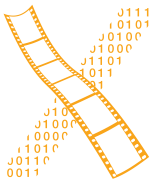

Chair for Computer Science 10 (Media Computing and Human-Computer Interaction)

RWTH AACHEN UNIVERSITY

Challenges in Recruiting Participants for Studies in HCI

Master's Thesis
submitted to the
Media Computing Group
Prof. Dr. Jan Borchers
Computer Science Department
RWTH Aachen University

by
Anam Sohail

Thesis advisor:
Prof. Dr. Jan Borchers

Second examiner:
Prof. Dr. Ulrik Schroeder

Registration date: 17.07.2019
Submission date: 02.01.2020

Eidesstattliche Versicherung

_____ _____

Name, Vorname Matrikelnummer

Ich versichere hiermit an Eides Statt, dass ich die vorliegende Arbeit/Bachelorarbeit/ Masterarbeit* mit dem Titel

_____

_____

_____

selbständig und ohne unzulässige fremde Hilfe erbracht habe. Ich habe keine anderen als die angegebenen Quellen und Hilfsmittel benutzt. Für den Fall, dass die Arbeit zusätzlich auf einem Datenträger eingereicht wird, erkläre ich, dass die schriftliche und die elektronische Form vollständig übereinstimmen. Die Arbeit hat in gleicher oder ähnlicher Form noch keiner Prüfungsbehörde vorgelegen.

_____ _____

Ort, Datum Unterschrift

*Nichtzutreffendes bitte streichen

Belehrung:

§ 156 StGB: Falsche Versicherung an Eides Statt

Wer vor einer zur Abnahme einer Versicherung an Eides Statt zuständigen Behörde eine solche Versicherung falsch abgibt oder unter Berufung auf eine solche Versicherung falsch aussagt, wird mit Freiheitsstrafe bis zu drei Jahren oder mit Geldstrafe bestraft.

§ 161 StGB: Fahrlässiger Falscheid; fahrlässige falsche Versicherung an Eides Statt

(1) Wenn eine der in den §§ 154 bis 156 bezeichneten Handlungen aus Fahrlässigkeit begangen worden ist, so tritt Freiheitsstrafe bis zu einem Jahr oder Geldstrafe ein.

(2) Straflosigkeit tritt ein, wenn der Täter die falsche Angabe rechtzeitig berichtigt. Die Vorschriften des § 158 Abs. 2 und 3 gelten entsprechend.

Die vorstehende Belehrung habe ich zur Kenntnis genommen:

_____ _____

Ort, Datum Unterschrift

Contents

List of Figures

List of Tables

Abstract

User studies are an important part of HCI. Researchers often conduct these studies to evaluate and verify their systems or theories. Unfortunately, the process of conducting a user study is not always a simple one. Researchers have to recruit the participants by themselves. That is where they encounter various difficulties. The goal of this research was to find out what researchers do to recruit participants and what sort of problems they have to deal with, prior to, and while conducting the user study. To achieve this goal, we conducted interviews to find out what HCI researchers are currently doing to recruit participants for their user studies. Through analysis of the collected interview data and prior research, we identified the user study workflow, highlighting what researchers do to recruit participants in three stages – planning, recruiting, participating. We observed that there are some key aspects of the user study that affect user participation and the quality of the data collected: Relationship with participants, recruitment mediums, incentives, tasks and duration. We also analyzed why people participate in user studies and the different motivating factors behind their participation.

At the end, we suggest some recommendations that might be helpful for recruiting users for user studies in HCI.

Acknowledgements

I would like to thank my thesis advisor, Prof. Dr. Jan Borchers, and second examiner, Prof. Dr. Ulrik Schroeder for their time and support.

Thank you, Krishna Subramanian, for being my supervisor. I appreciate the guidance, feedback, and advice you have provided throughout the duration of my thesis.

Thank you to all the people who participated in my user studies and made this research possible.

Thanks to my parents and siblings for their love and support. Thanks to my husband, Wasae Imran, for always being there and being patient and supportive throughout this time.

Conventions

Throughout this thesis we use the following conventions.

Text conventions

Definitions of technical terms or short excursus are set off in coloured boxes.

EXCURSUS:
Excursus are detailed discussions of a particular point in a book, usually in an appendix, or digressions in a written text.

Definition:
Excursus

The whole thesis is written in American English. We use the plural form for the first person.

Chapter 1

Introduction

Validation in HCI is important

Researchers and practitioners in Human-Computer Interaction (HCI) need to frequently validate their system over the several stages of prototyping process or perform need-finding by conversing with end-users. Such tasks require finding and recruiting end-users. Prior research has identified several issues here: Low user participation rates and participants not being representative of the general population due to e.g., convenience sampling [Barkhuus and Rode, 2007].

Types of research contributions in HCI

In their book, Lazar et al. [Lazar et al., 2017] highlighted the work of Wobbrock and Kientz [Wobbrock and Kientz, 2016] by discussing the seven types of research contributions in HCI:

> *Empirical contributions*: Data (qualitative or quantitative) collected through any of the methods described in this book: experimental design, surveys, focus groups, time diaries, sensors and other automated means, ethnography, and other methods.
>
> *Artifact contributions*: The design and development of new artifacts, including interfaces, toolkits, and architectures, mock-ups, and "envisionments." These artifacts, are often accompanied by empirical data about feedback or us-

age. This type of contribution is often known as HCI systems research, HCI interaction techniques, or HCI design prototypes.

Methodological contributions: New approaches that influence processes in research or practice, such as a new method, new application of a method, modification of a method, or a new metric or instrument for measurement.

Theoretical contributions: Concepts and models which are vehicles for thought, which may be predictive or descriptive, such as a framework, a design space, or a conceptual model.

Dataset contributions: A contribution which provides a corpus for the benefit of the research community, including a repository, benchmark tasks, and actual data.

Survey contributions: A review and synthesis of work done in a specific area, to help identify trends and specific topics that need more work. This type of contribution can only occur after research in a certain area has existed for a few years so that there is sufficient work to analyze.

Opinion contributions: Writings which seek to persuade the readers to change their minds, often utilizing portions of the other contributions listed above, not simply to inform, but to persuade.

Most HCI contributions are empirical and artifact contributions

The majority of contributions in HCI are either empirical or artifact contributions [Lazar et al., 2017]. Study has shown a growing trend of evaluation being used in HCI user studies with more than 90% of papers published at CHI in 2006 using some sort of evaluation [Barkhuus and Rode, 2007]. The analysis done by Wobbrock and Kientz of research papers submitted to the CHI 2016 conference revealed that 70% of the papers submitted were either empirical studies of system use or empirical studies of people, and 28.4% were artifact/system papers. Hence, it is essential for this field to conduct user studies and to recruit participants. Evaluation and number of participants are also considered important for reviewers at many HCI related conferences [Barkhuus

and Rode, 2007].

The following examples highlight the different contributions and evaluation methods used in HCI.

System trials and interviews were conducted

4streams is a photo-sharing system that allows small groups of users to keep updated on each others' activities via concurrent photographs sent from their mobile devices; similar to the "feeds" found on Twitter or Facebook [Zargham et al., 2015]. Trials for the system were done on a geographically far-flung family, spread over three countries. The trial lasted seven weeks and collected both quantitative and qualitative data over that course of time. The quantitative data collected in the form of system logs of the activities of the user; uploading of images from platforms like Facebook, manual interactions and/or engagements of the user on the photos available. On the other hand, the qualitative data was collective predominantly outside the system use case; via interviews conducted before and after the use period in addition to analyzing the photos after the trial period for the type and/or style of content used [Zargham et al., 2015].

Interface was tested followed by survey for feedback

WorldBeat is an interactive exhibit on how computers can be used in musical education and musical production, in the form of musical instruments [Borchers, 1997]. The system and its user interface were developed through multiple evaluation levels and the feedback generated therein. Firstly, the interface was tested out by novice users during the design phase. Secondly, the author received direct feedback from users by directly showcasing the system to visitors that attended the exhibit, including noting first hand user issues in handling the system and any errors that occurred - these were recorded as a means of storing the data gathered. Lastly a large scale survey was conducted among the Ars Electronica Center (AEC) to gather general feedback about the WorldBeat exhibit [Borchers, 1997].

Different methods of collecting feedback

Voit et al. conducted a study with 60 participants comparing five different research methods (online, virtual reality, augmented reality, lab setup, and in-situ) and discussed how feedback is collected from users in different methods [Voit et al., 2019]:

Empirical studies are a cornerstone of HCI research. Technical progress constantly enables new study methods. Online surveys, for example, make it possible to collect feedback from remote users. Progress in augmented and virtual reality enables to collect feedback with early designs. In-situ studies enable researchers to gather feedback in natural environments.

Problems: convenience sampling and underpowered user studies

From prior research, we know that participants in HCI studies are often a convenience sample – graduate students, friends and family of the researcher(s), and so on [Barkhuus and Rode, 2007]. Caine surveyed publications at CHI 2014 and found that 75% of the publications reported whether the participants were students or not. Of which, 19 of them reported students to be the sole participants [Caine, 2016]. Furthermore, it is also well known that most empirical research in HCI is underpowered and leads to questionable findings. Why does this happen? What other difficulties and challenges are faced by HCI researchers nowadays. We will be exploring these questions in this thesis.

Interviews were conducted to collect data

We interviewed 21 researchers and industry practitioners all of whom have both recruited participants and have volunteered to participate in studies themselves. The collected data from the interviews was analyzed in detail. After a series of coding rounds, findings were generated that highlighted the issues faced by researchers when conducting user studies. We found that researchers often underestimate the time and effort that is required to recruit participants.

Chapter 2

Background and Related work

Recruiting users is essential for validating HCI research

HCI research is mostly validated through user studies. We know how essential user studies are and how frequently used this validation method is. To make this method possible, participants are needed. To get the participants, researchers must know how to find and recruit them. Seeing the struggle of fellow researchers, really made us wonder why recruitment is so difficult. Is it something that we as HCI researchers are doing wrong that we cannot find more participants that are representative of the target users? Why do people participate or do not participate in user studies?

Related work explored student recruitment and incentives

Similar research has also been conducted in social sciences and also in HCI which explores different aspects of conducting user studies and ways to encourage user participation. In universities, we have seen that there is a culture of recruiting students as participants in user studies. Research shows that it is very common to use either undergraduates or graduate students in user studies [Barkhuus and Rode, 2007]. Another research shows that people are significantly more willing to participate if a monetary reward is offered. This research was done for online studies, but we could assume that it probably applies to other studies as well [Fiore et al., 2014].

Project requirements may not allow participants to be part of the university

Prior research has also shown that recruiting specific groups of people, for example, older adults and young participants is difficult because of various reasons including privacy concerns [Foss et al., 2013, Martin-Hammond et al., 2018]. Many projects may also require participants that are not part of the university body, maybe for reasons such as external validity or being representative of the end-users. A study was conducted to understand how to better design touch interfaces for older adults. In order to recruit participants, the recruiters went to different care centers to find the target participation population [Bobeth et al., 2012]. Another example of a study where the required participants were not just from the university was conducted for the gaming community of "World of Warcraft." They wanted to study the effect of user created interfaces on the users. The requirement for participation in the study was that participants must have played the game.

Definition: *Representative sample*

REPRESENTATIVE SAMPLE:
For the purpose of this paper, this term would refer to the participation population in user studies to be representative of the end-users.

Internet recruitment also has low recruitment rates

Research has shown that internet recruitment is still a problem with low recruitment rates [Koo and Skinner, 2005]. In this case, recruitment was done using technologies like:

- Email
- Electronic discussion boards
- Usenet forums
- Websites

Difficult to differentiate between trustable and fraudulent emails

Recruitment rate was disappointingly low and the above technologies did not prove to be an effective approach for soliciting young subjects to participate in our research. One of the main reasons for such low recruitment rates was because of the issue of authenticity and legitimacy of information on the internet. They argue that it is difficult to differentiate between trustable and spam or fraudulent messages on the internet [Koo and Skinner, 2005].

Another research designed their own method for encouraging user participation. They created their own ranking system, called *"Top of Worlds"*, which presented rankings in multidimensional hierarchical sets. Through evaluation of the ranking system, it was found that their system encouraged user participation in a service – a web service where users could check their data regarding daily health, but did not encourage user participation in an activity – sending general health data (e.g., blood pressure, body weight, and the number of steps walked daily [Kawasaki et al., 2013].

Ranking system designed to encourage user participation

A psychology study also explored the issue of recruitment in 2003 [Patel et al., 2003]. A group of researchers collected data for recruitment approach in clinical research. For this paper, they did not conduct any studies or interviews, they collected previous findings and compiled them. They found that recruitment was difficult for study designs that involved follow-up, commitment, large sample size, etc. They identified some strategies that can be used [Patel et al., 2003]:

Recruitment approach explored in clinical research

- Hiring recruitment agencies
- Employing methods to increase study awareness by:
  - Making recruitment advertisements more prominent
  - Putting up advertisements in relevant places, e.g., clinics, supermarkets, etc.
  - Study announcements in key locations
- Maintaining a pool of participants who are interested in participating, e.g., the centralized recruitment program [Schechter et al., 1994].

Useful strategies for recruitment

The paper explores the reasons why participants take part in clinical trials. One of the reasons was that participants get free access to therapy and health treatment as part of the trial. However, the referred papers in this research were unique cases where patients had specific health issues, e.g. – recruitment for a study of sleep disruption in Alzheimer's disease and recruitment of homeless mentally ill participants. The paper focuses on the recruitment approach in

Participants benefit from participating in clinical research

the clinical setting where researchers can collaborate with clinics to recruit patients as participants [Patel et al., 2003].

HCI is different from clinical research

This paper can definitely be considered as a guide for helping recruiters in HCI but there are certain differences between clinical trials and HCI experiments. The users benefit by participating in clinical research as they get to use the therapy for free whereas in HCI it is not always the case that one might end up using the system that they worked on in the study with. And that is also not the main focus of HCI. Also, in clinical trials the user is not required to do cognitive tasks and this might influence people's decisions about participating in the user studies. In clinical trials, they might have the financial means to provide those incentives, whereas in HCI researchers usually do but it is not always the case, so what can we do apart from providing financial incentives? We can definitely use some approaches highlighted in this research paper but it makes sense to identify recruitment related challenges specific to HCI, where user studies require cognitive tasks, no health benefits are provided and the target participants can be of any criteria.

Chapter 3

Methodology

This chapter will focus on the methodology used for this research. The research was done through a series of semi-structured interviews which were later analyzed in detail to come up with key findings.

Throughout this thesis, we will use the term, *"interviewees"*, for the people who we interviewed. We will also refer to them individually at many places as *"P1, P2, ... P21"*.

Goal – find out recruitment status quo and problems faced

The goal of this research was to understand how HCI researchers recruit participants for user studies and the challenges they face in doing so. We analyzed how prevalent is the problem of recruiting and identified different techniques and strategies that are currently employed by our interviewees in order to recruit users.

3.1 Motivation

Evaluation and user recruitment are essential in HCI

As discussed in the previous chapter, evaluation in HCI is essential and researchers need to recruit participants for user studies in order to evaluate or validate their research. But the task of recruiting is not always a straightforward one. Many researchers face problems when recruiting users. One evidence of that is that researchers often do

"convenience sampling" by recruiting people who are easily accessible. Mostly, these people are students at the same university as the researcher [Barkhuus and Rode, 2007].

Definition: *Convenience sampling*

CONVENIENCE SAMPLING:
Convenience sampling is a nonrandom sampling where those people are recruited who fulfil a practical criteria, such as easy accessibility, geographical proximity, availability, or willingness to participate [Dörnyei, 2007].

To verify how true this was at the *i10 chair*, we looked at Master's and Bachelor's thesis of the past two years. Out of the 26 theses, 6 do not mention the participant details. Out of the remaining 20, 17 of them had students as their main participation population. This is problematic because:

- **Power dynamic**: a researcher can be in a position of power which can result in students agreeing to participate. They might also be afraid to say bad things about the system during the user study.
- **Students are tech-savvy**: students are generally more tech-savvy than the general population and they are more capable of learning new things. This does not make them truly representative of the general population [Barkhuus and Rode, 2007].

3.2 Interviews

Semi-structured interviews can make it possible to delve deeper into topics

Semi-structured interviews can allow researchers to delve into topics with greater depth than would not have been possible with traditional fully structured interviews. This stems from the fact that since the respondent might respond in a way that opens a new line of thinking or questioning that the interviewer did not anticipate beforehand – and in a fully structured interview would not have the option of following upon. This means that semi-structured interviews tend to work best when the researcher is looking to go beyond a set parameter of questioning and is interested

in understanding the participant's insights and taking note of their comments; especially useful when the research subject is not fully understood, or the topic is too complex to have clear line of questioning. Semi-structured interviews allow you to circumvent this restriction by allowing the participants to enlighten you on the topic, through understanding their viewpoints, experiences and ideas; this allows the researcher to then create a more robust version of structured interviews from the learned experience [Lazar et al., 2017].

Interviewed experienced HCI researchers

To explore this topic, it was appropriate to talk to people in this manner in order to get more useful insights that could direct the line of questioning. The topic of recruiting users and how researchers go about recruiting participants has still not been explored in detail in HCI. New researchers are often not sure about how to begin the recruitment phase. Hence, it was necessary to talk to people who have had experience with conducting user studies and recruiting participants to understand how HCI researchers conduct user studies and what problems they face during the whole process.

3.2.1 Participants

21 researchers were interviewed

We interviewed 21 researchers and practitioners[1] (10 female, average age = 29), which includes 16 HCI researchers, one energy economics researcher, and four practitioners from several domains such as Service Designer, Marketing, and Game Design. Interviewees ranged from Master students in their final year to researchers having more than 20 years of experience.

In grounded theory, saturation happens when a theory emerges

The sample for this study is HCI researchers and HCI industry practitioners who have experience with conducting user studies and also participating in user studies. In the beginning, the target number of participants was approximated to be more than 12 people. This was approximate and meant to change along the way as according to the grounded theory, the concept of saturation means that cat-

[1] "Practitioners": from HCI related industry

Table 3.1: Interviewee Information

Interviewee ID	Profession/ Education	Number of Studies Conducted	Number of Studies Participated
P01	Gaming Research Analyst	>10	0
P02	Service Designer	>50	-
P03	Research Associate (*Economics*)	2	0
P04	M.Sc. Media Informatics	1	6
P05	M.Sc. Media Informatics	2	6
P06	M.Sc. Media Informatics	3	5
P07	M.Sc. Media Informatics	2	3
P08	M.Sc. Media Informatics	1	4
P09	Market Research Analyst	50	1
P10	Usability Engineer	>20	>20
P11	Researcher in Energy Economics	1	1
P12	Researcher in User Centered Ubiquitous Computing	20	7
P13	Researcher in User Centered Ubiquitous Computing	7	5
P14	Assistant Professor (*Interaction Design*)	>50	-
P15	User Experience & Digital Marketing	50	10
P16	HCI Researcher	>6	>5
P17	HCI Researcher	4	8
P18	B.Sc. Thesis in HCI	1	1
P19	HCI Researcher	6	>20
P20	M.Sc. Media Informatics	3	10
P21	M.Sc. Media Informatics	2	5

egories and their relationships are accounted for, thereby making it possible for a theory to emerge [Green and Thorogood, 2018]. After interviewing 21 people, there were clear categories pointing to key findings. Hence, the saturation for sample size for this study was 21 participants.

Interviewees were contacted through email with the help of friends and teachers

Practitioners from the industry and HCI researchers in other countries were contacted through email. We explained in the email about the research we were doing and what we aimed to achieve as a result of this research and asked whether they were interested in sharing their experiences with conducting user studies. Skype interviews were done with interviewees who were in other countries. For a more varied and generalized perspective, we tried to recruit industry practitioners as well. Recruitment was done through the help of friends and teachers.

3.2.2 Data Collection

Interviews took about 30-55 minutes

Semi-structured interviews were used to collect data. Each interviewee was provided with an explanation of the research and this *Informed Consent Form* A prior to the start of the interview. Participants were interviewed in-person or through Skype and it took approximately 30-55 minutes for each interview. The length of the interview depended on the amount of data gathered. The interviews were recorded using the voice recorder in a mobile phone or the recording feature in Skype. As we were following the semi-structured approach of conducting interviews, we had prepared a checklist of questions C we wanted to ask, and the rest of the interview was driven by what the interviewee said during the course of the interview.

3.2.3 Data Analysis

The collected data was analyzed through the grounded theory approach. This approach is an explorative one. It can be used in cases where the concept or subject matter has not been studied substantially. Charmaz identified the features of grounded theory as the following [Charmaz, 2008]:

- Collection and analysis of data done simultaneously
- Analytic codes and categories created through collected data
- Abstract categories constructed through induction
- Categories refined through theoretical sampling
- Analytical memos written between coding and writing
- Categories integrated into a theoretical framework

Definition: *Grounded Theory*

GROUNDED THEORY:
"The discovery of theory from data systematically obtained from social research." [Strauss and Corbin, 1997]

This approach made sense for this research as the topic of user recruitment in HCI has not been studied enough.

Data was coded using descriptive, attribute and in-vivo coding techniques

We analyzed the interview data through multiple rounds of *descriptive, attribute* and *in-vivo* coding to generate findings. Data coding involved two main phases: initial or open coding and focused coding. In initial coding, the transcripts are read and anything of interest, a word, a line or even a whole paragraph, is highlighted or put into a category. In this way, data is broken down into smaller parts which can then be analyzed closely. The initial categories are later merged, divided or discarded in further rounds of coding. In focused coding, the coded data is categorized based on themes and relationships. The most significant codes are developed into the main categories which helps in realizing key findings and concepts hidden in the collected data [Saldaña, 2015].

Memo writing facilitates the process of findings emergent themes

In order to help find the emergent themes and concepts, memo writing was also done. Analytic memo writing is essential in qualitative analysis as it helps to reflect on the coding process and the chosen codes. It makes it easy for the researcher to see how the process of analysis is taking form and what patterns are emerging. Clarke mentions [Clarke, 2005]:

"Memos are sites of conversation with ourselves about our data."

Coding and analytic memo writing are best done in parallel, for there is *""a reciprocal relationship between the development of a coding system and the evolution of understanding a phenomenon"* [Weston et al., 2001].

MAXQDA was used for qualitative analysis and coding

The qualitative coding process was done in MAXQDA Standard 2018. The software is useful in organizing data, codes and memos. The visual tools within MAXQDA streamline the process of inquiry. The *"Smart Coding Tool"* is helpful for further rounds of coding and makes the process of recategorization more organized.

Creation and organization of codes

As the first step, I read through all the interview transcripts and highlighted important paragraphs and phrases as the first round of coding. Simultaneously, I also wrote memos for each code and interview and also a general overall memo was kept as a journal for collecting the most relevant and important findings. With more rounds and methods of coding, I was able to create new codes along the way and highlighted. Figure 3.1 shows how the coding process is organized in MAXQDA. Furthermore, thorough reading allowed the formation of categories for the assigned codes. Similar codes were assigned to the same category. For example, where the interviewee was talking about the details about the participants - number of participants, their relationship with the participants, etc., these similar codes were moved under the parent code of "Participants". As the code system was created and analyzed, key findings were realized.

2039 coded segments with 422 codes in 7 main categories

At the end of the analytical process, 2039 segments were coded in 21 interview transcripts. We ended up with 422 codes in 7 main categories. These codes and categories encompass how researchers plan and conduct user studies and what problems they face during this process. Code maps of some of the main categories are shown in figures 3.2, 3.3, 3.4 and 3.5.

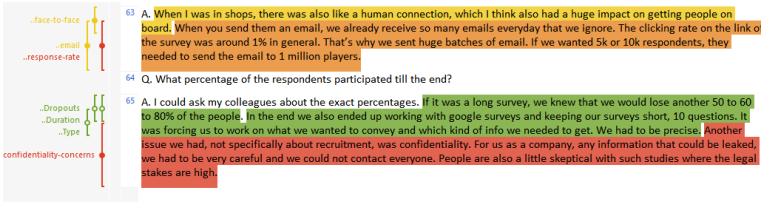

Figure 3.1: Coding Process - MAXQDA 2018

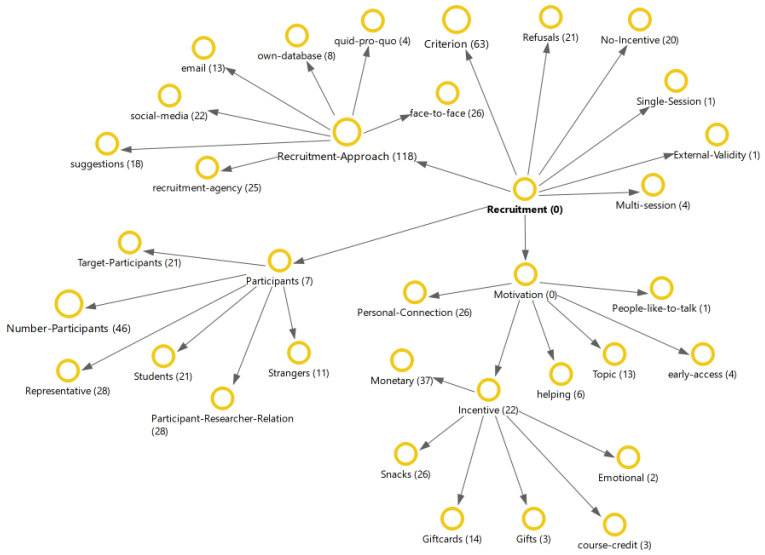

Figure 3.2: Code Map of Category - Recruitment

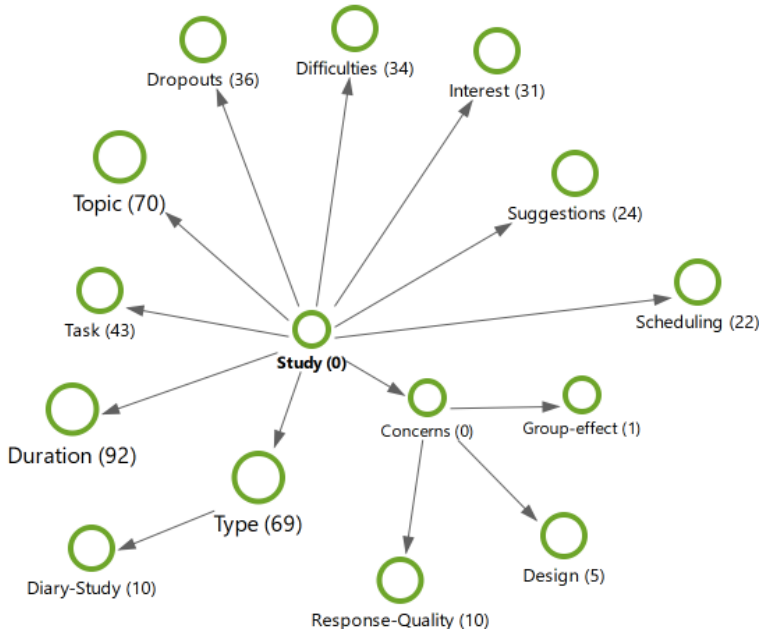

Figure 3.3: Code Map of Category - Study

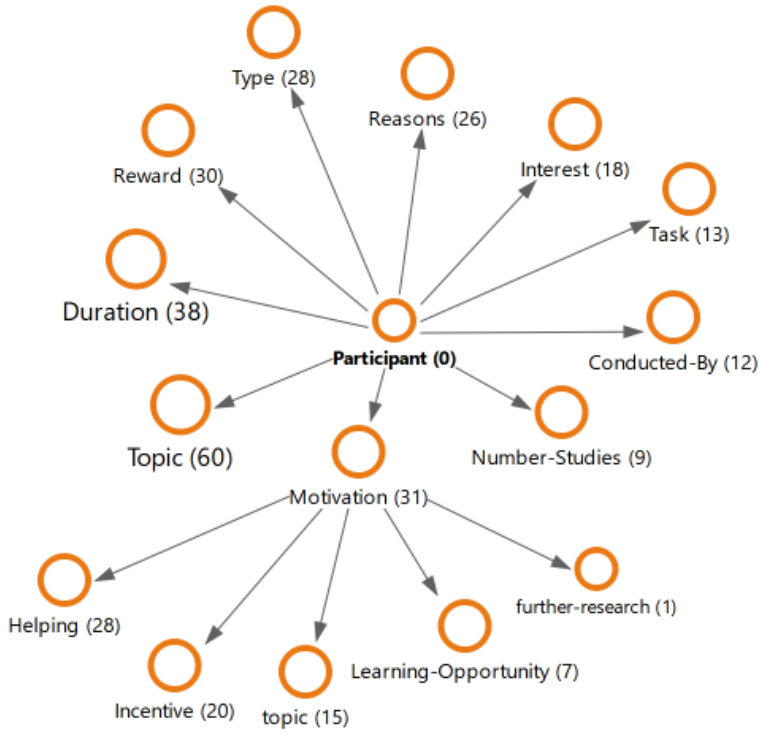

Figure 3.4: Code Map of Category - Participant

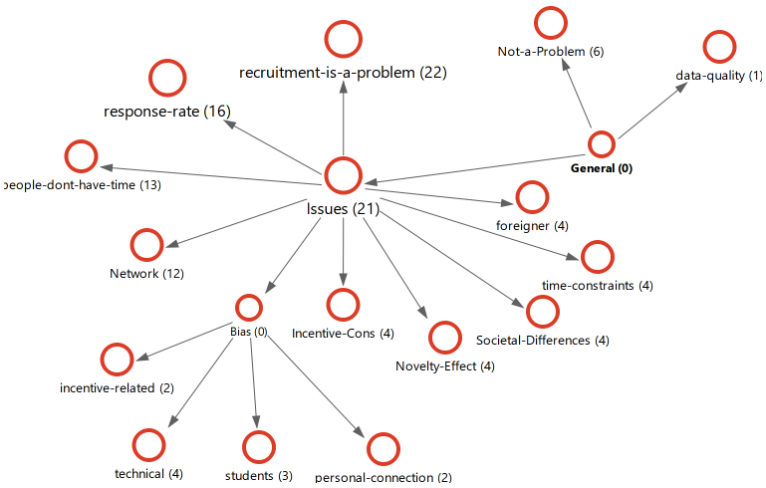

Figure 3.5: Code Map of Category - General

Chapter 4

Findings

In this chapter, we will explore various questions related to user studies including the following:

- Is it better to offer an incentive for user participation or not?
- What are the different types of incentives offered by researchers?
- What recruitment techniques are employed by researchers?
- What factors impact user participation and user involvement in a user study?

Findings are discussed in 3 subsections

This chapter is divided into 3 subsections. The first section, 4.1, focuses on what researchers do during the whole process of a user study - from planning the study to conducting the actual study. The second section, 4.2, digs deeper into the different aspects involved in the user study workflow and how they might affect user participation. The last section, 4.3, sheds a light on why people participate in user studies - the different motivations behind user participation and how that might affect the collected data.

4.1 Stages of the Study

Stages of user study

From prior research and analysis of the collected interview data, we observed different stages that were involved in recruiting participants.

Planning: the researcher plans out the whole user study.
Recruiting: the researcher contacts people and try to convince them to participate.
Participating: users participate in the study.

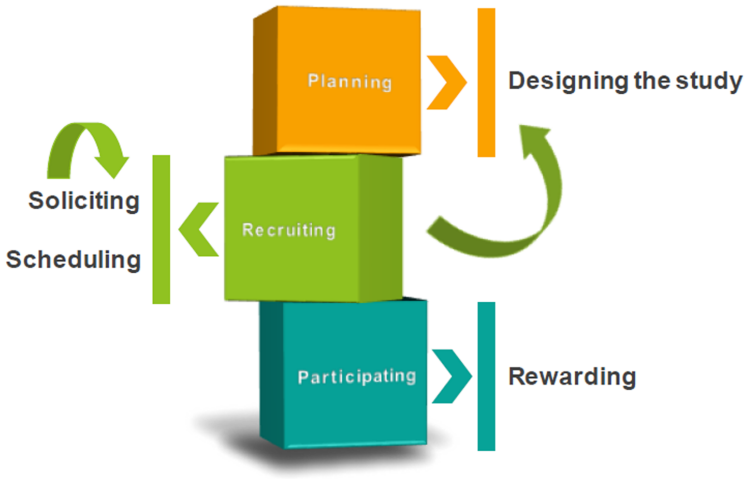

Figure 4.1: User Study Workflow

Researchers plan the study, then recruit and then participation in study takes place

Recruiting participants for a HCI user study involves multiple steps. A researcher needs to plan her study to decide the number of participants; recruit participants through an iterative process of back-and-forth solicitation and eventual scheduling; and finally, optionally reward the participants following successful participation.

Let's look at these steps in further detail.

Planning

Researchers plan and design the study

Before the researcher seeks participants for her study, she must plan for it. First, she must design the study according to research questions and operational considerations e.g., funding, available participant pool and technical

resources. Budde et al. compiled a brief tutorial on how to plan and conduct experimental studies. They also pointed out that planning and designing the studies before conducting them is an important step. This plan should include hypothesis, participation population and study design [Budde et al., 2017].

The decisions made at this stage are crucial because without them it would be difficult to proceed with the user study. Following are the decisions that need to be made before recruiting users:

Deciding the type of study and study venue

- **Study type and context:** What should be the type of the study? (interview, focus group, usability, etc.) Are participants required to come to the lab? Or will the study take place in the participants' workplace or home? User studies can be conducted to gather quantitative and/or qualitative data. Subsequently, there are several types of studies, each with its own intended benefit. Interviews are typically long and are employed to help the researcher identify new problems and answer open-ended questions. Surveys are shorter and are used to gather answers to closed-ended questions. User studies can also be conducted in the lab, participants' workplace/home, or even online. 10 of our interviewees have conducted usability studies or in-lab experiments whereas only 5 interviewees have conducted user studies involving interviews.

Deciding the sample size of participants

- **Sample size:** Approximately, how many participants are required? Researchers are also considerate of the participants they need to recruit for their study. Quantitative analysis of study results requires adequate participants to have a high statistical power [Caine, 2016], and qualitative analysis requires enough data from participants for cross validation or induction [Graneheim and Lundman, 2004]. The average sample size of user studies conducted by our interviewees ranged between 15 to 25 participants. Some notable exceptions were online surveys and focus groups conducted by P01 with 3000 participants, P02 with 10,000 participants and P03 with 5000 par-

ticipants.

Deciding what sort of users can participate

- **Inclusion criteria:** What should be the inclusion criteria for the participants? Depending on the research hypothesis, a user study might have inclusion criteria of varying flexibility. E.g., a study conducted to understand how people having difficulties with nonverbal cues can take advantage of computer-mediated communication requires adults with high functioning autism [Burke et al., 2010]. In such cases where the participant pool is limited, recruitment strategies may require deep thinking. 11 of our interviewees have had experience with conducting user studies that had very specific inclusion criteria. On the other hand, studies that validate mobile interaction techniques e.g., [Corsten et al., 2019] have little to no inclusion criteria.

Designing the study; tasks, questions, etc.

- **Study tasks:** According to the study, what tasks/questions should be part of the study? This is part of the design method which can affect the duration of the study, which in turn may impact participation. Additionally, this can also impact the performance of participants during the study (discussed in the next subsection).

Estimate of the duration of study

- **Study duration:** How long should each session of the study be? Have a rough estimate of how much time it will take to complete the user study for each participant. This is important to know because when asking people to participate in your study, providing this information can be one of the important factors for the participants in deciding whether to participate or not.

Recruiting

Recruiting includes soliciting and scheduling

At this stage the researcher has come up with a plan which includes the inclusion criteria, study design, approximate number of participants and the recruitment approach. This phase has two further sub-phases: *Soliciting* and *scheduling*.

The first step, soliciting, is about following the recruitment

approach that was decided in the previous stage and convincing people to participate.

Researchers have to convince people for participation

Once the researcher has contacted the prospective participants, she might have to convince them to participate in the user study if they seem reluctant. It might be easier to recruit participants in cases where the researcher has a personal connection with the prospective participant or when a reward is offered for participation. These and some other factors that affect recruitment will be discussed in further detail in the next subsection.

Recruiting is an iterative process and can take 2 weeks to a month

Researchers have to revise their plans and study design. Even before getting to the stage of data collection, researchers revisit the basic plan and design considerations, e.g., the inclusion criteria, study tasks etc. [Bengtsson, 2016]. Also observed by Kujala and Kauppinen, the process of identifying and choosing the users is an iterative one [Kujala and Kauppinen, 2004]. According to our interviewees, the recruiting process can take anywhere between 2 weeks to a month. But at this point, researchers might not get the response rate they expected. To deal with such situations, one has to go back to the drawing board and tweak the plan, maybe scale down their expectations, e.g., by redesigning the study session so it takes lesser duration, and then get back to the recruitment phase. P04 had to revise their inclusion criterion once they were unable to recruit the target number of participants. They had to broaden the criterion from Master's students to also include Bachelor's students. Initially, P20 also thought that it would be easy to recruit users. But their inclusion criterion was very specific and they had to revisit from where to get that certain group of people and how to approach them.

> *"Initially, I guess I was over-optimistic... I had an impression that it will be easy [to recruit people]."*
> –P20

Recruitment can take place after knowing how and where to get participants from

Hence, it is important to have a clear idea of how to approach prospective participants and where to find them. Once that is done, the actual recruitment can be done. This proces is iterative – what that means is that one might have

to revisit the recruitment plan again, according to the response rate.

The process of planning and recruiting is iterative; researchers might revisit the following considerations during this process and change them if needed:

Deciding which recruitment medium and approach to use

- **Medium:** Which recruitment medium/approach to use? (email, social media, advertisements, etc.) Designing the advertisement, writing the email, etc. according to the recruitment medium being used. When contacting personal connections, most of the interviewees said that they used messaging apps or asked them directly for participation (P01-P06, P10, P14 and P16). On the other hand, for recruiting professionals who were also strangers, P11 had success with writing them personalized emails. P16 had great success with the approach of going around on-campus and asking people face-to-face.

Recruitment approach is where we can find participants from and how we approach them

One important aspect of conducting a user study is to find the relevant people and convince them to participate in the user study. There are different ways in which researchers approach people. If the inclusion criteria allow, researcher might just contact students from the university or people from his social circle. But a lot of times, the criteria is not so open, e.g., a study conducted to better understand mouse movements of motion-impaired users had to recruit users with motion-impairment [Hwang et al., 2004].

Deciding whether to offer incentives or not

- **Incentives:** Researchers may or may not think about offering incentives for participation. Incentives can include monetary rewards, personalized gifts, vouchers and snacks. Many researchers also start off by not offering any rewards, but they might change this along the way to attract more participants.

> *"I was starting to consider doing some sort of reward or something for participation."* –P05

> *"We are also thinking of giving an incentive..."* –P07

The study can be scheduled after or while recruiting

By the second step, scheduling, the previous considerations are all taken care of. The researcher and the participant agree on a time and date for the study. Many researchers combine this step with the previous one; inviting participants to participate in the user study. They send available time slots with the user study participation invite in the form of *"doodle"*[1] or other ways, e.g, writing the time slots in an email or a text message. 5 of our interviewees specifically mentioned using doodle for scheduling purposes: [P04, P14, P16, P18, P21].

> *"I created a doodle and showed them that's the time slots I have, like there are some people on that day like can you come this day or that day. And then they said okay we're fine with that."* –P21

> *"We create a doodle and then they just choose the time slot that is suitable for them."* –P14

Scheduling difficulties

There were cases where researchers struggled with the scheduling step. Scheduling was difficult where the requirements included having more than one participant in each session of the study and where the participants were in a different time zone.

> *"One of them, we actively couldn't find adequate time because he was from the USA"* –P20

> *"that was also kind of one of the tricky part because I had to find people who have coding experience and then I have to pair them together with people who didn't have any coding experience."* - P07

P21 had to conduct a study where they required two and four people in every session of the study. It was difficult to coordinate with more people for the same time slot because everyone had different schedules.

[1] www.doodle.com

"It was hard to manage all of them to have time at the same time." –P21

Participating

Researchers explain the study and make participants feel comfortable at the beginning

The last stage is where the participants take part in the user study. Researchers usually begin the study by explaining to the participant what the user study is about. They ask them to sign an informed consent form, similar to the one in appendix A. The researcher may offer a snack or a drink so that the participant can settle down in the new environment.

"We explained the workflow [of the user study] in the beginning." –P17

Breaks are given if required

During the user study, researchers ask participants whether they need a break, if the study is a long one or if they feel like the participant needs to refocus.

"I do always provide breaks in my study." –P16

"You give the participants time to adjust to your system, ... you explain everything to them, ... you make it as comfortable for them as possible" –P19

Rewards given at the end

At the end of the study, if a reward for participation was promised beforehand, participant is given that reward.

Usually, this stage is without many problems. In some cases, though, there can be problems related to the duration of the study and tasks involved.

The problems and different aspects of a user study highlighted in this subsection will be discussed in detail in the next subsection.

Here are all the above considerations in the form of an easy to follow checklist:

- Planning
  - Study type and context
  - Sample size
  - Inclusion criteria
  - Study task
  - Study duration
- Recruiting
  - Medium
  - Approach
  - Incentives
  - Scheduling
- During user participation

4.2 Aspects of a User Study

In the previous subsection, we looked at what researchers do before conducting a user study and the different considerations they have to think about. We highlighted some problems and aspects of the user study. We will be looking at them in detail in this subsection.

Approaching people can include sending emails, putting up posters, etc.

As shown in the background 2 chapter, many projects may require participants that are not part of the university body, maybe for reasons such as external validity and . In such cases, the approach can vary from putting up advertisements, sending emails or contacting specific people with particular expertise through various channels. The various approaches also offer varying reach and response rate. E.g., for a study where participants were recruited to participate in online panels, emails were the most successful medium, followed by flyers and then letters [Hansen and Pedersen, 2012].

For understanding the aspect of recruitment approach better, we have divided it into two categories: *Relationship with Participants* and *Recruitment Medium*

Relationship with Participants

Participants from one's social circle or university

One can find potential participants at their workplace (university or research institute) or from within their social circle (family, friends, friends of friends, etc.). But in cases where a representative sample is required, they have to recruit people who they do not know.

Researchers recruited participants who they already knew

We observed multiple instances where researchers recruited participants who they already knew in some capacity, e.g., friends, colleagues, students from the university, etc. As shown in figure 4.1, mostly people from within one's social circle or within a university were approached and recruited. Practitioners from the industry [P1, P2, P9, P11, P15], researchers at research institutes [P12] and researchers at universities [P14] also use past connections to recruit participants. In some cases, this can just be a list of past participants who are interested in participating in fu-

ture user studies. In other cases, this can be a database of people who sign up to participate in user studies.

Convenience sampling; easily accessible participants

This form of recruitment where researchers recruit people they already know or people from within the university is also known as *convenience sampling* [Etikan et al., 2016]. For [P14, P15], convenience sampling is not a concern in some cases and is sometimes a viable option:

> *"We know that there is data sampling bias because we use convenient sampling. In some of the studies, this doesn't matter because those could be the studies that just focus on the moderate differences in how fast a participant can move the controller to click one button and move to click another, like fitness studies."* –P14

> *"So it's not very representative of the general public which is OK for you know depending on the type of study."* –P15

Interviewees concerns about convenience sampling

On the other hand, [P01, P15, P16, P19] had concerns about how convenience sampling can impact the data collected:

> *"The disadvantage I think is that you have a very biased crowd. So, you have university students that limits the age group that limits the level of education that limits certain lifestyles and interests. So, you will find very few computer science students above 60 for example. So, I guess that's probably the biggest limitation."* –P15

> *"You always can have a technical bias, for example, so people who are at the university, people who study computer science, generally know technology. So, if you want to test something, whether, let's say, the everyday user can use an interface, using computer science students is already a bias."* –P17

Table 4.1 shows where our interviewees recruited participants from. This table shows only the cases where interviewees were recruiting people they already knew.

Table 4.1: Recruiting People You Know

Source of Participants	Frequency
Own professional network	7/21
Within university	10/21
Own social circle	13/21

The numbers do not add up to 21 (the total number of researchers) because the same researcher used more than one area to recruit or the area varied in different studies conducted by the same researcher.

Recruiting was also done through online communities

The above mentioned areas are not the only areas from which HCI researchers recruit participants. Through our interviews we found out that some of our interviewees also recruited participants outside of these areas, [P01, P02, P06, P09, P15, P17, P20]. When it was not an option to recruit people from within the university or one's own social circle, for example, when the inclusion criteria is specific, interviewees tried to recruit participants from other areas. Some researchers made use of online communities and blogs, [P06, P17, P20]. These online communities are groups of specific people, for example, an online community for data scientists. These communities exist on *Reddit*, *Facebook*, *Discord*, among many others. Interviewees were successful in gaining attention from specific groups of people for participation via this approach.

Table 4.2 shows where our interviewees recruited participants from. This table shows only the cases where interviewees did not already know the participants and hence searched beyond the university or their social circle.

Table 4.2: Recruiting Strangers

Source of Participants	Frequency
Online communities (*Reddit, Discord, etc.*)	3/21
Recruiting agencies	4/21

"So there's a discord for Aachen, people who play video games together...I figured they would like technology. And that worked out." –P17

"I put up posts on the Reddit R community, on two Facebook groups for Data Science. And on like Cologne R meetup" –P20

Practitioners hired recruitment agencies

Recruitment agencies are used in industry to make the process of finding and recruiting participants more streamlined and hassle-free for anyone looking for participants. They require basic information, e.g., sample size, inclusion criteria, duration of the study, study context, incentives, etc., before they can start the process of recruiting. After this information is provided, the agency usually gives an estimate of the time it would take to find and recruit the required participants. The agencies charge according to the number of participants recruited at the end. Interviewees always had a positive experience when working with recruitment agencies. [P01, P02, P09, P15] hired recruitment agencies for recruiting participants for many of their research projects.

"These jobs [recruiting] are normally outsourced to recruitment firms. Very often they have market research studios.... [Participant] come to the studio or to an agency where there is a usability lab and they get money. This is also beneficial just for handling because for tax reasons." –P02

"The agency takes care of the recruitment based on quotas that we put into place and we follow up with them every day." –P09

"Basically, what these recruitment agencies have, and that's basically their asset, is they have a database of people who have opted into doing studies.... So, they have thousands of people in the databases.... What we would always do is develop a

little questionnaire that we call the screener and then we would discuss the screener document with the recruiting companies, and they would give us a first assessment of how difficult it would be to find those people. And that also led to the price per recruited participant. So, they would charge us for each person that they would recruit for us." –P15

Recruitment Mediums

Recruitment mediums used by the researchers to recruit participants

A recruitment medium is the form or medium of communication used when recruiting participants. It can be face-to-face, via text message, email, etc. Various recruitment mediums were used by the researchers in recruiting participants. For example, sending emails, putting up posters, asking prospective participants face-to-face, etc. While emails and social media had the propogation effect which helped in getting the user study invitation to a number of people in a short period of time and without much effort, but it was not always successful.

"First, we tried to contact the people in [a research institute] through the mailing list. Roughly there are around 200 people working here in this department and the departments in this building. But finally we got like five people I guess and then I had to go around and ask people." –P13

Face-to-face approach was more successful

On the other hand, the face-to-face approach, although it was limited and required much more effort, it was more successful. Researchers had the impression that people are generally too nice to refuse when asked in-person.

"When I was in shops [recruiting people], there was also like a human connection, which I think also had a huge impact on getting people on board." –P01

"I go to a lecture. I go to my fellow PHD students and I tell them a shorter line for a story line. But

> *when it's face to face I don't need to compel them with the story. They know already that I really need help. And that's really compelling."* –P16

This approach seems to work but for smaller numbers. Hence, it depends on the sample size the researcher is looking for and how large their own social network is.

Face-to-face approach is not scalable

> *"We just ask them to participate like face-to-face but usually that approach is not scalable because it depends on how large your social network is and then how many people do you have brownie points with."* –P14

Table 4.3 shows the different recruitment mediums used by our interviewees in order to recruit participants.

Table 4.3: Recruitment Mediums

Medium	Frequency
Online Communities (*Reddit, Discord, etc.*)	3/21
Posters	5/21
Social Media	10/21
Face-to-Face	10/21
Email	7/21

The numbers do not add up to 21 (the total number of researchers) because the same researcher used more than one recruitment medium to recruit or the recruitment medium was different in subsequent studies conducted by the same researcher.

Incentives

Researchers also try to increase the participation population by offering incentives. The following factors can affect recruitment:

Incentives were offered to attract more people to participate

- personal connection

- reward
- nature of the task and/or participant's interest in the task/research

Personal connection with the researcher is more effective and requires less effort as people are compelled by their connection with the researcher to participate. But when it comes to rewards, people respond to them differently. Some people would be happy to participate only for free snacks, but usually that is not the case. The reward should be equivalent to the required time and effort asked of the participants. When asked if incentive was an important factor while deciding to participate in a study, 7 out of 14 interviewees said that incentive was indeed an important factor. Rewards can include money, gifts (personalized or not), vouchers, raffle, credit points (students), discount cards, points for a loyalty program or snacks. [P3-P5, P7, P8, P10, P12, P13, P15-P19, P21] offered snacks, [P1, P2, P9, P12, P14-P16] offered monetary rewards, [P10, P15] also offered gifts in some of their user studies, and [P1, P3, P14, P15, P20] offered giftcards, e.g., amazon vouchers. Convincing people to take part in an online study which takes about 30 minutes or less is not an issue. It gets difficult when you have to convince them to travel to a destination for that study. P16 said that they would never travel to another location for a user study, despite how good the reward is.

Table 4.4 highlights some of the factors mentioned by our interviewees. These are the important factors in deciding whether to participate in a user study or not.

Most interviewees did not offer incentives

Most of our interviewees did not offer incentives because most of them were students and researchers from academia. They may not always have funding dedicated for recruiting participants. Many of them still offered snacks during the study session as a way of showing appreciation and gratitude.

Offering incentives increased participation

In cases where there was budget allotted for recruitment, offering money was successful in getting more participants. Some interviewees offered inexpensive gifts for user participation. This approach also seemed to work.

Table 4.4: Deciding Factors for Participation

Factors	Number of Users
Personal Connection	21
Incentive * (*important*)	7
Incentive (*not important*)	7

* This question was only asked from 14 users because the questions became more focused as more participants were interviewed

> *"There is a circle after your immediate circle . . . you have to give like more things, so I bought electronics, €10-12 kind of thing. Like headphones, mouse and stylus, etc. So, compensation helps."* –P10

> *"They actually provided him money to do a study. So, he was able to offer every participant €10-15 Amazon voucher and he had a lot of participants."* –P19

Incentives not necessary when participants are friends or colleagues

In cases where the researcher invites people from her own social circle, rewards may not be necessary. In some situations, rewards may not even be an option.

> *"So I think as soon as you have personal contact it doesn't matter if they get something."* –P12

> *"We are working for [a research institute], we're not allowed to pay the participants. For the studies I'm conducting, our participants do not get incentives, not from us at least."* –P12

> *"We have some studies that we don't provide any incentive in the past. And usually those studies we recruit people who we know to have that certain expertise"* –P14

Offer incentives to show appreciation

Researchers do not offer incentives for the sole purpose of increasing response rate, but many researchers mentioned that they give incentives because they appreciate participants' time and effort.

> *"Depending on the situation, we always tried to incentivize them. And depending on how much investment we are asking from them, we had different rewards."* –P01

> *"You have to compensate them for the realistic amount of time they are going to spend."* –P09

> *"The content is only on top. I always give them incentive. Because I appreciate them."* –P02

Table 4.5 shows the different incentives offered for participation by our interviewees when they conducted their user studies.

Table 4.5: Incentives

Incentive	Frequency
No incentives offered	16/21
Snacks	14/21
Gift cards	5/21
Monetary	7/21
Gifts	2/21

The numbers do not add up to 21 (the total number of researchers) because the same researcher used different incentives in differnt user studies.

Tasks

Tasks can negatively impact the user study

Researcher designs the study in the planning stage of the user study workflow, as mentioned in the previous subsection. The design also includes the tasks of the user study. It is important to design the tasks carefully because there were some instances where the participants in a user

study had issues with the tasks. This resulted in negatively impacting the user study and the data collected. Such issues can lead to participants not being able to perform to their full potential. Some of the reasons for this may include:

- **Tedious and repetitive tasks:** If the tasks involved in the user study are tedious, they can cause the participants to feel exhausted. Having experienced such a case, P21 mentioned how they stopped paying attention at the task at hand because of exhaustion.

Tedious tasks made participants exhausted

> *"It was a bit exhausting since . . . I had to like hold the phone all the time and . . . my hand . . . was aching at some point. I like then doesn't matter like how much interesting is this study itself but like the pain in your arm and hand, like it makes you forget . . . and like just to finish it."* –P21

Similarly, tasks can also be repetitive. Repeating tasks is important for evaluation, as pointed out by Harter, there can be differences among experts performing the same tasks [Harter, 1996]. But it can be quite boring for the participants to repeat the same tasks many times. P07 and P04 had instances where the topic of the user study was interesting, but the tasks were repetitive to the point that it got boring and tiring. At that point they stopped paying attention.

Repetitive tasks were boring for participants

> *"There was one really long one, more than an hour, that was a bit hard and repetitive. I got a little bit bored in the middle. I didn't put much attention into it. I was fired up in the beginning but in the end not so much. The topic was interesting."* –P07

> *"They do things repetitively and its very simple. So, one of them was, for example, just pushing one or two buttons and you do that for 40 minutes. They do a lot of breaks, but it does make it a bit tiring.* –P04

Unclear tasks resulted in dropouts

- **Unclear tasks:** We also analyzed that participants also get confused and restless when the tasks were unclear or they were not familiar with them. There were instances when people started to leave a user study because of unfamiliar tasks.

  > *"It's one hour developing thing. I had a lot of stuff that they had to develop. Sometimes in the middle, they got a little bit confused, and they are questioning stuff. So I had to help them."* –P07

  > *"I could notice that people were becoming restless because they were not familiar with the task and leaving in between."* –P13

Duration

Duration of the study can negatively impact the study

Much like tasks, the duration of a user study can also impact participant attention and the quality of data collected. This can happen in both cases; when the user already knows about the duration and when it takes more time than was informed prior to the user study.

Longer durations resulted in bored and tired participants

- **Longer durations:** can also have an impact on the performance and the quality of data collected. Because of longer durations, participants got bored or tired and stopped performing to their full potential.

  > *"There was one really long one, more than an hour, that was a bit hard and repetitive. I got a little bit bored in the middle. I didn't put much attention into it. I was fired up in the beginning but in the end not so much. The topic was interesting."* –P07

Study took more time than was promised

- **More time than was communicated prior to the study:** This can be problematic. One of our interviewees took part in a study which took double the time than was promised, nonetheless they still completed it. But this can result in annoyed participants who might not participate in future studies because of this.

> *"It was pretty long but I still did it. Because once you start…then you like clock it and then it's already like…maybe it's double the time. But once you start it you already have the commitment … It's like a book. I always finish books even if it's hard, but I have to finish. Otherwise I feel really bad."* –P11

People reluctant to participate in longer studies

As observed through the collected interview data, people were more reluctant to participate in user studies with longer durations.

4.3 Why Do People Participate in User Studies?

People do activities because of extrinsic and intrinsic motivations

Human behavior is driven by different types of motivation, according to the *Self-Determination Theory* by Deci and Ryan. The two most basic types are *extrinsic* and *intrinsic* motivations. *Extrinsic* motivation is driven by external forces to attain some separable outcome such as money or praise. Whereas, *intrinsic* motivation is driven by the inherent satisfactions of doing an activity rather than for some external or distinguishable outcome [Ryan and Deci, 2000].

Participants can also be driven by extrinsic and intrinsic motivations

Similarly, people participating in user studies can be extrinsically motivated to participate in studies maybe because they will get some monetary compensation for their participation. They can also be intrinsically motivated to take part in user studies, for example, experts in the field the user study is being conducted in, people interested in the subject matter of the study, or people helping out someone they already know.

Extrinsic motivation can increase user participation but collected data can be biased

Prior research has shown that incentives, financial or otherwise, tend to increase rates of participation in user studies - however this does create a potential dilemma for researchers as these incentives could otherwise be construed to influence participants' responses or behaviors in negative ways for the research, i.e. telling the researcher what they want to hear rather than fact. Also, important to note is that the rationale of a participant engaging in the research from a perspective of monetary gain would always be different from one whose interest was to help in the research for scientific gain; thus an act of balancing is needed between motivating people to participate in a study and keeping them objective [Fiore et al., 2014].

4.3.1 Extrinsic Motivations

Extrinsic motivation does not always equal valid performance in user studies

While it has been noted that greater rewards incentivizes workers to perform more assignments [Mason and Watts, 2009, Rogstadius et al., 2011], good work quality is not al-

ways the result of this extrinsic stimulus, rather it is depending on multiple factors including how those extrinsic incentives are rewarded as well as intrinsic ones [Ho et al., 2015]. Studies have found that when responsibilities and assignments are given relevance for the worker, they tend to be far more productive in performing them [Ariely et al., 2008, Rogstadius et al., 2011, Shaw et al., 2011, Chandler and Kapelner, 2013].

Participants might participate for reasons other than doing a good job

For monetary gains

Participate to receive monetary benefits

We found out that for some people, monetary rewards are an important factor when deciding to participate. For many studies with a specific inclusion criterion, researchers post advertisements on social media and send out emails using different mailing lists. To tempt people to participate, a lot of the times such advertisements include that they are giving incentives for participants' time and effort. This works for increasing the response rate on that particular study advertisement, but this does not guarantee how much effort a participant is going to put in to the study [Hsieh and Kocielnik, 2016]. Do people just participate for money? Are their insights and feedback truly honest? Some of our interviewees [P01, P03, P07] showed similar concerns when offering money for their studies:

> *"Giving them money, it's like creating a bias. You're paying someone to answer. So, you have a respondent bias there."* –P03

> *"The purpose of having studies that you don't want them to just say positive stuff about you just because you gave them money."* –P07

Monetary incentives are a double-edged sword. They might motivate people to participate in user studies, but they might also compel them to give only positive or coerced feedback.

Crowdsourcing

Crowdsourced studies also provide monetary benefits

Similarly, monetary gains can also be a reason for participation for people who participate in online or remote user studies on crowdsourcing platforms, e.g., Amazon Mechanical Turk[2]. Often online surveys and other user studies that can be done remotely are crowdsourced. Anyone can outsource data validation and research related activities via these platforms. People can choose to participate in these online activities in return for monetary incentives. Talking about doing online surveys, our interviewees said that mostly when they are doing these surveys, they do not pay much attention and click through them. Most of the interviewees we talked to had concerns with this approach because they think that such participants do not really care about the user study, they just want the reward. Prior research has also shown that people participating in crowdsourced studies do more work when the monetary incentive is higher, but they usually do not perform better [Mason and Watts, 2009]. They are not really motivated to put in their best effort while participating in the study. These participants do not feel accountable as there is no one there physically to see what they are doing.

> *"We can do all sorts of very complex surveys today, but people just click through, they don't read it anymore."* –P02

> *"They're quite boring. And when I'm given one, I try my best to answer the questions but at some point, the one it gets too long, I just like to make up the answers."* –P21

> *"If you go with online it's difficult to probe the person and to read their face. We might get more people [through online approach] in terms of quantity and in terms of people who actually reply. In terms of the quality of the replies, it might not be so good."* –P09

People might be guilted into participating

People agree to participate when asked face-to-face or by a friend

As discussed in the previous subsection, it is easier to make

[2] www.mturk.com/

someone agree to participate in a user study by asking them face-to-face. This approach can sometimes compel people to participate maybe because they do not want to seem rude on the spot by not agreeing to take part in the study. People also just say yes when someone in their own social circle asks them to participate in their user study. Many researchers make use of this social contract they have with their friends and peers when recruiting.

> *"Generally, I just approach people directly. I try to do it face-to-face because, ... usually when you approach them directly, they are sometimes at least guilted into helping you. So, it's less easy to say no I don't have time if somebody is standing in front of you."* –P19

> *"I first used the initial circle of friends. And then everybody I knew. And everybody they knew."* –P10

> *"I knew everyone. They were my colleagues from work. And some colleagues from the university"* –P08

> *"I have little experience to people where I don't have any connection to. Even if it's someone I don't know, it's usually a friend of a friend, for example. So, I asked my friends whether they can also ask around their circle. I never actually recruited somebody from outside this circle."* –P19

> *"People usually go because of personal relations rather than being interested in the subject. I faced this a lot."* –P10

Recruiting only students

Students are obligated to participate

Similarly, students might also be guilted into or obligated to participate in user studies conducted by researchers higher in hierarchy than the students. Researchers may exploit this

power dynamic, knowingly or unknowingly, where they ask their students to participate in their user studies, where students might think their only option is to agree to take part in the study. This can also lead to biased results because students might not want to give negative feedback for a system that is authored by someone in a position of power. Many researchers also make it compulsory for students to participate in user studies, e.g., by making it compulsory to pass the course.

> *"Sometimes we do softly force the users to come from our lectures. So, what we say in order to graduate from a lecture you have to participate at least in one user study doesn't mean mine but any. The PHD gets some students and the student gets to experience something."* –P16

> *"I know that some people from the psychology department, the students have to participate in a certain number of studies in order to get credit for those."* –P14

> *"One of my professors made it mandatory [for students] to sign up [for a study]."* –P12

4.3.2 Which Participants Have Intrinsic Motivation?

Participants interested in the field

People interested in the topic lead to good quality data

There's a variety of work being done in HCI which also involves topics that are interesting for the general population, e.g., virtual reality and augmented reality. P08 conducted a user study for AR and had no trouble in finding participants. The trouble she had was to do with too much interest and people wanting to stay longer to try out the cool gadgets. Such participants are intrinsically motivated to participate in user studies that actually interest them. The data collected in such cases is also very useful because they

are motivated out of interest in the topic to perform well throughout the study.

Beginners vs. Professionals

Professionals are more invested in the subject matter

7 out of 21 of our interviewees had experience with recruiting professionals. Professionals are harder to recruit but their insights are more valuable. They are more motivated to take part and actually be invested in the study. Their input is generally of a higher quality and they are more intrinsically motivated to answer objectively, resulting from their motivation to actually be beneficial to the study rather than any extrinsic benefit.

Inclusion criteria might only allow for recruiting professionals

The inclusion criteria for a user study might be a bit restrictive and only allow professionals of a field to be participants. This is tricky because these people are harder to recruit because of reasons including, but not limited to, time. But once you do recruit them, their insights are more valuable than participants who take part in studies for other reasons. P11 conducted research in the energy sector and had to talk to professionals in the field. She observed that such professionals might be difficult to reach but once you do get through, they are more than willing to talk about what they are passionate about.

Tech-oriented people might volunteer to participate

Students or people from within a university can also be passionate about the subject matter of a user study. These people are in general more tech-oriented and they might just participate because of their interest in the subject matter.

> *"I was working with HoloLens . . . It was really fun for everyone. I didn't have to convince them to participate . . . I have had participants who wanted to use it more than was necessary."* –P08

Helping fellow researchers

Empathy makes researchers participate in each other's user studies

Almost all of our interviewees have had participated in user studies conducted by their colleagues. They said that they know the pain of finding and recruiting participants, so to ease this process, they help each other out by participating in each other's user studies. In universities and research institutes, there's a culture of taking part in user

studies conducted by fellow colleagues. This is because researchers already know how difficult it is to recruit participants and they want to help out their fellow researchers. When they do help, they also do not want to waste their time or their colleague's time, so they try to put in their best effort during the course of the user study.

> *"Mostly to be honest, empathy, because I know that if I approach people I'm really happy when they say yes. So, usually when people ask me, if I have the time, I participate."* –P19

> *"My main motivation was always helping those people because I know how hard it is to get users."* –P12

> *"To be honest, the main motivating factor was that when I tried a study and I couldn't get any people to participate in my study, I felt bad. So, I didn't want people to feel that. So, like giving back to the community."* –P13

People want to contribute to research

People who are passionate about research, usually participate just because they want to help the research community in achieving their goals. They feel valuable by participating in user studies as their feedback is given importance and taken into consideration.

> *"I do like to contribute to things that are trying to further research."* –P04

Chapter 5

Recommendations and Limitations

The aim of this research was to find out how HCI researchers were conducting user studies and recruiting participants for user studies, and what problems were they facing while recruiting and conducting user studies. From our findings, we know that researchers face challenges of low recruitment rates and difficulties with finding participants with intrinsic motivations. In this chapter, we have compiled recommendations that might prove to be helpful in recruiting participants, especially the ones who are intrinsically motivated to participate in user studies. In the previous chapter, we established why recruiting participants who are intrinsically motivated better than recruiting participants who are extrinsically motivated. This is because of reasons including better quality of data collected in user studies where participants are intrinsically motivated to participate.

5.1 Recommendations

Suggestions for researchers:

- While extrinsic motivators (like monetary reward)

Try to instill intrinsic motivation

can improve participants' response rate, do try to instill intrinsic motivation in your participants. Intrinsic motivators should be the main recruitment front, with extrinsic motivators playing a peripheral role. This is because intrinsic motivation will improve the participant's involvement and the correctness of her task in the study. You can do this by:

  - telling prospective participants that their contribution matters
  - incorporating storytelling, i.e., tell them about your research, the future you envision and how they can be a part of it

Minimize extrinsic motivators

- Avoid or minimize extrinsic motivators, e.g., monetary incentives. If you must use them (e.g., because your inclusion criteria is rather specific), then consider employing "amount surprises" [Fiore et al., 2014] or give the incentives to the user before the study [Church, 1993] to improve participants' response rate.
  - For surveys, lottery draws are shown to improve participants' response rate [Bosnjak and Tuten, 2001].
  - Extrinsic motivators can also serve as a follow-up recruitment technique. E.g., if you want to do a follow-up interview with a participant, offering them a monetary reward at the end of their initial study will improve the participant's response rate.

- Be honest about:
  - The tasks that the participants will have to do in the user study. (E.g., is the task going to fatigue the participant?)
  - The time it will take to complete the user study. Be conservative with the estimate of the study duration. If the recruiter recruits the participant under false claims (duration, task difficulty), participants may be annoyed during the study and might be reluctant to participate in future user studies.

Participants value honesty

Be conservative when estimating the duration of the user study

Researchers sometimes underestimate the time needed for a user study. They might tell the participant that it would only take 30 minutes of their time but might end up taking more than that. This annoys many people and even if they do not leave, they might not be as motivated as they were in the beginning. Researchers might also think that the tasks are not that difficult or not that tiring but maybe they end up being very repetitive or tiring for some participants. This again might not bode well with some participants and they might not give their hundred percent after some time. Being mindful of the task difficulties and assessing the actual time needed for user studies maybe by doing a few pilot studies and being honest with the participants is a better approach to get better insights/feedback.

- Use formal language in online studies to improve participant attention [August and Reinecke, 2019].

  This study explored how formality of language influences engagement. *Participant engagement* was measure by:

  - Participant attention
  - Dropout
  - Time spent on the study
  - Participant performance

  This was an online study that was conducted through crowdsourcing platforms – Amazon Mechanical Turk (paid) and LabintheWild (volunteer). 369 people participated in these studies. They concluded that formal language improves participant attention in both scenarios, paid and volunteer work.

- Consider the task design:

  - Design tasks to help participants achieve the state of "Flow"
  - Characteristics of such a task [Czikszentmihalyi, 1990]:
    * Concrete goals with manageable rules

    - Balance user skill and task difficulty
    - Provide feedback
    - Minimize distractions
  - Better to have smaller tasks
  - Make tasks more fun
    - Be careful about using gamification techniques, e.g., adding achievements and points, as it might extrinsically motivate participants and might compromise the ecological validity of the research.

Finding participants with intrinsic motivation is great but is not always possible. The extrinsic motivators, e.g., monetary incentives, can lead to higher participation, however this can also lead to ”crowding out” i.e. overriding the participant's intrinsic motivation [Deci, 1971, Osterloh and Frey, 2000, Lepper and Greene, 2015]. The participant could feel that the monetary incentive was too frivolous or even disparaging to them and might not be motivated to participate fully or at all. Conversely, the opposite might happen as in the case of ”crowding in” whereby the monetary incentive might be high enough to assume the main motivational rational for the participant [Frey and Jegen, 2001]. Non-monetary incentives tend to be better at improving the intrinsic motivation of participants without resulting in either ”crowding out” or ”crowding in” while still increasing participation; such recognition of contribution to scientific research [Ling et al., 2005, Cheshire, 2007, Cheshire and Antin, 2008, Raban, 2009]. As mentioned in the previous chapter, it is also important to note that the rationale of a participant engaging in the research from a perspective of monetary gain would always be different from one whose interest was to help in the research for scientific gain; thus an act of balancing is needed between motivating people to participate in a study and keeping them objective [Fiore et al., 2014].

Intrinsic and extrinsic motivations may be balanced, if extrinsic motivation cannot be avoided

5.2 Limitations

Most interviewees were from academia

Most of our interviewees were from academia. We tried

to contact more people working in recruitment agencies to get a better idea of how things are done over there, but the agencies we contacted did not respond. We might have been able to get better insights and understanding of the problem of recruiting if we had a chance of interviewing professional recruiters. We did manage to interview some people from the industry who had either hired recruitment agencies in the past or did recruiting themselves. Our findings are based primarily on the interviews we conducted.

Chapter 6

Summary and Future Work

6.1 Summary and Contributions

Goal – find out recruitment status quo and problems faced

The goal of this research was to understand how HCI researchers recruit participants for user studies and the challenges they face in doing so. We analyzed how prevalent is the problem of recruiting and identified different techniques and strategies that are currently employed by our interviewees in order to recruit users. Using the grounded theory approach, we based our findings on the interviews conducted with 21 researchers from HCI and related fields.

Current workflow of conducting user studies: planning, recruiting, participating

We found the current workflow which is used by HCI researchers to conduct user studies. The workflow starts off with the planning phase where the researcher plans their study, makes decisions about tasks to be involved in the study which influence the duration of the study. They also consider the sample size, inclusion criteria, and the study type and context. In the next phase, recruiting, researchers try to contact the prospective participants through various means, e.g., email, social media, face-to-face. Soliciting strategies can include offering monetary or other incentives for participation which proves to work in many cases. Once the prospective participant agrees to participate, participa-

tion can take place after a time a date is agreed upon.

Main aspects of a user study

The main aspects of a user study were discussed in detail. These aspects impact user participation: relationship with participants, recruitment medium, incentives, tasks and duration.

Different motivations of participants

We also found that people participate in user studies with different intentions and motivations. The extrinsic motivations include: monetary gains, social contract, and obligations. The intrinsic motivations include: interest in the field and technology and contributing to research. Researchers face difficulties recruiting people for user studies; not everyone is motivated enough to participate in user studies and for people who are motivated there is no network in place that can connect people who want to contribute to research with the researchers. We discussed different motivations of people and how that contributes to the data collected in the user study. We shared a few observations and suggestions from the experiences of the people we talked with, hoping to improve our understanding of people's motivations behind participating in user studies. This might help HCI researchers better understand participants and in turn the problem of recruiting.

Recommendations for researchers were compiled

6.2 Future Work

Verify recommendations and get insights from general population

Further research can verify the recommendations by applying them in different scenarios and report further problems they might face. Getting insights from more researchers and industry practitioners about their experiences with recruitment will also help getting a better understanding about this problem. Also, collecting insights from participants not related to HCI or the general population about their reasons behind participating or not participating might pave the way for better recruitment strategies. Studying recruitment strategies in fields like psychology and medicine can also be a part of future work.

Appendix A

Informed Consent Form

PRINCIPAL INVESTIGATOR: Anam Sohail, M.Sc. Media Informatics, RWTH Aachen University Email: anam.sohail@rwth-aachen.de

Purpose of the interview: The goal of this interview is to identify the difficulties faced by researchers in recruiting users for user studies, interviews and/or surveys. Participants will be asked about their experience with recruitment and the challenges they faced. The answers will be recorded and will be used to identify different challenges and difficulties faced in the recruitment process.

Procedure: Participation in this interview requires sharing your experience regarding finding users and answering the questions asked. The interviewer can clarify if some questions need further clarifications or explanations.

The instructor will record the interview (audio only) and may require other relevant material (documents, pictures, etc.). All information will be confidential (See Confidentiality)

Risks/Discomfort: If you become fatigued during your participation in the interview. You will be given several opportunities to rest, and additional breaks are also possible. There are no other risks associated with participation in the interview. Should the interview become distressing to you,

it will be terminated immediately.

Benefits: The results of this interview will be useful for identifying the problems faced by researchers in recruiting users for the user studies.

Alternatives to Participation: Participation in this interview is voluntary. You are free to withdraw or discontinue the participation.

Cost and Compensation: Participation in this interview will involve no cost to you. There will be snacks and drinks for you during and after the participation.

Confidentiality: All information collected during the interview will be kept strictly confidential. You will be identified through identification numbers. No publications or reports from this project will include identifying information on any participant. If you agree to join this study, please sign your name below.

☐ I have read and understood the information on this form.

☐ I have had the information on this form explained to me.

Participant's Name	Participant's Signature	Date

Principal Investigator	Date

Appendix B

Demographic Questionnaire

1. What is your age?

   ☐ 18 - 30 years old
   ☐ 31 - 40 years old
   ☐ 41 - 50 years old
   ☐ 51 - 80 years old

2. What was your subject area in each of the following degrees?
   (Please answer for the degrees you have completed or are enrolled in)

   Bachelor's degree _____
   Master's degree _____
   Doctorate degree _____

3. What is your profession?

   _____

4. How many studies have you conducted?

   _____

5. Have you also participated in user studies? If yes, how many?

   _____

6. Do you have experience with recruitment agencies (for recruiting participants for user studies)?

   ☐ Yes

   ☐ No

7. Have you also conducted iterative/multi-session studies?

   ☐ Yes

   ☐ No

Appendix C

Interview Protocol

The goal of this research is to try and find out more about user recruitment in HCI. We know that user participation is important in HCI but there are issues that HCI researchers face in recruiting people. We want to explore if there is some way we can help the experimenters by identifying the challenges we all face during the recruitment phase and based on that identifying what strategies or solutions might be employed for better success with recruitment. So I will ask questions about the studies you have conducted and participated in.

Questions (for researchers)

- How many user studies/surveys/interviews have you conducted for research purposes?
- What was it about?
- How long did it take?
- How many participants were you initially looking for?
- How many participants actually participated?
- Did you have to give the participants any incentives to participate?

- Did you have to motivate the participants to continue participating in the study (if it was long)?
- Who were the participants (students, adults, etc)?
- What difficulties did you face finding the participants?
- What difficulties did you face convincing the participants to participate?
- Were you able to find relevant/target participants?
- How did you contact the participants initially?

Questions (for participants)

- Did you participate in a user study, interview or survey?
- What motivated you to participate?
- What was it about?
- How long did it take?
- What factors were important for you in deciding to participate in it?
- Would you participate in a study without any incentives?
- Is it important for you to be able to trust the researcher conducting the study to continue participating in it?
- Is it important for you that the research is being conducted in a reputable university or firm?

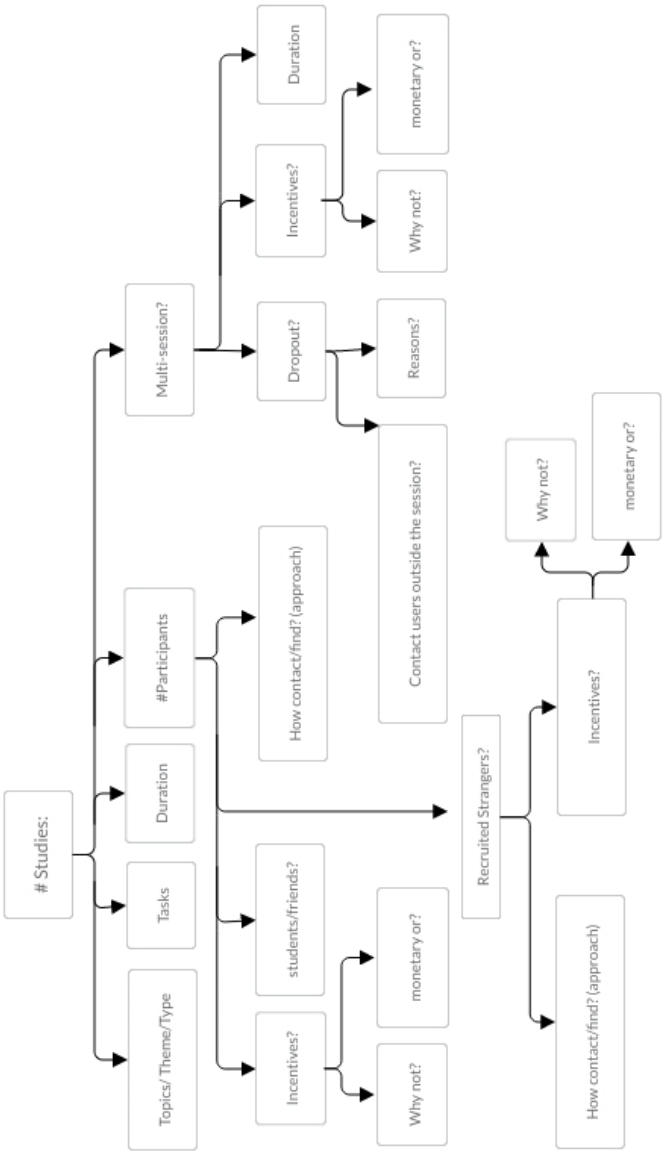

Figure C.1: Interview Questions - Researchers

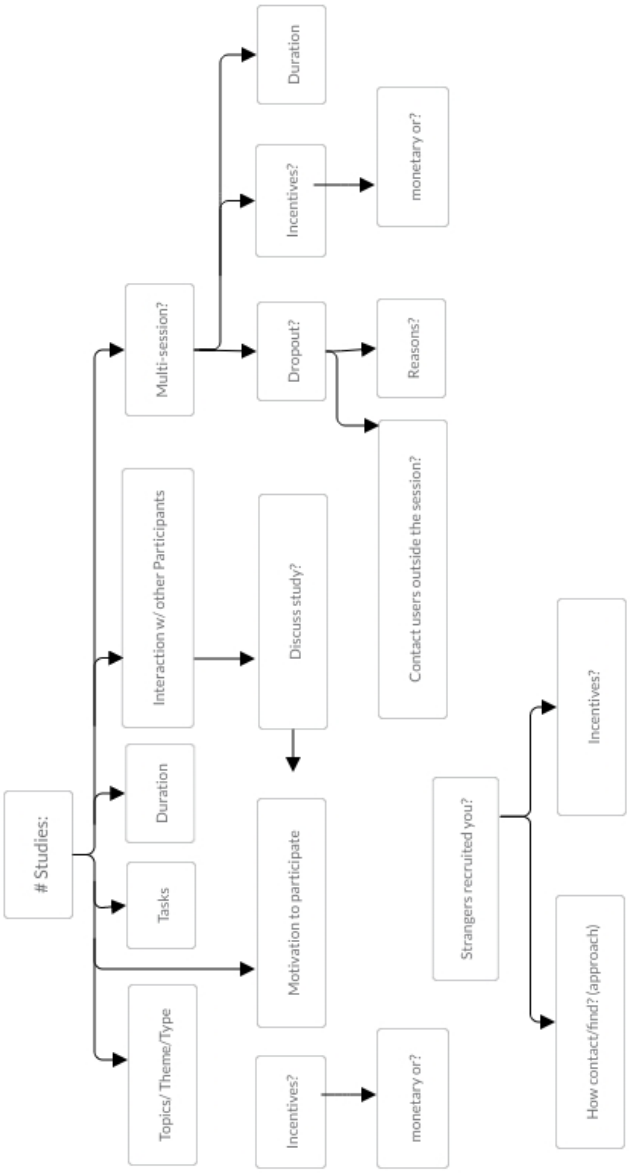

Figure C.2: Interview Questions - Participants

Bibliography

Dan Ariely, Emir Kamenica, and Dražen Prelec. Man's search for meaning: The case of legos. *Journal of Economic Behavior & Organization*, 67(3-4):671–677, 2008.

Tal August and Katharina Reinecke. Pay attention, please: Formal language improves attention in volunteer and paid online experiments. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*, page 248. ACM, 2019.

Louise Barkhuus and Jennifer A Rode. From mice to men-24 years of evaluation in chi. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, pages 1–16, 2007.

Mariette Bengtsson. How to plan and perform a qualitative study using content analysis. *NursingPlus Open*, 2:8–14, 2016.

Jan Bobeth, Stephanie Deutsch, Susanne Schmehl, and Manfred Tscheligi. Facing the user heterogeneity when designing touch interfaces for older adults: a representative personas approach. *NordiCHI 2012 Proceedings*, pages 1–4, 2012.

Jan O Borchers. Worldbeat: Designing a baton-based interface for an interactive music exhibit. In *CHI*, volume 97, pages 131–138, 1997.

Michael Bosnjak and Tracy L Tuten. Classifying response behaviors in web-based surveys. *Journal of Computer-Mediated Communication*, 6(3):JCMC636, 2001.

Matthias Budde, Anja Exler, Till Riedel, Micheal Beigl, and Andrea Schankin. Lessons from failures in designing and

conducting experimental studies: a brief anecdotal tutorial. In *Proceedings of the 2017 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2017 ACM International Symposium on Wearable Computers*, pages 992–999. ACM, 2017.

Moira Burke, Robert Kraut, and Diane Williams. Social use of computer-mediated communication by adults on the autism spectrum. In *Proceedings of the 2010 ACM conference on Computer supported cooperative work*, pages 425–434. ACM, 2010.

Kelly Caine. Local standards for sample size at chi. In *Proceedings of the 2016 CHI conference on human factors in computing systems*, pages 981–992. ACM, 2016.

Dana Chandler and Adam Kapelner. Breaking monotony with meaning: Motivation in crowdsourcing markets. *Journal of Economic Behavior & Organization*, 90:123–133, 2013.

Kathy Charmaz. Grounded theory as an emergent method. *Handbook of emergent methods*, 155:172, 2008.

Coye Cheshire. Selective incentives and generalized information exchange. *Social Psychology Quarterly*, 70(1):82–100, 2007.

Coye Cheshire and Judd Antin. The social psychological effects of feedback on the production of internet information pools. *Journal of Computer-Mediated Communication*, 13(3):705–727, 2008.

Allan H Church. Estimating the effect of incentives on mail survey response rates: A meta-analysis. *Public opinion quarterly*, 57(1):62–79, 1993.

Adele E. Clarke. *Situational analysis: Grounded theory after the postmodern turn*. Thousand Oaks, CA: Sage, 2005.

Christian Corsten, Marcel Lahaye, Jan Borchers, and Simon Voelker. ForceRay. pages 1–12, 2019. doi: 10.1145/3290605.3300442.

Mihaly Czikszentmihalyi. *Flow: The psychology of optimal experience*. New York: Harper & Row, 1990.

Edward L Deci. Effects of externally mediated rewards on intrinsic motivation. *Journal of personality and Social Psychology*, 18(1):105, 1971.

Zoltán Dörnyei. *Research methods in applied linguistics: Quantitative, qualitative, and mixed methodologies*. Oxford University Press Oxford, 2007.

Ilker Etikan, Sulaiman Abubakar Musa, and Rukayya Sunusi Alkassim. Comparison of convenience sampling and purposive sampling. *American journal of theoretical and applied statistics*, 5(1):1–4, 2016.

Andrew T Fiore, Coye Cheshire, Lindsay Shaw Taylor, and GA Mendelsohn. Incentives to participate in online research: an experimental examination of surprise incentives. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, pages 3433–3442. ACM, 2014.

Elizabeth Foss, Allison Druin, and Mona Leigh Guha. Recruiting and retaining young participants: Strategies from five years of field research. In *Proceedings of the 12th International Conference on Interaction Design and Children*, pages 313–316. ACM, 2013.

Bruno S Frey and Reto Jegen. Motivation crowding theory. *Journal of economic surveys*, 15(5):589–611, 2001.

Ulla H Graneheim and Berit Lundman. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse education today*, 24(2):105–112, 2004.

Judith Green and Nicki Thorogood. *Qualitative methods for health research*. Sage, 2018.

Kasper M Hansen and Rasmus Tue Pedersen. Efficiency of different recruitment strategies for web panels. *International Journal of Public Opinion Research*, 24(2):238–249, 2012.

Stephen P Harter. Variations in relevance assessments and the measurement of retrieval effectiveness. *Journal of the American Society for Information Science*, 47(1):37–49, 1996.

Chien-Ju Ho, Aleksandrs Slivkins, Siddharth Suri, and Jennifer Wortman Vaughan. Incentivizing high quality crowdwork. In *Proceedings of the 24th International Conference on World Wide Web*, pages 419–429. International World Wide Web Conferences Steering Committee, 2015.

Gary Hsieh and Rafał Kocielnik. You get who you pay for: The impact of incentives on participation bias. In *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing*, pages 823–835. ACM, 2016.

Faustina Hwang, Simeon Keates, Patrick Langdon, and John Clarkson. Mouse movements of motion-impaired users: a submovement analysis. In *ACM SIGACCESS Accessibility and Computing*, number 77-78, pages 102–109. ACM, 2004.

Hitoshi Kawasaki, Atsushi Yamamoto, Hisashi Kurasawa, Hiroshi Sato, Motonori Nakamura, and Ryuma Kakinuma. An evaluation of method for encouraging participation. In *Proceedings of the 2013 ACM conference on Pervasive and ubiquitous computing adjunct publication*, pages 883–890. ACM, 2013.

Malcolm Koo and Harvey Skinner. Challenges of internet recruitment: a case study with disappointing results. *Journal of Medical Internet Research*, 7(1):e6, 2005.

Sari Kujala and Marjo Kauppinen. Identifying and selecting users for user-centered design. In *Proceedings of the third Nordic conference on Human-computer interaction*, pages 297–303. ACM, 2004.

Jonathan Lazar, Jinjuan Heidi Feng, and Harry Hochheiser. *Research methods in human-computer interaction*. Morgan Kaufmann, 2017.

Mark R Lepper and David Greene. *The hidden costs of reward: New perspectives on the psychology of human motivation*. Psychology Press, 2015.

Kimberly Ling, Gerard Beenen, Pamela Ludford, Xiaoqing Wang, Klarissa Chang, Xin Li, Dan Cosley, Dan Frankowski, Loren Terveen, Al Mamunur Rashid, et al.

Using social psychology to motivate contributions to online communities. *Journal of Computer-Mediated Communication*, 10(4):00–00, 2005.

Aqueasha Martin-Hammond, Sravani Vemireddy, and Kartik Rao. Engaging older adults in the participatory design of intelligent health search tools. In *Proceedings of the 12th EAI International Conference on Pervasive Computing Technologies for Healthcare*, pages 280–284. ACM, 2018.

Winter Mason and Duncan J Watts. Financial incentives and the performance of crowds. In *Proceedings of the ACM SIGKDD workshop on human computation*, pages 77–85. ACM, 2009.

Margit Osterloh and Bruno S Frey. Motivation, knowledge transfer, and organizational forms. *Organization science*, 11(5):538–550, 2000.

Maxine X Patel, Victor Doku, and Lakshika Tennakoon. Challenges in recruitment of research participants. *Advances in Psychiatric Treatment*, 9(3):229–238, 2003.

Daphne Ruth Raban. Self-presentation and the value of information in q&a websites. *Journal of the American society for information science and technology*, 60(12):2465–2473, 2009.

Jakob Rogstadius, Vassilis Kostakos, Aniket Kittur, Boris Smus, Jim Laredo, and Maja Vukovic. An assessment of intrinsic and extrinsic motivation on task performance in crowdsourcing markets. In *Fifth International AAAI Conference on Weblogs and Social Media*, 2011.

Richard M Ryan and Edward L Deci. Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary educational psychology*, 25(1):54–67, 2000.

Johnny Saldaña. *The coding manual for qualitative researchers*. Sage, 2015.

Dianne Schechter, Tracey J Strasser, Christa Santangelo, Eusun Kim, and Jean Endicott. "normal" control subjects are hard to find: A model for centralized recruitment. *Psychiatry research*, 53(3):301–311, 1994.

Aaron D Shaw, John J Horton, and Daniel L Chen. Designing incentives for inexpert human raters. In *Proceedings of the ACM 2011 conference on Computer supported cooperative work*, pages 275–284. ACM, 2011.

Anselm Strauss and Juliet M Corbin. *Grounded theory in practice*. Sage, 1997.

Alexandra Voit, Sven Mayer, Valentin Schwind, and Niels Henze. Online, vr, ar, lab, and in-situ: Comparison of research methods to evaluate smart artifacts. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*, page 507. ACM, 2019.

Cynthia Weston, Terry Gandell, Jacinthe Beauchamp, Lynn McAlpine, Carol Wiseman, and Cathy Beauchamp. Analyzing interview data: The development and evolution of a coding system. *Qualitative sociology*, 24(3):381–400, 2001.

Jacob O Wobbrock and Julie A Kientz. Research contributions in human-computer interaction. *interactions*, 23(3): 38–44, 2016.

Sam Zargham, Janko Ćalić, and David M Frohlich. 4streams: an ambient photo sharing application for extended families. In *Proceedings of the 2015 British HCI Conference*, pages 165–174. ACM, 2015.

Index

Typeset January 2, 2020