



Norwegian University of  
Science and Technology

# Infobits: a Crowdsourced Video Platform for Information Sharing among Refugees

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*Jeg vil dedikere denne masteroppgaven til min bestefar, Terje, alltid interessert og sulten på ny kunnskap, som har bevist gleden i å lære så lenge man lever.*

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# Abstract

Refugees and other migrants face many challenges while adapting to a new life context. In the process of resettling into a new society, accessing information is essential for learning about new cultures, languages, customs, regulations and to be socially included. Such information is provided by various sources wanting to support people in need. ICTs facilitate such information sharing and communication. However, finding quality information remains a challenge. Quality information is updated, relevant, accessible, valid, secure and presented in a format and language which the information customer masters. Such information can empower its customers, facilitating their taking informed action to overcome their challenging situations and improving their transient life situation.

This research project presents a mobile platform facilitating collaborative construction of multilingual quality information. The platform aims to empower people who are in the process of resettling into a new life context through increased knowledge of their surroundings. A prototype of the platform has been developed, piloted and evaluated with members of the target group as participants. The evaluation has produced result data which has been analyzed to assess how participants perceived the platform concept, its usability, trustworthiness and their motivation to use such a tool in real situations.

The main contributions of this thesis are design of a solution platform and an accompanying prototype, insights about the applicability of this proposed platform in real situations, possibilities for future work and a set of functionalities that contribute to trust in, and usability of the platform.

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# Sammendrag

Flyktninger og andre migranter møter mange utfordringer knyttet til det å skulle tilpasse seg en ny livssituasjon. Gjennom prosessen med relokalisering til et nytt samfunn er det essensielt å ha adgang til informasjon som kan bidra til opplæring i språk, kulturforståelse, lover/regler, skikk og sosial inkludering. Det finnes ulike kilder som tilbyr dette, med et ønske om å bistå de som har behov for slik informasjon. IKT legger til rette for slik informasjonsdeling og kommunikasjon. Likevel forblir det en utfordring å finne fram til kvalitetsinformasjon. Kvalitetsinformasjon er oppdatert, relevant, tilgjengelig, gyldig, sikker informasjon som er presentert i et format og språk som informasjonskunden behersker. Slik informasjon kan styrke mottakernes handlekraft og i større grad muliggjøre å handle velorientert for å takle utfordringene som preger deres flyktige livssituasjon.

Dette forskningsprosjektet presenterer en mobilplattform som støtter samarbeidsorientert konstruksjon av flerspråklig kvalitetsinformasjon. Plattformen tar sikte på å gi mennesker som befinner seg i en relokaliseringsprosess større handlingsrom gjennom økt kunnskap om sine omgivelser. En prototype av plattformen har blitt utviklet, pilottestet og til sist evaluert med en gruppe mennesker tilhørende prosjektets målgruppe som deltakere. Evalueringen har produsert resultatdata som har blitt analysert for å vurdere hvordan deltakerne oppfattet plattformkonseptet, dets brukbarhet, troverdighet og deltakernes motivasjon til å ta i bruk et slikt verktøy i ekte situasjoner.

Hovedbidragene i denne avhandlingen er design av en løsningsplattform med en tilhørende prototype, innsikt i anvendeligheten til denne foreslåtte plattformen i en ekte situasjon, muligheter for fremtidig arbeid og et sett med funksjonaliteter som bidrar til plattformens brukbarhet og tillit.

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# Preface

This is the master's thesis executed for the course TDT4900 - Computer Science, Master's Thesis at the Norwegian University of Science and Technology (NTNU), completed in the period August 2017 - January 2018. This report concludes a five-year master's degree programme in Computer Science with specialization in Interaction Design & Game Technology.

I would like to thank my supervisor Monica Divitini for invaluable feedback and support towards shaping this project and thesis, and the refugee recruiter who generously spent so much of his time planning and supporting the realization of the final evaluation sessions.

I would also like to thank members of the refugee group who agreed to spend their weekend offering their support through the final evaluation, and the students who volunteered to participate in piloting the prototype.

Finally I want to thank the brave souls who volunteered to create example videos for the prototype database.

Trondheim, January 2018

*William Tisdall*

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# CHAPTER 1

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## Introduction

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This chapter will briefly introduce the research project of this master's thesis and its positioning. An introduction to the problem domain will be given, followed by the context of the research project. Research questions and methods will be introduced. Finally a quick overview of the report results and an outline for the rest of the report is presented.

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## 1.1 Problem definition

Millions of people in the world are forcibly displaced[1], fleeing from conflict, persecution and disasters. Lives of refugees are disrupted against their will, and they are forced to adapt to life in a new and foreign context. In the face of completing a successful resettlement process, there are a range of barriers to overcome. This master's thesis aims to empower people in such vulnerable situations by designing a tool to support their resettling process through information sharing.

The tool will be developed and evaluated in an attempt to decide its effectiveness as a platform supporting the target end users towards the goal of finding and exploring quality information. The project aims to assess how the target users perceive the tool, how they view its potential for use in real situations, whether they find it useful, usable, trustworthy and whether they could be motivated to use such a tool themselves.

## 1.2 Context

This student research project is carried out as for the course *TDT4900 - Masters Thesis in Computer Science (TDT4900)* at the Norwegian University of Science and Technology (NTNU). This thesis is informed by previous work carried out for the course *TDT4501 - Computer Science, Specialization Project*[41].

## 1.3 Research questions

The following research questions have been formulated to guide the project towards contributing to the problem context of this thesis:

**RQ 1:** *Can the social inclusion of transitioning refugees be supported by a mobile crowd-sourcing platform facilitating access to high-quality, multilingual, trustworthy informational videos?*

To further refine the aim of testing carried out in the project, the following sub-questions have been posed:

**RQ 1.1:** *What functionality is required by such a platform in order for it to be considered*

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*usable by its target audience?*

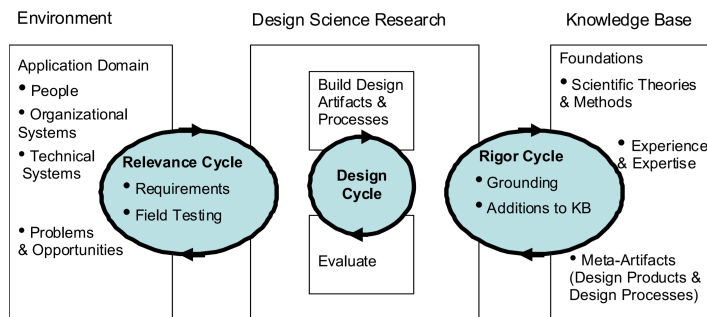
The more recent groups of refugees generally have lower competences using mobile applications than their more experienced counterparts. However, this group have the greatest need for information. Thus designing the interface such that it is conceived as simple and usable for this group is essential.

**RQ 1.2:** *What functionality is required by such a platform in order for it to promote justified trust in information amongst its target audience?*

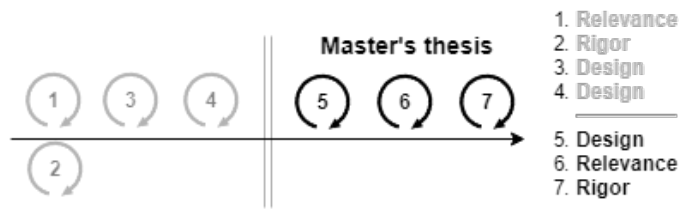
Distrusting information and the host society is a common barrier for recent refugees. Designing and implementing the platform with mechanisms that promote trust in the video content is necessary to ensure quality of the shared information.

## 1.4 Research method

This project follows the design science research methodology[17] to produce and evaluate a proposed system design. Design science research embodies three cycles of activities as identified by[18] and are shown in Figure 1.1. During the rigor cycle, the research is grounded in and contributes to the existing knowledge base. The relevance cycle draws requirements from the problem context and ensures that they are met by introducing constructed artifacts into the real environment. Design cycles iterate through design and evaluation, where artifacts are constructed and consequently evaluated, improving the design of the next iteration.



**Figure 1.1:** Design science research cycles[18].



**Figure 1.2:** Timeline showing the design science cycles already performed during the project thesis in the past (greyed out), and the current master's thesis.

### Project thesis

An independent project thesis, working on the same research project, was completed during the spring of 2017. Work with the project thesis completed an initial relevance cycle with a document analysis to identify the problem context. Following this, a rigor cycle grounded the research in existing knowledge through a literature review.

Two iterations of the design cycle were completed. The initial cycle produced paper mock-ups and drafted scenarios of use to illustrate a concept. The cycle was evaluated through an in-depth interview with a student expert.

The second design cycle refined the scenarios of use and produced a wireframe prototype of the proposed system. At the end of this cycle two in-depth interviews were performed: one with a Syrian refugee and one with an experienced volunteer worker, both living in Trondheim. Through these interviews, the scenarios and wireframe were evaluated, the relevance of the proposed system was confirmed and design insights collected.

### Master's thesis

The current master's thesis has been informed by the design insights that had been gathered and presented by the project thesis. The starting point of this thesis is where the project thesis ended.

A third design cycle has been conducted as part of this thesis. The insights from the project thesis have been utilized and implemented in a functional prototype of the proposed system. The functional prototype was finally evaluated during usability testing and group interview sessions with members from the target user group.

During the third design cycle, intermittent pilot usability tests were performed with students participating as test users to gain rapid insights and help consider whether further



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changes had to be made to the prototype user interface before the final evaluation.

A rigor cycle was performed following the final evaluation sessions. This cycle analyzed and summarized the gathered results and insights about the proposed platform and prototype as a contribution to the knowledge base.

## 1.5 Results

This thesis provides results gathered during the final design and relevance cycles of this research project. This includes the design of a proposed platform for information sharing, a functional prototype of this proposed platform and insights gathered during usability tests and group interviews conducted with groups of Syrian refugees.

## 1.6 Report outline

This chapter briefly presented the scope, research questions, methods and findings of this project. The remainder of the thesis is arranged as follows: Chapter 2 will define the problem context and present related work. Chapter 3 will summarize the main relevant findings of the preceding project thesis. Chapter 4 explains the choices in design and technology that have been made. In chapter 5, detailed information on the proposed system, *Infobits*, and the prototype implementation is provided. Chapter 6 and 7 present details on execution, discuss and results of the design cycle iterations performed. Finally chapter 8 concludes the thesis, summarizing the work done, contributions, reflections, limitations and future work.

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## CHAPTER 2

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### Problem elaboration

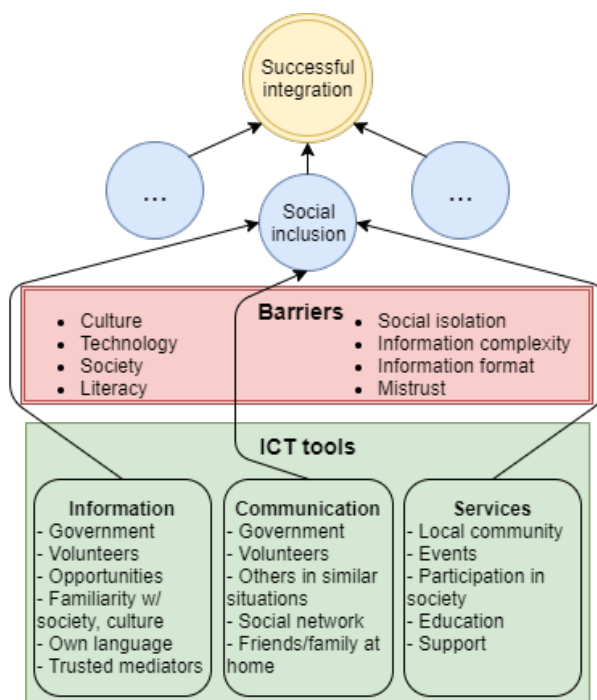
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This chapter will explore and present the problem domain of people who are adapting to a new life context in a foreign society. First, the problem context will be presented. Then, requirements that have been extracted from this context are briefly mentioned. Finally, a well defined scope is set and research questions are posed.

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## 2.1 Adapting to a new life context

Fleeing ones home, arriving in a new country and successfully adapting to the disruptive changes of life this involves requires overcoming a number of challenges and barriers. This section will present the problem context as a relationship between the possibilities of ICTs and how these can be related to the common barriers and goals that people in the process of resettling are facing and seeking.



**Figure 2.1:** How ICT tools can support overcoming barriers when adapting to a new life context.

Figure 2.1 provides a roadmap of the problem context, explicating the relationships between the effect of ICT tools, barriers of the problem context and refugees' common goals. Leveraging ICT tools can facilitate access to information, communication and services to support overcoming common barriers, such as cultural, literacy, trust, technological, information complexity, information overload and lack of social connections. These barriers stand between resettlers and important life building blocks such as housing, education, health, employment and social inclusion, which ultimately support 'successful integration' [2].

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### 2.1.1 ICT tools

Refugee migrants view digital technology as a vital tool for learning, assimilating with the wider community, accessing education and job opportunities, and contact with family and friends[3][7][14]. Various studies [5][6][12][15][23][40] have formulated in different ways a number of the challenges faced by refugees to which ICTs can respond:

- Communicating effectively
- Participating in an information society
- Understanding a new society
- Social connectedness
- Expressing a cultural identity
- Accessing services
- Integration and social inclusion in host communities
- Journeying to safety
- Communicating with the government
- Participating in educational programs

#### Mobility

The needs of refugees align with general requirements for mobile technology proposed by Sharples[37]:

- Highly portable
- Individual
- Unobtrusive
- Available
- Adaptable
- Persistent
- Useful
- Intuitive

Particularly during the transitioning phase of settlement, including journeying to safety, accessing transportation and keeping in contact with family members, it is strictly necessary for tools to be mobile. Accordingly, smartphones have emerged as an instrumental piece of technology central to refugees[15].

#### Access to information, communication and services

Lloyd et al.[21][23] have studied integration and the social inclusion of refugees as an information problem, and propose that a prerequisite for social inclusion is knowledge about a society, which can be attained by connecting and engaging with the society's information landscape. The study highlights that social exclusion can be defined as lack of awareness of information. Expanding the social networks for refugees enable refugees to

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access information and services in the host community, and will maintain communication with their host country[5]. Effective access to information is important, and according to Alam & Imran[3] the information needs of refugees are linked to their social inclusion.

Another study by Gordano & Híjar[14] on immigrants settling in London showed how mobile devices supported them in accessing needed information in-situ, scaffolding communication with members of the host society and transnational family communication. A Norwegian report[38] on the self arranged housing agreement found that the main communication sources amongst refugees are social media and word of mouth, resulting in that refugees with greater social networks have better opportunities of participating in the arrangement.

### **Sharing information**

Successful information sharing relies on several interrelated factors, amongst others information quality and language. Migrants prefer and seek out information that is shared in their own language or ethnic community[14][21][23][41]. Sharing experiences between people with experiences from similar vulnerable situations, either volunteers, organizations or those that have been through similar situations, can benefit those that face such situations now[4][5].

### **Technology leverage**

Use of smartphones and Facebook is widespread amongst refugees[15]. The *Infobits* platform aims to leverage refugees' familiarity with this technology to offer safe, intuitive and effortless access to the system's informational content. While mobile communication improves access to information, it does not ensure information quality[14].

### **Transience**

Three distinct *phases of resettlement* of that new settlers move through has been identified by Kennan et al.[21]: transitioning, settling in and being settled. Information needs are changing in each phase, with a greater number of barriers to overcome in the former two phases. Gordano & Híjar[14] points out that immigrants are a homogeneous group, that migration is not a static phenomenon and that therefore, each moment of the migration process involves different ICT needs, expectations and practices. Brown & Grinter[12] introduced the notation of *designing systems for transient use* to tackle barriers without creating long-term dependencies on a tool. This aligns with the phases identified by Kennan et. al[21] which acknowledge that the information needs of refugees are highly dynamic.

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## Locality

An important finding from the project thesis[41] (more detail in Section 3.4) was that *local* information is of great importance - whether during travelling or when settling in to a host local community. Engaging with locals and participating in local communities is related to perceived 'quality of life', and is recommended for the benefit of refugees[7][41]. ICTs facilitate ubiquitous communication with friends, family and societies in their home country[15][23].

## Pitfalls

While there are opportunities for ICTs towards the aim of empowering settling refugees, such technologies can also facilitate social isolation[7]. Development of parallel societies within host societies is also a challenge, and Krasnova et al.[15] formulate the need to ensure that ICTs enable an acceptable balance of social connectedness between the local host society and families back home. Brown & Grinter[12] also emphasize that avoiding prolonged dependence on supporting tools is necessary to ensure that refugees realize the importance of learning the host language. Another challenging point is that access to information (through ICTs) does not necessarily ensure the quality of information[14] which in turn can encourage mistrust. Information overload can also become a barrier in itself[23].

## 2.1.2 Barriers

The barriers presented in Figure 2.1 are interrelated and of a transient nature. Some barriers are long term: learning technologies, a language or deep knowledge of a culture/society requires substantial time. The needs for constructing trust and making information available and consumable in preferred formats however can be addressed immediately.

## Cultural differences

Cultural differences complicate relationships between different communities of refugees and between refugees and the host community[5][7][12][15][21]. Such issues are amplified by lack of language skills, psychological trauma and the context of a foreign language[5][7][15]. However, Andrews[7] has documented a widespread wish amongst asylum seekers for opportunities to participate in activities outside of reception centers. Further cultural barriers arise when refugees are expected to connect with foreign information, societies, people[12], technology, systems or services, e.g. when forced to interact with computer systems[23].

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## Trust

Sztompka[39] defines trust very generally as “*a bet about the future contingent actions of others*” - something we endow other people with (directly or indirectly) to better be able to predict and handle future events. Trusting others is a common barrier for refugees[3][5][21]. Information quality and methods of sharing information are thus important facilitators for trust. This limits social connections and can contribute to social isolation. Refugees prefer and value information which is shared by trusted mediators using familiar methods, particularly in the transitioning phase[21][23]. The UN Refugee Agency (UNHCR) report that refugees prefer to speak with their staff face-to-face to gather information, even though this information is available online[20].

## Information format and complexity

Information format is one of the dimensions of information quality as formulated by Miller[26], which further divides format into two components: the underlying form and its context for interpretation. Oral and visual information sources are preferred by many refugees, especially during early phases of settlement, caused by lacking language proficiencies, conventions and cultural differences[23]. The same study suggests that an overwhelming flow of information can be counterproductive and encourage social exclusion, as people experience information overload when they are unable to process all the information presented to them.

## Social isolation

Trust issues cause refugees to be wary about sharing personal information, leading to less social interaction with other refugees as well as government services[5]. Religion, shame and dignity are other factors that may prevent refugees from seeking help, cooperation and establishing social connections[5]. A qualitative Norwegian study [7] aiming to map the everyday life at Norwegian reception centers, reported on patterns of social isolation. The study describes residents feeling apathetic, passive and lacking a sense of purpose in a situation where waiting indefinitely is an only option and thereby withdrawing from social life.

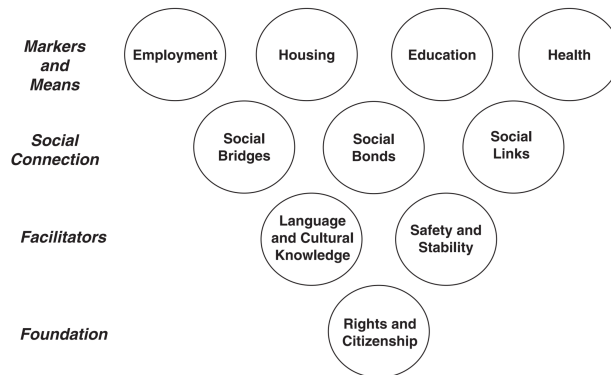
## 2.1.3 Integration

‘Integration’ is a chaotic concept. Despite the fact that refugees are a very heterogeneous group of people, aiming to integrate into the host society is a shared overarching goal in the problem context, as shown in Figure 2.1. Towards the aim of conceptualizing integration, Ager & Strang[2] developed a framework of ten core domains to summarize perceptions of



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what constitutes 'successful' integration, which can be seen in Figure 2.2. We can see that challenges discussed in this section - breaking down cultural barriers; social inclusion; improving communication; spreading information and knowledge; providing education; finding housing - all contribute to one or more domains of 'successful' integration.



**Figure 2.2:** Domains of 'successful' integration[2]

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## 2.2 Requirements and scope

Table 2.1 below summarizes high-level requirements (HLRs) to a system supporting the resettlement process of refugees as they were identified in the project thesis. The overall design of *Infobits* was developed to satisfy these HLRs[41].

**Table 2.1:** Project thesis high-level requirements[41]

ID	High-level requirement	Elaboration
HLR 1	<b>Information and experience sharing</b>	A solution design should support its users sharing information and personal experiences related to the phases of resettlement.[5] A shared repository to store information and experiences can benefit others to come[5][14].
HLR 2	<b>Accessible information formats</b>	Differing backgrounds, language proficiency and inherited cultural preferences are barriers to efficient information sharing[23]. Succeeding in sharing information and experiences requires suitable formats for recipients[23][26].
HLR 3	<b>Trustworthiness</b>	Shared information should be as precise and reliable as possible. New refugees especially are liable to mistrust their foreign context during early phases of resettlement[5]. Mechanisms should ensure quality of the content.
HLR 4	<b>Mobility</b>	Tools to assist this group should be usable in situ, and mobile - thus in alignment with general requirements of [37] to be useful 'anywhere, anytime'. Using mobile devices can allow users to produce and/or consume videos and information in context[35].
HLR 5	<b>Collaboration</b>	Constructing content collaboratively has been recommended[4][5][19] and supports connecting refugees and establishing trust. Collaboration aims to ensure that information is updated and relevant in a context where rumours about regulations/policies are changing rapidly[20].

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The project thesis identified the problem domain, and initiated design of a mobile platform to support the resettlement process of refugees in general. This thesis will narrow the scope by focusing in on a specific interface to the resettlement process and expose the platform prototype in this particular context. This section will briefly introduce a model of the *phases of resettlement* for later reference and define the scope of this thesis.

## Phases of resettlement

A model[41] identified in and adopted from both literature[12][21] and practical use by Trondheim kommune is the *phases of resettlement*. The model acknowledges that the process of adapting to a new life context, as in the case for refugees, is *transient*. This entails that their situation is fleeting, changing rapidly. The three phases of resettlement are as follows: the 'transitioning' phase, the 'settling in' phase and the 'being settled' phase.

This model is referenced frequently throughout the project, and a experimental mechanism based on the model has been implemented in the prototype to increase its usability and align with the notion of *designing for transient use*[12]. Table 2.2 below explains a typical user in each phase and his/her relation with the *Infobits* system.

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**Table 2.2:** The stages of resettlement[41].

<b>Stage of resettlement</b>	<b>Description</b>
Transitioning - newcomers	Recently arrived or soon to be arriving individuals with little or no knowledge about the host country, language and culture. Many are also unfamiliar with certain technologies and lack digital competences. This group have a significant need for basic information, and lack capacity to contribute significantly.
Settling in - intermediates	Individuals with different information needs than those struggling with basic challenges and language. With some knowledge of language, they typically want to communicate and connect with others or gather information about where to find certain goods or services etc. Users are capable of both receiving and sharing some information.
Being settled - experts	Well integrated and established individuals with knowledge of and familiarity with the host society and its systems. No troubles regarding the language, and capable of engaging with more complex system functionalities. This group have a lesser need for information and is better suited to share expertise and experiences. People that just want to help out fall into this category.

---

The initial overarching design of *Infobits* aimed to support refugees generally through all the phases of resettlement. The remainder of this thesis will however have a narrower scope, focusing in on those in newcomers and intermediates, as these groups form the majority of critical information consumers (see Section 2.2 and Figure 2.3). These groups are characterized as the most vulnerable, with the greatest information needs, having least trust in institutions, possible lowest technological competences and least familiarity with their surroundings. Emphasis will be put on designing the system interface for these groups such that it is perceived as usable, trustworthy and that it offers appropriate mechanisms to support information quality and facilitating leaving feedback. The research questions of this project reflect these focus areas.

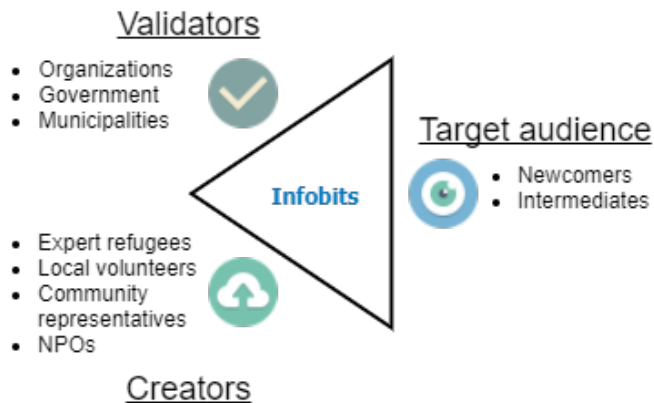
## Scope

The general design of the *Infobits* system intrinsically satisfied the identified HLRs presented in Table 2.1. The platform should have interfaces adapted to the various actors affiliated with it. Figure 2.3 below shows a division of roles and actors that would typi-

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cally fill them.

Focusing on the target audience interface implies focus on usability, facilitating trust and ensuring information quality, as these are main concerns of this group. Additionally, this group fills the role of information critics: they are consuming and judging the information and thus should be provided with mechanisms to provide such feedback. Refugee groups that would fall into the target audience group are newcomers and intermediates, meaning those who are travelling or recently arrived in a country, as well as those that are in the midst of resettling, creating a new life. These groups have dynamic, transient information needs, and thus the design should support transient use.



**Figure 2.3:** Various interfaces of the *Infobits* platform.

In a platform such as *Infobits*, it is not possible or sensible to discuss trust or quality by looking at a single part of the triangle in Figure 2.3, as information assumes meaning only when it is seen in the overall context. The ten information quality dimensions[26] are reliant on interrelated factors across the interfaces suggested in the Figure. E.g., how a piece of information is perceived by a newcomer refugee cannot be determined without looking at its context, i.e. the creator, validator, fellow audience judgments and relevance.

The remainder of the thesis will thus focus on how one of the target user groups perceive the **trust**, **information quality** and **usability** of the proposed platform's target audience interface and content.

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## Research questions

The following main research question has been formulated:

**RQ 1:** *Can the social inclusion of transitioning refugees be supported by a mobile crowd-sourcing platform facilitating access to high-quality, multilingual, trustworthy informational videos?*

To break this down and further specify particular focus on the interface of the target audience, the following two sub-questions were posed:

**RQ 1.1:** *What functionality is required by such a platform in order for it to be considered usable by its target audience?*

**RQ 1.2:** *What functionality is required by such a platform in order for it to promote justified trust in information amongst its target audience?*

## CHAPTER 3

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### Related work

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This chapter will introduce aspects that are relevant to consider when approaching supporting trust, information quality and usability in the context of this project. Then, selected research project applications will be presented and their approaches to relevant aspects reviewed. Information sharing process models for these applications are discussed next. Finally, a section is devoted to presenting design insights from previous work which has driven the development of the proposed solution platform presented in the next chapter.

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## 3.1 Relevant aspects

This section will briefly introduce aspects of existing applications which are relevant to the problem context, and which will be explored in-depth in the following sections. The aim is to highlight different approaches that existing work has taken to leverage opportunities offered by mobile technologies and crowdsourcing to collaboratively construct and share repositories of quality information.

### 3.1.1 Mobile technology

The lives of refugees in the early phases of resettlement[21] are characterized by uncertainty and temporary living arrangements. For gathering information in this context, smartphones have emerged as an invaluable tool for refugees and migrants[14][15]. The transient informational needs of refugees align well with general requirements for mobile technology proposed by Sharples[37], which have informed the design of the tool proposed in this project.

All five applications presented in the succeeding section have demonstrated, through case studies, various ways in which mobile technologies can be leveraged to support and empower people. These systems have been deployed successfully in a variety of situations, e.g. resources constrained contexts, classrooms, every day practical information, in-situ translation, personal advice and experience sharing.

### 3.1.2 Information quality

Miller[26] argues that information quality occurs along ten dimensions, is defined by the information's customer, and is constantly changing over time - i.e. transient. The ten dimensions/attributes of information quality according to Miller are: **relevance, accuracy, timeliness, completeness, coherence, format, accessibility, compatibility, security and validity**. The importance of several of these attributes have already been highlighted in this report, in particular **format** and **accessibility** - how the information is presented to the information customer and that information should be obtainable when it is needed. Preferred information format varies from culture to culture. Typical host societies often tend to rely heavily on textual information[12][25][30][35].



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### 3.1.3 Crowdsourcing

Information sharing through crowdsourcing is a way to collaboratively construct information and share experiences, driven by trust in a motivated crowd[10]. With crowdsourcing, borders between consumers and producers are blurred and allows a communal constructivist[19] approach to learning, where learners contribute and form the content as they consume it - aligning well with the transient nature of the resettling process. Further, collaborative construction of information helps ensure the relevance of and trust in the information in a context filled with rumours and constantly evolving regulations[20].

### 3.1.4 Social inclusion

From an information perspective, the ability to become socially included can be viewed as being predicated on the ability to connect and engage with the information of a community[23]. Furthermore, and particularly in technology-rich societies, digital inclusion is closely related to social inclusion[3][16]. ICTs can furthermore facilitate social inclusion of refugees through supporting cross-cultural learning, linguistic capabilities and participation in local communities, which are important building blocks to social inclusion[4][5].

In Ager & Strang's conceptual framework of integration[2], social inclusion encompasses three of the ten core domains that constitute the building blocks of 'successful integration'. The importance of refugees' inclusion in local communities and environments is emphasized particularly as an important factor for their quality of life.

## 3.2 Existing applications

Previous work has explicitly suggested that successful platforms for empowering refugees via information should be collaborative and should facilitate communication, interactions and sharing of information and experiences in a language and format that the recipients are familiar with[4][5][14][23]. This section will take a brief look at five existing research projects, each presenting mobile applications and frameworks for use in similar problem contexts. Attention will be paid to learn how these applications have approached supporting the aspects presented in the preceding section.

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## RivrTran[12]

RivrTran is a simple voice and text messaging platform to support interpretation and translation for resettling refugee families, developed and studied in the field. The system mediates refugee-mentor communication asynchronously, and lets refugee families ask questions by interacting with a voice UI. Messages are then translated if needed, by a 'human-in-the-loop', and then answered by volunteers in the local host society before being translated again, if needed, and finally sent back to the refugee family.

### Information quality

Assuming that the volunteers providing the refugees with information are not intentionally malicious, the information provided by the *RivrTran* system is of excellent quality. Information is personalized, presented in audio or textual format in the information consumer's own language and could be requested and delivered on demand through their phones.

RivrTran[12] enabled migrant families to asynchronously receive personalized support with translations and practical every day tasks from host country volunteers.

### Crowdsourcing and collaboration

The crowdsourcing model of RivrTran utilizes a crowd of volunteers to perform two tasks: translation and answering. The application facilitates collaborating asynchronously by performing these tasks when crowd members have available time. Information that is created is so personalized that there is no storage and reuse of it - each question answered support only the family that posed the question.

### Social inclusion

*RivrTran* has limited direct support for social inclusion. Through the application, a refugee family will correspond with a single volunteering host family, exchanging information and practical support.

## MApp[13][22][29]

The MASELTOV research project introduced an incidental learning framework which has informed the design and evaluation of the MASELTOV app (MApp). The MApp features a context aware mobile serious game, and furthermore offers recent immigrants an ecology

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of tools and resources to support language and culture learning, navigation, social interaction with peers and locals, translations and to provide context-aware recommendations. Emphasis of the MApp is to encourage and push its users to interact with local citizen in various situations.

### **Information quality**

Information in the MApp is communicated through games or social interactions with peers and/or locals. The game encourages users to take action and gain knowledge by incidentally learning through interactions with the host country's culture and people. Beyond the information implemented in the tool by the developers, the MApp supports forums open for textual input and discussion from both migrant users and volunteers.

### **Crowdsourcing and collaboration**

Peer-reviewing of language learning tasks, forum for social interaction and the possibility for users to appear in the application as volunteers constitute the areas of the MApp which are facilitated through collaboration with the crowd. Other content is created by the application creators.

### **Social inclusion**

The MApp encourages social interactions by use of a recommender system and gamification towards the goal of language learning. Additionally the application offers users a forum for sharing experiences and a geo-social radar which will enable them to find available local volunteers who may be able to support them.

## **PaperChains[30]**

The *PaperChains* interface for mobile devices was developed for collaborative creation and annotation of evolving audio-visual documents. *PaperChains* allows users to sketch on paper and then augment with digital audio, allowing both the physical and digital objects to evolve simultaneously over time[30]. It was specifically designed with high affordability and accessibility in mind, and adapted specifically for use in resource-constrained environments. PaperChains facilitates collaborative authoring and recognizes the importance of using audio to support storytelling in resource constrained contexts.

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### **Information quality**

Stories are told through an audio-visual format, which was shown to be effective in the resource constrained environment where *PaperChains* was tested. Information sharing in this study was focused on sharing personal stories rather than practical information, thus issues such as security, validity, accuracy etc. become less relevant.

### **Crowdsourcing and collaboration**

Annotation of physical objects is done collaboratively. The purpose of the tool is to create, interpret and share common user stories. Contributing to the collaborative construction of information requires physical proximity to the physical object however, limiting the reach of shared content.

### **Social inclusion**

The tool successfully allowed people to share and interpret stories, facilitating cross-cultural learning and understanding in an appropriate context. Participation also requires proximity to a physical object, which promotes face-to-face interactions between users.

## **LingoBee[31]**

A study conducted three case studies of using the mobile, crowdsourced app *LingoBee* in the context of mobile supported language learning. The application is a crowdsourced mobile app supporting situated informal language learning and also assisting users in gaining linguistic and cultural knowledge. The application is designed such that user can capture language elements that they encounter in their everyday lives in articles. All content is generated and annotated by the users themselves, and stored in a cloud repository for future use.

### **Information quality**

*LingoBee* offers users access to a shared cloud repository of information articles, which are represented in one or several formats. Articles conveys meaning of everyday language elements, e.g. words, sayings, cultural objects or events that can be described by images, text or audio recordings.

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### **Crowdsourcing and collaboration**

Content of the shared cloud repository of information is collaboratively created and annotated entirely by the users of *LingoBee*. The repository is constructed through entering new articles or annotating existing articles with images, audio, descriptions, ratings and links.

### **Social inclusion**

*LingoBee* supports user profiles and adding web links to articles. The intended use of *LingoBee* is as a complement to activities in existing formal language learning classes or settings, thus the application also supports creation of groups.

### **Virtual.Cultural.Collaboration[35]**

Sarangapani et al. performed a case study using video technology on mobile phones in collaboration with schools and migrant families. The project piloted an application supporting migrant families in creating informational videos to share their culture. These videos were later shown in the classroom of the migrant families' children. The study showed that smartphones are an accessible, evocative and affordable avenue to aid the development of cross-cultural resources and strengthen communication. The study found that using personal devices encouraged families to explore personal, communal and social places for learning and required very little investment to participate.

### **Information quality**

The information delivered with the approach presented is displayed by the school, a trusted source of information, and in video format. Furthermore, the information is relevant, as it is produced by peers of the information consumers.

### **Crowdsourcing and collaboration**

Minority families collaborate to construct cross-cultural learning resources which are later shared with a wider audience in the classrooms.

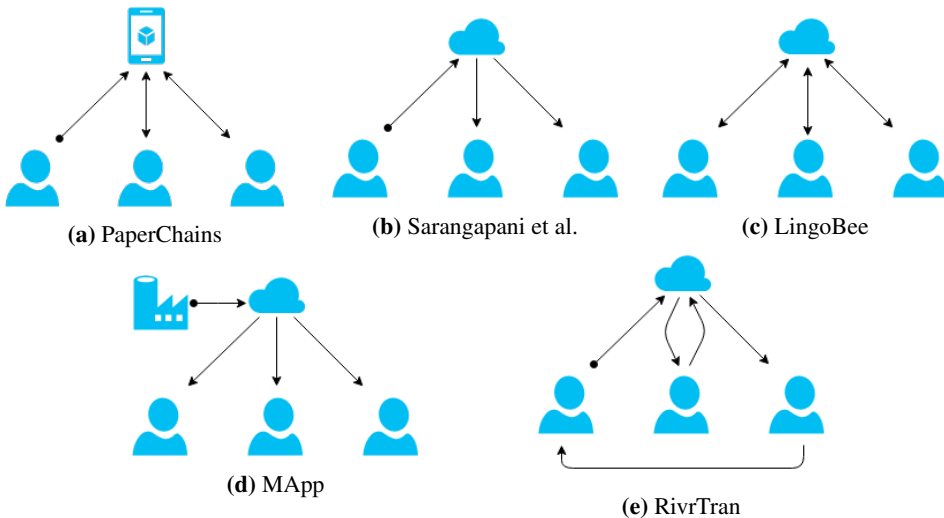
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## Social inclusion

The approach of Sarangapani et al. facilitates information sharing between migrant families and school classrooms. The study also found that their approach strengthened home-school and school-home communication. Indirectly, fellow students gained better knowledge and understanding of foreign cultures, which might support inter-cultural social ties in a bigger picture.

## 3.3 Information sharing process models

Figure 3.1 below shows the different approaches that the systems presented in the preceding section follow to sharing and/or creating information[41]. In PaperChains (Figure 3.1a) anyone can create new augmented objects which others then can access and annotate. The video system from Sarangapani et al.'s study made it possible for certain students to create and share videos that would later be broadcast to the whole community of students to watch (Figure 3.1b). Figure 3.1c describes the approach of LingoBee: any member of the community can add to a shared repository or modify existing entries in the repository (by annotating, rating, commenting or adding resources). Figure 3.1d describes the information approach of the MApp, where the available information is implemented in the application which users can read from only. Lastly, RivrTran's approach (Figure 3.1e) does not store information for later use, rather it facilitates translation support (human-in-the-loop) to support communication between two end-users.



**Figure 3.1:** Models of information sharing processes[41]

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## 3.4 Design insights

This section will briefly present the core design insights that have informed the design of the *Infobits* platform.

Table 3.1 summarizes the main insights gathered in the project thesis[41]. The insights were collected during in-depth interviews with various domain experts, evaluating earlier prototypes of the *Infobits* system.

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**Table 3.1:** Project thesis design insights[41]

General	System specific
<ul style="list-style-type: none"><li>● Facebook and other social media are actively used to spread info.</li><li>● Most refugees have a smartphone and are used to communicate through it.</li><li>● Considerable need for <i>proper</i> info. Many rumours circulating, lots of untrustworthy info. Quality assurance is critical and challenging.</li><li>● Always focus on supporting newcomers, designing for users lacking digital competencies or who are discouraged by foreign technologies.</li><li>● Focusing on and making long term goals or benefits clearly visible can help motivate refugees.</li><li>● Official info is not easily accessible in understandable formats.</li><li>● Refugees often prefer F2F communication over instant messaging or social media</li><li>● Getting through directly to official body representatives in order to obtain useful info is extremely challenging for refugees.</li><li>● Municipalities are not capable of providing personalized support.</li></ul>	<ul style="list-style-type: none"><li>● It is very important that the system interface is available in many languages.</li><li>● Info about local opportunities should be included and separated from general/global info.</li><li>● <i>Sharing info</i> and <i>finding info easily</i> are the most important features, facilitating social interaction turned out to be less important (from a related student project).</li><li>● System navigational state/options should be made explicit and clear. Use of informative symbols/icons/images etc. is more attractive to navigate by than foreign language text.</li><li>● Use the stages of immigration to group users according to their info needs and filter functionality and content accordingly.</li><li>● Requiring logging in to make contributions supports quality assurance, but adds complexity for newcomers.</li><li>● Administrator activity is critical. Illegal or hateful content must be filtered and unwanted criteria for ratings could emerge.</li></ul>

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The following set of quotes from related studies have provided valuable insights into system design in the relevant problem context:



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Almohamed & Vyas[5]:

*Refugees and asylum seekers have shared goals, such as learning English, finding jobs, and integrating with their host community. Each of these vulnerable people has had different experiences regarding these goals, with some of them may have very successful experiences. Sharing them would be beneficial for others who face similar difficulties in achieving these goals.*

[...]

*A successful intervention technology should improve the communication between refugees and asylum seekers, allowing these people to share their experiences and access to large resources. [...] Technology can encourage these people to communicate freely and share information with their counterparts who share the same social issues.*

Peile & Hajar[14]:

*The most popular sources of information were web forums, blogs, and social networking sites, where content was provided informally and in Spanish by other Spanish-speaking immigrants who had already arrived in London and shared their experiences, doubts, and tips online, constituting true communities of interests.*

LLoyd et al[23]:

*Social inclusion becomes possible when the pre-existing and emerging information practices of refugees are taken into account, and where information is provided through the transition and settling in phases via information sharing through trusted mediators who can assist with information sharing, information mapping, and through provision of visual and social sources. Other information, such as that provided in text on web sites, in booklets and pamphlets, by complex interactions with telephones and computers, with the best will in the world, continue to be alienating and exclusionary for quite some time after settlement.*

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## CHAPTER 4

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### The Infobits platform

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This chapter will give a brief overview of the platform's initial design, which was created during the project thesis. Then, the *Infobits* concept will be presented. Following, detailed reasoning about the design elements of the concept are discussed. Finally, the functional prototype that was constructed will be presented thoroughly next.

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## 4.1 Evolution of *Infobits*

This section will provide a quick overview of the foundational platform design and how it has been created through previous work with the past project thesis.

### Past

The initial overarching design for the *Infobits* platform was informed by a literature review and document analysis conducted in the project thesis. Two iterations of design and evaluation were performed. The first iteration produced paper mockups and use scenarios. The second iteration presented a wireframe prototype and refined use scenarios. Both iterations were evaluated during in-depth interviews with various domain experts.

### Present

Table 3.1 in Section 3.4 summarized the main design insights that were presented as the main findings of the first two design iterations carried out for the project thesis. Before the implementation described in Chapter 5 began as a part of the master's thesis work, these insights were evaluated and used to inform the design of the current prototype.

### Basic assumptions

Platform design is based on assumptions that the users have affordable access to the internet and a smartphone, that they are motivated to participate in consuming and/or producing information to receive support and support others and finally that users have some basic linguistic capability, sufficient to navigate the application in their preferred language.

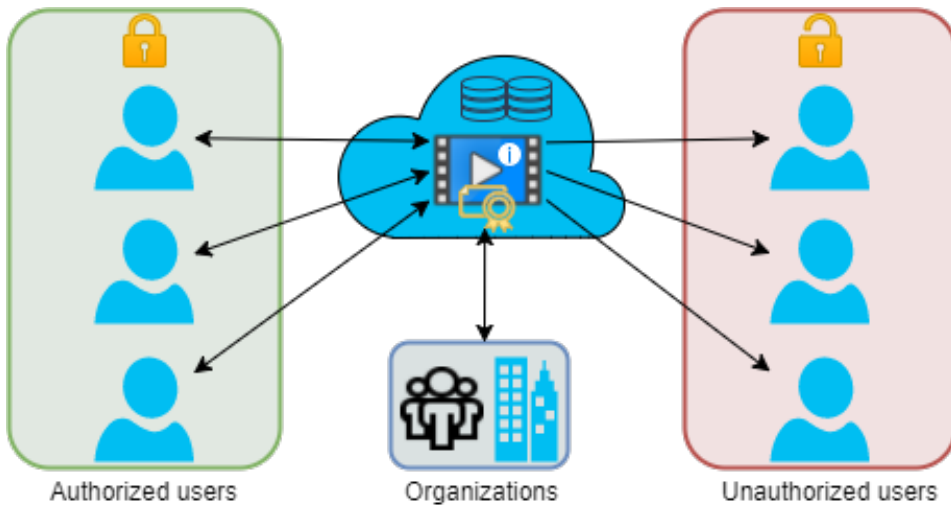
## 4.2 Concept

The *Infobits* concept consists of a mobile platform facilitating crowdsourced information sharing in the form of short contextual videos. Its overarching goal is to empower people who are adapting to a new life context by providing a shared repository of collaboratively constructed information in multiple languages that can be helpful to others in the same situation. The platform allows users to watch, create, upload, rate and bookmark videos. Official bodies and organizations can also register in the app to give videos in the system a 'seal of approval' to imply that their organization approves of that specific piece of content.

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## 4.2.1 Information sharing model

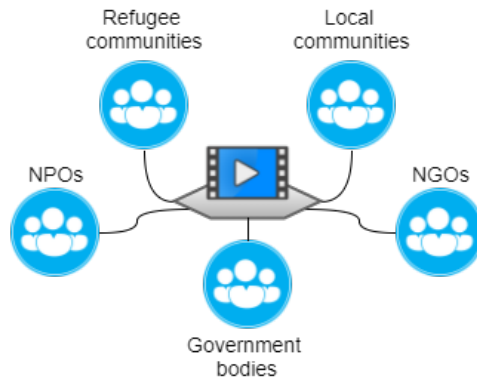
Information sharing is following the model shown in Figure 4.1, where any authorized participant of a community may create and contribute to the shared information pool by uploading and/or rating videos. The informational content is available to view for anyone, including unauthorized users. Organizations, official bodies etc. can also register to annotate video content with *seals of approval*, indicating that the content of selected videos is supported by that specific organization.



**Figure 4.1:** *Infobits'* information sharing model.

## 4.2.2 *Infobits* as a shared platform

The platform aims to bridge information gaps between refugees and host communities, and support collaboration between various groups such as refugee communities, local communities, NGOs, official bodies and volunteering organizations. It should facilitate collaborative construction of a common information repository interfacing a number of actors in distinct manners as illustrated in Figure 4.2 below.



**Figure 4.2:** The *Infobits* platform as a common repository across communities in a host country.

By separating responsibilities of stakeholders in the *Infobits* platform, one can distinguish different use patterns. The collaborative construction of information in the system can be divided into three separate processes: 1) consuming & criticizing content, 2) uploading/creating content and 3) validating content quality. Figure 2.3 illustrated these cases as distinct interfaces to the platform.

Various people, organizations and communities, as illustrated in Figure 4.2, collaborate to construct and annotate the repository through an appropriate interface, as illustrated in Figure 2.3. The common goal is to efficiently share information of high quality in suitable formats to benefit all involved stakeholders. *Infobits* facilitates a common ground for information sharing and mechanisms to ensure information quality for the stakeholders.

## 4.3 Elements

This section explains the various system elements, linking them to the identified requirements and providing reasoning for including them.

Table 4.1 shows a set of design choices that have been made to demonstrate how they support trust, information quality and usability. Reasoning behind the choice of design elements follows.

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**Table 4.1:** Design elements

<b>ID</b>	<b>Design element</b>	<b>Trust</b>	<b>Quality</b>	<b>Usability</b>
<b>D1</b>	Ratings	✓	✓	
<b>D2</b>	Seals of approval	✓	✓	
<b>D3</b>	Content reporting		✓	
<b>D4</b>	Facebook authentication	✓	✓	(✓)
<b>D5</b>	Crowdsourcing	✓	✓	
<b>D6</b>	Video format	(✓)	(✓)	✓
<b>D7</b>	Localized content	✓	?	(✓)
<b>D8</b>	Internationalized UI		(✓)	✓
<b>D9</b>	Phases of resettlement	?		✓

**D1.** Ratings are included to let the many users collaboratively judge the quality of a video. It is a possibility for authenticated users to contribute to the system and a mechanism let users separate videos that are of high quality and are trustworthy.

**D2.** This mechanism facilitates visibility for verified and trusted organizations that want to signal publicly that the organization approves of the information in the video.

**D3.** Having a visible option to signal to administrators of the application whenever a user finds content (s)he deems inappropriate is intended to display to users that bad or false information gets dismissed quickly by collaborative effort.

**D4.** The project thesis[41] found that Facebook is a very important platform for many refugees, assisting in keeping up with friends, family, social networks and also as a source of information. Leveraging familiarity with the platform to de-anonymize users that want to participate in the platform was done to increase trust and to discourage destructive behaviour.

**D5.** Constructing information collaboratively, in manners of communal constructivism[19], aligns with the transient process of adapting to a new life. Previous work has recommend collaborative approaches in a refugee context 'cites' and collaboration keeps information up to date and relevant in a dynamic context of rumours and uncertainty.

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**D6.** Information complexity and overload are barriers that face many refugees[21]. Part of this is due to the majority of the information available being presented in textual formats and often foreign languages[23]. Video is an alternative that the project thesis work suggests could be preferred by many refugees, and makes it possible to find information in one's own language or by a countryman.

**D7.** Results from system evaluations during the project thesis found that local content was strongly encouraged and considered highly relevant[41]. Labeling videos as either 'global/general' or 'local' could contribute to refugees' participation in local activities.

**D8.** The decision to offer the UI in multiple languages was a direct recommendation of the project thesis[41]. The prototype offers only Norwegian and English as a demonstrator.

**D9.** The choice to leverage the concept of resettlement phases adopted from Lloyd et al.[23] and Trondheim kommune aims to increase usability by simplifying the UI for newcomers. Furthermore, to design for transient use, the users are given the option to adapt the interface to suit their changing needs.

## 4.4 Prototype

This section will provide a walkthrough of the user interface (UI) of the *Infobits* functional prototype as it was implemented for the final evaluation session presented in Chapter 7. The UI will be presented through screenshots with corresponding explanations, showcasing the prototype functionality. The aim of the prototype was to instantiate a possible solution for the target audience interface, focused on facilitating finding information easily as well as demonstrating the concepts of 'seals of approval' and 'phases of resettlement' to the participants. Instructions explaining how to run the prototype on a smartphone can be found in Appendix D.

As mentioned in Chapter 2, the scope and features of the functional prototype have been restricted to the needs of recent refugees in the transitioning phase and settling in phases[21].

Designing for the viewpoint of newcomers and intermediates, i.e. the target audience, the prototype has been implemented with focus on supporting users who might be "*unfamiliar with certain technologies and lack digital competences*" and "*lack capacity to contribute significantly*" (from Table 2.2) to facilitate their finding information.

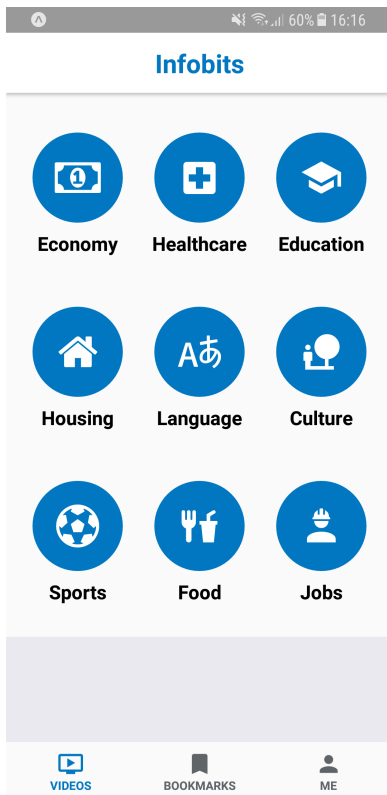
The prototype thus leaves out more advanced aspects of the crowdsourcing process such



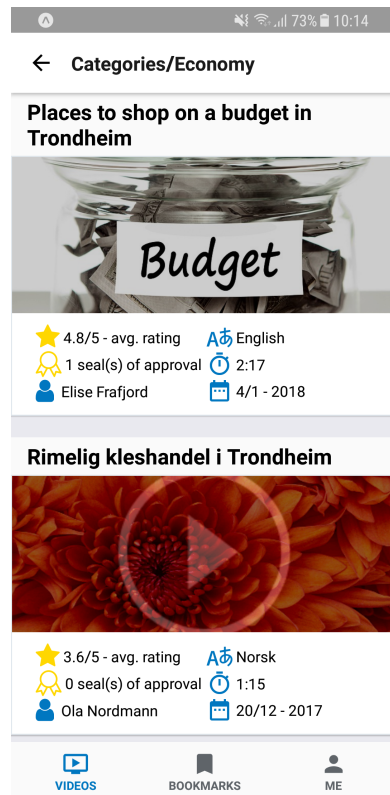
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as creating and uploading content, as well as interfaces for registering as an organization to distribute seals of approval. Relating to Figure 2.3, the system features implemented in the prototype are those concerning the target audience.

## Browsing information videos



**Figure 4.3:** Initial screen showing information categories.



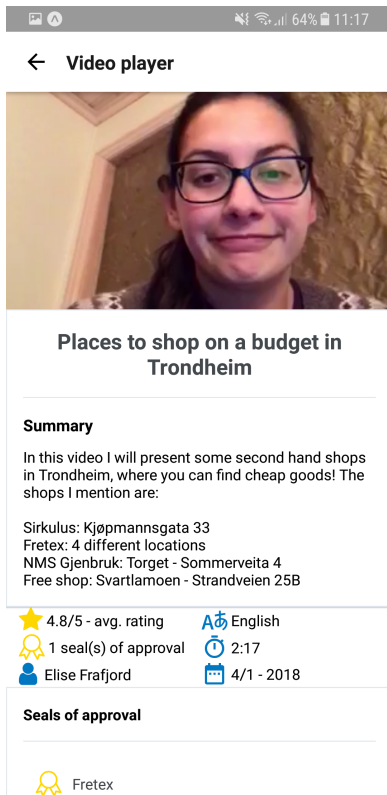
**Figure 4.4:** A list of videos belonging to a selected category.

The screen shown in Figure 4.3 presents the users with various information categories. Icons with corresponding labels have been chosen to represent categories to supply the textual descriptions with a visual element.

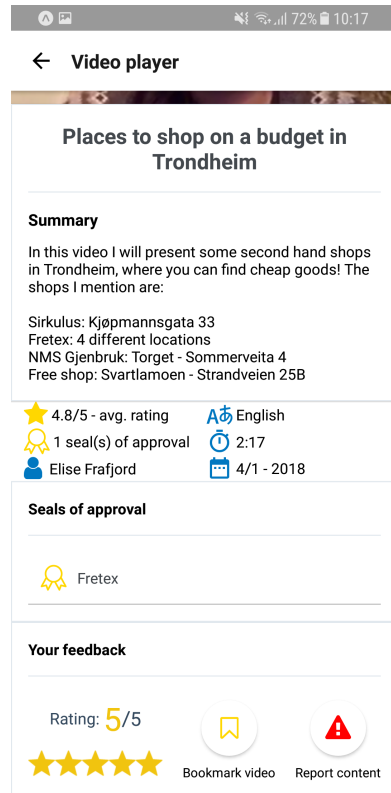
Once a user has pressed and selected a category in the grid, (s)he enters the video list screen, seen in Figure 4.4. This list offers meta information, presented by icons, and a

thumbnail image for each video that exists in the chosen category. Clicking any part of the list element will navigate the user to the video player screen seen in Figure 4.5 and 4.6.

## Video



**Figure 4.5:** Video player, showing the video, a textual summary and meta information.



**Figure 4.6:** Seals of approval for the video are listed, and a section where authorized users can provide feedback.

The video screens seen in Figure 4.5 and 4.6 consist of several sections: the video player, a video title and summary section, meta information, a list 'seals of approval' and a feedback section. In the case that a user is not signed in, the feedback section will be replaced by an authentication section, visually similar to the one shown in Figure 4.8 below. The feedback section offers the user possibility to rate the video, bookmark it for later or report inappropriate content. Tapping on a seal will open an information modal providing additional information about seals.

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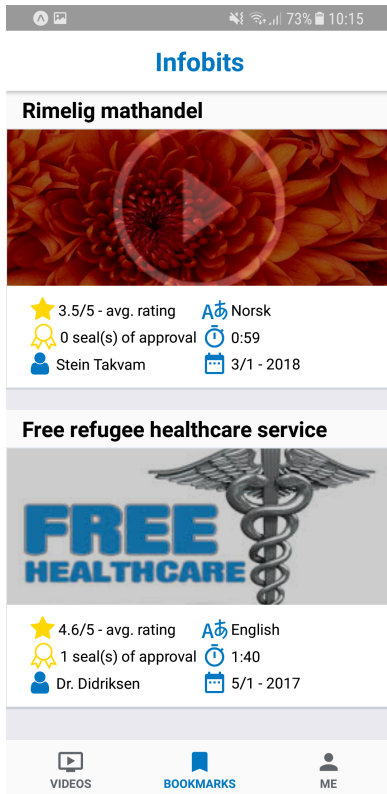
A few example informational videos were made prior to testing during the final evaluation described in Chapter 7 in order to saturate the prototype with real videos for a more authentic demonstration of the platform. The example videos were made by volunteers recruited through personal connections of the author.

### **Seals of approval**

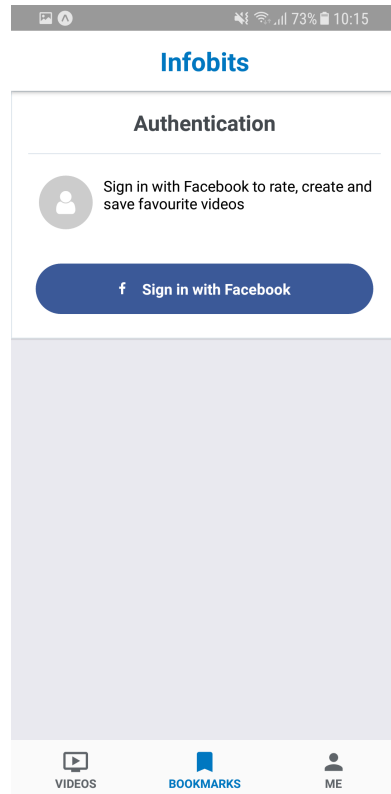
The video view contains a section called *Seals of approval* in the case that one or more such seals exists for the specific video (see Figure 4.5 and 4.6). This mechanism demonstrates a trusted/validated organization, person, official body or similar has approved of the content in the current video. This seal is a mechanism for creators to promote trust in the information and its quality for end users.

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## Bookmarked video list



**Figure 4.7:** List of videos a signed in user has bookmarked.

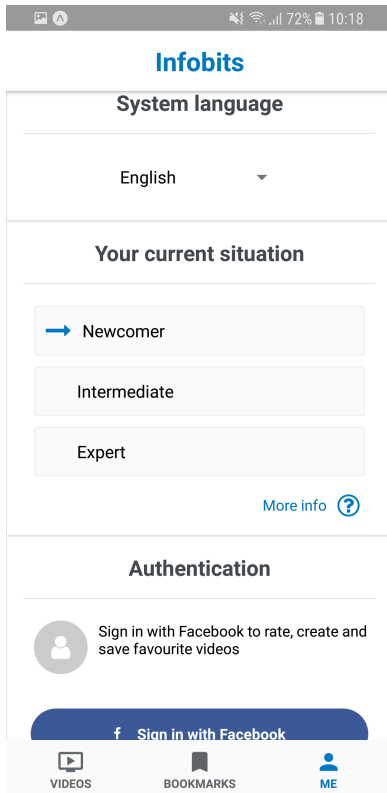


**Figure 4.8:** Optional view when user is unauthorized.

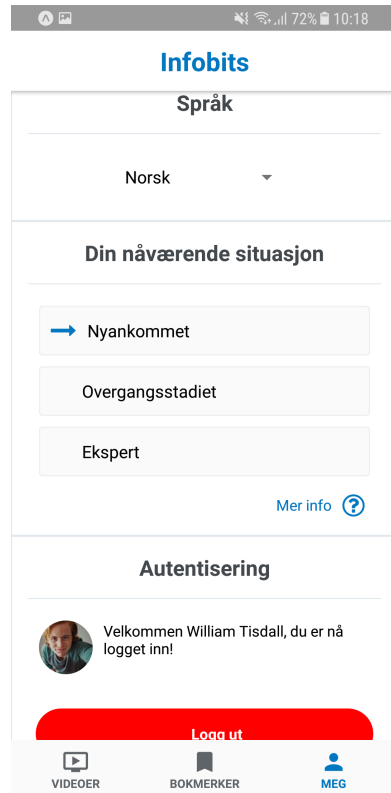
This screen renders a list similar to the video list for categories, displaying the videos a user has bookmarked. If a user is not signed in, this screen will simply offer the user the possibility to sign in. Figure 4.7 and 4.8 show these two cases.

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## Preferences



**Figure 4.9:** Preferences screen in English for an unauthorized user.



**Figure 4.10:** Preferences screen in Norwegian for a signed in user.

The screens in Figure 4.9 and 4.10 offer users a way of authenticating through Facebook sign in, customizing the language of the UI and their current phase of resettlement.

### UI language

This section lets the user pick a preferred language for the UI from a list. Despite that work done in the project thesis emphasizes the importance of supporting many languages in a real application, the prototype was restricted to English or Norwegian as a quick demonstrator of the concept.

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### **Phase of resettlement**

By selecting which phase of resettlement a user belongs to, the UI would change slightly e.g. hiding (for newcomers) or showing (for experts) advanced tools to create and upload material. In the functional prototype, this is a dummy component offering only additional information about the various phases, since advanced tools are not implemented.

### **Authentication**

Users can sign in through their Facebook account. Users have to be signed in order to participate by rating, bookmarking and reporting content. Signing in through Facebook authentication for doing anything other than watching was required to prevent destructive behaviour and reinforce trust by knowing that other users have also had to identify themselves. Users will be prompted to do this in the preferences tab (Figure 4.9) or whenever functionality is restricted due to authorization status (Figure 4.6 and 4.8).

## CHAPTER 5

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# Implementation

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This chapter will briefly present an overview of the various technologies that were used to develop the functional prototype of the *Infobits* system. Then, the architecture and finally the data flow of the prototype are presented. Appendix D contains a document with instructions on how to run the prototype on smartphones running either the iOS or Android operating systems.

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## 5.1 Technology

This section will very briefly introduce the core technologies which were used to develop the functional prototype of *Infobits*. The development environment was provided by Expo. React Native + Redux were used for the UI and local state. Various Firebase services were used for storage, database and authorization services.

This set of technologies was chosen aiming to produce a quick, cheap, available and modifiable prototype of the system. The result has been a system with clear separation of concerns, where media and a realtime database is stored in the cloud and is readily scalable. The UI is separated from the application state and the server and back-end services. In addition, the set of technology allows cross-platform use of the prototype application.

To save time, certain features of the application, e.g. location sensitivity, average video ratings and seals of approval distribution, have not been properly implemented and automated in the prototype, but are rather set manually to 'simulate' situations for users in the usability tests.

### React Native

*React Native*<sup>1</sup> is a Javascript library developed by Facebook for building user interfaces for mobile applications. React Native facilitates creation of concise declarative components, which can be composed into complete UI views. The React Native library allows developers to focus on defining how the view of an application should look and present data, without being concerned with logic.

React Native is a modern tool, growing rapidly in popularity[9][24][27]. React Native aims to gap the bridge between web and mobile development, and facilitate simpler android - iOS cross-platform development. The framework is based on the ReactJS<sup>2</sup> library for web development.

### Redux

*Redux*<sup>3</sup> is an open source Javascript library designed for managing application state. Redux and React (Native) work well together, separating concerns of UI and application

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<sup>1</sup><https://facebook.github.io/react-native/>

<sup>2</sup><https://reactjs.org/>

<sup>3</sup><https://redux.js.org/>



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state. The Redux library manages the application state in a deterministic manner, clearly defining possible states and actions, thus mapping relations between states.

### **React-Redux**

React-Redux is a library that connects the Redux store to the to React Native components, such that information can be passed from the store state to the view.

### **Redux Thunk**

The Redux Thunk<sup>4</sup> library was used to connect the application to the Firebase services by faciliating asynchronous calls from the action creators to Firebase.

### **Expo**

The *Expo XDE (Expo Development Environment)*<sup>5</sup> is a free open source tool that provides sophisticated scaffolding to support efficient creation of cross-platform native mobile applications with React Native. *Expo XDE* supports creation, development, debugging, easy testing/sharing and publishing of applications. *Expo SDK* also provides access to native system functionality through Javascript.

### **Firebase**

*Firebase*<sup>6</sup> is a mobile and web application platform developed by Google, offering an array of tools and services. *Infobits* makes use of the the Firebase Realtime Database, Storage and Autentication services to supply the application with secure database and server solutions. Small-scale use of Firebase services is free of charge, and the platform services are backed by the Google Cloud Platform, offering scalability support.

### **Firebase Realtime Database (FBDB)**

The FBDB is a cloud-hosted NoSQL database, synchronized across clients in real time. Data is stored as a single JSON<sup>7</sup> object and accessible directly from client devices.

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<sup>4</sup><https://github.com/gaearon/redux-thunk>

<sup>5</sup><https://expo.io/>

<sup>6</sup><https://firebase.google.com/>

<sup>7</sup>JavaScript Object Notation - <https://www.json.org/>

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### **Firestore Authentication (FBA)**

FBA provides authentication options for clients to gain access to the Firestore services (DB + storage). In the case of Infobits, signing in with Facebook credentials has been the only option to access the *Infobits* application content that is not publicly available.

### **Firestore Cloud Storage (FBCS)**

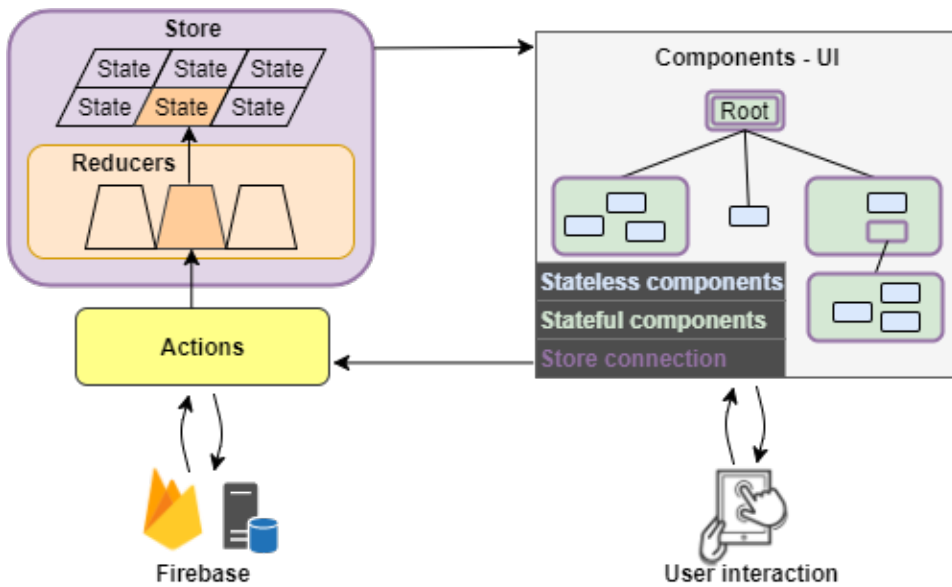
FBCS provides secure and scalable storage to upload or download media files and generates references to serve content to clients.

## **5.2 Architecture**

*Infobits* has been implemented revolving around a strict unidirectional data flow that follows from using Redux as the application state manager. This architecture helps separate concerns of the UI appearance from the data and logic behind it, facilitating quick and simple modifications of the UI. This has been a great benefit during a design process focusing on usability, when the appearance of the UI has been subject to changes. In addition, the predictability of this approach supports a more comfortable development process.

### **Unidirectional data flow**

In a Redux application, all application state is stored in a single object. Thus, all application data flows from this object to the React Native component hierarchy which constitutes the view which the user interacts with. Figure 5.1 shows the flow of data from the Redux store to the UI components. User interactions trigger actions which indirectly modify the state, causing a re-rendering of the UI components with the new state.



**Figure 5.1:** Unidirectional data flow architecture with Redux.

## The Redux Store

The Redux store manages application state by storing the complete state in a single object and by making changes to this state predictable. Redux is built around three fundamental principles, which are as follows: the Redux store... 1) ...needs to be the 'single source of truth' for the application, 2) ...is read-only and 3) ...can be modified only by a pure function<sup>8</sup>.

In addition to the state object, the store contains a reducer. A reducer is a pure function which takes as arguments the current state and an action, and then returns the next state. In case of an unknown action, the reducer will return the current state. The single reducer in an application is split into separate parts, separate reducers, each managing small, independent parts of the total state object.

<sup>8</sup>A pure function always returns the same output for a given input and causes no side effect, i.e. alter any external state.

---

## React Native components

The UI or View of the application prototype consists of a hierarchy of React Native components. There exists two distinct types of components: *stateful* and *stateless* components, described in more detail below. Components receive actions and data from a React-Redux layer connecting the Redux store to the React Native components. Components define how data and actions from the application state is displayed in the view, and when to trigger actions. User interactions with the view will trigger actions, which may ultimately change the application state and cause a re-rendering of the component with new state data. Since the Redux store is deterministic, a given state will always render the same view output.

### Stateful components

Stateful components are the ones connected to the application Redux store. Stateful components may contain local state and have child components. The responsibility of a stateful component is to organize a set of children components and provide these children with data and actions from the application store. The stateful components usually don't render parts of the view themselves, but rather children components.

### Stateless components

Stateless components, also referred to as 'dumb' components, are pure functions mapping data to graphical output. Stateless components typically only define where and how to display the data they receive. Styling is performed at component level, and in most cases all the styles will be defined in stateless components.

## Actions

A set of *actions* is available to be called by the application UI components. In the Redux architecture, these actions are called *action creators*. Such an action creator is a function which creates an action, i.e. a function returns an object fitting the format of an action object. An action object has a type and a payload, and is dispatched by the action creator to a reducer within the store. Actions are the only source of information for the store. Any asynchronous calls to external services, such as Firebase, are executed before dispatching an action object.

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## 5.3 Data model

The Firebase Realtime Database used during the final evaluation was quickly constructed for demonstration purposes, and contains only a minimal amount of manually entered data needed for the final evaluation sessions. The data was stored in a NoSQL database and consists of 3 collections - users, videos and categories. Figure 5.2 below shows a user object in the users collection. The categories collection lists all videos for a chosen category. The users collection contains a user's chosen phase of resettlement, list of bookmarks and ratings. Finally, the videos collection contains metadata about videos, including a url pointing to the location where the media files are stored in the Firebase Cloud Storage.

```

{
  "categories": {},
  "users": {
    "FXxD77zVN8Y6hr3ZI6MgzFVe4Ff1": {
      "bookmarkedVideos": [
        { "index": 0, "value": "spotify" },
        { "index": 1, "value": "big_buck" }
      ],
      "ratings": {
        "big_buck": 3.7,
        "example_video": 2.2,
        "spotify": 4.7
      },
      "stage": 2
    }
  },
  "videos": {}
}

```

The screenshot displays a JSON tree structure. The root node is 'json' (object). It contains three main branches: 'categories' (object), 'users' (object), and 'videos' (object). Under 'users', there is a user ID 'FXxD77zVN8Y6hr3ZI6MgzFVe4Ff1' (object). This user object has four properties: 'bookmarkedVideos' (array), 'ratings' (object), 'stage' (number), and 'example\_video' (number). The 'bookmarkedVideos' array contains two elements: an object with index 0 and value 'spotify' (string), and an object with index 1 and value 'big\_buck' (string). The 'ratings' object contains three key-value pairs: 'big\_buck' with value 3.7 (number), 'example\_video' with value 2.2 (number), and 'spotify' with value 4.7 (number). The 'stage' property has a value of 2 (number).

**Figure 5.2:** Database example. *json* is the root object, which contains 3 collections for categories, users and videos.

## 5.4 Discussion

Selecting the technologies presented in this chapter has facilitated creation of a functional prototype of the proposed *Infobits* platform. By using these tools it has been possible to quickly develop a system ready to run on both the Android and iOS smartphone operating systems. Logic and data elements have been separated from presentational components, facilitating modifications and augmentations to either part of the system independently of the other.

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## CHAPTER 6

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### Pilot testing

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This chapter will present the participants, methods used, execution and results of a set of pilot usability tests conducted with fellow university students. The aim of these tests was to rapidly discover weak points while testing the usability of the *Infobits* functional prototype's interface, which could quickly be improved before the final evaluation sessions. Appendix A contains all the documents utilized during testing.

---

## 6.1 Participants

University students were recruited as pilot test users through the author's personal social network. In total, four participants completed the pilot test. The author was present at the tests, filling the role of test leader and observer. University students are not representative as part of the target user group of *Infobits*, which is the reason that usability was the main focus of these tests.

## 6.2 Method

This section will present methods used during the pilot tests. The aim to gain rapid usability insights and pilot methods motivated these choices. Reflecting the fact that the participating pilot test users did not properly represent the target user group, the test aimed to rapidly gather applicable, general feedback on usability and trustworthiness of the UI, without a strong connection to the context of use. For this reason, only dummy videos were provided in the prototype, rather than actual informational videos.

### Informal walkthrough

The pilot tests followed the informal walkthrough method[33]. With this method, test users have the general purpose of the system explained to them, before they are asked to explore the system on their own. Informal walkthrough[33] lets us observe the initial interaction between test user and the system without any constraints or specific tasks to focus on, providing insight into its intuitiveness. Further, it was expected that the student test users were familiar and experienced with the concept of browsing a video catalogue for information, which aligns well with this method.

### Rapid notation

Notation during the usability tests performed in this iteration utilized the notation system for rapid usability testing by Potts et al.[32]. Coloured notes were made directly on printed out screens from the application, and a feature checklist was kept to ensure that the intended features were all tested by every test user. The observation templates were similar to those presented in the findings report found in Appendix A.5.



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## SUS

Test participants were asked to fill out a SUS form[11] in order to gather a measure of system usability for later comparison. Brooke[11] states: “[...] *the usability of any tool or system has to be viewed in terms of the context in which it is used, and its appropriateness to that context.*” It is important then to note that the context in which the SUS provides a score in this case is *not* connected to the main target context of transitioning refugees. Rather the evaluated context is one of utilizing a mobile platform to navigate and access information in video format from a catalogue.

### Questionnaire prototype

The second form which participants were presented with, was a pilot of a questionnaire (see Appendix A.4), intended to be used during the final evaluation (Chapter 7). The purpose of the pilot tests was to discover whether questions or wordings are difficult to understand, answer, are ambiguous, if instructions are clear, whether the responses could provide the desired feedback and how long it would take to complete[28]. After pilot tests were completed, the questionnaire pilot was further evaluated with an expert at the university. The feedback gathered informed the revision of the questionnaire, which was then utilized in the final evaluation sessions described in Chapter 7.

## 6.3 Execution

This test was conducted with an earlier version of the *Infobits* prototype. The prototype presented in Section 4.4 is the implementation used in the final evaluation, after incorporating insights presented in this chapter and adjusting the interface accordingly.

Before initiating the test, the scope and aim of the system were explained to the participants. The role of the usability was clarified, and it was explained that the current videos in the application were simply placeholders, since the participants were not members of the target user group, and thus the main focus was on the interface usability and *not* content. Participants were given user credentials for use in case would want to log in to the system without providing their personal Facebook account details.

Upon finalizing the introductory explanations, the participants were prompted to explore the system at their own pace while thinking aloud. The test leader observed their actions, making notes according to the rapid notation[32] method. A feature checklist[33] (see Appendix A.2) was utilized, keeping track of whether participants discovered the complete

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set of available functionality of the system on their own, and whether this functionality was properly understood and utilized.

After completing the pilot test, users were asked to fill out the SUS form, and then review and discuss the questionnaire pilot.

## 6.4 Results

This section will summarize results gathered during the student pilot testing observations and following discussions surrounding the system.

### Usability findings report

A report summarizing findings from the pilot testing was produced and can be found in Appendix A.5. Figure 6.1, taken from the mentioned report, shows the key issues from the tests together with recommendations for solving them. Text color indicate severity of the issue.

#### Key findings

Issue description	Recommendation	Issue type
Seal of approvals in video view appear clickable, but does not offer functionality.	Add info modal with additional information about seal of approval when users taps seal.	Flow
Seal of approvals needs to be better explained.	Same as above. Additional information will be added to info modal.	Content
Seal of approvals are not visible when browsing videos in the category list.	Add this information to the video list metainformation.	Flow
Hard to distinguish between avg./personal rating. Avg. rating not visible in video view.	Change avg. rating appearance. Include metainformation in video view.	Flow
Several text labels too ambiguous	Rewording labels in question for clarity	Flow
Not enough metainformation about videos	Add information. Improve consistency.	Flow
Global/local indications are unnoticed	Refactor video title headers	Discoverability

**Figure 6.1:** Key findings table from the usability findings report in Appendix A.5.

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## Feature checklist

The feature checklist showed clearly that the only feature which was not easily discoverable for the test users were the icon indicating whether a video contains local or global information. Additionally, the phases of resettlement stages were not always well understood, judging from the users' interaction with this setting.

## SUS score

Due to the test participants being students, and not part of the target groups, they found it awkward to give a sensible response to the first statement<sup>1</sup> of the SUS form. Thus, this question was removed when calculating the SUS scores, shown in Table 6.1 below. The average score was then calculated to 82,5 out of 90, equivalent to 91,7 out of 100. This suggests that the students indeed found the interface usable for its purpose, quite independently of the content.

**Table 6.1:** SUS scores

Participant	User 1	User 2	User 3	User 4	Average
SUS score (out of 90)	80	90	80	80	<b>82,5</b>
Adjusted to /100	88,9	100	88,9	88,9	<b>91,7</b>

## Questionnaire pilot feedback

Pilot test participants were all willing to briefly discuss the proposed pilot questionnaire after completing their tests, despite that some felt slightly out of place when faced with the questionnaire pilot, which was targeted at refugees. A few new questions were proposed, some re-wordings were suggested, and a rough estimate of how long it would take someone to complete the questionnaire was recorded. Based on these discussions, the questionnaire was re-worked, and its final version be seen in Appendix B.2.

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<sup>1</sup> "I think I would like to use this system often."

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## 6.5 Discussion

The participating students were not refugees. Thus, the test were naturally less contextualized, more focused on the pure usability of the UI. The students are likely to have a different background of technological experience and cultural preferences compared to a typical refugee, which could have produced inaccurate feedback if they would have been faced with actual informational content in the same way as the test users in the final evaluation were.

The use of the rapid notation method yielded efficient results. While the method required a lot of paperwork and intense note-taking during the test, analyzing and summarizing the findings rapidly produced clear results. Letting users explore the application following the informal walkthrough method was an effective way of gaining a deeper understanding of how users interpret the user interface and what they expect from it.

The feature checklist was another tool that proved useful to have during test execution, in order to keep track of which functions the users had tested during the informal walkthrough. The feature checklist also supported the test leader in improvising tasks to test specific functionality as needed in cases where the user did not discover functionality on their own.

Results uncovered several weaknesses with the user interface which have since informed a rapid redesign of the UI. Despite these weaknesses, SUS scores indicated that the test users were very satisfied with the overall usability of the system prototype.

# CHAPTER 7

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## Final evaluation

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This chapter will present the participants, how they were recruited and privacy concerns. Then methods, execution and results from the final evaluation sessions. These sessions aimed to assess the one of the target user groups' perceived usability of the *Infobits* prototype's user interface and evaluate it in terms of supporting the collaborative creation of quality information. Finally, a discussion and summary of the findings is presented. This final evaluation constitutes the third design cycle of the research project (see Figure 1.2). The documents used during the final evaluation sessions can be found in Appendices B, C.1, A.2 and A.3.

---

## 7.1 Participants

Two groups of three refugees each were contacted and agreed to participate in the research. One of the six total participants had to cancel the appointment. The five remaining participants were all males from Syria currently living in Trondheim. All participants were native Arabic speakers learning Norwegian, and with varying, but sufficient English capabilities.

Participant number 5 (**P5**) pointed out that he was not a 'normal' refugee, in the sense that he had come to Norway as an exchange student, and then later applied for asylum, rendering him a unique perspective.

### Recruiting

Participants for the final evaluation sessions were recruited through the social network of a Syrian refugee. This recruiter had previously been involved with the research project as an interviewee, and had a strong social network of possible participants through volunteering work as a culture assistant. Initial contact with participants was carried out by this recruiter.

### Privacy and research ethics

The research project has been notified to the Norwegian Centre of Research Data (NSD). NSD is a resource centre, which assists researchers with regard to data gathering, data analysis, and issues of methodology, privacy and research ethics[36].

### Consent

Participants agreed to sign an informed consent, allowing audio and screen recordings to be made while they were testing the system and during a group interview. The consent form and data collection methods had been approved by the NSD[36].

## 7.2 Methods

This section will briefly introduce the methods used during the final evaluation sessions. The overarching goal of the final evaluation has been to gather data about the target group's

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insight into the topics of usability, trust and the potential viability of the proposed platform in order to provide answers to the research questions.

## **Informal walkthrough**

The goal of the usability testing part had two aims: to let the participants get to know the system and its functionality, and to assess its usability. Informal walkthrough[33] was chosen and used as the method of introducing the participants to the platform concept. The informal walkthrough method lets participants explore the prototype and its functionalities at their own pace. In cases where the participant overlooked part of the prototype functionality, the author posed the participant with a specific task to complete, in order to reveal such functionality.

The tool AZ Screen Recording<sup>1</sup> was used to record the device screen, the participants' interactions with the screen and their voice simultaneously during the informal walkthrough part of the usability test.

## **SUS**

Participants were asked to fill out a SUS form[11] immediately after testing the prototype in order to assess how they perceived it in terms of usability.

## **Questionnaire**

A two-part questionnaire (see Appendix B.2) was designed, following guidelines of Oates[28], and used during the final evaluation. An early version of the questionnaire was piloted during the student usability tests described in Chapter 6 and later reviewed with experts at the university before being finalized.

The first part of the questionnaire consisted of three questions that were answered on a 1-5 likert scale (strongly disagree - strongly agree). The second part consisted of three cases, in which the participants were asked to indicate which video they would like to watch the most, given three alternatives. These three cases can be seen either in Appendix B.2 or in Figures 7.1, 7.2 and 7.3. In each case, there were three alternative videos with the same exact title, duration and upload date. The alternatives differed however in name of the

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<sup>1</sup><https://play.google.com/store/apps/details?id=com.hecorat.screenrecorder.free>

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uploader<sup>2</sup>, language spoken in the video, average user rating and seals of approval.

The aim of presenting these cases was to explore the relationships between these variables (language, uploader nationality, user ratings and seals of approval) and which were most important towards facilitating trust amongst the participants. While the participants were going through, filling out these cases, the author prompted them to reason about their choice, asking why they preferred one video over another.

## Group interview

After all the participants in one test group had completed the usability test and become familiar with the platform concept, a semi-structured[28] group interview was conducted. The interview was audio recorded, and the author acted as a discussion facilitator while taking brief notes simultaneously. The Syrian refugee participant recruiter was present during the interviews and assisted in facilitating discussion. A topic guide (see Appendix C.1) was developed according to the guidelines of Ritchie & Lewis[34] and used to guide the discussion topics during the interviews.

Analysis of the qualitative data produced during usability tests and group interviews has been following the recommendations and guidelines of Oates[34]. Audio tapes were not transcribed at length.

## 7.3 Execution

Final evaluation of the prototype took place over two days, each with one group of three participants. All tests and interview were conducted in English. The prototype database was populated with several video entries for demonstration purposes. A few of these entries included example videos, created by volunteers recruited personally by the author.

Each session began with greetings and introductions, before presenting the research project to participants and conducting in turns one-on-one usability tests with all participants in a group. Following the tests, the SUS form and questionnaire were filled out. After all participants had completed the usability test, there was a brief break with refreshments, followed by a final group interview. Each usability tests lasted approximately 30 minutes, and the group interviews 45 minutes.

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<sup>2</sup>Three archetypal names were used - one Norwegian, one English and one Arabic.



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## 7.4 Results

This section will present empirical results, themes that have emerged during analysis of qualitative data as well as remarks or comments made by participants during the evaluation sessions. Result data gathered includes:

1. Written notes and corresponding screen/audio recordings from usability tests.
2. Responses to SUS forms.
3. Responses to the questionnaire presented in Section 7.2.
4. Written notes from and corresponding audio tapes recorded during group interviews.

### Observations

Following is a summary of observations made during the usability testing and participant discussion surrounding it. Several common issues were identified and are presented below, along with one possible solution to address them.

- Ambiguity surrounding the implications of signing in with Facebook. Concerned about spam and wondering whether signing in would connect to friends.
- Several participants first reacted with skepticism as to whether they could trust the informational videos initially.
- Novel concepts (e.g. seals of approval) were never completely understood through engaging with the prototype alone.
- Several participants asked about the meaning of icon usage to make sure they were understood correctly.
- The intended way of interacting with a few components was not assumed correctly by the participants.

Participants seemingly did not perceive a great benefit of signing in or having signed in with Facebook. Some signed in immediately and did not realize that this actually unlocked additional functionality for them. Others were less interested in leaving their feedback, and more concerned about their issues regarding connecting 'yet another app' to their precious

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Facebook account. A single participant reasoned that Facebook sign ins would reduce misuse of the system.

It was apparent that the purpose and nature of seals of approval needed to be made much clearer. They were not understood without support. However, once participants grasped the concept, they seemed to appreciate this trust mechanism. Several participants were not confident they had understood the true meaning of the icons in the meta information section (Figure 4.4) as well, and had to ask to make sure they were understood correctly.

As suggested during discussions and also later during group interviews, one way to address the first four issues listed above would be to include a kind of tutorial for new users, preferably in video format. Such videos would be available in an array of languages, and could briefly explain how the system of seals of approval work, icon usage, what actually happens when/if you sign in with Facebook as well as other novel concepts unique to *Infobits*. The fifth issue of interaction issues could easily be addressed through rapid redesigning of various relevant screen components.

## SUS scores

**Table 7.1:** SUS scores.

Participant	P1	P2	P3	P4	P5	Average
Score out of 100	83,3 <sup>3</sup>	92,5	88,9 <sup>4</sup>	72,5	92,5	<b>85,6</b>

Bangor et al.[8] have found SUS scores to strongly correlate with a 7 point adjective score, ranging from 'worst imaginable' to 'best imaginable'. Using this adjective scale to interpret the SUS scores, the *Infobits* interface, as evaluated by participants of the final evaluation, would be translated and described as 'excellent'.

Although SUS scores from this final evaluation were encouraging, they were lower than during the testing conducted with students, presented in Chapter 6. This in spite that the interface of the prototype version used during the final evaluation had supposedly been improved. This could indicate that there are differences in cultural backdrops and interface conventions between Norwegian students and Syrian refugees affecting perceived usability.

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## Questionnaire results

This subsection will present results and remarks gathered from the two-part questionnaire and discussion surrounding it.

### First part

Table 7.2 below summarizes the participants' responses to the first part of the questionnaire. These results indicate that participants would be motivated to contribute to the platform by creating and uploading. Participants indicated that they felt somewhat safe when using the system. However, regarding signing in with your real Facebook account, participants indicated that this would be slightly uncomfortable. These results aligned well with other observations and remarks made, whereby participants made it clear that requiring to sign in with Facebook, particularly for newcomers, would indeed cause worry.

**Table 7.2:** Questionnaire results. Percentages of responses on a 1-5 likert scale (Strongly disagree - strongly agree).

Question	1	2	3	4	5
1 - "I feel safe when using the <i>Infobits</i> system"	-	-	.6	.4	-
2 - "I would feel uncomfortable signing in with my personal Facebook account"	-	.4	.4	.2	-
2 - "I would like to create and upload my own video to <i>Infobits</i> "	-	.2	-	.6	.2

## Case 1

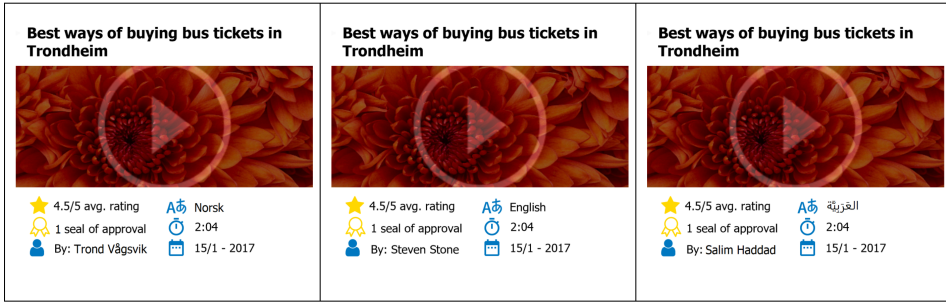


Figure 7.1: Case 1 of the trust questionnaire.

Table 7.3: Case 1 participant responses.

	Response	Reasoning
P1	2 (English)	”English is the most convenient for others”
P2	1 (Norwegian)	”A Norwegian would know more than others”
P3	1 (Norwegian)	”I think those who speak Arabic has little information”
P4	3 (Arabic)	”As a newcomer, I would choose Arabic”
P5	2 (English)	”With my background, I would always go for the English version”

The first case sparked varied responses from the participants. Two chose the Norwegian because of assumed superior local knowledge. Two chose the Englishman, because they were comfortable with the language, and found English to be most convenient. One participant chose the Arabic video given the newcomer scenario. Conversely, two other participants commented that they would rather not receive information in Arabic, recalling Facebook groups where false information and rumours were spread.

## Case 2

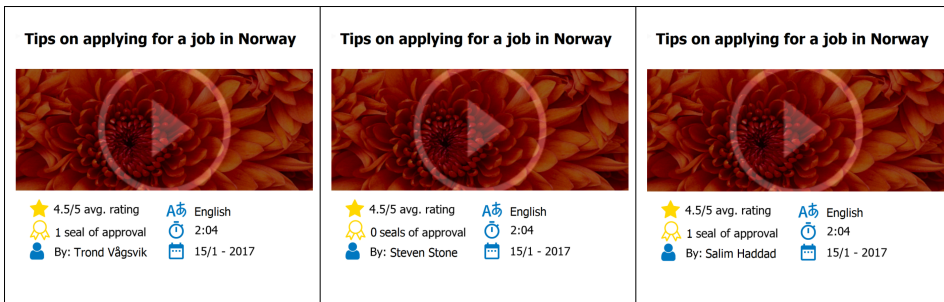


Figure 7.2: Case 2 of the trust questionnaire.

Table 7.4: Case 2 participant responses.

	Response	Reasoning
<b>P1</b>	1 (Norwegian)	''''
<b>P2</b>	1 (Norwegian)	''A Norwegian can lead you to find a job here''
<b>P3</b>	1 (Norwegian)	''I would choose someone who is native again''
<b>P4</b>	1 (Norwegian)	''The Norwegian because he would know more about finding jobs in Norway''
<b>P5</b>	1 (Norwegian)	''I would prefer the Norwegian. Second choice would be the Arabic, since he has likely gotten a job here since he is making a video''

In the second case, all participants chose to trust the Norwegian uploader to have the best knowledge about finding a job. This indicates that the target audience appreciates local knowledge and that engaging locals to contribute to the platform is of value.

### Case 3

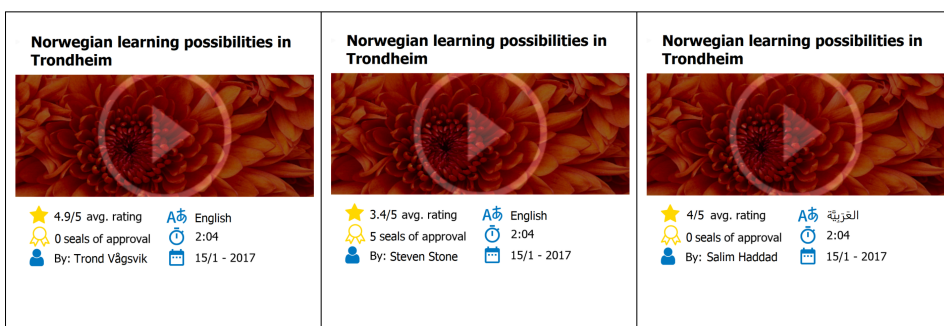


Figure 7.3: Case 3 of the trust questionnaire.

Table 7.5: Case 3 participant responses.

	Response	Reasoning
P1	2 (English)	"Approval from 'offentlig places' is the most important to me. The people are moody. I can trust 'offentlig places'."
P2	1 (Norwegian)	"I prefer it because of the rating"
P3	2 (English)	"I prefer the seals. It's more accurate maybe"
P4	2 (English)	"Seals of approval are more important than rating. They should be better explained in the app, it is not clear what the seals are"
P5	3/2 (Arabic/English)	"I don't care at all about seals or ratings, I only considered the person behind. Would like more background info."

Three out of the five participants chose the second alternative (English) in the final case, stating the many seals of approval this option had received as the reason for their choice. One participant chose the alternative that had a high average user rating. The last participant was undecided between the English and Arabic video, stating that he did not at all care about ratings nor seals of approval, but only about the uploader. In the case of language learning, he stated, he would rather listen to foreigners, as they would have a perspective most similar to his own.

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## Group interview results

This subsection will present topics discussed, suggestions, consensus reached and common themes that arose during the group interviews following the usability tests. The following list provides a quick overview of the main discussion themes:

- Increasing social interaction and connection to other social media
- Mechanisms to increase further increase trust
- Application and timing of *Infobits* usage in real situations
- Target group
- Perceived benefits of use
- Motivation to contribute

### Social interaction

Both groups discussed adding more options of social interactions to the platform. Suggestions included adding forums or comments to answer questions and facilitate discussion, adding events that could connect refugees to locals and connecting to other social media. It was also argued that increased social interaction possibilities could encourage people to return to the app, encouraging long term engagement.

While some perceived social interactions as necessary, drawbacks to this approach were also mentioned. Increased social interactions would also increase the need for content moderation. Adding forums and/or commenting would also results in reliance on textual interaction.

There was consensus in both groups that the *Infobits* platform would not support social inclusion between local citizens and refugees. One participant remarked that various refugee communities are not well integrated across cultures/ethnicities, and suggested that *Infobits* could rather support social interaction between different refugee and foreigner communities:

*“If you make it for only refugees, only Norwegians who are interested in contacting refugees would upload videos. If you make it for foreigners in a city in general, it would make it more open. [...] I think this application is more for connecting refugees. Syrian, Somali, Eritrean etc., they are not very well integrated with each other.”*

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### **Increased trust**

There was room for improvement regarding creation of trust, explanation of seals of approval being the most critical. Offering tutorials, preferably in video format, was agreed as a solution to this problem. Several participants would have liked more background information of the people uploading videos, suggesting that also uploaders could be 'verified' - similarly to videos receiving seals of approval.

Another concern several participants brought up was the importance of information relevance, and the need for a mechanism to ensure this. Videos (about certain topics) would have to regularly be controlled, deleted or renewed to avoid spreading outdated information.

### **Applicability and timing**

There was some ambiguity as to exactly what the 'newcomer' phase encompassed. Participants explained that the time period between arriving at a reception center until one is settled in a municipality is very well defined in Norway, with clear instructions and contact persons available along the way. One participant suggested that, as a group, these newcomers would need only limited additional information, e.g. a list of emergency phone numbers.

However, at a certain point after having settled in a municipality, they are told that "now you are on your own". It was widely agreed that from this point on, the *Infobits* application could be of greatest benefit, supporting people in solving practical problems that are not emergencies. While one still has a contact person, an advisor ('rådgiver') for a two year period, they are usually busy, and have limited time with their clients. As two of the participants put it:

*"There are many people that, after one year, don't know things like how to go to university, secondary school, how to register, how to search for a job - different things. I think that videos in different languages will be attractive for many people."*

*"At that point you need a lot of information. For example signing up for electrical bills - you won't pick up the phone and call your rådgiver."*

### **Target group**

Consensus was that the *Infobits* platform would not support connecting refugees to locals, but rather be a tool to support refugees and/or foreigners. Participants perceived that



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the only locals that would contribute to the platform were volunteers who would already be working towards supporting refugees, thus *Infobits* would not cause additional local citizens to contribute.

One participant suggested that *Infobits* could be used "like finn.no" for foreigners struggling with Norwegian/English text in a city/municipality. Several participants also mentioned that the platform could be extended to target foreigners in general, rather than just refugees.

### **Benefits of use**

Participants commended the *Infobits* platform for providing a safe environment, facilitating sharing of local and trustworthy informational content. Several participants made a point that while there exists platforms such as YouTube and Facebook, these are so open that finding local content becomes infeasible, while moderation, preventing hateful/racist/sexist content and ensuring valid information is an issue. It was mentioned that existing Facebook groups which offer informational video already exist. One participant suggested that such videos could be transferred easily to the *Infobits* platform. However, these groups were also described by some as full of "ignorant people", "fake information" and "rumours". One participant underlined that the categories for housing, healthcare, economy and education would be the most important, while topics such as culture and food would be subordinate.

There was agreement that *Infobits* would be more trustworthy than groups built on completely open platforms (YouTube, Facebook). Participants also explicitly stated that they would prefer to watch videos, like those in the application, over reading text. One participant elaborated:

*"Everyone can go to Google and ask for information, but you don't get this personal touch, you get advice from another person that has been through what you are going through. So I think people would be more engaged than if just Googling for answers."*

### **Motivation to contribute**

The consensus reached was that the main motivation for former refugees to contribute and upload videos would be their sense of duty to give something back to the community. For municipalities and other organizations, collaborating to construct a repository of quality information could lighten their future workloads by referring people to look up information there instead of booking an appointment or phone in. Adding elements of gamification to encourage increased interaction with the platform as a contributor was also suggested.

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## Privacy

Group consensus was that people would be skeptical to signing in with their personal Facebook accounts. Participants agreed that this would be especially true for newcomers when asked whether they themselves felt comfortable signing in with Facebook:

*“As a newcomer, no.”*

*“It would be better to have another option, like email. There are many that wouldn’t want to connect their Facebook. Facebook account is SO important!”*

*“Yes, it is, almost like a passport nowadays.”*

Several participants suggested an option to sign in with only email, or to simply make the application ‘read-only’ for newcomers, hiding all feedback functionality.

## 7.5 Limitations

For the first part of the trust questionnaire, it could have been more appropriate with either a larger number of respondents or more questions, to delve deeper into the *why* behind the participants’ answers. The second part of the questionnaire was more successful in this regard, facilitating reflection and reasoning behind the participants’ choices and preferences.

Both the author and all test participants were speaking English. It is likely that participants could have expressed themselves more precisely in their native tongue. Furthermore, the only two languages represented in the prototype were English and Norwegian, which might have skewed participants’ impression of the system.

Several factors limits the representability of the participants of the final evaluation. They were all males, all from Syria and all had a background in higher education. As a sample, they represent only a small subset of refugees.

The database was scarcely populated during the final evaluation sessions, and thus options to filter and/or search through available content was redundant and not present in the prototype. One participant stated: *“I would use it like Google”*, indicating that such functionality indeed would be relevant had the platform been well saturated with video content. Additionally, not having an option to create and upload videos implemented and present in the prototype could have had an effect on the participants’ impressions of the platform.

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During the group interviews, some participants suggested using the platform in ways which would be undesirable. One participant suggested that *Infobits* could be an alternative for 'finn.no'<sup>5</sup> by and for foreigners struggling with English and Norwegian in written form. Such usage could quickly cause excessive dependence on a single tool. Furthermore, this use pattern could support creation of parallel societies.

## 7.6 Discussion

SUS scores indicated that users were satisfied with the user interface, despite some issues observed during testing. The results of the questionnaire designed to inquire about trust mechanisms highlighted how different video variables affected the participants' trust. Group interviews gave participants opportunity to elaborate on issues they had experienced and discuss these with their peers.

Table 7.6 and 7.7 below summarizes and elaborates on the main insights related to trust and usability.

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<sup>5</sup>[www.finn.no](http://www.finn.no)

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**Table 7.6:** Trust findings.

<b>Issue</b>	<b>Elaboration</b>
Seals of approval	Through observation and discussions during every usability test and further remarks during group interviews, it was made clear that the participants did not understand fully the concept of seals of approvals without explicit explanation by the test leader. However, once it was understood it was an effective mechanism to increase trust, as results of the trust questionnaire showed.
Facebook authentication	Observations and questionnaire responses indicated that participants were reluctant to signing in to the prototype through a Facebook account, also expecting to be connected to their friends once they did. Comments and discussions during group interviews reflected this reluctance, and underlined that newcomer refugees would be especially hesitant about connecting their Facebook account to any novel system.
Local knowledge	The cases of the trust questionnaire (Figures 7.1, 7.2 and 7.3) revealed that in certain scenarios, the Norwegian uploader was perceived as the most trustworthy because of his assumed superior local knowledge. During the group interviews it was further strongly suggested to involve people working in the field, who would be recognized by refugees in the locality.
Uploader background	During usability testing, participants were observed to initially question the accuracy of information shared through example videos (presented by people unfamiliar to them). Questionnaire results indicated that the background of the person who has uploaded is indeed an important factor for trust. During group interviews, adding additional background info and possibly a 'verification' of people was requested by participants.

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**Table 7.7:** Usability findings.

Issue	Elaboration
Concept introduction	Observations and group interviews revealed a major concern, in that the unique concepts of <i>Infobits</i> , such as phases of resettlement and seals of approval, were not sufficiently explained to or understood by participants on their own. Group discussion led to a consensus that some kind of tutorial should be offered by the system, preferably in video format, briefly explaining aspects of the application.
Phases of resettlement	There was some confusion surrounding the phases of resettlement. Although partly due to the system offering an insufficient explanation, the participants had naturally assumed that this system would be used in the <i>settling in</i> phase. Participants explained that in Norway, the <i>new-comer</i> phase was well defined, people had a lesser need for an information support tool such as <i>Infobits</i> during this time and that the application had potential to reflect this more clearly.
Information format	Observations indicated, and group interview remarks confirmed, that the video format is preferred to textual. All participants were native Arabic speakers, while the system content and interface was in Norwegian and English, meaning this conclusion applies at least to participants' foreign languages. Additional remarks from a group interview praised the videos facilitating a 'human touch' by receiving support from a person with similar experiences.
Relevance concern	During the usability testing, several participants inquired the test leader about the icon indicating upload date. During group interviews a concern about the relevance of videos was brought up for discussion. Participants expressed that in certain categories, old videos would have to be updated or deleted as their informational content becomes obsolete.

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Following are a few additional points of interest that were discovered through interaction with participants during the final evaluation sessions.

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- Increased social interaction was suggested by several participants.. Some disagreed. There were discussions in both groups about the trade-offs between increasing social interaction (facilitating comments, forums, sub-topics, events etc.) and the need to moderate content and minimizing reliance on textual format.
  - *Infobits* was not perceived as an app that would facilitate social interaction between locals and refugees, but one that could possibly increase interaction between different refugee communities, who typically have little to no contact.
  - Adding gamification elements to motivate recurring engagement with the app and avoid one-time usage was suggested.

Relating to the design elements presented in Table 4.1, the final evaluation findings demonstrated the usefulness of the majority of these elements. Exceptions were the Facebook authentication, in particular, and the phases of resettlement element. Findings indicated that neither element had any desirable effect on perceived trust, usability and quality. Facebook accounts are considered to be so important that connecting applications to it is a major consideration for individuals. The phases of resettlement mechanism would need to be developed further to adjust better to the needs of the target audience.

## CHAPTER 8

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### Conclusion

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This chapter will summarize and conclude the work completed in this master's thesis. First what has been done and what can be learned will be presented. Methods used during the project, reflections and limitations will be considered and discussed. Finally, thoughts and recommendations for future work are proposed.

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## 8.1 Summary

This research project set out to support and empower refugees through design and creation of a tool to support collaborative sharing and creation of information in an accessible format. This thesis builds on the work conducted by the same author during an earlier project (specialization project), reported in [41]. In the mentioned project thesis[41], an initial design of *Infobits* was proposed. This current thesis has picked up the lessons learned in the preceding project thesis and developed the design further, focusing in particular on the platform interface concerning the target audience, i.e. mainly newcomer and intermediate refugees. Then, a working prototype has been developed, which has been piloted and evaluated in sessions involving participants who were members of the platform target audience.

## 8.2 Contributions

This section will connect the results from the final evaluation sessions to the research sub-questions and main question that have been posed for the work of this thesis.

**RQ 1.1** *What functionality is required by such a platform in order for it to be considered usable by its target audience?*

Introductory functionality and explanations of how the platform works and various concepts, in particular novel ideas and mechanisms, were explicitly requested and deemed as lacking from the prototype. The interface of the prototype as presented in this thesis was perceived as simple, which was appreciated for this sort of system. The crowdsourced video platform enables creation of information in any language, which was perceived as potentially providing huge benefits as users can access information in their own native tongue. Furthermore, in cases where information is not available in their native language, the video format was preferred over textual. For the target audience group, results indicated that avoiding the burden of connect their Facebook account to the system would have provided a better user experience.

**RQ 1.2** *What functionality is required by such a platform in order for it to promote justified trust in information amongst its target audience?*

The proposed seal of approval mechanism which promoted involvement of official bodies and organizations proved to be the single most reliable predictor of trust. Another important aspect of videos that affected trust was the uploader. Background information of



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uploaders did have a significant impact on trust, despite very limited such information was available in the prototype. Test users made explicit requests for more background information and possibly a mechanism similar to the seal of approval that could verify or approve of uploaders. Requiring users to log in with Facebook to contribute was intended to affirm users that content was created and annotated by authenticated users only, however it turned out to cause more uncertainty than assurance. Engaging familiar faces (e.g. cultural workers, volunteers, municipality advisers) from local communities to upload videos would greatly boost trust in informational content. Results have indicated that the knowledge possessed by local citizens is highly valued in specific contexts, meaning that for certain topics, citizen engagement could contribute to increased trust.

**RQ 1:** *Can the social inclusion of transitioning refugees be supported by a mobile crowd-sourcing platform facilitating access to high-quality, multilingual, trustworthy informational videos?*

Consensus of the final evaluation was that the platform would likely not succeed at supporting social inclusion in the sense of creating social bridges, bonds and links between refugees and local citizens. Main benefits of the platform were suggested to be supporting access to information, particularly about healthcare, education, employment and housing, and additionally support creation of social bridges between different refugee communities. From an information perspective however, supporting access to information about healthcare, education, employment and housing will improve one's ability to become included in a society[23]. Furthermore, the four main information fields mentioned above align perfectly with four of the domains of 'successful integration' as presented in the framework of Ager & Strang[2].

Thus, while the platform might not engage locals and refugees in direct social interaction and in creating new communities, its suggested effect could indirectly support social inclusion. In addition, the platform could strengthen other life domains which together with social inclusion underlie the overarching goal of becoming successfully integrated in a host society[2].

This thesis has identified three distinct phases of resettlement in the Norwegian resettlement process, which align well with the theory of Kennan et al.[21]. Going a step further, with focus on the Norwegian context, this thesis has found results indicating that there is a significant gap in informational needs occurring between the first and second phase. This sudden need for increased amounts of a wide array of practical information is not sufficiently supported in the context of a Norwegian municipality.

Chapter 2 discussed how migrants prefer and seek out information which is shared in their own language and ethnic communities. Findings of this thesis suggests that a platform

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such as *Infobits*, with functionality to properly support information quality, could provide a space for such sharing of information which would be safer, better support information quality and with a potential wider reach compared to similar information sharing performed on open platforms such as YouTube or Facebook.

## 8.3 Reflections

Conducting quick pilot usability tests focused on rapid feedback was an effective method towards the goal of finding issues with the UI as well as facilitating reflection on test methods themselves before the final evaluation.

During the final evaluation, it could have been beneficial to have had a dedicated discussion facilitator, leaving the author to concentrate fully on taking notes. Splitting participants into two groups was done for the convenience of participants, to avoid withdrawals or participants not appearing at follow up appointments. Including all five to six participants in a single group interview would have required them to either meet at two separate occasions or wait several hours for other participants to finish usability testing before group interviews. The drawback of this approach was limited size of the group discussions, particularly when one participant could not meet.

Developing the prototype required becoming acquainted with a range of different technologies and frameworks, which has been a worthwhile and entertaining opportunity to gain familiarity and experience with contemporary web and mobile application technologies.

Having the opportunity to collaborate and work with the group of Syrian refugees has also been a rewarding experience, witnessing utmost willingness to cooperate and support the research project in order participate in supporting others in need.

## 8.4 Limitations

The prototype using during the final evaluation did not demonstrate a complete platform. The number of videos, languages and functionality that was available and displayed to participants during the final evaluation was limited.

The participants of the final evaluation were all male, native Arabic speaking Syrian refugees with backgrounds from higher education. This group does not thoroughly rep-

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resent the diversity of cultures, languages and backgrounds amongst newcomer and intermediate refugees in general.

A significant part of the literature that has informed work in this research project has been conducted in other countries than Norway. While there are generalizable lessons to be learned, the context in which such research is done will have many variables differing from a Norwegian context.

## 8.5 Future work

The findings of this thesis indicate a gap between the information needs and readily available information resources of refugees. Indications are that starting from the point in time where they have settled in a municipality and been told that they 'are on their own', there is an unmet need for accessible practical everyday information. Future work should explore how to bridge this gap and meet these informational needs.

A possible future approach would be to generalize the system, adapting it to a target audience of anyone in the process of resettling and adapting to a new life context, including foreigners in general (e.g. exchange students, interns or foreign workers) who share the common experience of one day being 'on their own' in a foreign society.

Continuation the development of *Infobits* would naturally include exploring implementation of the interfaces targeting creators and validators (see Figure 2.3). Further work could also include implementation of some features suggested in this thesis, such as tutorial functionality and verification of uploaders. Going further, implementing an interface for creators to upload videos would be a required step before realizing the system for practical use could be considered. To realize use of the platform in practice would require cooperation to spark the engagement of pioneering creators to begin saturating the repository with information. Additionally, realization would require efforts towards spreading and creating awareness about *Infobits* in appropriate communities.

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## Bibliography

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- [1] U. T. U. R. agency. UNHCR - FIGURES AT A GLANCE. [Online: accessed June 11, 2017].
- [2] A. Ager and A. Strang. Understanding Integration: A Conceptual Framework. *Journal of Refugee Studies*, 21(2), 2008.
- [3] K. Alam and S. Imran. The digital divide and social inclusion among refugee migrants. *Information Technology & People*, 28(2):344–365, 2015.
- [4] A. Almohamed and D. Vyas. Designing for the Marginalized: A step towards understanding the lives of refugees and asylum seekers. 2016.
- [5] A. Almohamed and D. Vyas. Vulnerability of Displacement: Challenges for Integrating Refugees and Asylum Seekers in Host Communities. *Proceedings of the 28th Australian Conference on Computer-Human Interaction*, 2016.
- [6] A. D. Andrade and B. Doolin. INFORMATION AND COMMUNICATION TECHNOLOGY AND THE SOCIAL INCLUSION OF REFUGEES. *MIS Quarterly*, 40(2):405–416, 2016.
- [7] T. Andrews. MENS DE VENTER -Hverdagsliv i asylmottak. 2014.
- [8] A. Bangor, P. Kortum, and J. Miller. Determining What Individual SUS Scores Mean: Adding an Adjective Rating Scale. *Journal of Usability Studies*, 4(3):114–123, 2009.

- 
- [9] A. Boduch. *React and React Native*. Packt Publishing, 2017.
- [10] D. Brabham. *Crowdsourcing: A Model for Leveraging Online Communities*, 2011.
- [11] J. Brooke. SUS - A quick and dirty usability scale. *Usability evaluation in industry*, 189(194):4–7, 1996.
- [12] D. Brown and R. E. Grinter. Designing for Transient Use: A Human-in-the-loop Translation Platform for Refugees. *CHI '16 Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*, pages 321–330, 2016.
- [13] M. Gaved, P. Luley, S. Efremidis, I. Georgiou, A. Kukulska-Hulme, A. Jones, and E. Scanlon. Challenges in context-aware mobile language learning: The MASEL-TOV approach. *Communications in Computer and Information Science*, 479:351–364, 2014.
- [14] C. Gordano Peile and A. R. Híjar. Immigrants and mobile phone uses: Spanish-speaking young adults recently arrived in London. *Mobile Media & Communication*, 4(3):405–423, 2016.
- [15] Hanna Krasnova. *Leveraging Technology for Refugee Integration: How Can We Help?* 2016.
- [16] V. L. Hanson. Social inclusion through digital engagement. In *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, volume 6765 LNCS, pages 473–477, 2011.
- [17] A. Hevner and S. Chatterjee. *Design Science Research in Information Systems*, volume 22. 2010.
- [18] A. R. Hevner. A Three Cycle View of Design Science Research. *Scandinavian Journal of Information Systems*, 19(2):87–92, 2007.
- [19] B. Holmes, B. Tangney, A. FitzGibbon, T. Savage, and S. Mehan. Communal Constructivism: Students constructing learning for as well as with others. *Society for Information Technology & Teacher Education International Conference*, pages 3114–3119, 2001.
- [20] U. innovation. *IS YOUR APP THE BEST WAY TO HELP REFUGEES? IMPROVING THE COLLABORATION BETWEEN HUMANITARIAN ACTORS AND THE TECH INDUSTRY*. [Online: accessed June 11, 2017].
- [21] M. A. Kennan, A. Lloyd, Qayyum Asim, and Thompson Kim. Settling in: The Relationship between Information and Social Inclusion. *Australian Academic & Research Libraries*, 42(3):191–210, 2011.

- 
- [22] A. Kukulska-Hulme, M. Gaved, L. Paletta, E. Scanlon, A. Jones, and A. Brasher. Mobile incidental learning to support the inclusion of recent immigrants. *Ubiquitous Learning*, 7(2):9–21, 2015.
- [23] A. Lloyd, M. Anne Kennan, K. M. Thompson, and A. Qayyum. Connecting with new information landscapes: information literacy practices of refugees. *Journal of Documentation*, 69(1):121–144, 2013.
- [24] E. Masiello and J. Friedmann. *Mastering React Native : leverage frontend development skills to build impressive iOS and Android applications with Native React*. Packt Publishing, 2017.
- [25] M. Merkt, S. Weigand, A. Heier, and S. Schwan. Learning with videos vs. learning with print: The role of interactive features. *Learning and Instruction*, 21:687704, 2011.
- [26] H. Miller. The multiple dimensions of information quality. *Information Systems Management*, 13(2):79–82, 1996.
- [27] V. Novick. *React Native - Building Mobile Apps with JavaScript*. Packt Publishing, 2017.
- [28] B. J. Oates. *Researching Information Systems and Computing*. SAGE Publications Ltd, 1st edition, 2006.
- [29] L. Paletta, I. Dunwell, M. Gaved, J. Bobeth, S. Efremidis, P. Luley, A. Kukulska-Hulme, S. De Freitas, P. Lamerias, and S. Deutsch. Advances in MASELTOV - Serious games in a mobile ecology of services for social inclusion and empowerment of recent immigrants. In *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, volume 8253 LNCS, pages 440–455, 2013.
- [30] J. Pearson, S. Robinson, and M. Jones. PaperChains: Dynamic Sketch plus Voice Annotations. In *Proceeding of the 2015 ACM international conference on computer supported cooperative work and social computing (CSCW)'15*, pages 383–392, 2015.
- [31] S. A. Petersen, E. Procter-Legg, and A. Cacchione. LingoBee: Engaging mobile language learners through crowd-sourcing., 2014.
- [32] L. Potts, M.-T. Nguyen, and H. Turner. Notation System for Rapid Usability Testing. *Proceedings of the 34th ACM International Conference on the Design of Communication - SIGDOC '16*, pages 1–2, 2016.
- [33] S. Riihiaho. User testing when test tasks are not appropriate. *Proceeding ECCE '09 European Conference on Cognitive Ergonomics: Designing beyond the Product — Understanding Activity and User Experience in Ubiquitous Environments*, 2009.
-

- 
- [34] J. Ritchie and J. Lewis. *Qualitative Research Practice: A Guide for Social Science Students and Researchers*. 2003.
- [35] V. Sarangapani, A. Kharrufa, M. Balaam, D. Leat, and P. Wright. Virtual.Cultural.Collaboration Mobile Phones, Video Technology, and Cross-Cultural Learning. *Proceedings of the 18th International Conference on Human-Computer Interaction with Mobile Devices and Services*, pages 341–352, 2016.
- [36] N. senter for forskningsdata. Nsd - norsk senter for forskningsdata. [Online: accessed January 4, 2018].
- [37] M. Sharples. The design of personal mobile technologies for lifelong learning. *Computers & Education*, 34:177–193, 2000.
- [38] S. Søholt, E. Henningsen, and E. Dyb. Bosettingsklare flyktninger og avtalt selv-bosetting. Technical report, NIBR, 2017.
- [39] P. Sztompka. *Trust: A Sociological Theory*. Cambridge University Press, 2000.
- [40] R. Talhouk, S. I. Ahmed, V. Wulf, C. Crivallero, V. Vlachokyriakos, and P. Olivier. Refugees and HCI SIG: The Role of HCI in Responding to the Refugee Crisis. *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems*, pages 1073–1076, 2016.
- [41] W. Tisdall. Infobits : a Crowdsourced Video Platform for Information Sharing among Refugees. Technical report, NTNU, 2017.



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# Appendices

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# APPENDIX A

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## Usability testing

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This appendix contains the various documents that were produced and used for usability testing:

- Consent form
- Feature checklist
- SUS form
- Questionnaire pilot
- Findings report
  - Key themes and findings
  - Participant overview
  - Complete issue overview

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## A.1 Pilot testing consent form

### Consent form

William Tisdall  
+47 916 96 587  
Kløbuveien 34, 7030 Trondheim

*"Infobits: a Crowdsourced Video Platform  
for Information Sharing among Refugees"*

#### Context

This research project is conducted as a student project for the master's thesis course TDT4900 - Computer Science, Master's Thesis at the Norwegian University of Science and Technology (NTNU). The purpose of the project is to develop, implement and evaluate a mobile platform facilitating crowdsourcing of information aimed at refugees in video format. The project focuses on evaluating the perceived usability of the system and how well users trust the system's information content. The research is neither commissioned nor financed by any institution.

#### Purpose

The purpose of the usability test is to gather information about the usability of the proposed crowdsourcing platform *Infobits*. During the usability test, the test user will be prompted to explore and carry out specific tasks in the *Infobits* application. The aim is to observe how you (the test user) approach the system and interact with the UI. The object that is being tested during the usability test is *NOT* the user, but rather the *Infobits* application. The intention is to discover strong/weak aspects of the application interface and to gain insight into how users interact with the system.

#### Execution

The test user will be prompted to explore and use the system as mentioned above on a smartphone - either their personal phone or a phone provided by the test leader. Should the user agree to use their own phone, a third party application will be installed prior to initiating the test to run the *Infobits* application.

During the test, the user is encouraged to 'think out loud' to let the observer(s) better understand their thought processes. During the test, the observer(s) will take notes of how the test user goes about navigating, exploring and using the application. The test leader might ask the test users specific questions or to perform specific tasks during the test. After the test user, (s)he will be asked to fill out two short paper questionnaires related to the test. Finally, there will be time for both the test leader and the test user to ask questions and discuss remaining issues.

## Risk

The usability test will last up to 45 minutes. During the test, the test user is free to request a break or abort the test. The test user can at any time withdraw his/her participation, without stating a reason.

## Confidentiality

No personal data will be gathered or recorded at any point in time during the test. All information gathered during the usability test will be kept confidential and anonymized. No reports from this project will contain information that can be used to identify the test user in any way.

*By signing below, the test user confirms that (s)he has read and understood the information above and gives his/her consent to participate in the usability test.*

---

Test user's signature

---

Date, place

---

Test leader's signature

---

## A.2 Feature checklist[33]

### Feature checklist

Feature/button/concept	User found it him/herself	Correct use	User was helped
Toggling UI language			
Understanding stage of resettlement			
Setting/using stage of resettlement			
Browsing videos			
Local/Global videos			
Bookmarking a video			
Finding bookmarks			
Facebook auth.			
Reporting content			
Rating video			
Seals of approval			
Finding specific information on request	N/A		

---

## A.3 SUS form[11]

### *System Usability Scale*

© Digital Equipment Corporation, 1986.

	Strongly disagree					Strongly agree
1. I think that I would like to use this system frequently	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	1	2	3	4	5	
2. I found the system unnecessarily complex	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	1	2	3	4	5	
3. I thought the system was easy to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	1	2	3	4	5	
4. I think that I would need the support of a technical person to be able to use this system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	1	2	3	4	5	
5. I found the various functions in this system were well integrated	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	1	2	3	4	5	
6. I thought there was too much inconsistency in this system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	1	2	3	4	5	
7. I would imagine that most people would learn to use this system very quickly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	1	2	3	4	5	
8. I found the system very cumbersome to use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	1	2	3	4	5	
9. I felt very confident using the system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	1	2	3	4	5	
10. I needed to learn a lot of things before I could get going with this system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	1	2	3	4	5	

---

## A.4 Questionnaire pilot

### Questionnaire

Following are eight statements regarding the system that you have just used.  
Please mark the **one** box which matches your view most closely for each statement.

Statement	Strongly disagree	Disagree	Indifferent	Agree	Strongly agree
I think there could be a lot of useless videos in <i>Infobits</i> .					
I could apply information in the video(s) to my own life in order to achieve a goal.					
Being asked to sign in with my personal Facebook account made me uncomfortable.					
I am able to contribute to making <i>Infobits</i> more valuable to other people.					
I feel more uncertain about the topic of the video(s) than I did before watching.					
The people behind the videos have great knowledge about their video topics.					
Uploading my own video to <i>Infobits</i> would be a waste of time.					
People in the videos are friendly.					



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## A.5 Findings report[32]


### Key themes uncovered


- Seal of approvals and phases of resettlement concepts are foreign to users and should be better presented/explained
- Confusion about ratings (my own vs. average) - more distinct difference between my rating and avg. + show avg. in video view
- Users would have liked more metainfo in video view
- Local/global distinction not clearly visible/discoverable and goes unnoticed


### Key findings


Issue description	Recommendation	Issue type
Seal of approvals in video view appear clickable, but does not offer functionality.	Add info modal with additional information about seal of approval when users taps seal.	Flow
Seal of approvals needs to be better explained.	Same as above. Additional information will be added to info modal.	Content
Seal of approvals are not visible when browsing videos in the category list.	Add this information to the video list metainformation.	Flow
Hard to distinguish between avg./personal rating. Avg. rating not visible in video view.	Change avg. rating appearance. Include metainformation in video view.	Flow
Several text labels too ambiguous	Rewording labels in question for clarity	Flow
Not enough metainformation about videos	Add information. Improve consistency.	Flow
Global/local indications are unnoticed	Refactor video title headers	Discoverability

## Participants

	Field of study: Civil engineering Age group: 25-29 Sex: Female
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	Field of study: Computer tech. Age group: 25-29 Sex: Male
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	Field of study: Urban planning Age group: 25-29 Sex: Male
---	---

	Field of study: Architecture Age group: 25-29 Sex: Male
---	---



### Issues

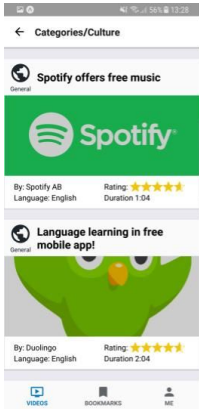
1. Name of the application is not visible
2. No contact info or guide to becoming a contributor

### Recommendations

1. Add application title
2. Nothing. This is intended for newcomers

### Quotes

❖



#### Issues

1. Seal of approvals not visible
2. Average rating appears clickable/resembles personal rating too closely
3. Local/global indication is generally unnoticed
4. No upload date
5. Lack of filtering options (e.g. searching, sorting)

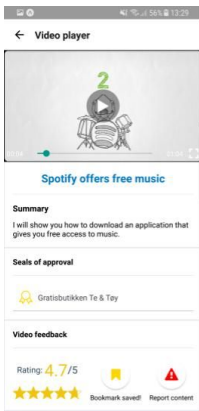
#### Recommendations

1. Indicate presence of seals in the video list
2. Change text to "average rating:" and show numbers instead of stars
3. Refactor video title header
4. Add upload date
5. Nothing. For test purposes with few available videos, this is not a priority.

#### Quotes

- ❖ "It looks like I can rate the video from here... (user tapping avg. rating) but I can't - that's frustrating."

6



#### Issues

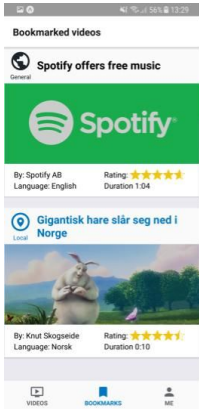
1. Seals of approval appears highly "clickable", but does not do anything.
2. Lacking information about the seal of approval system.
3. Feedback does not apply directly to user (rating vs. YOUR rating etc.)
4. Missing meta-information (avg. rating, duration, language, date)
5. "Report content" button too big. Reporting feedback very generic.

#### Recommendations

1. Add information modal when tapping a seal.
2. Add explanation on the nature of seals.
3. Reword text labels.
4. Add the meta-information which already exists in the category list
5. Nothing. Intended to show users that bad content will be handled.

#### Quotes

- ❖ "I would think a seal of approval from UDI is better than one from *Gratisbutikken Te & Tøy*, but I don't know."
- ❖ "Now I'm feeling like something's wrong" (user tapping a seal of approval, but nothing happens)



#### Issues

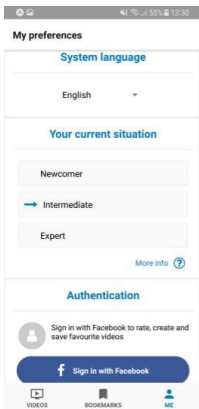
1. When user has no bookmarks, the screen is completely empty
- 2.
- 3.

#### Recommendations

1. Add a line of text to explain the situation
- 2.
- 3.

#### Quotes

❖



#### Issues

1. Lacking information about the phases of resettlement
2. Lacking information about what changing this setting will actually do
3. Description text in authentication card is overlooked
4. Users try to tap on blue headers

#### Recommendations

1. Refactor the "More info" modal.
2. Lock the setting at "Newcomer" to align with project scope and simplify
3. Resize text/button
4. Change header color to look less like hyperlinks

#### Quotes

❖ "I didn't understand *why* I had to log in"

## APPENDIX B

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### Final evaluation documents

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This appendix contains the documents used during the final evaluation sessions. In addition, the SUS form and feature checklist (Appendix A.3 and A.2) from the pilot usability test were also reused.

- Consent form
- Questionnaire
- Findings report

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## B.1 Final evaluation consent form

### Request for participation in research project

#### ***"Infobits: a Crowdsourced Video Platform for Information Sharing among Refugees"***

##### **Background and Purpose**

This research project is conducted as a student project for the master's thesis course TDT4900 - Computer Science, Master's Thesis at the Norwegian University of Science and Technology (NTNU). The purpose of the project is to develop, implement and evaluate a mobile platform facilitating crowdsourcing of information aimed at refugees in video format. The project focuses on evaluating the perceived usability of the system and how well users trust the system's information content. The research is neither commissioned nor financed by any institution.

Participants have been selected on basis of their experiences as refugees. You (the participant) are requested to participate since the intended end users of the system being evaluated are refugees.

##### **What does participation in the project imply?**

Participating in the study involves taking part in an evaluation session lasting up to one hour, during which the participant will be asked to test a mobile application. The test device will be recording the screen and user input during the test. After the test, the participant will be asked to answer two short questionnaires, each consisting of 8-10 statements, to which the participant is requested to indicate how much (s)he agrees with the statement. After the questionnaires are completed, the participant and test leader will have an opportunity to discuss or ask questions about the evaluation session.

The aim of the test is to assess how well the system design meets the system requirements concerning trust and usability. The first questionnaire will be concerned with how easy or hard the participant found the system to use. The second questionnaire will be concerned with the degree to which the participant trusted practical information about certain practical topics that was presented during the test. Written notes may be taken during the test and discussion. No further data concerning the participants will be collected or stored.

After the usability test is terminated, the participant is invited to a focus group to discuss his/her experiences with the system with other test users. The aim of the focus group is for participants to share and compare experiences and to gather collectively refined insights about the system.

### **What will happen to the information about you?**

All personal data will be treated confidentially. All collected data will be stored securely and will not be accessed by anyone other than the project group (i.e. the student carrying out the project). The collected data will be anonymized, reviewed and analyzed before being destroyed.

No participants will be recognizable in any publication related to this project.

The project is scheduled for completion by 28th of January, 2018. At this point, the data will be stored for up to a year before being destroyed.

### **Voluntary participation**

It is voluntary to participate in the project, and you can at any time choose to withdraw your consent without stating any reason. If you decide to withdraw, all your personal data will be made anonymous.

If you would like to participate or if you have any questions concerning the project, please contact William Tisdall (student) at 916 96 587 or Monica Divitini (supervisor) at 73 59 44 62.

The study has been notified to the Data Protection Official for Research, NSD - Norwegian Centre for Research Data.

## **Consent for participation in the study**

I have received information about the project and am willing to participate in:

- usability testing of the *Infobits* system
- a focus group about the *Infobits* system

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(Signed by participant, date)





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## B.2 Questionnaire

### Questionnaire

Please indicate one box that most closely matches your opinion for each of the following statements:

1

I feel safe when using the *Infobits* system

<b>Strongly disagree</b>	<b>Disagree</b>	<b>Neutral</b>	<b>Agree</b>	<b>Agree strongly</b>
--------------------------	-----------------	----------------	--------------	-----------------------

2

I would feel uncomfortable signing in with my personal Facebook account.

<b>Strongly disagree</b>	<b>Disagree</b>	<b>Neutral</b>	<b>Agree</b>	<b>Agree strongly</b>
--------------------------	-----------------	----------------	--------------	-----------------------




3

I would like to create and upload my own video to *Infobits*




<b>Strongly disagree</b>	<b>Disagree</b>	<b>Neutral</b>	<b>Agree</b>	<b>Agree strongly</b>
--------------------------	-----------------	----------------	--------------	-----------------------

Please indicate which one of the three videos you would like to watch the most by making a mark in the row below the images.




1

<p><b>Best ways of buying bus tickets in Trondheim</b></p>  <p>             ★ 4.5/5 avg. rating    🗣️ Norsk              👤 1 seal of approval    ⌚ 2:04              👤 By: Trond Vågsvik    📅 15/1 - 2017         </p>	<p><b>Best ways of buying bus tickets in Trondheim</b></p>  <p>             ★ 4.5/5 avg. rating    🗣️ English              👤 1 seal of approval    ⌚ 2:04              👤 By: Steven Stone    📅 15/1 - 2017         </p>	<p><b>Best ways of buying bus tickets in Trondheim</b></p>  <p>             ★ 4.5/5 avg. rating    🗣️ العربية              👤 1 seal of approval    ⌚ 2:04              👤 By: Salim Haddad    📅 15/1 - 2017         </p>
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2

<p><b>Tips on applying for a job in Norway</b></p>  <p>             ★ 4.5/5 avg. rating    🗣️ English              👤 1 seal of approval    ⌚ 2:04              👤 By: Trond Vågsvik    📅 15/1 - 2017         </p>	<p><b>Tips on applying for a job in Norway</b></p>  <p>             ★ 4.5/5 avg. rating    🗣️ English              👤 0 seals of approval    ⌚ 2:04              👤 By: Steven Stone    📅 15/1 - 2017         </p>	<p><b>Tips on applying for a job in Norway</b></p>  <p>             ★ 4.5/5 avg. rating    🗣️ English              👤 1 seal of approval    ⌚ 2:04              👤 By: Salim Haddad    📅 15/1 - 2017         </p>
---	---	---

3

<p><b>Norwegian learning possibilities in Trondheim</b></p>  <p>             ★ 4.9/5 avg. rating    🗣️ English              👤 0 seals of approval    ⌚ 2:04              👤 By: Trond Vågsvik    📅 15/1 - 2017         </p>	<p><b>Norwegian learning possibilities in Trondheim</b></p>  <p>             ★ 3.4/5 avg. rating    🗣️ English              👤 5 seals of approval    ⌚ 2:04              👤 By: Steven Stone    📅 15/1 - 2017         </p>	<p><b>Norwegian learning possibilities in Trondheim</b></p>  <p>             ★ 4/5 avg. rating    🗣️ العربية              👤 0 seals of approval    ⌚ 2:04              👤 By: Salim Haddad    📅 15/1 - 2017         </p>
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## APPENDIX C

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### Group interview topic guide

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## C.1 Group interview topic guide

### Topic guide

- **Introduction**
- **Initial impressions of *Infobits***
- **Challenges to initial use**
- **Strengths/weaknesses of other sources of information**
  - **Comparison**
- **Trusting *Infobits* and its content**
  - **System**
  - **People**
  - **Organizations**
  - **Misuse**
- **Strengths/weaknesses of *Infobits***
  - **Video format**
- **Reasons to trust/distrust information/people**
- **Privacy**
  - **Signing in with personal Facebook account**
- **Motivation to use *Infobits***
  - **Threshold for contributing (creating a video)**
- **Using *Infobits* in real situations**
- **Suggestions**
- **Other**

## APPENDIX D

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### Running the prototype

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This appendix presents a document with steps to follow in order to run the *Infobits* functional prototype on an iOS or Android smartphone.

1) Download the Expo application on your smartphone from either the [Google Play](#) (Android) or the [App Store](#) (iOS)

2) Launch the Expo application on your phone, then either...

a) ...scan the following QR-code:



b) ...follow [this link](https://exp.host/@wiltis/infobits) (<https://exp.host/@wiltis/infobits>)

c) ...go to the 'Explore' tab. Search for **@wiltis/infobits** and tap 'Tap to attempt to open project at @wiltis/infobits'

3) Explore the prototype! The following test accounts can be used to sign in with

Facebook:

a) email: `bill_nzislhx_testingfield@tfnw.net`

b) email: `nancy_fbslhbx_exampleton@tfnw.net`

i) Password (for both accounts): **Test123!**