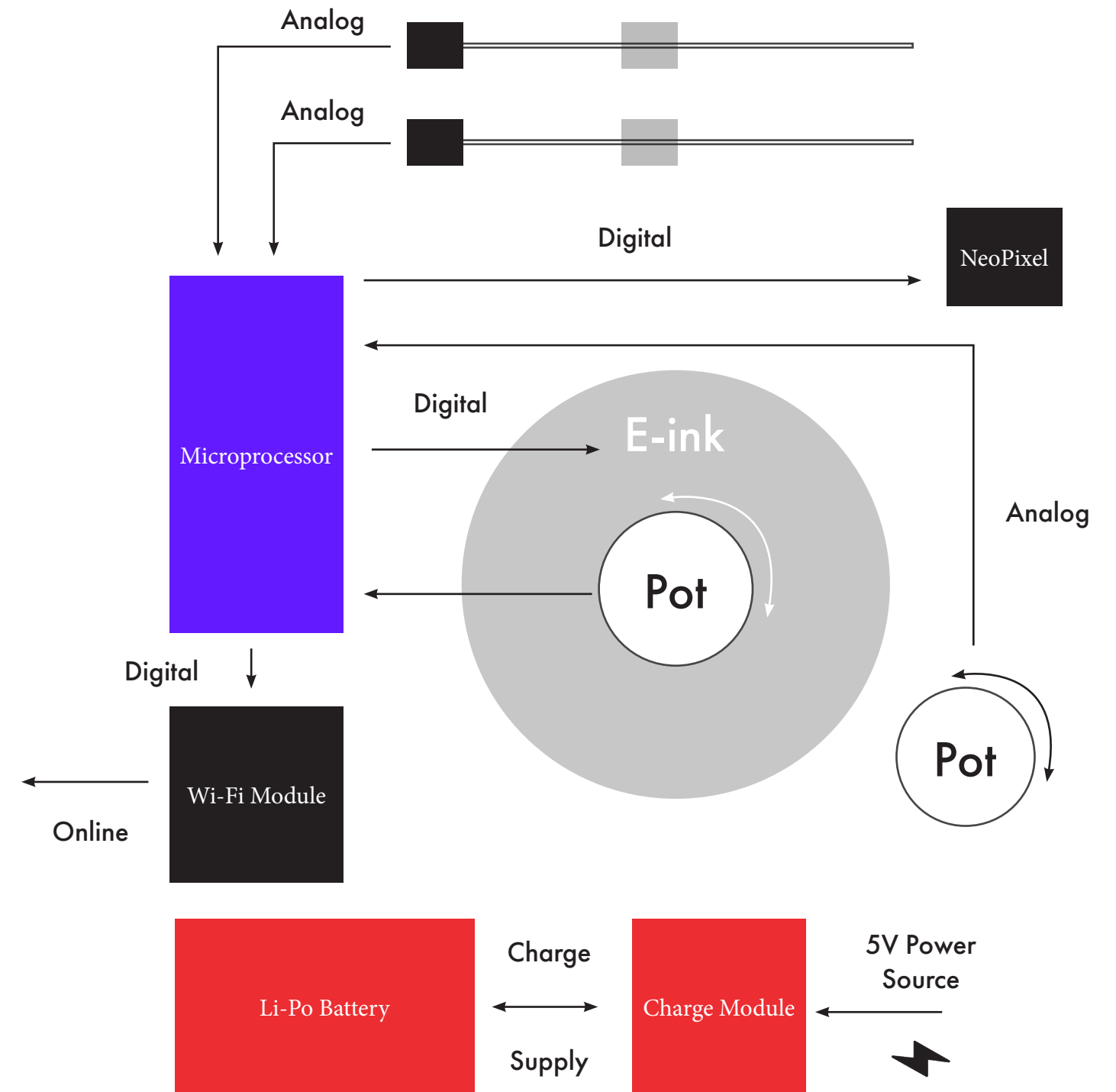
2.5/ User Testing

For the user testing of the final concept, the same procedure is followed as the third prototype. A final 3D model of the design is created in Fusion 360 CAD software, which is then exported to .fbx file type for integrating into Unity. Afterwards the test application exported as an HTML file from Unity, it is uploaded to Github. The test is accessible from:

https://erketellal.github.io/piN/
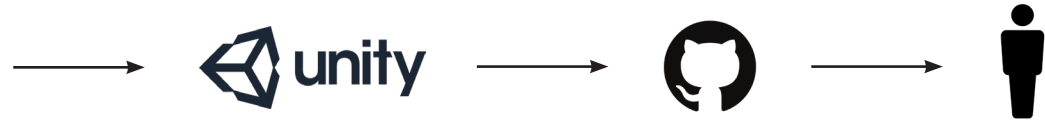
2.5.1 Set Up

The user test is set up as a one-way linear application system, so that participants would go to the next scene each time. The initial scene is the opening scene, which is followed by the explanation of the product and how to user. The third scene is the main user testing scene, where users can test to product with a sample screen representing digital news-feed. The final scene is the feedback form, that allows to capture user insights through in-application responses.
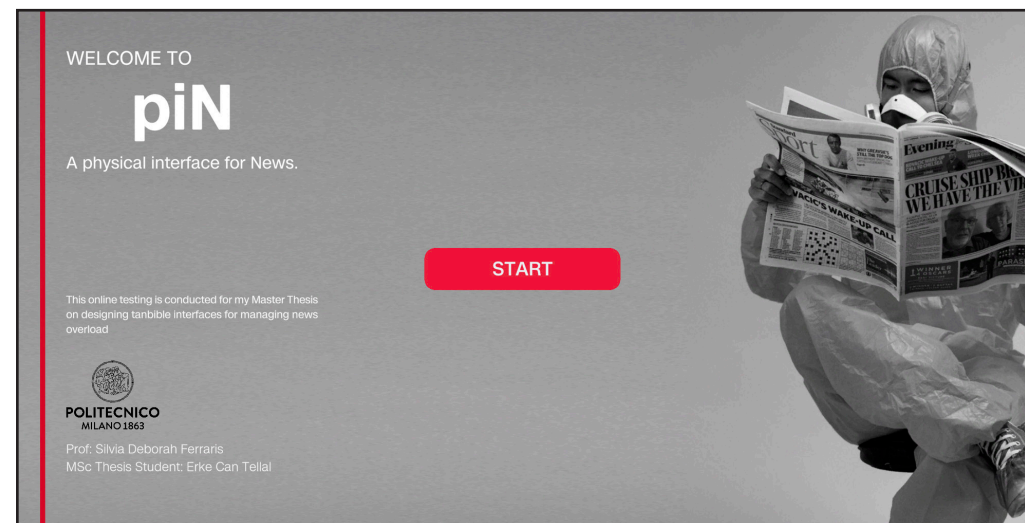
Fig 3.23: The Opening Scene, including small description of the user test and the affiliated researchers and academic institution.
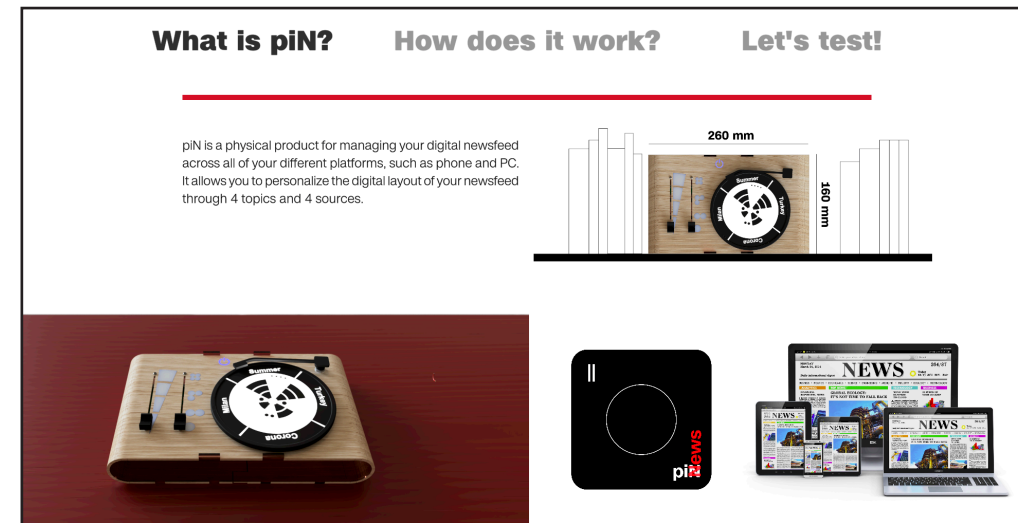
Fig 3.24: About piN scene, where product is described along with the animated use guidelines.

Fig 3.25: User testing scene with the 3D model of the product, a sample digital news feed and a user interface menu for managing the news search parameters.
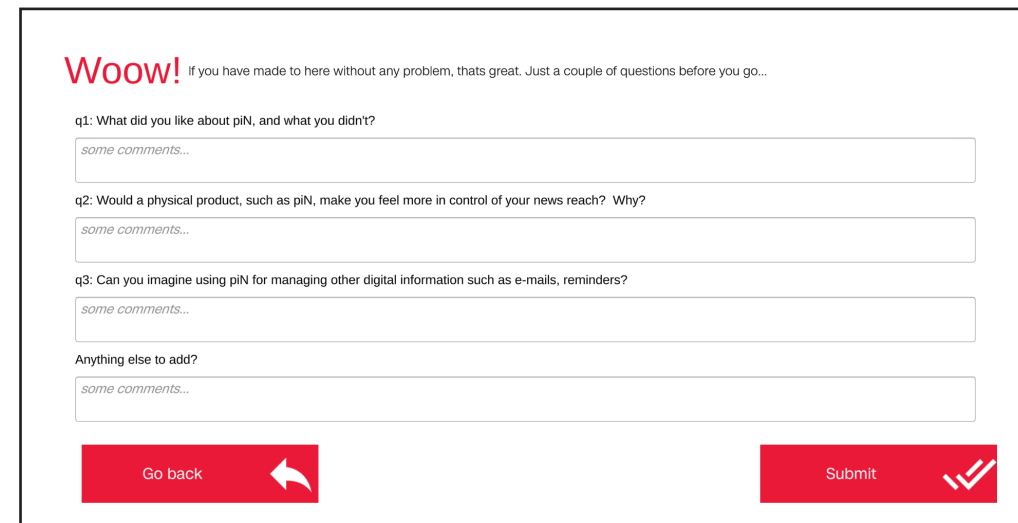
Fig 3.26: Feedback scene with the feedback questions, and the end of the test.

2.5.2 User Testing Outcomes

The final version of the test link is then shared with 8 users during a 10 day period between 1-10 May 2020. All of the users managed to carry out the test process themselves without any external help. However, half of the survey participants skipped the feedback scene part and didn't answer the feedback questions.

The main of this research work is designing new physical interaction methods for managing a user's digital news intake. Thus, it is imperative to analyze if users were able to understand the newly created interaction links between news and the piN. Three questions are asked to the user Test Participants (TP) for understanding their interest and use capability. Some answers of the TPs are listed below.

Question 1: Is product clear, intuitive and easy to understand? What was the biggest challenge?

TP1: "It had some problems with topics i chose. Some of them were misplaced and some of them were irrelevant. Turning the topic disc was a bit frustrating, maybe for music"
TP2: "Using the physical interface was a bit challenging."
TP3:" If you rotate the disc it changes instantly the setting, doesn't seem super intuitive. "
TP4: "easy to use at the second time"
TP5: "Not bad! I tried mobile, clearly mobile browsing is not at the top. The idea is nice."

Question 2: Imagine to use the product in a real context. Do you think the product makes you feel more in control of your news reach? Or would you need more news filters such as popularity, author, publishing date?

TP1: "I can see myself using it but i would like to see more of the news not just the headline. publishing date would be good or a link to the news., it would be nice if i could omit certain topics."
TP2: "Products improves the control we have over the news we consume. I believe we end up seeing more recent news more, but a feature to control the relevance/date trade-off (a more continuous version of what YouTube does with sorting with respect to relevance or upload date) would be nice.)"
TP3: "you could have a different arrangement on the news that maybe would not be as strict as the table, with colors attributed per topic,"
TP4: "it gives a general idea about which are the main news of the day related to the topic choosed, maybe the user would like to go deeper into the article showing him-her the link of the news"
TP5: "I don't know how much sense it makes to enlarge and decrease the size, and to have

from one to 4 articles. I would make the sections of the screen scrollable, list of articles sorted by importance"

Question 3: Can you think an another way using of using piN for managing other digital information (e-mails, photos, documents, etc.)?

TP1: "Maybe for music"
TP2: "It can be used for managing multiple information types from a single item, if piN had different modes"
TP3: "Maybe for the topics it'd be cool if it would give some suggestions on the most looked up topic, Google trends or idk which criteria"
TP4: "Using the physical interface was a bit challenging."

Last but not the least, the search topics of each user is collected for constructing a word-cloud of the overall searched topics. As it can be seen from the figure below, users are interested in a mix of news topics that can be a location (city, country etc.), a recently happening event (corona, US elections etc.) or a general concept (design, sustainability etc.).
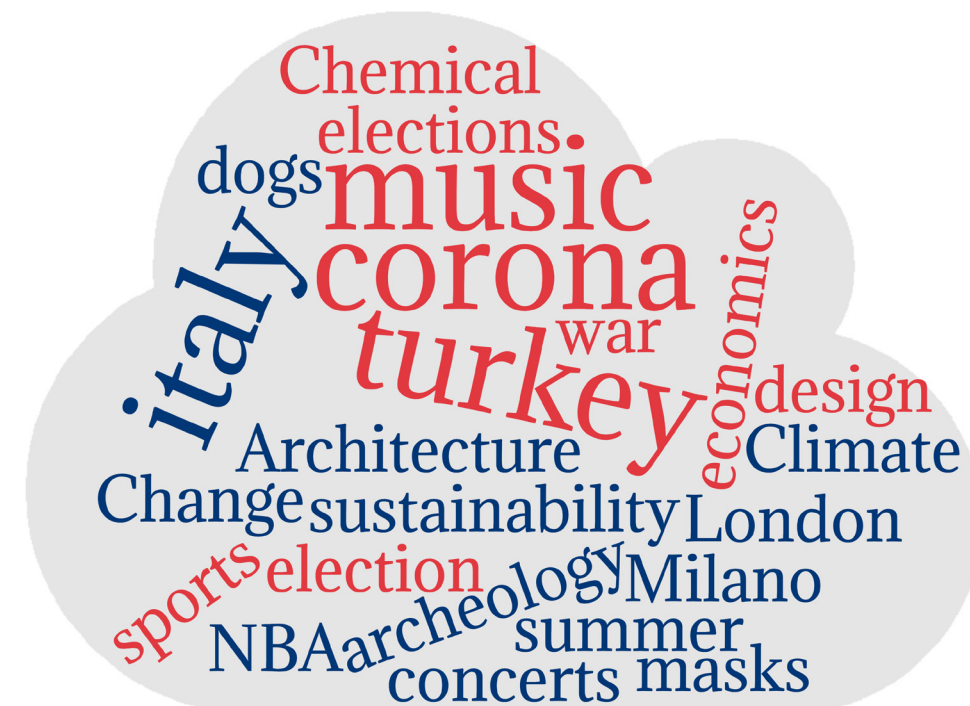
Fig 3.25: Wordcloud of the searched items

What users liked? +

What users didn't like? -
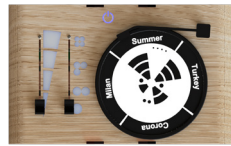
the product

Tangible Interaction
The physical interaction offered by the product for managing a digital information such as news, is welcomed with surprise and playfulness by the test participants.

Easy to learn
All of the test participants carried out the user testing alone in a distant mode with only following the instructions given to them. The product is found to be very easy to learn.

Selection Difficulty
It is found to be difficult choosing the news topic by using of the selection arm. This idea was stemmed from the analogy of using a record player, however users didnt find the this interaction to be intuitive.

Digital Prototype
The use of an online user test for simulating a physical interaction proved to be a difficult challenge. This is mainly due to the fact that, test participants could only use the mouse of the keyboard, which can't imitate the tangible feedback of interaction tools.

the information

General Control over Consumption
The idea of having a standalone product for personalizing newsfeed across different mobile devices is favored by the test participants. Especially, they expressed that the products empowers them over their digital news consumption.

Daily Life Integration
Another important aspect is that all of the test participants agreed on the idea of having a physical device integrated into their daily lives for managing digital news content.

Limited filtering & sorting
The prototype offered only two filters for controlling the newsfeed. User repeatedly expressed the need for more filtering options and more control for sorting the news according to popularity, relevance or publish date.

Fixed Layout
The fixed layout of 4 columns and 4 rows is found to be limiting, as users preferred more personalized arrangement options including color of the elements, type and size of the fonts.

the future

Mixed Media Applications
When asked for the other possible use opportunities for the product, test participants expressed that different media types, such as audio and video, could be included into the digital information management system.

Social
An another possibility is to think about the product in a social environment, allowing to share or comment through a physical interaction of the digital information.

Fig 3.26: Discussion of the user test results.

**Chapter 4/
Conclusions**

Main Contribution

This master thesis presented a research process for investigating the possibility of communicating digital news information to the news audiences by a physical interaction interface. The need for exploring this topic stemmed from the transformations that have occurred and still continue to do so in the field of journalism and media. Since, news has been the integral part of the communication habits of people, the development of fast, mobile and omni-present communication platforms directly influenced the news engagement habits both on social and personal levels.

This research work investigated how physical interfaces can provide a different approach for managing the ever-growing news information, that is overloading people on a personal level and crippling their cognitive abilities. The literature review and conducted user surveys pointed out that users are aware that they are having difficulties and lacking the necessary tools for selecting the news that matters for them. The detailed case studies of communicative products enabled to construct the news information flow diagram through physical interaction.

Through the design brief the user need from the physical interaction system is defined. Four different prototypes are designed and tested with users. Development of an online testing platform for a physical product proved to be a great opportunity for having remote user feedback without an actual physical object. And a final product concept is designed according to feasible manufacturing methods.

The main contribution of this master thesis is the identification and analysis of an abstract notion, the news overload, from a product design and design research perspective and finally to provide a physical solution that is developed in accordance with continuous user feedback.

Limitations

It is important to point out the limitations of the project in order to provide a better overall evaluation of the work.

One of the most challenging part of the research was conducting all the processes by a single person. Since news information and its engagement habits on personal and societal levels are the area of interest for many other disciplines, working as an inter-disciplinary group could provide more socially inclusive solutions.

The main aim of the thesis was to replace the completely digital news interaction with a tangible product. Thus, physical prototyping and in-person user testing are crucial to exploit the full potential of the experiment. However, due to the Covid-19 outbreak the physical testing couldn't be carried out and this largely limited the real-life positioning of the product into regular habits of the users. Nonetheless, the online testing has proved to be an another efficient method.

Another limitation for this work is caused by the API service that is used for receiving updated news from the online news sources. Although News API is one of the most developed API services, it only offered limited news filtering options, sources.

Future Works

Through the research it is found that there are many different methods that can be used for filtering and categorization of the news content, and it changes according to the personal habits and interests. Thus, there is an opportunity to explore different filtering systems for news except from the ones used in here.

The MIDI controller analogy used in this research is just one of the examples for creating a physical interaction for digital information. A more creative design process for exploring other analogical interaction methods can be carried out for testing with users.

As news is part of the habit cycles of the users, it could be very interesting to make longer user tests, that are more integrated to the daily lives of the participants.

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