

KOÇ UNIVERSITY
GRADUATE SCHOOL OF SOCIAL SCIENCES AND HUMANITIES

Turkish Coffee Fortune-telling Ritual as A Source of Inspiration for Designing Object-mediated Advice Interactions

By
Ahmet Börütecene

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of
Doctor of Philosophy
in
Design, Technology and Society Interdisciplinary Program
(Specialized in Interaction Design)

Koç University

August 2017

KOÇ UNIVERSITY
GRADUATE SCHOOL OF SOCIAL SCIENCES AND HUMANITIES

This is to certify that I have examined this copy of a PhD dissertation by
Ahmet BÖRÜTECENE
and have found that it is complete and satisfactory in all respects, and that any and all
revisions required by the final examining committee have been made.

Committee Members:

Prof. Dr. Oğuzhan Özcan

Asst. Prof. Dr. Tilbe Göksun

Asst. Prof. Dr. Aykut Coşkun

Assoc. Prof. Dr. Kerem Rızvanoğlu

Dr. Ayça Ünlüer

Prof. Dr. Sami Gülgöz

Asst. Prof. Dr. Barış Akgün

DATE: _____

STATEMENT of AUTHORSHIP

This dissertation contains no material which has been accepted for any award or any other degree or diploma in any university or other institution. It is affirmed by the candidate that, to the best of his knowledge, the dissertation contains no material previously published or written by another person, except where due reference is made in the text of the dissertation.

Signed

Ahmet BÖRÜTECENE



ABSTRACT

This dissertation is a collection of papers, written as a result of the studies of an original and completed doctoral research that examined Turkish coffee fortune-telling as an inspiration for designing object-mediated advice interactions. Several studies have been made on advice encounters supported by tabletop displays, yet the potential of handheld devices in enhancing advice interaction still remains open to research. As an attempt to fill this gap in the literature, we chose Turkish coffee fortune-telling, as it is a centuries-old practice of giving advice that is based on the use of a cup and saucer. We organized sessions with 34 fortune-tellers and analyzed their verbal and non-verbal interaction during advice instances. Our analysis resulted in 7 preliminary design considerations. To see how these considerations would be employed in practice, we organized a participatory design workshop which yielded 6 handheld device concepts that proposed stimulating mechanisms for advice interaction (Figure 1, Section 4: Paper A).

Following these first studies, we turned to our cup reading recordings to focus on the fortune-tellers' engagement with the particular form factor of the cup (Figure 1, Section 5: Paper B). Although mugs are familiar social artefacts, there has not been sufficient research on what kind of affordances mugs could offer as tangible interfaces and how people might use them in face-to-face social settings. In this regard, our aim was to identify the characteristics related to the interaction with handheld cylindrical objects as it would also create a basis for an augmented mug prototype that has a cylindrical form factor. Our analysis yielded 11 characteristics reflecting user behavior with cups. A follow-up cross-cultural study served as a first step for understanding the potential generalizability of these findings. Our main contribution in these studies consists of the characteristics we derived and the related potential interaction techniques we discuss for augmented mugs with an inner display. We also contextualize our findings by two scenarios in which the mug is used as a tangible interface in social interaction settings.

Inspired by our characteristics, and the previous studies, we prototyped an augmented mug, the Glance Mug, to support advice-givers in performing opportunistic search in a subtle manner during meetings (Figure 1, Section 6: Paper C). We organized 15 pairs of one-to-one advising meetings between students to see the mug in action and gather user reflections. The user study revealed that the mug has the potential for supporting instant search and affords sufficient subtlety to conceal user actions. Yet, it provoked some anxiety for the users in maintaining eye contact with their partners. Our main contributions are the context-aware mug concept tested in a real-life setting and the analysis through Hornecker and Buur's Tangible Interaction Framework that discusses its design space, and its impact on the users and social interaction.

TEZ ÖZETİ

Bu tez, nesne kullanımına dayalı akıl danışma-tavsiye iletişimi tasarımına bir ilham kaynağı olarak Türk kahve falını inceleyen orijinal ve tamamlanmış bir doktora araştırması çerçevesinde üretilmiş makalelerin biraraya gelmesinden oluşmaktadır. Masa ölçeğindeki ekranlarla desteklenen danışma toplantıları üzerine birçok çalışma yapıldıysa da elde taşınır cihazların bu toplantılara olası katkıları hala araştırmaya açık bir konudur. Literatürdeki bu boşluğu kapatmak amacıyla, bir tür akıl danışma-tavsiye iletişimi olan; kahve fincanı ve tabağını kullanmaya dayalı yüzlerce yıllık geçmişe sahip Türk kahve falı ritüeline yöneldik. 34 falcıyla fal seansları düzenleyip onların tavsiye verdikleri esnadaki sözlü ve bedensel etkileşimlerini analiz ettik. (Figure 1, Section 4: Paper A). Analizimizden 7 tasarım öndeğerlendirmesi ortaya çıktı. Bu öndeğerlendirmelerin pratikte nasıl kullanılacağını görmek için katılımcı tasarım çalıştayı düzenledik. Bu çalıştayda öndeğerlendirmelerimizden esinlenen 6 elde taşınır cihaz konsepti üretildi.

Bu ilk çalışmalarımızı takiben, falcıların kahve fincanının kendine has formuyla girdikleri etkileşime odaklanmak üzere tekrar seans kayıtlarını inceledik (Figure 1, Section 5: Paper B). Kahve bardakları sıkça kullanılan tanıdık sosyal eşyalar olsalar da, bardakların bir arayüz olarak nasıl olanaklar sunacağı ve insanların onları sosyal ortamlarda yüzyüze iletişim içinde nasıl kullanabileceği üzerine yeterince araştırma bulunmamaktadır. Bu bağlamda, hedefimiz, form olarak silindirik olan bir zenginleştirilmiş bardak prototipine de temel oluşturacağı düşüncesiyle elde taşınır silindirik nesnelerle etkileşime ilişkin karakteristikler tespit etmektir. Analizimiz kullanıcıların fincanlarla gösterdiği davranışları yansıtan 11 karakteristik ortaya çıkardı. Bunun ardından yürüttüğümüz kültürlerarası bir çalışma, elde ettiğimiz bu bulguların genelleştirilebilir olup olmadığını anlamaya yönelik bir ilk adım oldu. Bu çalışmalar aracılığıyla yaptığımız ana katkı ortaya çıkardığımız karakteristikler ve bunlarla ilişkili, içinde ekran olan bardaklar için olası etkileşim tekniklerinden oluşmaktadır. Bunun yanı sıra, kahve bardağının sosyal etkileşim ortamlarında elde taşınır bir arayüz olarak kullanıldığı iki senaryo önererek bulgularımızın bir bağlama oturtulmasını sağlamaktayız.

Bu sürecin sonucunda, ortaya çıkardığımız karakteristikler ve önceki çalışmalarımızdan ilham alarak, tavsiye veren kişilere bir toplantı sırasında bilgiye ihtiyaç duydukları anda arama yapmalarına imkan verecek, ve bunu konuştukları kişiye belli etmeden yapabilmelerine destek olacak bir zenginleştirilmiş bardak tasarladık: Glance Mug. Öğrencilerin akıl danışma amacıyla biraraya gelip sohbet etmeleri üzerine kurulu bir çalışma çerçevesinde 15 çift ile birebir toplantılar organize ederek tasarladığımız bardağı gerçek dünyada katılımcılara deneyimlettik ve onların görüşlerini topladık. Çalışma bardağın anında arama yapmayı destekleyecek potansiyele sahip olduğunu ve kullanıcı eylemlerinin dışarıdan anlaşılmasını engelleyecek kadar ince hareketlerle etkileşime elverdiğini gösterdi. Bununla birlikte,

partnerleriyle göz temasını sürdürmek konusunda kullanıcılarda bir endişe yarattığını tespit ettik. Bu çalışmayla ana katkımız; gerçek bir ortamda test ettiğimiz Glance Mug prototipinin yanısıra Hornecker ve Buur'un Dokunmayla Etkileşim Çerçevesi'ni kullanarak bardağın tasarım uzamını, ve kullanıcılar ile sosyal etkileşim üzerinde yaptığı etkiyi tartıştığımız analizdir.



ACKNOWLEDGEMENTS

I would like to thank Prof. Dr. Oğuzhan Özcan for his supervision and constant support throughout my doctoral journey and Asst. Prof. Tilbe Göksun for guiding and motivating me at all times with her invaluable feedback. I thank Asst. Prof. Aykut Coşkun for his helpful critiques regarding theoretical aspects; Prof. Dr. Kerem Rızvanoğlu for his enriching feedback on user studies; and Dr. Ayça Ünlüer for her constructive feedback on various aspects of my project. I would also like to thank Prof. Dr. Sami Gülgöz, Prof. Dr. Zeynep Aycan and Prof. Dr. Morten Fjeld for sharing stimulating thoughts at the initial phase of my phd project. Asst. Prof. Dr. Evren Yantaç gave helpful feedback and support regarding the design activities I conducted during my PhD. I thank Asst. Prof. Dr. Barış Aktemur for his critiques on my work and also Asst. Prof. Dr. Barış Akgün for his comments on my dissertation.

Special thanks go to Sevgi Terzi from Sevgi Café, Ayşegül from Zodiac Café and all other anonymous participants of our studies for their generous support.

I would like to thank Selim Ölçer for his advice on electronic components and providing me materials in difficult times; Muharrem Güler for guiding me in exploring glass materials for my project and Muzaffer Bütün for helping me shape the electronic and solid components right way. I would also like to thank Turgay Ağca from CIT for his support. Ali Vatansever, Çetin Tunca and Onur Gürkan gave kind support by providing me with necessary equipments. I thank Çetin Tunca also for providing me with the props to set up user studies.

I would like to thank Çiğdem Yıldırım and Kamil Yeşiltaş for their support in finding various audiovisual resources from the library; Tuna Dağlı and Seray Nasırlı for helping with our user study in advising context and sharing their experience and thoughts on counselling; Sedef Erçetin and Elif Çeltikçi for their support in finding participants; Rena Polat Korkmaz for providing us with materials complementing this user study setup. Huge thanks go to Tuğçe Şatana, Gülçin Erdiş, Zeynep Coşkun and Elif Yılmaz for their patience and immense support in administrative processes; also to Asiye Bilgin, Selma Akkaya and Zehra Tosun for their kind support in helping organizing the project related events and providing assistance in obtaining necessary materials for classes and workshops.

I would like to thank Elifnaz Yalçınöz, Yağmur Nas and Bilge Eren for their transcription work of the user study videos; Şeyma Taşel, Jiyan Erincik, Ece Kantemir for their invaluable coding of the study videos. I thank Sinan Karaçam for his transcription and motion graphics work for the project; Büşra İzgi, Ekin Akyürek, Alpay Sabuncuoğlu for their efforts in organizing the user studies. I would like to thank Çağlar Genç for his help and support in 3D fabrication of the mug prototypes. I thank all my colleagues from KUAR Design Lab for their support in various activities and stimulating talks.

I thank my parents Sabri B r tecene and Hayr nnisa B r tecene, I always felt their immense support in everything I have done. I thank Osman B r tecene for his enlightening talks; Handan B r tecene for her inspiring stories and support in crafting materials for the prototypes; and Zeynep Sipahi for exciting narrative exchanges. I also thank İlhan B r tecene for supplying fabrics and advising on knitting techniques for the prototypes. And I thank Nevin Doĝan for her presence, precious company, soothing talks and patience. Last but not least, I thank my cat Karabiber that always supported me by sitting around my workspace.



DEDICATION



To my family

LIST OF PUBLICATIONS

Papers included in the PhD dissertation

Paper A: Ahmet Börütecene, İdil Bostan, Tilbe Göksun, Oğuzhan Özcan. (2016). Informing Design Decisions for Advice Mediating Handheld Devices by Studying Coffee Cup Reading. Proceedings of the 9th Nordic Conference on Human-Computer Interaction: Game-changing Design (NordiCHI '16) [h5-index: 16, h5-median: 22, Acceptance Rate: %26]

Paper B: Ahmet Börütecene, İdil Bostan, Gülben Şanlı, Çağlar Genç, Tilbe Göksun, Oğuzhan Özcan. (2017). Coffee Cup Reading as An Inspiration for Looking into Augmented Mugs in Social Interaction. Proceedings of the 19th International Conference on Human-Computer Interaction. Lecture Notes in Computer Science LNCS - (HCII '17). Springer International Publishing. (ISI Index) [h5-index: 21, h5-median: 25, Acceptance Rate: %28]

Paper C: Ahmet Börütecene, İdil Bostan, Ekin Akyürek, Alpay Sabuncuoğlu, İlker Temuzkuşu, Çağlar Genç, Tilbe Göksun, Oğuzhan Özcan. (2017). Through the Glance Mug: A Familiar Artifact to Support Opportunistic Search in Meetings. Proceedings of The Tenth International Conference on Tangible, Embedded, and Embodied Interaction (Submitted to TEI '18) [h5-index: 23, h5-median: 33, Acceptance Rate: %34]

Related Publications not Included in the Dissertation

Paper D: İdil Bostan, Ahmet Börütecene, Oğuzhan Özcan, Tilbe Göksun. (2016). Temporal Expression in Speech and Gesture. Proceedings of the 38th Annual Conference of the Cognitive Science Society (CogSci '16). [Acceptance Rate for Oral Presentation in this edition: %34]

Unrelated Publications not Included in the Dissertation

Paper E: Eric P.S. Baumer, June Ahn, Mei Bie, Elizabeth M. Bonsignore, Ahmet Börütecene, Oğuz Turan Buruk, Tamara Clegg, Allison Druin, Florian Echtler, Dan Gruen, Mona Leigh Guha, Chelsea Hordatt, Antonio Krüger, Shachar Maidenbaum, Meethu Malu, Brenna McNally, Michael Muller, Leyla Norooz, Juliet Norton, Oğuzhan Özcan, Donald J. Patterson, Andreas Riener, Steven I. Ross, Karen Rust, Johannes Schöning, M. Six Silberman, Bill Tomlinson, and Jason Yip. (2014). CHI 2039: speculative research visions. In CHI '14 Extended Abstracts on Human Factors in Computing Systems (CHI EA '14). [h5-index: 83, h5-median: 122, Acceptance Rate: %26] (for this paper 15 future visions have been selected among 33)

TABLE OF CONTENTS

STATEMENT OF AUTHORSHIP	iii
ABSTRACT	iv
TEZ ÖZETİ	v
ACKNOWLEDGEMENTS	vii
DEDICATION	ix
LIST OF PUBLICATIONS	x
TABLE OF CONTENTS	xi
I DISSERTATION	1
1. Introduction	2
1.1 Motivation	4
1.2 Dissertation Outline	5
1.3 Easy Reading Guide.....	5
2. Research Description	6
2.1 Research Questions	6
2.2 Research Methods	9
2.3 Expected Results	12
II INCLUDED PAPERS	13
4. Paper A: Informing Design Decisions for Advice Mediating Handheld Devices by Studying Coffee Cup Reading	14
5. Paper B: Coffee Cup Reading as An Inspiration for Looking into Augmented Mugs in Social Interaction	25
6. Paper C: Through the Glance Mug: A Familiar Artifact to Support Opportunistic Search in Meetings	46
III CONCLUSION	57
7. Research Contributions	58
8. General Conclusions and Future Work	61
9. Bibliography	63

I

DISSERTATION



1. Introduction

Advice giving and receiving are based on a verbal exchange between two people. Everyday we tend to both give and ask for advice in interpersonal communication to provide or receive social support. In this regard, Turkish coffee fortune-telling refers to a conversational advice interaction that occurs by means of a handheld object, that is, the coffee cup and saucer. In this practice, nonverbal interaction also plays an important part as people use their hands to manipulate the cup and saucer, and perform gestures while telling their fortune. We examined this rich traditional practice in detail and explored what kind of design inspirations it would provide for face-to-face advice interactions in diverse settings. Initially, we organized and videotaped coffee cup reading sessions with 34 fortune-tellers. We observed and analyzed how fortune-tellers used gestures, gaze direction and objects in relation to advice messages. As a result of this analysis we derived 7 preliminary design considerations for a potential handheld device to be employed in advice interaction in informal settings. Following this, we organized a participatory design workshop with 16 participants (6 product designers, 6 interaction designers, 4 potential users) to see what kind of design directions our considerations would indicate. In the end we obtained 6 conceptual device prototypes designed for informal advice interaction in social contexts (Figure 1, Section 4: Paper A).

After this first examination, we aimed to explore in detail the fortune-tellers' bodily relationship with the main object of this practice: the coffee cup. Turkish coffee fortune-telling employs the cup itself as the central object during advice giving. It presents a visual content to the fortune-tellers that allow them to create stories and guide the advice interaction. We thought that examining how the fortune-tellers engaged with the cup could inspire us in exploring the potential of an augmented mug to be employed in social contexts as a supportive device for advice purposes. In other words, our aim was to understand whether such an everyday artifact might contribute to enhancing conversational interaction in advice settings. Therefore, in this second analysis, we focused on how fortune-tellers manipulated the cup during the sessions (Figure 1, Section 5: Paper B). As an outcome, we derived 11 characteristics regarding the use of a device with a coffee cup form-factor, which we named Handheld Cylindrical Object (HCO).

After having derived these characteristics, we designed an experiment that imitated the coffee fortune-telling practice (Figure 1, Section 5: Paper B). As objects we used coffee mugs with icons placed inside and asked individuals to construct and tell a story to another person by looking at these. Our intention was to disguise the cultural dimension of the practice and see how people whose native language is not Turkish would behave in such a setting. By doing this, we observed if the participants would demonstrate similar behaviors in relation to our 11 characteristics. Our results indicated a similarity. However, this experiment alone would not be sufficient to prove that our findings are

generalizable to all users. In order to have a ground for such a claim further research is required.

The coffee cups appear as an established and natural artefact for advice settings in social contexts as they are familiar artefacts and companions of social gatherings. This quality makes them considerable as a potential device for social interactions as they might be less disruptive and visible than smartphones or tabletop displays. For our research we also considered the mug as the most suitable artifact for prototyping and conducting user studies in terms of technical feasibility. Therefore, we started working on an augmented coffee mug prototype inspired by the 11 characteristics.

This mug was conceived as a supportive artefact for the advisors in one-to-one meetings. During a meeting, we occasionally come across unknown words or subjects and feel the need to look up a piece of information. This phenomenon is called opportunistic search. Although previous works addressed design issues related to opportunistic search, they are limited to the use of smartphones and tabletop systems [7,15]. However, in some contexts, especially in one-to-one meetings, reaching one's smartphone or tablet might be perceived as a rude or disruptive act because a certain level of attention, interest and participation is expected for the social interaction [3,14]. Moreover, the interlocutors might not want to expose themselves while using their mobile device or doing online search in a conversation. The reason for this can be that of concealing their ignorance or weakness on the subject matter; or their ability to access information, which makes them feel personally empowered [8,15]. As a result, in addition to the need for opportunistic search, a demand for subtle interaction with the artefact also emerges. An augmented coffee mug could enable advisors to perform opportunistic search in a subtle way. The cup form factor is suitable for these contexts as they offer a private space for looking up information that might be displayed on the inner surface of the cup. This space is mostly invisible to the others. Regarding subtlety, as the mug is a familiar object in social interactions (e.g., coffee talks), and is available for handling by nature, it could also offer sufficient cover for subtle interactions with hand gestures.

Thus, we designed a coffee mug, the Glance Mug, with an inner display for dyadic communication that constantly listens to the conversation. It allows the mug owners to do instant search, by performing hand gestures on the object, when they encounter an unknown or unfamiliar conversation content produced by the other interlocutor. Whenever requested, it recognizes a certain interval of the verbal interaction and displays related visuals and descriptions on the hidden screen inside. The mug can be used in two ways in an advice setting. First, having an impression about the topics foreign to the mug owner during the conversation. This might be helpful in providing a coherent and satisfying guidance for the advisee while it would support the advisor in terms of information. Second, having visual or textual stimulation around an on-going discussion, or a question put forward by the interlocutor.

The prototyping was hindered by technical limitations and we could not integrate all the characteristics we had derived into the mug design (e.g., flexible display, mid-air gesture recognition). We presented the Glance Mug prototype to the users in a context where the need for advice giving or receiving might emerge. As an advice setting, we organized encounters between students that were centered around exchange experiences in abroad. The students who have been in an exchange program before were replying the candidate students' questions and they were giving them advice on the experience. With this prototype, our aim was not to create an end product but rather to have an opportunity to observe the hands-on experience of the users with such an augmented mug. The participants appreciated the concept and tried to use the Glance Mug. We observed how the advisor-students used this kind of device, and received feedback on the physical and social challenges related to the use of the mug and on our design, in order to further develop our prototype in an iterative approach. On the other hand, we analyzed the Glance Mug by using Hornecker and Buur's Tangible Interaction Framework [12] to reveal its potential for enhancing social interaction and identify, by the help of the user reflections, challenges and opportunities for the design of augmented mugs (Figure 1, Section 6: Paper C). This framework has been previously used to explore several tangible experiences in social settings [5,9,17,22], including augmented everyday objects [2]. It is composed of 4 different themes that are related to understanding embodied and social aspects of tangible interfaces: (a) Tangible Manipulation; (b) Spatial Interaction; (c) Embodied Facilitation; and (d) Expressive Representation. Each theme is explained in Paper C, and in the Research Methods section in this dissertation.

1.1 Motivation

Turkish coffee fortune-telling motivated us as it represents a traditional example of supportive communication, which is based on a co-located, face-to-face, and object-mediated setting. From an HCI perspective, we consider this centuries-old phenomenon a practice related to tangible interaction and social computing. In this regard, we can think of the cup and saucer as interactive handheld devices; the coffee ground as content; the fortune-tellers and the listeners as users; and the communication between them as advice interaction.

Hence, we were interested in examining how people interacted with these artefacts, and their visual content, and exploring how they communicated with each other, verbally and nonverbally, for advice purposes. Our aim was to derive from this existing advice exchange experience design implications and device concepts to enhance advice interactions. Therefore, in our research, we took this socio-cultural practice as a source of reference and inspiration for the design of handheld devices to be employed in advice settings.

1.2 Dissertation Outline

This dissertation work is composed of 3 parts. The first part consists of 3 sections that describe the research and methods. The second part consists of three papers included in the dissertation. Finally, the third part includes two sections related to the research contributions, and general conclusions and future work.

In the first section, we describe our research subject, the studies we conducted and motivation. In the second section, we share our research questions that guided our studies and describe the methods we followed, with expected results. After the sections that contain the papers, the dissertation ends with the general conclusions alongside the contributions and possible research directions for future work.

1.3 Easy Reading Guide

In order to facilitate the reading, we greyed out the sentences or paragraphs within the included papers that are already mentioned in the the body of the dissertation.

2. Research Description

2.1 Research Questions

As mentioned above, advisory sessions in formal settings have previously been addressed by several studies [10,19,20]. In these works, tabletop systems and large screens were taken into consideration. However, handheld artefacts such as coffee mugs, pens or notebooks that accompany the meetings have not been examined as potential interfaces for advising encounters. Therefore, our main research question in this dissertation is (Figure 1):

RQ: How could we design for face-to-face advice interactions in informal settings in which the advice exchange between two people is mediated by a handheld device?

This question led us to investigate Turkish coffee fortune-telling, a traditional advice giving practice, based on physically manipulating and reading the cup and saucer. In order to examine this practice in detail, we organized fortune-telling sessions to gather empirical data on the fortune-tellers' behavior during advice giving. In searching for potential answers to this overarching question, we came across, in the course of the research, other challenges that formulated sub-questions. One of these was related to the verbal and nonverbal interaction of the fortune-tellers. We first focused on observing their advice messages, and how they used hand gestures, gaze direction and objects. Therefore, our first sub-question was (Figure 1, Interpretation A):

SQ1: What type of advice do fortune-tellers give and how do they manage hand gestures, gaze direction and contact with objects while giving advice messages?

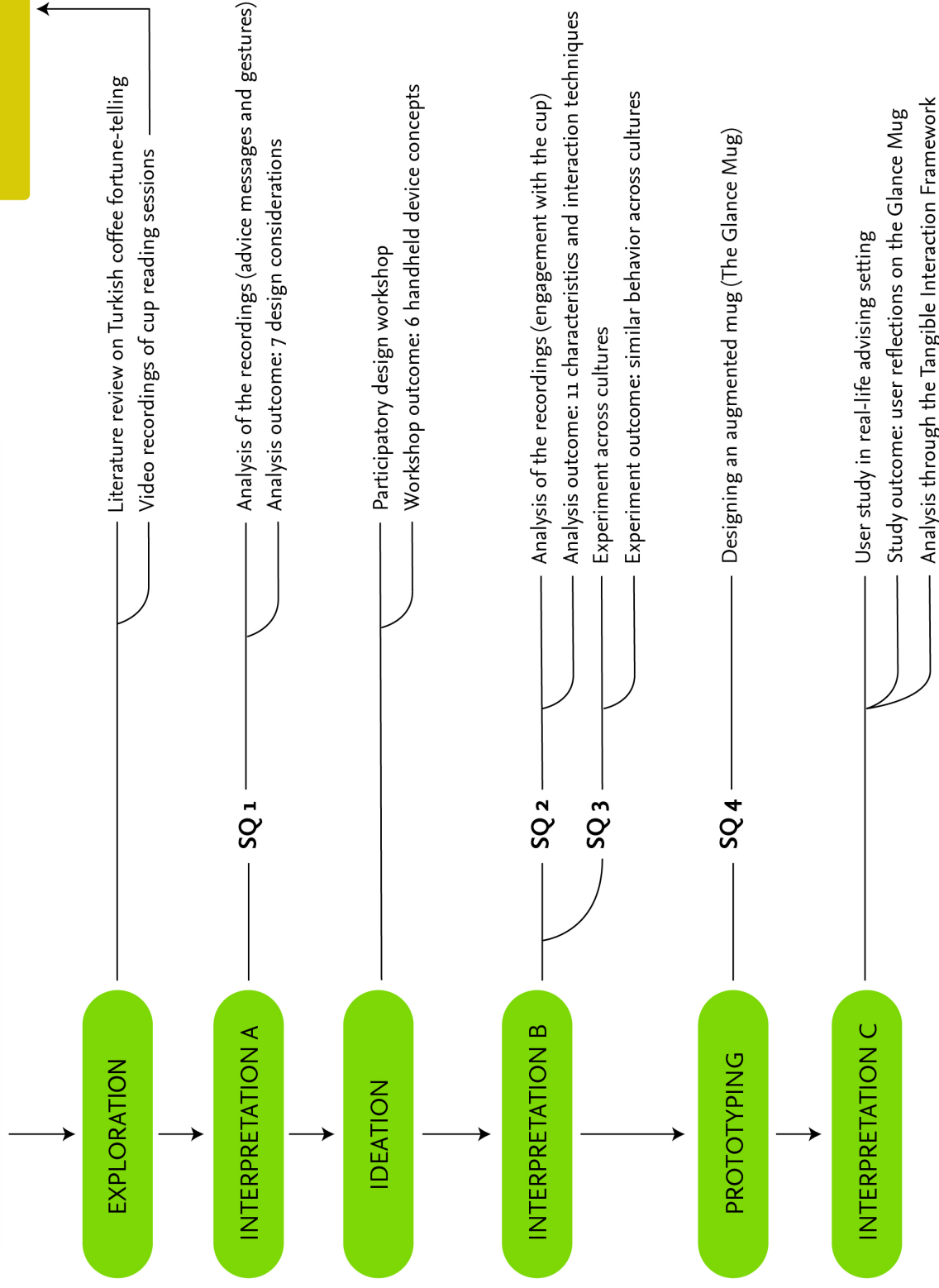
Another sub-question was related to the interaction with the coffee cup. As Turkish coffee fortune-telling is based on engaging mostly with the cup, we also analyzed the ways in which fortune-tellers were manipulating this artefact during the course of their social interaction. This would enable us to explore potential interaction techniques for handheld cylindrical objects that might be the basis for an augmented mug interface. Hence, the second sub-question emerged (Figure 1, Interpretation B):

SQ2: How do fortune-tellers engage with the coffee cup and what kind of nonverbal gestures do they perform on/with the cup during the entire session?

Research Steps, Highlights and Related Publications

Main Research Question (RQ)

How could we design for face-to-face advice interactions in informal settings in which the advice exchange between two people is mediated by a handheld device?



Although we derived some characteristics related to the use of cup-shaped objects by analyzing the video-recordings of the fortune-telling sessions, these characteristics might be connected to the cultural aspects of this practice and could not be generalized. In order to understand this, we designed an experiment in which we tried to remove the cultural characteristics of the cup reading practice by following our third sub-question (Figure 1, Interpretation B):

SQ3: Would people behave the same, and demonstrate the 11 characteristics we derived, if they were exposed to a cup reading practice without any cultural elements attached to it?

After reporting on these questions, we evaluated our previous device concepts and designed an augmented coffee mug prototype, the Glance Mug, inspired by the 11 characteristics we derived for handheld cylindrical objects. Our aim was to understand whether an augmented familiar artefact such as a mug could be used in a face-to-face meeting for advice purposes. The mug as a social object, and the literature related to the challenges in meeting contexts, led us to two concepts studied in HCI: opportunistic search and subtle interaction. Opportunistic search refers to the instant need for information during an activity such as meeting[15]. Subtle interaction refers to the modality in which users engage with the interface by subtle and non-revealing gestures in order to maintain an uncompromised privacy and uninterrupted social interaction [3]. These concepts provided a ground for the dimensions of advice interaction we could support or enhance. In this regard, we designed the Glance Mug to support the advisors in case they would need to look up information during conversation, and to enable them to interact in a subtle manner with the interface and information. Therefore, our fourth sub-question was (Figure 1, Prototyping):

SQ4: Could an augmented familiar object, the Glance Mug, support people in performing opportunistic search and subtle interaction during advising encounters in social settings?

This last sub-question also shaped our Interpretation C phase in which we tested the Glance Mug in a real-life setting to see whether it could actually support the users. Additionally, we analyzed the mug concept and the user reflections through Hornecker and Buur's Tangible Interaction Framework to reveal the Glance Mug's potential for enhancing social interaction and identify challenges and opportunities for the design of augmented mugs, and similar augmented everyday objects (Figure 1, Interpretation C). Above mentioned research questions guided our studies and helped us to structure and complete the phases of the doctoral research.

2.2 Research Methods

Rather than departing from the current technological advancements in the first place, we studied a traditional practice, Turkish coffee fortune-telling, to get inspiration for advice interaction systems. Investigating cultural phenomena is an accepted approach in HCI [11,21]. In other words, instead of adopting a technology-oriented approach, we assumed a culture and vision-oriented one. In so doing, we followed a path similar to that of Design Thinking [6]. We can divide our research process into 6 main phases: Exploration, Ideation, Prototyping and three Interpretation phases (Figure 1).

Exploration

In the exploration phase, we studied the literature on Turkish coffee fortune-telling to understand how this advice interaction system works, the interaction between fortune-tellers and clients, and the relationship of fortune-tellers with the cup and the saucer [4,18]. As this socio-cultural practice represents a popular way of counselling, not only in Turkey but also in several other countries, by offering an opportunity to speculate, and share opinions, on one's past, present and future life [1,13,16], it was a suitable interaction space to probe deeper.

In order to examine this phenomenon in a more detailed manner, we planned a fieldwork. As the coffee fortune-telling is practiced almost everyday in Turkey, and there are even fortune-telling cafes, we had the opportunity to conduct a study in real-life settings. Observing the actual sessions was important to have a reliable and realistic account of the practice. It also enabled us to have video-recording of the interlocutors' interaction in order to draw up a detailed qualitative and quantitative analysis. We therefore organized and videotaped coffee cup reading sessions, to examine the fortune-tellers' verbal and nonverbal interaction both with their clients, and the artefacts specific to the practice (Figure 1, Section 4: Paper A).

Interpretation A

Once sufficient data had been collected, all speech in the video recordings was transcribed into written format by native Turkish speakers. For our first study with these recordings, we created a coding scheme to analyze the fortune-tellers' nonverbal behavior during the advice instances. We identified the moments in which they were giving direct and indirect advice messages (e.g., "You should go there"). In addition, we wanted to understand what kind of gestures they performed (e.g., deictic, iconic, manipulative), how they managed their gaze direction (e.g., at the cup, interlocutor) and how frequently they contacted the objects (e.g., holding the cup, the saucer, both hands free). By coding these nonverbal behaviors, we derived design considerations that could inform the design of handheld devices for advice interactions (Figure 1, Section 4: Paper A). These considerations were later employed in the participatory design workshop we organized, in which we explored novel device concepts.

Interpretation B

In our second study, we solely focused on the physical manipulation of the coffee cup - the main artefact of the fortune-telling practice - during the whole session (Figure 1, Section 5: Paper B). We assumed both qualitative and quantitative approaches in our coding. After watching all the videos, we identified two main categories of bodily engagement with the cup during interaction: manipulative gestures and positioning of the cup. For the first category, we coded how fortune-tellers handled the coffee cup and what kind of actions they performed on and with it. For the second, we coded how the participants approached the cup and where they most engaged with it in the space around them. Two researchers coded six participants (30% of the data), discussed conflicts and the rest of the coding was completed based on agreed terms.

As a follow-up to the second study, we also conducted an experiment across cultures (Figure 1, Section 5: Paper B). By conducting this study, we observed whether people would still reflect the 11 characteristics found in the previous study when they were not exposed to the cultural dimension of the Turkish coffee fortune-telling ritual. The traditional practice is based on two main components: examining the coffee ground on the inner surface of the cup and constructing a narrative on someone's life based on this content. In designing the experiment, we imitated this underlying structure, but did not mention the cultural name and roles associated with it, that is, fortune-telling and fortune-tellers. Instead, we defined this narrative structure as a personal storytelling experience. Thus, we entitled the experiment as “Storytelling in Interpersonal Communication” and described it as a study on the role of storytelling between students in the campus. In addition to this experimental setup, we included a group of non-Turkish individuals by recruiting native English speakers alongside native Turkish ones, as narrators. These participants were asked to compose and tell a story, by looking at the symbols placed inside a mug, in which the protagonist was the listener. We coded the video recordings of the sessions according to the categories we used in our first study (manipulative gestures and positioning of the cup).

In these studies, our empirical approach provided us with sufficient material to explore the practice in depth in terms of advice interaction as well as physical engagement with the artefacts. These studies enabled us to propose design considerations for potential handheld devices to be employed in advising encounters and consequently provided us with design directions for ideation.

Ideation

We organized a participatory design workshop in order to see how the design considerations derived from our coding and analysis of the video recordings could inspire the designers and potential users in producing stimulating device concepts for advice interaction (Figure 1, Section 4: Paper A). We can refer to Design Thinking for the steps we followed to guide the workshop. We started by describing to the participants the conditions of the advice interaction to be

considered during the workshop. These conditions were deliberately mentioned as they were corresponding to the interaction setting we examined in our study on Turkish coffee fortune-telling. Therefore, as the discovery and interpretation phase the participants studied the face-to-face and co-located advice encounters a) between two people; b) occurring in a non-institutional and informal setting; c) taking place while sitting at the table; d) and based on the use of handheld objects. We also introduced our preliminary design considerations, however, we did not mention coffee fortune-telling neither disclose our research on the phenomenon. Following this, we asked them to generate as many ideas as possible for a conceptual handheld device without considering technological or form factor boundaries for the described setting. We then asked them to work on prototyping their selected idea(s). As a result, we obtained 6 device concepts. These workshops allowed us to observe the potential users' approach to advice interaction. We analyzed these concepts and tried to understand what kind of devices could contribute to such an interaction for advice purposes.

Prototyping

The last phase of our research process consisted of creating and developing a prototype inspired by our design considerations and workshop outputs. We wanted to deploy a tangible device concept in a real-life advice setting to gather user reflections about the experience. After reflecting on the device concepts, underlying design considerations and potential advice settings, we decided to build an augmented coffee mug, the Glance Mug, for a one-to-one advising meeting context (Figure 1, Section 6: Paper C). To see this mug in action and gather feedback to understand if users could really employ it during meetings, we decided to make an experience prototype. Experience prototyping [4] is a useful way for exploring design ideas and in communicating design concepts as it allows both designers and users to experience the system themselves. We adopted a scenario based on advising encounters according to the students' exchange program experience we had previously set up.

Our motivation for prototyping a mug was related to its direct connection with the essential artefact of the fortune-telling practice, the coffee cup, in terms of its form factor and being a social object. In relation to this, we considered the mug as a suitable artefact for advice interactions as it is commonly used in meeting settings. Another reason for which we chose the mug was that developing the device concepts which had been proposed during the workshop would have exceeded the temporal limits of the doctoral research, due to technological challenges. Therefore, we kept the features of the Glance Mug as minimal as possible to put our device concept in use, which enabled us to see the design challenges and opportunities in a rapid manner.

Interpretation C

In order to test the Glance Mug, our experience prototype, we designed a study by organizing 15 minutes one-to-one meetings at the university in which

two students talked about the experience of going abroad as an exchange student (Figure 1, Section 6: Paper C). We recruited 30 participants and organized 15 pairs of one-to-one advising meetings in a real-life setting. Our main aim in conducting this user study was to understand what people would think of the interaction mechanism and opportunities that the Glance Mug proposed, and whether they could use it while interacting with another person in a social setting. Following the study, we analyzed the Glance Mug by using Hornecker and Buur's Tangible Interaction Framework. This framework is composed of 4 different themes that are related to understanding embodied and social aspects of tangible interfaces: (a) Tangible Manipulation; (b) Spatial Interaction; (c) Embodied Facilitation; and (d) Expressive Representation. **Tangible Manipulation** refers to the bodily interaction with physical objects equipped with computational resources, that is, the users are able to control the computation by directly manipulating objects. **Spatial Interaction** refers to the fact that tangible interfaces occupy real space in the world and the users interact with them by moving in real space. **Embodied Facilitation** refers to the physical and procedural structure of tangible interfaces that influence user actions and behavior, and consequently shape social configurations. **Expressive Representation** refers to how digital functions and data are physically represented in tangible interaction, often implemented by combination of materials and digital elements. Our analysis yielded 4 salient traits of our mug prototype that incorporate the challenges and opportunities that would shed light on the design of similar augmented mugs for supporting co-located social interaction.

2.3 Expected Results

The expected results for this dissertation are:

- Identifying verbal (advice messages) and nonverbal behavior (gestures, gaze, contact with objects) during the fortune-telling sessions
- Deriving design implications based on the analyses of these behavior for handheld interfaces
- Proposing device concepts based on the design implications for advice settings
- Identifying the fortune-tellers' interaction styles with the coffee cup and deriving characteristics to inform the design of handheld cylindrical objects
- Understanding the effect of the cultural aspects of the cup reading practice on the gestures performed with/on the cup
- Proposing and testing a working prototype
- Receiving user reflections on interaction with the prototype
- Understanding challenges and opportunities presented by the prototype
- Understanding how the prototype could support advice giving by enabling the users to perform opportunistic search in a subtle way
- Identifying the characteristics regarding the design space of the augmented mugs, and of similar augmented everyday objects, designed for social interaction

II

INCLUDED PAPERS



4. Paper A:

Informing Design Decisions for Advice Mediating Handheld Devices by Studying Coffee Cup Reading

Ahmet Börütecene, İdil Bostan, Tilbe Göksun, Oğuzhan Özcan. (2016). Informing Design Decisions for Advice Mediating Handheld Devices by Studying Coffee Cup Reading. Proceedings of the 9th Nordic Conference on Human-Computer Interaction: Game-changing Design (NordiCHI '16) [h5-index: 16, h5-median: 22, Acceptance Rate: %26]



Informing Design Decisions for Advice Mediating Handheld Devices by Studying Coffee Cup Reading

Ahmet Börütecene¹, İdil Bostan¹, Tilbe Göksun², Oğuzhan Özcan¹

Koç University, Istanbul, Turkey

{aborutecene13, idbostan, tgöksun, oozcan@ku.edu.tr}

ABSTRACT

Several studies have been made on advice encounters supported by tabletop displays, yet the potential of handheld devices in enhancing advice interaction still remains open to research. As an attempt to fill this gap in the literature, we chose Turkish coffee fortune-telling, as it is a centuries-old practice of giving advice that is based on the use of a cup and saucer. We organized sessions with 34 fortune-tellers and analyzed their verbal and non-verbal interaction during advice instances. Our analysis resulted in 7 preliminary design considerations: *single-hand interaction, beat gestures to augment advice messages, body as a reference point, different ways of sharing information, manipulating objects to soften advice messages, multiple advisor profiles and regulating gaze interaction*. To see how these considerations would be employed in practice, we organized a participatory design workshop which yielded 6 handheld device concepts that proposed stimulating mechanisms for advice interaction.

Author Keywords

Advice interaction; coffee culture; fortune-telling; co-located interaction; handheld devices; cylindrical displays.

ACM Classification Keywords

H.5.2 User Interfaces.

INTRODUCTION

Advice is present in our daily life in various contexts. In this research, we consider the definition of advice as “recommendations about what might be thought, said, or done to manage a problem” which is believed to be the most frequent single type of communication in supportive interactions [7, p1]. We tend to both give and ask for advice in interpersonal communication to provide or receive social support. Yet, advice-giving situations in informal settings [18,p7], such as meeting with a friend at a coffeehouse to ask for advice, have not been investigated comprehensively in HCI. Existing research on advice interaction is limited to

workplace as it addresses how information technology (IT) artifacts, specifically tabletop systems, could support formal advice interactions in institutional settings such as financial advice encounters [10,22,24]. Compared to institutional settings, the informal encounters are mostly marked by spontaneous social interaction that is unfolding according to the problems, mood, personality and expectations of the advisee, which are not always obvious or predictable. Therefore, establishing a helpful communication can be socially and emotionally demanding for the advice-givers as they have no reference except the conversation itself to interpret the situation of the advisee. We think that IT artifacts might present novel ways for advice-givers to confront such challenges in these settings. In this regard, however, the mediation of tabletop displays or large screens for face-to-face communication might be less common or undesirable in informal settings (e.g., home, cafes, pubs). Although smartphones are pervasive, they are not devices conceived to support co-located interactions [9]. Yet, familiar objects intrinsic to these places like coffee mug that people handle regularly, or sometimes play with on purpose to reinforce their verbal discourse, can be worth examining as they might assume a role in mediating conversations, in our case advice interactions.

These differences between two advice settings, and our literature review, guided us in formulating our research problem: how could we design for face-to-face advice interactions in informal settings in which the advice exchange between two people is mediated by a handheld device? *More specifically, what could be the elements to consider in designing for an advice mediating handheld device to be used in such a setting?* In approaching this design challenge, we considered that Turkish coffee fortune-telling practice, that one comes across almost everyday in Turkey, might trigger us as a source of reference and inspiration [27]. Investigating cultural phenomena and practices have been considered in HCI as a fruitful resource to exploit existing mental models of individuals and explore new metaphors for tangible interaction [12, 26]. Turkish coffee fortune-telling motivated us as it represents a traditional example of supportive communication, which is based on a co-located, face-to-face and object-mediated setting, just as the challenge suggests. From an HCI perspective, we can think of the cup and saucer as interactive handheld devices; the coffee ground as content; the fortune-tellers and the listeners as users; and the communication between them as

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than the author(s) must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from Permissions@acm.org.

NordiCHI '16, October 23 - 27, 2016, Gothenburg, Sweden

Copyright is held by the owner/author(s). Publication rights licensed to ACM.

ACM 978-1-4503-4763-1/16/10...\$15.00

DOI: <http://dx.doi.org/10.1145/2971485.2971523>

¹ Koç University – Arçelik Research Center for Creative Industries (KUAR)

² Department of Psychology

advice interaction. In this regard, how fortune-tellers handle and manipulate the cup and saucer, and their way of reading the coffee ground inside these objects have the potential to propose a stimulating vocabulary of interactions. Thus, we conducted fortune-telling sessions to understand if this cultural practice could provide any feedback for a potential handheld device for advice interaction. As the practice revolves around fortune-tellers' continuous interaction with the cup and saucer in various ways, and they cover the role of advice-giver, we focused on them in our study and kept the listeners constant across participants. Our aim was not to replicate or renew the traditional advice-giving practice but rather to explore its interaction mechanism that might help us to inform design decisions for advice mediating handheld devices.

In this paper, we first introduce and provide the context of Turkish coffee fortune-telling practice. Then, we report our empirical study by providing an account of how fortune-tellers, as advice-givers, manipulated objects, delivered advice messages, performed gestures and directed their gaze in interacting with the listener. We discuss how these behaviors and actions could inform the design of handheld devices for advice interaction by presenting preliminary design considerations and sharing the outcomes of the participatory design workshop we conducted.

IMPORTANCE OF TURKISH COFFEE FORTUNE-TELLING FOR ADVICE INTERACTION

In Turkey, this socio-cultural practice is a traditional form of advice giving. It is quite popular among people from all ages and is a common daily social activity. On one hand, there is a population quite interested in having their cup read by friends or relatives. On the other, there are special coffeehouses called "fortune-telling cafés" that offer readings to customers and where many people practice fortune-telling as a profession. As a matter of fact, there is no official document that certifies their level of expertise, or what they practice as a profession. However, the fortune-tellers working at these cafés are perceived by people as "specialists" or "professionals".

This cultural practice transforms the coffee from a type of drink into an object that mediates a conversation. The coffee ground in the cup is believed to bear traces related to the life of the person who has drunk the coffee, and the practice is based on "reading" this ground and talking about the past, present and future life of this person. Although, fortune-telling is usually associated with foreseeing the events to come, the practice is not limited to that [1,4,21]. Studies indicate that fortune-telling is perceived as a way to seek social support and advice in different societies [16,19,28]. During Turkish coffee fortune-telling practice fortune-tellers discuss the state of various aspects such as emotions, friends, relationships, education, family etc. They tend to express their opinions on these, ask questions and give advice on problems in order to provide insight to one's life and personality. Turkish coffee fortune-telling practice

involves two people: the fortune-teller and the listener. The initial steps and cup reading in a typical Turkish coffee fortune-telling session are as follows (Figure 1): (1) The person drinks the coffee until there is only the residue left in the bottom. (2) Then, the saucer is placed on the cup; the cup is handled in this configuration and turned around three times. (3) Then the cup is turned upside down and placed on the table. This shapes the coffee ground inside the cup and extends it on the saucer. (4) When the bottom of the cup cools down, the fortune-teller starts the session by lifting and reading the cup. (5) By examining first the coffee ground inside the cup and then on the saucer the fortune-teller tells the person's fortune.



Figure 1. The initial steps (1,2,3) and cup reading (4,5) in Turkish coffee fortune-telling practice

Basically, the fortune-teller looks at the stains that the coffee ground created inside the cup, interprets them, construct the fortune-telling discourse and convey messages related to the life of the listener. Some shapes the coffee ground creates are signs that have fixed meanings. For example, a fish means good fortune; a snake refers to enemies; a camel indicates wealth and so on [3,p104]. However, they are open to diverse interpretations and the fortune-teller can use these meanings or interpret the shapes differently according to the listener.

EMPIRICAL STUDY: INVESTIGATING TURKISH COFFEE FORTUNE-TELLING PRACTICE

Procedure

In order to observe this traditional practice we organized fortune-telling sessions. Each fortune-telling session was composed of a fortune-teller, a listener and the researcher. The fortune-teller and the listener were sitting at the table facing each other. The fortune-teller was telling the listener her fortune by reading the cup and saucer she used to drink the coffee on location. The sessions were held at various coffeehouses around the city, or at similar places within the university campus. There was no limit to the duration of the session and the average duration of each session was around 10 – 15 minutes. Before each session the fortune-tellers were asked to complete an informed consent form and a questionnaire with demographic questions. We used a cover research subject in the form to avoid participant bias and told people that we aimed to examine "Fortune-telling scenes in Cinema" and compare real-life fortune-telling sessions with those in films. The sessions started with the fortune-teller reading the cup of the listener. When the fortune-teller was finished with the cup, she was moving onward by reading the saucer. When the reading of the saucer was completed, the session ended. The sessions were video recorded by the researcher sitting at approximately

150-200cm from the table, with an iPhone 4. A small tripod was also used in order to obtain a stable image and give freedom to the researcher to observe and take notes during the sessions. The camera was positioned to frame the hands, arms and faces of both participants to record the body movements. In small locations we used wide angle lens. The video recordings were 720p video files that provided sufficient image quality to identify and examine our coding categories, including changes in gaze direction. For a clear audio the conversations were recorded by an iPad placed on the table. These audio files were later synced with the video recordings for the transcription and analysis.

Participants

We conducted the study with two groups of fortune-tellers. The first group consists of individuals that were telling fortune occasionally only as a social activity at meetings with friends or colleagues. We called them Occasional Fortune-tellers. The second group consists of individuals that were practicing fortune-telling regularly at coffeehouses as a service on payment. We called them Regular Fortune-tellers. We considered the existence of these configurations as a promising variety. In order to encompass and evaluate the whole range of possible interaction styles that this practice could offer, we included both of these fortune-teller profiles in our sample. In the end, we conducted fortune-telling sessions with 34 people who were knowledgeable in fortune-telling and have been practicing it in different contexts.

Fortune-tellers: 34 people participated in the study as fortune-tellers. Among them 16 were Regular Fortune-tellers and 18 were Occasional Fortune-tellers. In the group of Regular Fortune-tellers there were 12 females and 4 males ($M_{age} = 38.4$, $SD = 9.4$). In the group of Occasional Fortune-tellers there were 15 females and 3 males ($M_{age} = 22.4$, $SD = 2.1$). We recruited the Regular Fortune-tellers by contacting fortune-telling cafés. The Occasional Fortune-tellers were recruited among undergraduate/graduate students.

Listeners: Two female university students, one 22 and the other 23 years old, were selected to participate in the fortune-telling sessions. These participants were selected among female individuals who were undergraduate/graduate students and passionate about fortune-telling. Only one listener participated in each session and had her cup read by a fortune-teller. The purpose for recruiting two listeners was to schedule more sessions in a shorter time.

CODING SCHEME

Our literature review [1,3,21,27], pilot fortune-telling sessions and preliminary view of all the recordings gathered from the study guided us in identifying the components to focus on for the coding and analysis of the data. Regarding the verbal interaction, identifying advice messages to mark the advice instances was fundamental. By doing this, we wanted to see what type of advice the fortune-tellers

delivered in order to observe if their nonverbal behavior with the cup and saucer changed according to their advice strategies. Therefore, our first component was *advice messages*. The fortune-tellers' hand movements were fundamental as they were an inseparable part of their discourse [20] and nonverbal interaction, with or without the cup and saucer. Consequently, our second component was *hand gestures*. How the fortune-tellers directed their gaze was another component that would provide information on their connection with the listener and the cup and saucer. Hence, our third component was *gaze direction*. The fortune-tellers' physical engagement with the cup and saucer, that is, how they get into contact with these objects and position them around, was of interest to us. This way, we wanted to understand if they tended to engage with these objects frequently or not, as well as how. Thus, our fourth component was *contact with objects*. In summary, we identified 4 components for coding: *advice messages*, *hand gestures*, *gaze direction* and *contact with objects*.

Advice Messages

We first transcribed the dialogues to identify the advice messages and mark the advice instances in the sessions. We searched for phrases that contained recommendation(s) by examining the use of linguistic features [11,17] recorded in the transcription. We coded these as advice messages and classified them into two types: *direct* and *indirect advice*. These indicated two types of advice-giving strategies that the fortune-tellers used. *Direct advice* consists of recommendations expressed with imperatives or modal verbs of obligation as in "Talk to him" or "You should go there". *Indirect advice* is the expressions that imply a recommendation by using a milder language as in "If I were you I wouldn't do that". By coding *Advice Messages* component, we wanted to analyze the advice strategies in order to see if they provoked a change in the way the fortune-tellers used the cup and saucer, or gaze direction.

Hand Gestures

Gestures, in particular meaningful ones including hand movements, have a significant place in embodied cognition theory since they help connect and transmit language and thought [2, p502]. We examined the fortune-tellers' spontaneous hand gestures with and without the cup and saucer, and types of gestures employed. We also looked at the frequency of all gestures performed by one hand or both hands. Then, we focused on the kind of gestures the fortune-tellers performed. Within the category of communicative gestures which do not involve handling or manipulation of objects, we followed McNeill's categories [20] and coded the gestures as *deictic*, *iconic*, *metaphoric* and *beat*. *Deictic gestures* are used to indicate an object, as in pointing at the table with the index finger. *Iconic gestures* reflect the objects' shapes and their relationship with each other. For example, when we give directions on the street we explain the way by moving our hand from left to right. *Metaphoric gestures* are used to convey abstract concepts, and metaphors used in language. The role of

gestures in this case is to express the abstract thought in a concrete manner with the aim of facilitating the mental imagery for both the speaker and the listener. *Beat gestures* are short and quick movements that accompany the rhythm of the speech. They are used to mark the words and reflects the structure of a narrative discourse. To these categories, we added *manipulative gestures* [13,15,23], which are related to objects such as moving, touching, twirling and shaking the cup or saucer. By coding *Hand Gestures* component, we aimed at revealing the the fortune-tellers' hand preferences (single-hand or double-hand) and analyzing the types of gestures to inform the design of potential interaction techniques for handheld devices to be used in advice interaction.

Gaze Direction

As managing eye contact is considered as an important behavior in interpersonal communication for reflecting self-confidence and trust in front of the other [5,6,17] as well as for regulating cognitive load, we wanted to see the fortune-tellers' use of gaze direction during advice-instances. During the interaction there were five possible spots where they might direct their gaze: *cup*, *saucer*, *listener*, *environment* and *other*. The *cup* and *saucer* refer to the gaze directed at the principal objects of the fortune-telling practice. *Listener* refers to the body of the person that was the target of advice messages. *Environment* refers to the gaze directed elsewhere, outside the space where the advice interaction occurs such as walls, windows etc. *Other* refers to the gaze directed at nearby objects such as pen, notebook and tarot cards. By coding *Gaze Direction* component, we expected to reveal if the fortune-tellers focused their attention on the cup and saucer, and how frequently, during advice instances.

Contact with Objects

We examined how the fortune-tellers approached the cup and saucer, and how they handled them. During advice giving the fortune-tellers held or positioned the cup and saucer in different states. We coded the different states that these objects assumed in the sessions. We identified four categories of object state for the cup and saucer as they were: a) *held on the table*; b) *held in mid-air*; c) *left untouched on the table* and d) *when the saucer was held above the cup*. The first two categories indicate the moments in which fortune-tellers held the cup or saucer. Holding refers to the state of keeping the object in the palm of one's hand with or without manipulating it. The third category indicates that fortune-tellers held neither the cup nor the saucer so their hands were free. The last category is a special case as a fortune-teller always has to place the saucer above the cup, at least for a while, to avoid the coffee ground from dripping down from the saucer down on the table. By coding *Contact with Objects* component, our aim was to analyze how frequently the fortune-tellers contacted the cup and saucer, and in which state, as well as to observe if the contact changes according to the advice strategy in use.

RESULTS

Once data was collected, every instance of speech in the video recordings was transcribed into text by native Turkish speakers. We coded and analyzed how the fortune-tellers manipulated objects and used advice messages, gestures and gaze in interacting with the listener. Coding was done by one of the authors who is experienced in linguistic and gesture research areas. We present the results under the 4 categories according to the components explained in the previous section: *advice messages*, *hand gestures*, *gaze direction* and *contact with objects*.

Advice Messages

We identified 151 advice messages in total. Among the 34 fortune-tellers 5 did not give any advice. In the analysis, we excluded these 15% of the fortune-tellers from our sample. All fortune-tellers gave mostly direct advice: 83% of all the advice messages they used reflected direct advice, while they only used indirect advice 17% of the time (Table 1).

Advice Type	Advice Messages
Direct advice	83.39%
Indirect advice	16.61%

Table 1. Types of advice employed by the fortune-tellers

Hand gestures

All fortune-tellers preferred to produce gestures with one hand while communicating advice messages (86% *single-hand* vs. 14% *double-hand*), $t(28)=3.72$, $p=0.001$.

Hand Preference	Gestures
Single-hand	85.96%
Double-hand	14.04%

Table 2. The fortune-tellers' hand preference for gesturing

Gestures that do not involve handling of objects such as pointing, iconic and beat gestures, in other words communicative gestures, were also used more than manipulative ones (%82.51 *communicative* vs. %17.49 *manipulative*), $t(28)=4.24$, $p=0.001$.

Gesture Types	Gestures
Iconic	7.62%
Deictic	6.73%
Metaphorical	9.42%
Beat	58.74%
Manipulative	17.49%

Table 3. Gestures performed by the fortune-tellers

These results indicate that fortune-tellers mostly used one hand only and preferred free-hand gestures in communicating their advice (Figure 2).

Gaze Direction

We found that all the fortune-tellers changed their gaze direction according to the type of advice messages they used (Table 4). In giving direct advice messages fortune-tellers tended to spend more time talking while their gaze was directed at the face of the listener (53%). However, in giving indirect advice messages fortune-tellers tended to focus their gaze on the cup (47%) and saucer (22%).



Figure 2. Screenshot from an experiment recording. Listener on the left; fortune-teller on the right.

Gaze Direction	Direct Advice	Indirect Advice
Cup	22.26%	46.94%
Saucer	13.14%	22.45%
Listener	53.28%	16.33%
Environment	5.84%	6.12%
Other	5.47%	8.16%

Table 4. Gaze behavior during direct and indirect advice

Contact with Objects

In engaging with objects we noticed a particular distinction between Regular Fortune-tellers and Occasional Fortune-tellers (Table 5). During the communication of advice messages Regular Fortune-tellers held the *coffee cup* 19% of the time and the *saucer* 35% of the time. In the remaining 47% of the time they used free-hand gestures. In other words, they did not engage with the cup and saucer for half of the advice instances. In contrast to Regular Fortune-tellers, Occasional Fortune-tellers held the cup 54% of the time and held the saucer 34%. Only 11% of the time did they leave the objects on the table. Therefore, the free-hand situation frequency was significantly different between Occasional Fortune-tellers and Regular Fortune-tellers (47% vs. 11%), $t(27)=2.92$, $p < 0.01$.

Contact with Objects	Regular Fortune-tellers	Occasional Fortune-tellers
Holding the cup	18.75%	54.4%
Holding the saucer	34.66%	34.4%
Both hands free	46.59%	11.1%

Table 5. Showing how the fortune-tellers engaged with objects

DISCUSSION OF THE STUDY

We derived the following preliminary considerations for the design of handheld devices to be used in advice interaction. We provided the rationale based on our findings under each consideration:

Precedence to Single-hand Interaction

Designers should consider that advice-givers use mostly single-hand whenever they manipulate the objects or perform freehand gestures. Therefore, the handheld device should allow input from single-hand gestures and it should offer a space that would not hinder free-hand gestures used for expressing oneself in social interaction.

Above consideration is based on Table 2 and 3. Table 2 shows that the fortune-tellers preferred using single-hand gestures, whether their hand was empty or manipulating an object. In addition, Table 3 shows that the fortune-tellers used mostly communicative gestures. We can explain this preference by the narrative nature of fortune-telling. Fortune-tellers look at the cup and saucer, interpret the coffee stains, build a narrative around them and transform it into a discourse. In doing this, as the results suggest, they do not benefit only from verbal language but also from expressive hand movements. However, holding the objects with two hands gives no room for producing communicative gestures, that is, expressive freehand gestures. Therefore, the fortune-tellers tended to hold the cup or saucer in one hand so that the empty hand was ready for gestures to communicate the discourse. Regarding the double-hand gestures, we can say that employing both hands might give the advice-givers more freedom to express themselves as it is possible to perform also simultaneous gestures by using empty hands together. However, this would interrupt the contact with the cup and saucer, which might not always be preferable as they represent the source object of advice. When it comes to manipulative gestures, using both hands could be preferred to rotate and revolve a cup-shaped handheld device, as in our study, to examine the contents in a careful manner.

Beat gestures as an input to augment advice messages

Designers should benefit from beat gestures by exploring their function of highlighting speech and helping memory, and integrate it into the device to augment advice messages.

This consideration is based on Table 3, which shows that more than half of the gestures produced by the fortune-tellers were beat gestures. Beat gestures are rhythmic or repetitive hand movements. We believe that the frequent use of beat gestures are linked to emphasizing advice messages and increasing their memorability [25]. In addition, they are considered as a sign of feeling competent about the subject matter.

Whole body as an extension of handheld devices

Designers should consider the potential of connecting the body and the handheld device for advice-giving. They might introduce wearables and smart textiles as a part of advice interaction. For example, bodies can become interactive spaces where advice messages can be projected.

The consideration above is derived from Table 3 as well, which shows that during giving advice messages the fortune-tellers used few deictic gestures. Interestingly, among these pointing gestures 53% of them referred to the body of the listener or that of the fortune-teller. 27% of them referred to tarot cards or a notebook. Only 20% referred to the saucer. In other words, the fortune-tellers used deictic gestures mostly to point at bodies, but not at the objects. This means that the coffee ground in the cup and saucer is not the only representative of the listener but the listener's body is a reference point as well. Therefore,

the body, alongside the objects, appears to be a significant reference point for gestures in advice interaction.

Different ways of sharing information

Designers should recognize the information sharing preference of advice-givers and consider the effect of different form factors of handheld displays (curved vs. flat) on this behavior.

Also this consideration is based on Table 3. We see the deictic gestures used by the fortune-tellers suggest that they did not prefer to disclose the content of the cup during advice instances. However, they pointed at the saucer to show what they saw. This behavior seems to have a relation with the form factor of the objects. The saucer is slightly arched but has a flat surface. The small cup is shaped like a cone and is marked by a cylindrical surface. The inner surface of the cup that holds the coffee ground is most easily seen by whom handles the cup. The form factor of the cup might make it more demanding to show the inner surface. The saucer instead offers an open and flat surface therefore it presents a more exposed surface respect to that of the cup. This might have rendered easier for fortune-tellers sharing the images they saw inside the saucer with the listener.

Handheld devices as a tangible support to soften advice messages

Designers should consider how the existence of an interactive object would support the advice-giver in softening advice messages. Slight touch or movements applied on the device that do not seem as commands might be an important input for the device in advice-giving situations.

The consideration above emerged when we examined the manipulative gestures performed by the fortune-tellers. We noticed a particular use of hand movements. We can compare it to a phenomenon in linguistics: the words employed to soften strong expressions are called *hedge devices*. For instance, instead of “You should talk to him!”, one says “*Just* try talking to him”. Hedge words are used in advice interactions to mitigate the oncoming advice [14]. We observed that this linguistic phenomenon demonstrated itself also in the way the fortune-tellers used objects. Among the manipulative gestures employed, 28% of them were related to softening the advice by contacting objects such as touching the cup for a short time or moving it slightly (Figure 3). The data indicates that the fortune-tellers used one-third of their manipulative gestures for mitigating the advice messages. These suggest that fortune-tellers tend to soften the impact of their advice on the listener not only by playing with words but also by playing with the objects. This behavior might be linked to reducing face threat in interpersonal communication, which is an important part of social communication [4]. The short touches and slight movements applied on the cup and saucer creates an implicit and tacit interaction between the fortune-teller and listener. This also demonstrates that the

presence of the objects could function as a tangible aid in advice interaction.

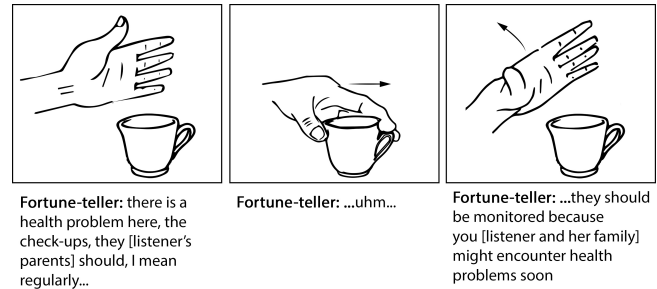


Figure 3. Fortune-tellers move objects slightly, or touch them, to soften advice messages

Individual differences in engaging with objects

Designers should consider the existence of multiple advice-giver identities and approaches, and the resulting non-verbal behavior. The handheld device should be responsive both to the confident and the inexperienced.

This consideration is connected to the results in Table 5, which indicates that Regular Fortune-tellers contact objects less frequently than Occasional Fortune-tellers. In other words, Regular Fortune-tellers tended to give more importance to use free-hand gestures in communicating advice. This result was particularly important for us as it demonstrated the usefulness of including both fortune-tellers profile in the experimental design. This way, we were able to reveal more than one approach in the fortune-tellers' engagement with objects. Previously we stated that the Regular Fortune-tellers are perceived as “experts” as they practice fortune-telling as a profession and read more cups than the Occasional Fortune-tellers. Playing with other objects during speech can be interpreted as being nervous or not feeling confident [8] therefore keeping the cup and saucer in hand during the advice instances could compromise the “specialist” and “expert” image of the Regular Fortune-tellers. The result indicates that there is more than one advice-giver profile and each one might have a level of confidence and experience of their own. Behavior and needs of each might dictate different design decisions. Welcoming diverse approaches and identities emerges as an important point in designing for advice interaction.

Regulating gaze interaction

Designers should take into account that in a potential interactive system mediating advice, the feedback should not be invasive and interrupt the natural flow of gaze interaction. In this regard, different kinds of feedback in the same device might also be considered according to the level of experience or confidence of the advice-giver (i.e. haptic feedback for the experienced and visual feedback for the inexperienced). As the gaze is not always directed at the object, the device should allow input/output also in eyes-free mode.

The consideration above is related to the results of our gaze direction analysis in Table 4. It shows that the fortune-

tellers tended to look at the face of the person with whom they communicated while they were giving direct advice. In other words, when the fortune-tellers were confident about their advice they maintained eye contact most of the time with the listener. This data supports previous research on the effect of eye contact with the other interlocutor as a sign of competence and credibility [17]. The previous research shows that financial advisors dedicated considerable amount of time looking towards their clients during advice encounters supported by tabletop display [10]. Our study demonstrates that also in the context of using handheld objects the same behavior occurs. However, in giving indirect advice the fortune-tellers tended to move their gaze towards the cup or saucer rather than the face. In other words, if advice-givers are inexperienced, or not confident enough about their advice, they tend to direct their gaze at the source object rather than the face. Another point to consider regarding gaze interaction, and also hand gestures, is that they are related to cultural behavior as well and therefore their use might differ across cultures. In summary, a potential handheld device should be responsive to the changes in nonverbal behavior caused by different advice strategies and cultural approaches.

PARTICIPATORY DESIGN WORKSHOP

To observe what kind of device concepts, themes and settings the design considerations we obtained could trigger in practice, we organized a participatory design workshop by recruiting 16 people: 6 interaction designers, 6 product designers and 4 potential users. We created 6 groups: 4 of them were made of 3 people selected from each circle of participants. As 2 potential users renounced in the last moment, the remaining 2 groups were composed of an interaction designer and a product designer. Although the lack of two potential users created a numeric difference in terms of group members, it did not alter the flow of the workshop. Interaction designers and product designers were practitioners and fundamental for the workshop as we wanted to see how they would interpret our design considerations in practice and transform them into interactive system prototypes. In recruiting potential users, however, we did not ask for a specific background, as everyone was a potential user in the study since the advice interaction in question was not institutional (i.e., financial, legal or medical advice). Yet, we preferred those engaged in different fields respect to the other two participant profiles to maintain diversity during the group discussions.

We can refer to Design Thinking for the steps we followed to guide the workshop. We started by describing to the participants the conditions of the advice interaction to be considered during the workshop. These conditions were deliberately mentioned as they were corresponding to the interaction setting we examined in our study on Turkish coffee fortune-telling. Therefore, as the discovery and interpretation phase the participants studied the face-to-face and co-located advice encounters a) *between two people*; b) *occurring in a non-institutional and informal setting*; c)

taking place while sitting at the table; d) and *based on the use of handheld objects*. We also introduced our preliminary design considerations however we did not mention coffee fortune-telling neither disclose our research on the phenomenon. Following this, we asked them to generate as many ideas as possible for a conceptual handheld device without considering technological or form factor boundaries for the described setting. Then we wanted them to work on prototyping their selected idea(s).

Workshop Outcomes

Concept No.1: A ball-shaped object for personal use that supports an individual in giving advice by allowing her to share own experiences and memories related to the similar problems faced by the advisee (Figure 4). The concept aims to strengthen the advice by showing evidence from one's own life. The object is based on a layered structure, which unfolds in form of leaves as the conversation goes on. These leaves behave as small displays that show visuals related to personal experiences of the advisor. The object slowly assumes a flower-like shape in the course of interaction. *This "blooming" is regulated by the advisor, and the level of acquaintance between the interlocutors is determined according to hand gestures and other data recognized from the sensors. The mechanism benefits from beat gestures as a way to highlight an important point on the leaves by tapping. Moving this personal object towards the advisee is considered by the group as a way to soften advice messages.* Regarding this, they stated that sharing a personal artifact with the other demonstrates trust and thus sincerity or belief in the advice.

Concept No.2: A turn-based advice exchange system based on the hourglass metaphor (Figure 4). Both interlocutors have a small cup-shaped object. Their form is similar to that of the two recipient parts of an hourglass. In the beginning of the conversation the cups of both sides are placed on the table upside down. *Both sides talk in turns by grasping the cup and whispering into it. Then to transmit what is told inside, a question, problem or advice, the cup is placed on the other interlocutors' cup, which creates an hourglass structure. In accordance with the metaphor, the content in the advisee's cup flows into the advisor's cup. In the end the advisor turns the hourglass structure upside down to grasp and brings it close to the body, specifically to the ear to listen to the cup now filled with the advisee's message.* This concept tries to regulate the advice exchange by introducing in a face-to-face interaction, which is by nature a synchronous communication, a turn-based character to regulate the advice exchange. *On one hand, this aims to prevent both sides to interrupt their talk and on the other it allows to maintain the characteristics of a co-located interaction as it allows eye contact and gestural interaction during talking/listening.* During the ideation process this group also sketched an alternative concept which was an artifact in form of pyramid inspired by fortune-telling practice. We considered this approach particularly interesting and supportive to our research as the participants

regarded, and tried to benefit from, coffee fortune-telling as an advice-giving experience, too, although we did not disclose our research on the phenomenon.

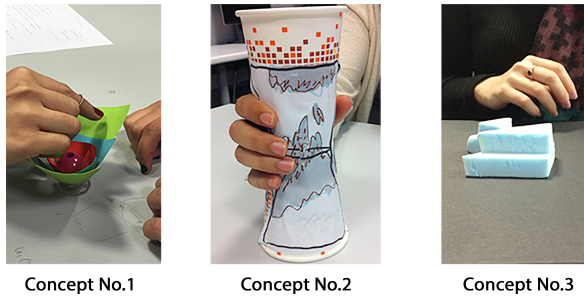


Figure 4. Concept No.1, Concept No.2 and Concept No.3

Concept No.3: A concept on creating mutual empathy by allowing the exchange of emotions and rational thoughts in advice interaction (Figure 4). It is a game based on the use of two different pieces, one for each interlocutor, that unite and becomes a single object when both sides reach a consensus. *These pieces are capable of recognizing the gestures, voice and biofeedback of both the advisor and the advisee.* They help both sides track the communication in progress. Once put on the table, they position themselves closer to each other or viceversa according to the data received from the sensors. *The aim of the concept is to provide a support to the advisor in evaluating the advice situation and guiding the interaction.* One piece, made of hard material, represents reason while the other, of flexible structure, represents emotion. The scenario used for the concept was about a relationship in crisis. If an emotional approach is expected from the advisee, the advisor handles the emotion object and gives advice, for example, by focusing on the feelings, sentimental state of the partners. During the interaction the advisor might also want to take the reason object in hand to highlight the importance of rational behavior according to the case. *The pieces also warn the advisor by vibration whenever a situation arises that requires softening the advice message or general approach in advising. So the pieces in this concept, like the cup in coffee fortune-telling, assign a certain role to the advisor and become an instrument to understand and guide the interaction.*

Concept No.4: An object that resembles a claw is conceived to support verbal expressions by the material changes of its inner surface (Figure 5). *It is equipped with various sensors to track biofeedback of the interlocutors. By using this claw with one hand, the advisor can grasp or rub the other person at various body points and transmit in a way a haptic discourse.* The concept is inspired by hand movements, specifically touch gestures, that some Turkish women employ while talking to each other. Some of these are used to express encouragement, warning or to highlight an argument in the conversation. *This object is supposed to accompany the advisor and help strengthen the discourse by providing a tactile impression to the body of the advisee*

of what is being advised. The inner surface assumes different material characteristics according to what is told. For example, if the advisor talks about difficulties ahead or a moment of crisis in the past, the inner surface of the claw becomes softer to lessen the negative effect of the discourse.

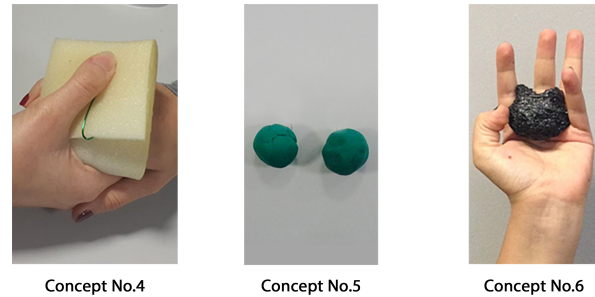


Figure 5. Concept No.4, Concept No.5, Concept No.6

Concept No.5: The concept aims to aid in creating awareness of the advisee's sensibility regarding the privacy or the range of topics to be discussed (Figure 5). It is inspired by stress balls and based on the use of two small balls equipped with sensors, one by each interlocutor. *The ball held by the advisee recognizes hand gestures, body temperature, blood pressure. For example, when the advisee is feeling embarrassed he plays around with the ball, which warms up the ball held by the advisor. This informs the advisor of the emotional reaction of the advisee regarding a statement or question.* This system might help a person talk about difficult subject matters in face-to-face advice settings. In this regard, we can say that this concept assumes a kind of diminished reality as an approach.

Concept No.6: A small charcoal-like personal object that increases self-confidence to engage in supportive interaction with complete strangers (Figure 5). It concerns situations in which a person thinks that someone is emotionally in a difficult or stressful moment. Train journey was used as a scenario for the concept where the passenger in front of the person has a quarrel on the phone. Then this person approaches to provide support to the passenger. In these moments advising and convincing someone requires skill and experience. *The concept particularly aims to support people with low self-confidence and inexperienced in advice-giving.* The objects is conceived as a personal artifact, like a necklace or bracelet, that is not intimately known to the others. *The object, held inside the palm, guides the owner in advice-giving by conveying the emotional states of the stranger as vibrations or color codes.* The owner can customize what emotion each color corresponds to so that the stranger does not know about their meanings. Interestingly, also this group mentioned fortune-telling: they used it as an analogy to describe that the object "reads" the emotional state of the advisee as a fortune-teller reads a coffee cup.

DISCUSSION OF THE WORKSHOP

Our expectation from the workshop was not to find the right design but rather to see a range of design possibilities

explored by empirical data. In this sense, it was encouraging to see that our considerations presented stimulating directions for the participants in exploring the design possibilities for advice mediating handheld devices. Although they could not integrate every consideration into their concepts, they took into account all of them and created meaningful system prototypes in the sense that they provided us a space to discuss the role of handheld devices specific to advice settings.

An important contribution of the concepts proposed in the workshop was a series of themes and settings for advice interaction. As themes they dealt with *maintaining privacy*, *emotional support*, *creating mutual empathy*, *sharing personal experiences* and *improving self-confidence* in advice-giving. In other words, they focused on creating a device that allowed for an advice interaction based on providing emotional support rather than information. In this regard, the groups had a tendency to benefit from the bodily cues to provide the emotional and mental state of the advisees. Therefore, biofeedback emerges as an important aspect of a potential handheld device for advice exchange. We can list the settings the workshop groups came up with as follows: *augmenting non-verbal cues in social gatherings between women*; *enabling supportive communication in public transports, such as in train journeys*; *triggering conversation among strangers in public spaces such as coffeehouses*; and *facilitating supportive dialogue between friends in various places*. The settings proposed by the participants demonstrate that our design considerations are not limited to the advice interaction in Turkish coffee fortune-telling and can be extended to other advice-giving situations. For instance, a concrete use case could be that of browsing and interpreting the lifelog/quantified-self data of the advisee by a handheld device which might trigger new forms of conversation and advice interaction. Moreover, although we obtained our design considerations by analyzing the interaction with the cup and saucer, the participants produced device concepts that have different form factors respect to these. This shows that the considerations did not limit them to think within a certain form factor.

All the concepts used single-hand interaction as the primary input method. In relation to changing the tone of strong advice messages the participants thought of a kind of haptic discourse by using tactile metaphors: in Concept no.4 the inner surface of the claw was becoming softer to mitigate the negative effect of a message. Regarding beat gestures, Concept no.4 proposed an interesting approach. Even though beat gestures are performed with freehands, the same group combined these with grasping gesture applied on the hand. For example, the advisor could perform a beat gesture while holding the hand of the advisee with the claw. Holding a hand and shaking it gently is perceived in Turkey as a gesture to encourage/calm the other person. The group thought that using the claw object, with the help of the changing tactile quality of the inner surface, could augment

this existing gesture, which they interpreted as a beat gesture. Here we see that the cultural aspect of gestures is important in advice interaction as they allow the advisor to convey subtle messages. The handheld device can be designed to augment such gestures by the help of haptic technologies. Two concepts included the whole body in the design. For Concept no.2 the ear is a fundamental element for the advisor to hear the messages. Concept no.4 behaves almost as an extension of the body as the claw becomes somehow attached to the hand. The other projects did not include the whole body in the interaction. However, nearly all the concepts tended to consider biological data an important element in the device. The participants preferred multimodal interfaces for their concepts by integrating touch gestures with palm and fingers, mid-air gestures for around-device interactions, and voice input. However, we noticed that no concept used gaze as an input method. Although we mentioned gaze interaction among our considerations, the concepts did not include it in the interaction as an expressive element. This is interesting as the concepts highlighted the importance of emotional support and the eye was not considered as a biological data.

CONCLUSION

In this paper, we reported our research on designing handheld devices for face-to-face advice-giving situations in informal settings. Our contributions are as follows: (1) studying for the first time a traditional form of object-mediated advice interaction, Turkish coffee fortune-telling practice, as a source of inspiration to inform design decisions for advice mediating handheld devices. Our approach and framework could be an example for similar studies based on cultural practices; (2) 7 preliminary design considerations derived from the empirical study of this cultural phenomenon; (3) participatory design workshop guided by these considerations that proposed themes, settings and 6 handheld device concepts.

The concepts demonstrated that the emotional dimension of advice interaction in social contexts is important and thus the participants tended to use biological data in designing the devices. Therefore, sensors that enable biofeedback from the advisee to the advice-giver are an important element of potential handheld devices for advice settings. However, the input and output modalities for this feedback presents challenges in terms of design and ethics. On the other hand, we found that handheld devices can be used to augment or re-interpret culture-specific gestures. We also noticed that the participants did not consider gaze as an input method in their devices. We believe that the findings of this research contribute to discussion on the role of handheld devices for advice settings in a more informed manner. As future work, we aim to build upon these conceptual prototypes and evaluate their usefulness in real advice-giving scenarios. As we mentioned in the discussion of our findings, the use of gaze and hand gestures might differ from culture to culture. Conducting cross-cultural studies to investigate this point would help us understand

better their generalizability. This way, we also expect to test further the validity of our design considerations.

ACKNOWLEDGMENTS

We thank the anonymous fortune-tellers in our study for their generous support, and the participants in the workshop for their time and feedback. We thank Sabri Börüteçene for drawings in Figure 1-2. We also thank Jiyan Erincik, Şeyma Taşel, Ece Kantemir, Yağmur Nas, Sinan Karaçam, Elifnaz Yalçınöz and Bilge Eren for their help in transcribing and coding the data.

REFERENCES

1. Aphek, E., & Tobin, Y. (1990). *The Semiotics of Fortune-telling*. John Benjamins Publishing.
2. Autumn, H.B., Alibali, M.W. (2008). Visible embodiment: Gestures as simulated action. In *Psychonomic Bulletin & Review* 15, 3, 495-514.
3. Ayvazoğlu, B. (2011). *Turkish Coffee Culture. A Cup of Coffee Commits One to Forty Years of Friendships*. Ministry of Culture and Tourism Publications.
4. Brown, P. & Levinson, S.C. (1987). *Politeness: Some Universals in Language Usage*. Cambridge University Press, Cambridge Cambridgeshire; New York.
5. Doherty-Sneddon, G., Bruce, V., Longbotham, B.S., & Doyle, C. (2002). Development of gaze aversion as disengagement from visual information. *Developmental Psychology* 38, 3: 438-445.
6. Doherty-Sneddon, G., & Phelps, F.G. (2005). Gaze aversion: a response to cognitive or social difficulty? *Memory & Cognition* 33, 4: 727-733.
7. MacGeorge, E.L., Feng, B., & Thompson, E.R. (2008). "Good" and "Bad" Advice: How to Advice More Effectively. In *Studies in Applied Interpersonal Communication*, Michael T. Motley (ed.). SAGE Publications, California, United States, 141-165.
8. Goman, C.K. (2008). *The Nonverbal Advantage: Secrets and Science of Body Language at Work*. Berrett-Koehler Publishers, San Francisco, California.
9. Lundgren, S., Fischer, J.E., Reeves, S., & Torgersson, O. (2015). Designing Mobile Experiences for Collocated Interaction. *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing*, ACM, 496-507.
10. Heinrich, P., Kilic, M., Aschoff, F., & Schwabe, G. (2014). Enabling Relationship Building in Tabletop-supported Advisory Settings. *Proceedings of the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing*, ACM, 171-183.
11. Herring, S., Stein, D., & Virtanen, T. (2013). *Pragmatics of Computer-Mediated Communication*. Walter de Gruyter.
12. Horn, M.S. (2013). The Role of Cultural Forms in Tangible Interaction Design. *Proceedings of the 7th International Conference on Tangible, Embedded and Embodied Interaction*, ACM, 117-124.
13. Hoven, E., & Mazalek, A. (2011). Grasping gestures: Gesturing with physical artifacts. *AI EDAM* 25, Special Issue 03: 255-271.
14. Jan, J.M., & Pung, W.C. (2014). Women's online strategies in giving advice. In *Recent Trends in Social and Behaviour Sciences*, Ford Lumban Gaol, Seifedine Kadry, Marie Taylor and Pak Shen Li (eds.). CRC Press, 141-144.
15. Kendon, A. (2004). *Gesture: Visible Action as Utterance*. Cambridge University Press, Cambridge ; New York.
16. Kissman, K. (1990). The role of fortune telling as a supportive function among Icelandic women. *International Social Work*, 33(2), 137-144.
17. Kleinke, C.L. (1986). Gaze and eye contact: A research review. *Psychological Bulletin* 100, 1: 78-100.
18. Limberg, H., & Locher, M.A. (2012). *Advice in Discourse*. John Benjamins Publishing.
19. Long, S.O., Roberts, G.S., & Kawano, S. (2014). *Capturing Contemporary Japan: Differentiation and Uncertainty*. Honolulu: University of Hawaii Press
20. McNeill, D. (1992). *Hand and Mind: What Gestures Reveal about Thought*. University of Chicago Press.
21. Naskali, E.G. (2011). *Türk Kahvesi Kitabı*. Kitabevi Yayinlari, Istanbul.
22. Nussbaumer, P., Matter, I., & Schwabe, G. (2012). "Enforced" vs. "Casual" Transparency – Findings from IT-Supported Financial Advisory Encounters. *ACM Trans. Manage. Inf. Syst.* 3, 2: 11:1-11:19.
23. Quek, F., McNeill, D., Bryll, R. et al. (2002). Multimodal Human Discourse: Gesture and Speech. *ACM Trans. Comput.-Hum. Interact.* 9, 3: 171-193.
24. Schmidt-Rauch, S., & Nussbaumer, P. (2011). Putting Value Co-creation into Practice: A Case for Advisory Support. *ECIS 2011 Proceedings*. Retrieved from <http://aisel.aisnet.org/ecis2011/138>.
25. So, W.C., Chen-Hui, C.S., & Wei-Shan, J.L. (2012). Mnemonic effect of iconic gesture and beat gesture in adults and children: Is meaning in gesture important for memory recall? *Language and Cognitive Processes* 27, 5: 665-681.
26. Svanaes, D., & Verplank, W. (2000). In Search of Metaphors for Tangible User Interfaces. *Proceedings of DARE 2000 on Designing Augmented Reality Environments*, ACM, 121-129.
27. UNESCO Representative List of the Intangible Cultural Heritage of Humanity - Turkish Coffee Culture and Tradition. 2013. Retrieved September 22, 2015 from <http://www.unesco.org/culture/ich/en/RL/00645>
28. Ægisdóttir, S., & Gerstein, L.H. (2000). Icelandic and American Students' Expectations About Counseling. *Journal of Counseling & Development*, 78(1), 44-53.

5. Paper B:

Coffee Cup Reading as An Inspiration for Looking into Augmented Mugs in Social Interaction

Ahmet Börütecene, İdil Bostan, Gülben Şanlı, Çağlar Genç, Tilbe Göksun, Oğuzhan Özcan. (2017). Coffee Cup Reading as An Inspiration for Looking into Augmented Mugs in Social Interaction. Proceedings of the 19th International Conference on Human-Computer Interaction. Lecture Notes in Computer Science LNCS - (HCII '17). Springer International Publishing. (ISI Index) [h5-index: 21, h5-median: 25]



Coffee Cup Reading as An Inspiration for Looking into Augmented Mugs in Social Interaction

Ahmet Börütecene^{1*}, İdil Bostan¹, Gülben Şanlı¹, Çağlar Genç¹, Tilbe Göksun²,
Oğuzhan Özcan¹

¹ Koç University – Arçelik Research Center for Creative Industries (KUARI), Istanbul, Turkey
aborutecene13, idibostan, gsanli15, cgenc14, oozcan@ku.edu.tr

² Koç University, Department of Psychology, Istanbul, Turkey
tgöksun@ku.edu.tr

Abstract. Augmented mugs are mostly used as non-interactive displays showing images, or providing information about the liquid content. However, there has not been sufficient research on what kind of affordances mugs could offer as tangible interfaces and how people might use them in face-to-face social settings. To fill this gap, we examined Turkish coffee fortune-telling, a socio-cultural practice based on deliberate physical interaction with coffee cup for reading and creating stories out of coffee ground shapes. First, we organized coffee cup reading sessions with 18 fortune-tellers whose analysis yielded 11 characteristics reflecting user behavior with cups. A follow-up cross-cultural study served as a first step for understanding the potential generalizability of these findings. Our main contribution consists of the characteristics we derived and the related potential interaction techniques we discuss for augmented mugs with an inner display. We also contextualize our findings by two scenarios in which the mug is used as a tangible interface in social interaction settings.

Keywords: Handheld devices; cylindrical displays; drinkware; co-located interaction; fortune-telling; quantified self; lifelogging

1 Introduction

Mugs may be one of the most pervasive objects that accompany us in daily life. Their natural presence in various activities such as business meetings, friendly conversations, morning commutes and small-talks in hallways mark them as a potential actor in social encounters. From this point of view, we consider that mugs are social objects worth investigating for HCI to explore the interaction opportunities that computerized everyday objects could present for enriching existing social interactions [6]. Although there are some efforts in augmenting mugs, the focus is mostly on designing smart drinkwares that provide information about the liquid content and drinking-related activities [24, 25], or on considering them as non-interactive flat displays for triggering social interaction [12, 23]. However, there has not been sufficient research on

what kind of affordances mugs could offer as tangible interfaces and how people might use them in face-to-face social settings.



Fig. 1. Coffee ground shapes inside a cup (h:5.5cm, r:5.5cm) that people “read” to tell fortune.

As an attempt to shed light on these gaps, we turned to Turkish coffee fortune-telling ritual, a socio-cultural practice based on “reading” coffee ground shapes inside the cup and narrating this visual content to the other; thus, creating from an ordinary mug a display and interface for social interaction (Figure 1). Our choice was motivated by the approach in HCI that considers investigating cultural phenomena and practices as fruitful resources to exploit existing mental models of individuals and explore new metaphors for tangible interaction [11, 20]. As this fortune-telling practice is based on deliberate physical interaction with a coffee cup (revolving, tilting, touching, pointing etc.) in a natural setting it allowed us to gather empirical data on actions performed with/on cups. Second, as the practice requires the person to examine the visual content inside a cup, that is the coffee ground shapes, it helped us explore potential interaction techniques for handheld cylindrical objects with an inner display.

Therefore, we first conducted coffee cup reading sessions with 18 fortune-tellers and analyzed their nonverbal behavior with the cup. The analysis yielded 11 characteristics that reflected how people used such a form factor with a visual content during social interaction. Following the analysis, we wanted to see whether these behaviors have the potential to be considered as valid and generalizable across cultures. Thus, we conducted a second study with 34 people (18 native Turkish and 16 native English speakers) that was designed on purpose to imitate the structure of coffee fortune-telling by concealing any direct cultural reference to it. Our aim was to observe whether people across cultures would still reflect the 11 characteristics in a setting where they were not exposed to the cultural dimension of the traditional practice. As a result, we observed a similarity between the groups in relation to the characteristics. Although this experiment alone would not be sufficient to prove that our findings are valid for all, it helped us to have an idea on the potential generalizability of the characteristics.

In this paper, we first provide a background on Turkish coffee fortune-telling and present the previous research on augmented mugs. We then report both of our studies in detail explaining the 11 characteristics we found, discussing the related interaction techniques we derived from each, and giving an account of the cross-cultural experiment. We conclude by contextualizing our findings by two potential scenarios in which an augmented mug is used as a tangible interface in a social interaction setting.

2 Background and Related Work

2.1 Overview of the Turkish Coffee Fortune-telling

Turkish coffee drinking and fortune-telling sessions create an enjoyable, warm and sometimes humorous social environment. In other words, Turkish coffee fortune-telling transforms coffee from a simple drink into an object that mediates a friendly exchange of thoughts and emotions. As Turkish coffee is made by using a very fine powder, it leaves a considerable residue at the bottom of the cup. This coffee ground is believed to bear traces regarding the future of the drinker. Essentially, Turkish coffee fortune-telling ritual is based on “reading” this ground and telling what the person will face or what events will happen, how and when (Figure 2). The fortune-teller uses the cup and saucer as a source of information to construct the fortune-telling discourse. Although, fortune-telling is generally associated with foreseeing the events to come, the practice is not limited to that. During the ritual fortune-tellers also refer to the past and present life of the person by discussing the state of various aspects such as emotions, friends, relationships, education, family etc. The perspective that fortune-tellers present is considered as a guidance which makes people reflect on their situation, behavior and actions. In other words, this phenomenon creates an opportunity for self-reflection and helps decision-making. Studies indicate that the fortune-telling is perceived as a method to seek social support and advice in different societies [1, 13, 14]. This supportive dimension of fortune-telling has also been examined from an interaction design point of view in terms of advice mediating handheld devices [4].



Fig. 2. Coffee cup turned upside down after drinking (1,2,3), reading the cup and saucer (4,5)

2.2 Augmented Mugs

Studies that consider coffee mug as an interactive object and examine it thoroughly are rare. The most notable one is The Media Cup developed by Gellersen et al. which is an augmented ceramic coffee mug prototype with diverse sensors placed on the bottom [3]. Through these sensors the mug could perceive the temperature of the liquid it contained, sense its motion and send these data to other devices in the environment. The researchers’ main interest here was to create a network of computerized devices that would communicate to each other. Therefore, they did not address comprehensively the social dimension that coffee culture presents. Although they tried to detect different positions and user gestures related to the use of the mug (stationary, moving, drinking out of it and fiddling with it), they did not examine or discuss the role of these in augmenting face-to-face social interactions.

Coffee mugs conceived as interactive objects to be used in social interaction are also rare. There are two related projects in this respect. One of them is the Paulig Muki, a coffee mug that allows people to share images with each other both remotely and in a co-located setting [23]. When people pour fresh coffee in their mug they see an image sent by a friend in the flat e-ink display on the outer surface of the mug. This project demonstrates that coffee mugs can introduce alternative ways of communication between people. Although it is a product that triggers social interaction and can be used in face-to-face settings, it does not sense how people handle the mug and benefit from the potential interaction techniques these gestures (drinking, holding, shaking the cup etc.) could offer to augment the cup and social interaction.

The other salient work is Mugshots, a coffee mug prototype with a small flat LCD display attached on the outer surface [12]. They were inspired from the theory of Goffman who suggested that social interactions are performative. By using the theater metaphor he explained that people perform differently in front stage and back stage, which correspond to public and private spaces. The aim of the researchers was to introduce the mug into the workplace to facilitate this switching between private and public performance. For instance, the user can see the picture on the flat display related to an incoming call from a relative in the personal office. When the user goes out on the corridor and meets with colleagues the picture on the display changes to an image predefined by the user for interactions in public. Although their study was exploring how coffee could be a social object and trigger conversations in face-to-face communication, they did not address how users handled the mug as an object and what kind of manipulative gestures they could perform with the mug during the conversation.

On the other hand, mug represents an unconventional form factor compared to flat surfaces as it has a cylindrical structure composed of curved surfaces. It is made of two circular adjacent areas: the inner and the outer surface. This way, it offers a potential space for cylindrical displays with both sides whose exploration could lead to novel interfaces and design challenges, however, we did not come across a study on how users could interact with these unconventional screens. The most relevant example of a seamlessly embedded curved screen is a mug designed by Intel that has LED lights integrated into the outer surface and displays basic images such as smileys, numbers or letters [22]. Although this mug makes it possible to use the outer surface of a cup for displaying information, it is not touch sensitive and it does not consider the inner surface as a space for interaction.

In summary, the literature review presented above indicates two research gaps: there is a) no empirical data on how people tend to physically interact with mugs in a social setting and b) lack of interaction techniques for handheld cylindrical objects that have a display on the inner surface. Our research aimed at addressing these gaps by conducting the studies reported in the following sections.

3 Study 1: Observing Fortune-telling Rituals

3.1 Participants

Fortune-tellers. We recruited 18 undergraduate students who were knowledgeable in fortune-telling and have been practicing it in a social context. There were 15 females and 3 males ($M_{age} = 22.4$, $SD = 2.1$).

Listeners. Two female university students, one 22 and the other 23 years old, were recruited to participate in the fortune-telling sessions. These participants were selected among female individuals who were undergraduate/graduate students and passionate about fortune-telling. Only one listener participated in each session. The purpose for recruiting two listeners was to schedule more sessions in a shorter time.

3.2 Procedure

The fortune-telling sessions were held at coffeehouses, or at cafes within the university campus. We chose coffeehouses as experiment space as they are popular places for fortune-telling activities. In order to obtain a consistency between each session we always conducted the study indoors and were attentive to maintain the same setting in each place: we selected calm environments, arranged participants to sit always at the table facing each other and placed the camera at the same angle and position. Each fortune-telling session was composed of a fortune-teller, a listener and the researcher. The fortune-teller and the listener were sitting at the table facing each other. The fortune-teller was telling the listener her fortune by reading the cup and saucer she used to drink the coffee on location. There was no limit to the duration of the session and the average duration of each session was around 10 – 15 minutes. Before each session the fortune-tellers were asked to complete an informed consent form and a questionnaire with demographic questions. The fortune-tellers were not given any instructions regarding gesture or object use. We used a cover research subject in the form to avoid participant bias and told the participants that our project aims to examine “Fortune-telling scenes in Cinema” and therefore compare real-life fortune-telling sessions with those depicted in films. We also planned a debriefing to send after the study.

The sessions started with the fortune-teller reading the cup of the listener. When the fortune-teller has finished with the cup s/he continued by reading the saucer. When the reading of the saucer was completed, the session ended. The sessions were video recorded with a smartphone camera by the researcher sitting at a distance from the table. A small tripod was also used in order to have a stable image, consistency in camera position and angle, and give freedom to the researcher to observe and take notes during the sessions. In some small locations we employed wide-angle lens to be able to maintain the same view. The camera was positioned to frame the hands, arms and faces of both participants to record the body movements.

3.3 Coding

After data was collected, all speech in the video recordings was transcribed into written format by native Turkish speakers. Two researchers coded six participants (30% of the data), discussed conflicts and then the rest of the coding was completed based on agreed terms. We assumed both qualitative and quantitative approach in our coding. After watching all the videos we identified two main categories of bodily engagement with the cup during interaction: manipulative gestures and positioning of the cup. For the first category, we coded how fortune-tellers handled the coffee cup and what kind of actions they performed on and with it. For the second, we coded how the participants approached the cup and where they most engaged with it in the space around them. Regarding these categories, we aimed to capture the following instances during the coding: manipulative gestures performed on and with the cup; touch and mid-air gestures involving both surfaces of the cup; areas used for positioning the cup and frequency of contact with it; position of the cup according to body and the table.

Regarding the positioning areas the participants used, 4 different approaches emerged from the video recordings. We noticed that at some points during the sessions they were holding and manipulating the cup 1) *on table*; 2) *at lower torso*; 3) *at upper torso*; or 4) leaving it on the table and using only free-hand gestures. *On table* refers to manipulating the cup on the table surface. *Lower torso* refers to the area between the table surface and the chest while *upper torso* indicates the area from the chest to the eye-level. *No contact* refers to leaving the cup on the table, fully interrupting contact with it and starting to perform free-hand gestures. In determining these areas and calculating the spatial relationship between body, table and cup we consulted two sources [18, 19]. Beyond these points above we were attentive to search for interesting patterns or singular gestures that we could not predict prior to this study that could be a source of inspiration for the field. We thought that coding and analyzing these non-verbal behaviors could yield insights on how people bodily engage with coffee cups during social interaction and, this way, could inform us in designing interaction techniques for augmented mugs.



Fig. 3. Still image from the first study. The listener on the left, the fortune-teller on the right.

3.4 Results and Discussion

In the light of the coding described above, we obtained characteristics that could be a reference for user interactions with Handheld Cylindrical Object (HCO). We grouped our findings into the 3 following categories: *Common Manipulative Gestures*, *Object-handling Styles* and *Idiosyncratic Behaviors*. For each characteristic we first describe the underlying user behavior, then propose and discuss the potential interaction techniques for augmented mugs with inner display. We included *Idiosyncratic Behaviors* as we wanted to gather all kinds of user engagement with the cup and indicate as many interaction techniques as possible for designers to consider for such a form factor.

Common Manipulative Gestures. Below we placed a table that shows the manipulative gestures performed by the fortune-tellers.

Table 1. Common manipulative gestures performed on/with the cup in the first study conducted with 18 participants.

Gestures on/with the cup	Count
1. Revolving & Tilting	88
2. Revolving	88
3. Tilting	49
4. Touching	38
5. Pointing	33

Revolving and Tilting. These gestures were the most common manipulative gestures performed by the participants (Table 1). We intend by revolving, the hand gesture that turns the cup around itself. By tilting we intend the hand movements that change the inclination of the cup forward and backward in vertical axis. Revolving and tilting gesture performed together indicates that these two movements occur at the same time. The participants used this gesture as they were trying to see and browse through the visual content on the inner surface. Except for one participant, the most used gestures were revolving, tilting, or revolving and tilting together in every participant (Figure 4).

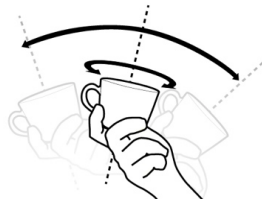


Fig. 4. Revolving and tilting gestures were used to examine the visual content inside the cup

While revolving alone was used to browse contents inside the cup, tilting seemed also to provide different viewing angles of the inner surface. Beyond these, people also made slight gestures that moved the cup around such as downwards, upwards,

towards self and away from self. Therefore, a Handheld Cylindrical Object (HCO) should be able to respond to these changes in angle and rotation. Let us think of a curved screen embedded into the inner surface of a mug. In terms of interaction, revolving the mug clockwise and counterclockwise can be used for basic navigation on this inner display (i.e., going to the next page). The speed of revolving gesture might be used to jump from one visual element to the other on the screen such as navigating among thumbnail photos. In this regard, tilting the HCO might correspond to vertical scrolling action. Furthermore, revolving and tilting gestures might also be used to create gradual changes in media elements on the inner display such as adjusting the visual content (i.e., changing the brightness/contrast of an image). Designers can exploit these gestures not only for manipulating the media inside the mug but also to control the surrounding devices such as TV screens [7].

Tilting the Cup to Share the Visual Content with the Listener. Almost half of the participants tilted the cup towards the listener and pointed to the exact spot where they recognized a visual element and made sure the listener was able to see it (Figure 5). Such instances of sharing the information were observed in 8 out of 18 participants (Table 1).

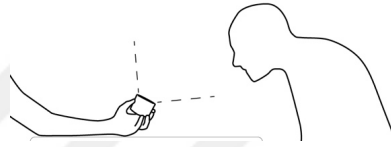


Fig. 5. The cup was tilted towards the listener to share the visual content

Therefore, HCO should provide the possibility for data sharing with the conversation partner. This gesture demonstrates that the inner surface of the cup is considered as a space not only for examining content but for sharing as well. In terms of interaction, the mug can be interpreted as an interface that allows the user to switch between private and public content. It is up to the user to expose what s/he sees inside the mug. In this respect, it also shows that a coffee mug does not only remain a personal artifact but might become a shared one during social interaction. For instance, while the mug is tilted towards the conversation partner to show an image, the user can manipulate the image by moving a finger on the outer surface of the mug. Designers can explore the potential of content sharing on devices with such a form factor by employing in-air or touch gestures in the interaction process.

Touching. Touching the outer surface of the cup was also a common gesture (Table 1). There were cases where this action was a singular and slight touch, as if poking or rubbing the cup. In other cases, participants continuously played with the outer surface or engaged in various actions (Figure 6, a). For example, we observed that one participant tapped on the outer surface while she was trying to remember what she was going to say. She made the same action 3 times during her session. In this case,

she uses the outer surface of the cup to communicate her frustration to the conversation partner.

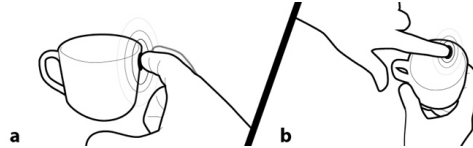


Fig. 6. Gentle and light touches were applied on the outer and inner surface of the cup

We also observed contact with the inner surface of the cup. One participant believed she saw an image which signaled undesirable events so she touched the inner surface to manipulate and erase the contents, therefore preventing those negative outcomes (Figure 6, b). This is intriguing in the sense that the participant got into contact with the inner surface with the intention of altering the information. It is also notable that an action which might not be socially acceptable, such as touching inside the mug, could be perceived as normal in the context created by an augmented mug. Therefore, the both surface of an HCO should be able to detect and respond to these types of contacts. In terms of interaction, touch gestures on the inner and outer surface of the mug can be used to select and manipulate content elements. Touching certain points on the mug can trigger actions such as sending messages, activating a process, responding to an incoming call etc. The fact that the user can see the inner and outer surface at the same time can create an interconnected touch space on the mug by providing a handheld double-sided display. For instance, while the user moves a finger along the outer surface, a visual element in the corresponding path on the inner surface can be triggered by this touch and start moving. Designer can benefit from this simultaneous touch interaction on both surfaces to explore novel interaction techniques for augmented mugs.

Pointing. Pointing was another common gesture among the participants. We found that 14 of them indicated the inner or outer surface of the cup during at least one instance of the conversation (Figure 7).

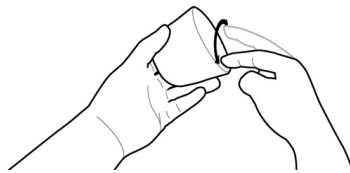


Fig. 7. Pointing gestures indicated inner and outer surface of the cup

In pointing, participants indicated either a specific visual element inside the cup, or they pointed at the general direction of the cup to refer to a concept they were talking about, as if the referent was actually in the cup. For instance, a participant said “... but this is a man...” without actually showing the part that contains this specific im-

age but instead indicating the cup in general. In this case, pointing is done mainly for the participants themselves as an expressive gesture and there is not an intention of signifying the pinpoint location of visual element. However, their gesture helps to highlight the referent in the discourse. In terms of interaction, this demonstrates that people do not only tend to use touch gestures but also hover above and around the mug. This behavior opens up many possibilities for designers. Therefore, HCO should be able to detect this kind of in-air movement of a single finger. Around-device interactions have been discussed in HCI in terms of extending the interaction space around mobile devices to include also mid-air gestures as an input method [15]. While these studies focus on smartphones with flat screens, devices with unconventional handheld displays, such as spherical ones, and cylindrical ones that have both inner and outer display, have not yet been explored. As we observed in our study, participants perceived the whole cup as the space where the elements of their narrative live and indicated these during the talk. These expressive gestures can be used to pull visuals from inside and send them to the outer display. They can also trigger various forms of media (i.e., visual, auditory, haptic) on the surrounding devices, or even smart clothes.

Object-handling styles. Below we show how the participants engaged with the cup in terms of contact and space.

Table 2. Indicates how frequently the cup was handled by the participants and in which positioning areas.

Cup	On table	Lower torso	Upper torso	No contact
Count	52	283	58	4
Percent	13,1%	71,3%	14,6%	1,0%

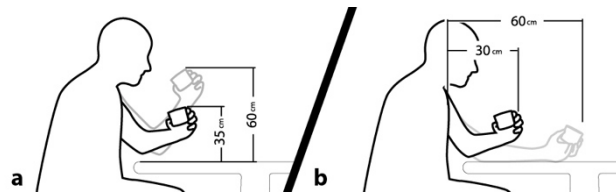


Fig. 8. a) approx. distance of the cup from the table surface; b) approx. distance of the cup from the body;

Position of the Cup According to the Table Surface. The cup is mostly held in the space between the table surface and 35 cm above it. The highest point the cup was held was the eye level, which is 60 cm above the table surface (Figure 8, a). Table 2 lists the positioning areas in which the gestures were performed. Therefore, HCO should be able to recognize the gestures performed in this height range.

Position of the Cup According to the Body. The cup is mostly held approximately 30 cm in front of the body. While showing the contents to the listener, the participants

extended their arms at most to approximately 60 cm (Figure 8, b). Therefore, HCO should be able to recognize the gestures performed in this range. The distances given in this characteristic, and the previous one, could also guide us in determining the visual content properties on the inner and outer surface of the mug in terms of visibility and readability (i.e., text size, image resolution etc).

Contact with the Cup. In 86% of all gestures performed, the cup was held in hand (Table 2) (Figure 9). Remaining 14% gestures were performed on table, although at least one hand was still holding the cup. Therefore, HCO should be designed in a way that its default status will be handheld. However, the interaction while the mug is left or handled on the table should not be ignored.

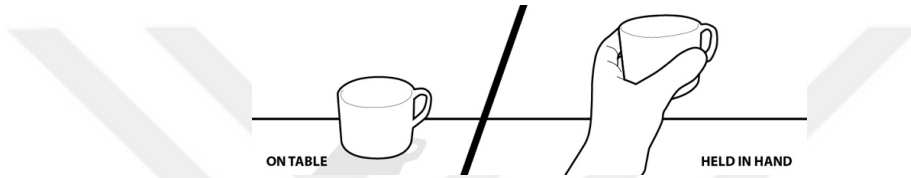


Fig. 9. Most of the gestures were performed while the cup was held in hand

Holding the Cup in a Straight Axis. Our observations revealed that the cup was mostly held in a straight axis, where the bottom was parallel to the table surface, although backwards and forwards tilting were also common (Figure 10). Therefore, HCO should be able to recognize its different inclination states. The changes in inclination might seem problematic for designers in creating stable content on a mug. However, it might also be an opportunity in designing for fluid content [21] that user can control by revolving and tilting the mug (such as controlling a drop on the inner surface).



Fig. 10. Backwards indicates tilting the cup away from self. Forwards indicates tilting the cup towards self.

Interrupting Contact with the Cup. We noticed that participants performed most of the manipulative gestures while examining the visual contents. They carefully surveyed the cup, making many revolving and tilting actions, and once they began to speak, they left the cup on the table (Figure 11, b). Most slight touch gestures occurred during speech to indicate the contents, while angle or position changing motion gestures were mainly performed during silent examination periods. While the participants were holding the cup in air with both hands during this examination, one of them let go of the cup before they started speaking. In this case, one hand was holding the cup and the other was performing communicative gestures, which are used to express thoughts

and intentions such as pointing at an object or hand movements describing a concept or thing [17] (Figure 11, a). In either way, contact with the cup was highest during examination and lowest during the conversation which is a commentary of the visual input.

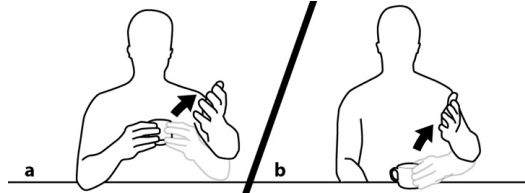


Fig. 11. The cup was used to regulate the talk.

Therefore, HCO should not only detect contact with the surface but also expressive hand movements performed around itself. As the mug accompanies the person while speaking, the gestures around the mug can be recognized as commands. For example, adjusting contact could be used to mark certain points in the talk, as leaving one hand indicates the start of speech.

Idiosyncratic Behaviors. Below we share the singular qualities of the participants' actions during fortune-telling.

Moving the Body around the Cup Left on the Table. 2 participants left the cup on the table and had no contact with it. However, they moved their bodies around it to be able to see the inner contents instead of moving the cup itself (Figure 12). They leaned forward or changed sitting position to get better visual frames. There were only 4 instances where the cup was left on the table without any contact however there was a gesture aiming at it. Therefore, HCO should be able to detect body movements around itself. The inclination of the body, head gestures and eye movements can provide information to the mug in terms of facial expression and gaze. The content inside the mug can change according to the proximity of the user's body.

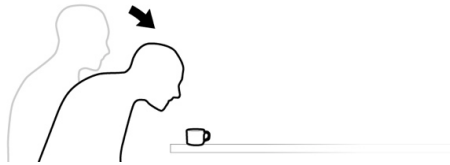


Fig. 12. Body moving around the cup

Using Long and Continuous Manipulative Gestures. We noticed that few participants continuously played with the cup in their hands and these manipulative gestures lasted much longer than other gestures (Figure 13). Therefore, HCO should be able to detect a succession of movements as one action alone. Although a rare behavior, designers can explore the potential effect of long duration movements and continuous contact

with the object for navigation purposes (e.g., browsing visual content slowly and in detail, zooming in a piece of data etc).

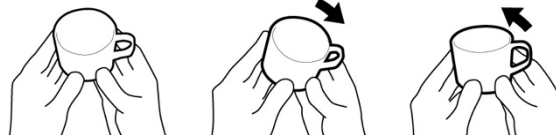


Fig. 13. Long and continuous manipulative gestures

4 Study 2: Cross-cultural Behavior Experiment

Our second study consists of a cross-cultural experiment to see whether the characteristics found in the first study tend to be culture-specific or generalizable.

4.1 Experimental Design

By conducting this study, we wanted to observe if people would still reflect the 11 characteristics found in the previous study when they were not exposed to the cultural dimension of Turkish coffee fortune-telling ritual. The traditional practice is based on two main components: examining the coffee ground on the inner surface of the cup and constructing a narrative on someone's life based on this content. In designing the experiment we imitated this underlying structure, but did not mention the cultural name and roles associated with it, that is, fortune-telling and fortune-tellers. Instead, we defined this narrative structure as a personal storytelling experience. Thus, we entitled the experiment as “Storytelling in Interpersonal Communication” and described it as a study on the role of storytelling between students in the campus. Complementary to this experimental setup, we included a non-Turkish population by recruiting native English speakers alongside native Turkish ones as narrators. These participants were asked to compose and tell a story, by looking at the symbols placed inside a mug, in which the protagonist was the listener.

In addition to the modifications above, we also changed the material components of the traditional practice. As the coffee cup is associated with fortune-telling practice in Turkey, we preferred to use a coffee mug, which is bigger in dimension, yet still manageable by single-hand, and usually not used for drinking Turkish coffee. It also presents a larger surface area that can be used for displaying visual content. To create the visual content on the inner surface, we used icons as symbols instead of abstract visuals resembling coffee ground, as otherwise this could have been perceived as a reference to the fortune-telling practice. First, we created a set of 16 icons from the website Flaticon¹. In doing this, we looked for providing visual consistency within the set to avoid creating bias so we randomly selected the icons among black/white ones

¹ www.flaticon.com

only, and those with similar visual qualities (Figure 14). Then, we arranged these icons in two basic layouts, ordered and unordered, inside two identical mugs. The first layout was composed of grouped icons in columns, distributed in an ordered manner that contained four icons. The second layout was composed of ungrouped icons distributed irregularly around the inner surface of the mug. The motivation behind using these two basic layouts was to gather data on the possible effects of content arrangement on the narrators. Therefore, we printed two copies of the icons as 12x12mm stickers and we placed each set on the inner surface of the mugs (Figure 15).



Fig. 14. The set of 16 icons we placed inside each mug

Although we asked the participants just to look at the content inside the mug, we also placed some icons, selected and printed in the same manner, on the outer surface to break the potential association of the experiment setting with fortune-telling practice. In addition, we preferred calling the icons as symbols in order not to make the participants perceive the mug as a digital device.

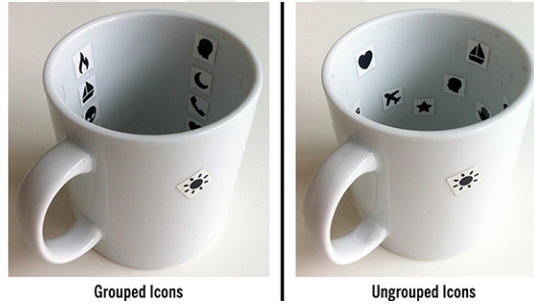


Fig. 15. Mugs (h:8.5cm, r:7.5cm) with two different layouts (grouped and ungrouped icons)

4.2 Participants

Narrators. In total we had 34 participants as narrators. For the group of native Turkish speakers we recruited 18 people ($M_{age} = 20.45$, $SD = 2.54$) among the students at our university. For the group of native English speakers we recruited 16 people ($M_{age} = 22.2$, $SD = 3.69$) among the exchange students in the campus. The participants were awarded course credits and bookshop vouchers for their participation.

Listeners. Two female university students, one 20 and the other 21 years old, were recruited to participate in the sessions. Both were native Turkish speakers and had a

good command of English. Only one listener participated in each session. They were awarded money for their participation.

4.3 Procedure

The experiment was held at the coffeehouse in the university campus to maintain the same environment as in the first study. The narrator, the listener and two researchers were present in the sessions. The narrator and the listener were sitting in front of each other at the table. One researcher recorded the sessions and the other gave the instructions to the participants. The sessions were videotaped with a digital camera. We used a tripod to have a stable image and consistent frame throughout the sessions. The camera was positioned to frame the hands, arms and faces of both participants to record the body movements, as in the previous study.

The sessions were held in two sections as there were two different mugs. Before each session the participants were asked to complete an informed consent form. In the first section we explained the procedure and asked them to compose a story to tell to the listener by examining the symbols on the inner surface of the mug given to them. We reminded the narrators to examine only the symbols placed inside the mugs and tell a story in which the listener would be the protagonist, as in fortune-telling sessions. We also told them that they were free to select, compose and interpret the symbols in any way they would like to. The listener was expected to follow the stories by providing basic verbal and nonverbal cues (e.g., saying yes-no, nodding) and ask questions whenever she was curious to know more about the details. Each story was expected to last for approximately 5 minutes. When the narrator was finished with the first mug, the second section started with the other mug following the same procedure in which we asked them to compose a different story. In order to prevent the primacy effect we changed the mug order in each experiment session. For example, if a session started with the mug of grouped icons, the following session with the next participant started with the mug of ungrouped icons. At the end of the sessions the narrators completed a survey with demographic information and questions related to the story-telling experience with the mug.

4.4 Results and Discussion

We coded the video recordings of the sessions according to the categories we used in our first study. We excluded one participant as he did not follow the procedure and created stories by using the icons on the outer surface of the mugs. Our analysis showed that the participants from both groups demonstrated considerably similar behavior in terms of the manipulative gestures with and on the mug (Table 2). Although the dimensions of the objects used in both studies were different, people tended to interact with the cup and the mug in similar ways. As in the first study, the most common manipulative gestures used by the participants were revolving & tilting and only revolving, which were mostly used to browse the icons inside the mug. Also tilting was a common gesture as a way to examine the inner surface. Touching and

pointing, although performed less, were used to contact the mug with fingers and indicate the content.

Table 3. Common manipulative gestures performed on/with the cup in the second study conducted with 33 participants.

Gestures on/with the cup	18 Native Turkish Speakers (Count/Percent)		15 Native English Speakers (Count/Percent)	
1. Revolving & Tilting	146	34,76%	98	31,01%
2. Revolving	177	42,14%	159	50,31%
3. Tilting	47	11,19%	35	11,08%
4. Touching	23	5,48%	11	3,49%
5. Pointing	3	0,71%	3	0,95%

The motivation for conducting a cross-cultural study was not that of comparing different cultural groups but rather designing a setting that allowed us to observe if people across cultures would demonstrate similar behaviors in interacting with coffee mugs. The main finding of this follow-up experiment is that people, regardless of their cultural experience, tended to perform the same actions with and on a coffee mug in a social context. Their behavior reflected 10 characteristics out of 11, which indicates that the characteristics might not be culture-specific. However, further studies are required to evaluate this. We noticed that one characteristic, tilting, was not used in this study for sharing the visual content with the listener, as it was the case with the coffee cup in the fortune-telling sessions. The ambiguous nature of the shapes created by coffee ground might have caused the fortune-tellers to share what they saw in the cup with the listener in the process of assigning a meaning to them. Instead, the icons in the mug were reflecting concrete images such as airplane, heart and thunder, and ready to be used as components for the stories without much need for interpretation. It seems that ambiguity created a collaborative space for making meaning together from the vague components of the visual content [9].

Regarding the role of the layout of the symbols, the survey at the end of the experiment showed that the grid-like, ordered layout on the inner cylindrical surface made it easier to compose stories as it provided a guide for navigating the visual content, and thus selecting and narrating the story components. Designers can explore this generative and supportive potential of a grid-based navigation in handheld cylindrical objects for storytelling purposes.

5 Potential Scenarios

The discussions around the results of our studies did not only demonstrate that the fortune-telling practice provided a natural and rich resource for identifying user behavior characteristics with coffee cups but also suggested two scenarios for the following contexts in which augmented mugs can be employed: (a) exploring lifelogs and (b) advising encounters.

5.1 Exploring Lifelogs

Elisa owns an augmented coffee mug that is connected to the apps and devices she uses for lifelogging and it receives the data they collect. This augmented mug presents Elisa's personal data by an interface on the inner display that covers the whole cylindrical surface inside. The outer surface of the mug is touch sensitive and used for interacting with the inner display. Elisa meets her date Erik today. She is so excited and thinks that she can bring her mug as an ice-breaker. After they have finished with their coffee, Elisa hands over her mug to Erik and asks him to tell what he sees through her personal data in the mug. Erik tries to understand what this data, represented by an abstract visualization for privacy and playfulness that are also present in coffee fortune-telling, could correspond to and how it could be part of a narration. Accompanied by Elisa he browses through the data and composes stories by combining different pieces to extend the conversation (Figure 16).

This scenario illustrates how the coffee mug, a familiar component of social interactions, can be used as a tangible interface for sharing and examining personal data, and transforming it into narratives [5, 10]. In line with previous research, we argue that a way to understand the personal data and discover new connections might be changing our tendency from goal-directed information seeking towards an exploratory and serendipitous one [8]. In this regard, the coffee mug, a handheld cylindrical object, appears as a meaningful interface to extend and re-purpose the lifelog material for generating new connections and perspectives as its circular form factor embodies a continuous, random and exploratory navigation of the content.



Fig. 16. Generating new or unexpected connections through continuous and exploratory navigation offered by the mug.

5.2 Advising Encounters

Peter owns an augmented coffee mug that listens to the conversations around itself and provide information on the inner display regarding the content. The texts and visuals shown inside are visible only to Peter as the form factor of the mug prevents the other person to see the inner surface. One of his students, Mark, comes to see him to talk about his class project. During the talk he mentions a television show that the professor never heard of. As Peter do not want to interrupt his student's discourse, and appear ignorant, he triggers a search on the internet by touching the mug (Figure 17, a). While Mark is explaining his project, Peter is getting information on the show

by looking at the results on the display (Figure 17, b). If Peter wants he can share the content with Mark on the outer display of the mug (Figure 17, c). As the search is saved, Peter can read more about the subject on computer after the meeting.

This scenario illustrates how an augmented coffee mug might be helpful for advisors' need for instant information during a meeting without revealing themselves as its form factor provides a private display space [16]. Sometimes advisors might not want to expose their search activity as they would not like to break the natural flow of the communication as well as it might compromise their knowledgeable image in front of the others [2]. We believe that an augmented mug might be perceived less intrusive than other digital devices in an interpersonal communication as the mug is associated with social contexts like coffee talks. This natural presence makes it a suitable object to be employed as a tangible interface for social interaction.

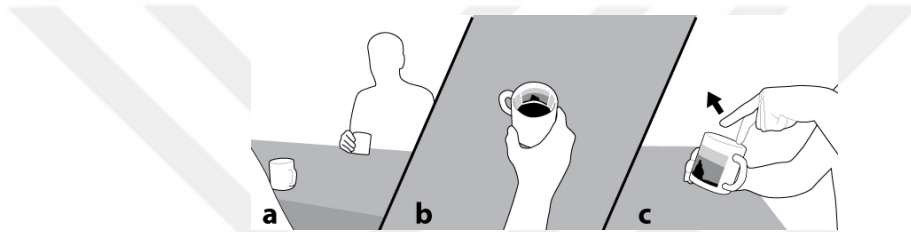


Fig. 17. The mug provides textual and visual information instantly

6 Conclusion

In this paper, we presented our empirical investigation of Turkish coffee fortune-telling ritual, a traditional practice, as an inspiration for exploring the potential of augmented mugs in social settings. Our aim was to examine how people engage physically with coffee cups during social interaction and how these behaviors can inform the design of augmented mugs. In this regard, we conducted two studies. First one was an observational study with 18 fortune-tellers. Our analysis yielded 11 characteristics regarding the use of coffee cups that we grouped in three categories: 4 *Common Manipulative Gestures*, 5 *Object-positioning Styles* and 2 *Idiosyncratic Behaviors*. In this regard, the analysis showed that during the examination of the content inside the cup, people hold it with single hand and mostly at chest level; they use mostly revolving and tilting gestures; touching the outer surface and pointing at the cup are also common. In addition, we noticed that people move their body around the cup as well as perform long and continuous gestures with it. Furthermore, we found that the cup is used for social interaction purposes, such as leaving it on table as a sign for the start of a speech. This shows that coffee mugs are also used in guiding one's talk and as a support for marking certain points in communication. These characteristics demonstrated how people tend to physically interact with coffee cups and constituted an empirical ground that enabled us to discuss potential interaction techniques for augmented mugs with inner display.

Then, we wanted to observe if people would still reflect these 11 characteristics when they were not exposed to the cultural dimension of Turkish coffee fortune-telling ritual. Thus, we designed a follow-up cross-cultural study with 34 participants, native Turkish and English speakers, in which we imitated the structure of fortune-telling without including any direct reference to it. Our analysis showed that the participants reflected 10 characteristics out of 11, which indicates the possibility that almost all the findings from the first study might be generalizable; that is potentially not culture-specific. Regarding the composition of visual content, we found that people consider grid-based layout helpful as navigation structure for storytelling on the inner surface of the mug. This grid-based structure can be exploited in designing novel tangible interfaces for storytelling purposes with cylindrical form factor. Furthermore, as these results were obtained in a setting independent of the fortune-telling context, these characteristics can be exploited as part of a tangible interface for interpersonal communication in various contexts.

The outcomes of both studies helped us propose scenarios that describe an augmented mug as a tangible interface for two potential contexts: exploration of lifelogging data and need for instant information in advising encounters. We believe that our characteristics and scenario enable an informed discussion of potential contexts and novel interaction techniques for augmented mugs, and for handheld cylindrical objects in general. They also provide a base for making prototypes and conducting user studies for further exploration of interaction possibilities with such form factor in social settings.

References

1. Aegisdóttir, S., Gerstein, L.H.: Icelandic and American Students' Expectations About Counseling. *J. Couns. Dev.* 78, 1, 44–53 (2000).
2. Anderson, F. et al.: Supporting Subtlety with Deceptive Devices and Illusory Interactions. In: *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. pp. 1489–1498 ACM, New York, NY, USA (2015).
3. Beigl, M. et al.: Mediacups: experience with design and use of computer-augmented everyday artefacts. *Comput. Netw.* 35, 4, 401–409 (2001).
4. Börütecene, A. et al.: Informing Design Decisions for Advice Mediating Handheld Devices by Studying Coffee Cup Reading. In: *Proceedings of the 9th Nordic Conference on Human-Computer Interaction*. p. 7:1–7:10 ACM, New York, NY, USA (2016).
5. Byrne, D. et al.: Life Editing: Third-party Perspectives on Lifelog Content. In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. pp. 1501–1510 ACM, New York, NY, USA (2011).
6. Charlesworth, T. et al.: TellTale: Adding a Polygraph to Everyday Life. In: *Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems*. pp. 1693–1698 ACM, New York, NY, USA (2015).
7. Corsten, C. et al.: Fillables: Everyday Vessels As Tangible Controllers with Adjustable Haptics. In: *CHI '13 Extended Abstracts on Human Factors in Computing Systems*. pp. 2129–2138 ACM, New York, NY, USA (2013).

8. Dörk, M. et al.: The Information Flaneur: A Fresh Look at Information Seeking. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. pp. 1215–1224 ACM, New York, NY, USA (2011).
9. Gaver, W.W. et al.: Ambiguity As a Resource for Design. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. pp. 233–240 ACM, New York, NY, USA (2003).
10. Hilviu, D., Rapp, A.: Narrating the Quantified Self. In: Adjunct Proceedings of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2015 ACM International Symposium on Wearable Computers. pp. 1051–1056 ACM, New York, NY, USA (2015).
11. Horn, M.S.: The Role of Cultural Forms in Tangible Interaction Design. In: Proceedings of the 7th International Conference on Tangible, Embedded and Embodied Interaction. pp. 117–124 ACM, New York, NY, USA (2013).
12. Kao, H.-L. (Cindy), Schmandt, C.: MugShots: A Mug Display for Front and Back Stage Social Interaction in the Workplace. In: Proceedings of the Ninth International Conference on Tangible, Embedded, and Embodied Interaction. pp. 57–60 ACM, New York, NY, USA (2015).
13. Kawano, S. et al. eds: Capturing Contemporary Japan: Differentiation and Uncertainty. University of Hawaii Press, Honolulu (2014).
14. Kissman, K.: The role of fortune telling as a supportive function among Icelandic women. *Int. Soc. Work.* 33, 2, 137–144 (1990).
15. Kratz, S., Rohs, M.: HoverFlow: Expanding the Design Space of Around-device Interaction. In: Proceedings of the 11th International Conference on Human-Computer Interaction with Mobile Devices and Services. p. 4:1–4:8 ACM, New York, NY, USA (2009).
16. Li, N., Dillenbourg, P.: Designing Conversation-context Recommendation Display to Support Opportunistic Search in Meetings. In: Proceedings of the 11th International Conference on Mobile and Ubiquitous Multimedia. p. 12:1–12:4 ACM, New York, NY, USA (2012).
17. McNeill, D.: *Hand and Mind: What Gestures Reveal about Thought*. University of Chicago Press (1992).
18. Neufert, E. et al.: *Architects' Data*. Wiley-Blackwell, Oxford ; Malden, MA (2002).
19. Openshaw, S., Taylor, E.: *Ergonomics and design: A reference guide*. Diane Publishing (2006).
20. Svanaes, D., Verplank, W.: In Search of Metaphors for Tangible User Interfaces. In: Proceedings of DARE 2000 on Designing Augmented Reality Environments. pp. 121–129 ACM, New York, NY, USA (2000).
21. Wakita, A., Nakano, A.: Blob Manipulation. In: Proceedings of the Sixth International Conference on Tangible, Embedded and Embodied Interaction. pp. 299–302 ACM, New York, NY, USA (2012).
22. Intel shows off a light-up smart mug, because why not?, <http://www.engadget.com/2014/01/07/intel-smart-mug-concept/>.
23. Paulig Muki, <http://www.pauligmuki.com/index.php?lang=en>.
24. Vessyl, <https://www.myvessyl.com/>.
25. Yecup: Your Perfect Wireless Smart Mug, <http://yecup.org/>.

6. Paper C:

Through the Glance Mug: A Familiar Artifact to Support Opportunistic Search in Meetings

Ahmet Börütecene, İdil Bostan, Ekin Akyürek, Alpay Sabuncuoğlu, İlker Temuzkuşu, Çağlar Genç, Tilbe Göksun, Oğuzhan Özcan. (2017). Through the Glance Mug: A Familiar Artifact to Support Opportunistic Search in Meetings. Proceedings of The Tenth International Conference on Tangible, Embedded, and Embodied Interaction (Submitted to TEI '18) [h5-index: 23, h5-median: 33, Acceptance Rate: %34]



Through the Glance Mug: A Familiar Artifact to Support Opportunistic Search in Meetings

Ahmet Börütecene¹, İdil Bostan¹, Ekin Akyürek³, Alpay Sabuncuoğlu⁴, İlker Temuzkuşu¹,
Çağlar Genç¹, Tilbe Göksun², Oğuzhan Özcan¹

Koç University, Istanbul, Turkey

{aborutecene13, idbostan, eakyurek13, asabuncuoglu13, itemuzkusu, cgenc14,
tgöksun, oozcan@ku.edu.tr}

ABSTRACT

During collocated meetings, the spontaneous need for information, called *opportunistic search*, might arise while conversing. However, using smartphones to look up information might be disruptive, disrespectful or even embarrassing in social contexts. We propose an alternative instrument for this practice: Glance Mug, a touch-sensitive mug prototype that listens to the conversation and displays browsable content-driven results on the inner screen. We organized 15 pairs of one-to-one meetings between students to gather user reflections. The user study revealed that the mug has the potential for supporting instant search and affords sufficient subtlety to conceal user actions. Yet, it provoked some anxiety for the users in maintaining eye contact with their partners. Our main contributions are the context-aware mug concept tested in a real-life setting and the analysis through Hornecker and Buur's Tangible Interaction Framework that discusses its design space, and its impact on the users and social interaction.

Author Keywords

Drinkware; tangible interface, augmented mug; coffee culture; subtle interaction; internet of things; liquid interfaces.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

Today, everyday objects can incorporate several technological components and become interactive devices while still looking like ordinary artifacts. This offers designers the opportunity to benefit from users' familiarity with the form factor, affordances and cultural aspects of these objects in exploiting technology and exploring novel interactions. All these make everyday objects resourceful

Paste the appropriate copyright/license statement here. ACM now supports three different publication options:

- ACM copyright: ACM holds the copyright on the work. This is the historical approach.
- License: The author(s) retain copyright, but ACM receives an exclusive publication license.
- Open Access: The author(s) wish to pay for the work to be open access. The additional fee must be paid to ACM.

This text field is large enough to hold the appropriate release statement assuming it is single-spaced in Times New Roman 8-point font. Please do not change or modify the size of this text box.

Each submission will be assigned a DOI string to be included here.



Figure 1. The Glance Mug prototype and system components

instruments by which we can approach various design challenges regarding our interaction with the information.

In this paper, we talk about one of these challenges: the need to perform instant search in meetings. During a meeting, we occasionally come across unknown words or subjects and feel the need to look up a piece of information. This phenomenon is called *opportunistic search*. Although previous works addressed design issues related to opportunistic search, they are limited to the use of smartphones and tabletop systems [6,15]. However, in some contexts, especially in one-to-one meetings, reaching one's smartphone or tablet might be perceived as a rude or disruptive act because a certain level of attention, interest and participation is expected for the social interaction [2,18]. Moreover, the interlocutors might not want to expose themselves while using their mobile device or doing online search in a conversation. The reason for this can be that of concealing their ignorance or weakness on the subject matter; or their ability to access information, which makes them feel personally empowered [9,19]. As a result, in addition to the need for opportunistic search, a demand for subtle interaction with the artefact also emerges.

In order to address these issues, we propose the Glance Mug, a novel, touch-sensitive mug prototype with an inner display converts speech to text (Figure 1). Nearly all

previous work on augmented mugs addressed well-being issues such as informing the users on their liquid consumption [23,24]. The difference of our research is that we consider the mug as an intelligent companion for social interaction, especially during meetings. The Glance Mug listens to the conversation and, once triggered by touch, it performs an online search based on the actual conversation content. Wikipedia summary and images from Google are displayed as search results on the inner screen of the mug. It allows the users to look up and view information instantly on the artefact itself without using another device.

In order to see the user response to the Glance Mug in a real-life setting, we conducted an exploratory study with the prototype by organizing 15 pairs of one-to-one advising meetings with university students. The users were expected to interact with the mug, in a subtle or open way according to their preference, and share with us their thoughts on the experience in semi-structured interviews. This study enabled us to gather user reflections on the augmented mug concept, its gestural and visual interface, its support for subtlety, and its influence on opportunistic search and the flow of conversation. On the other hand, we analyzed the Glance Mug by using Hornecker and Buur's Tangible Interaction Framework [15] to reveal its potential for enhancing social interaction and identify, by the help of the user reflections, challenges and opportunities for the design of augmented mugs. This framework has been previously used to explore several tangible experiences in social settings [4,10,20,21], including augmented everyday objects [1]. It is composed of 4 different themes that are related to understanding embodied and social aspects of tangible interfaces: (a) *Tangible Manipulation*; (b) *Spatial Interaction*; (c) *Embodied Facilitation*; and (d) *Expressive Representation*. Each theme is explained separately in the Discussion section.

In the following pages, we first explain the related work. Then, we describe the Glance Mug and report the user study. After the user reflections on the mug prototype, we present our analysis on its design space, and impact on the users and social interaction.

RELATED WORK

Opportunistic Search

In their theoretical paper Bruijn and Spence [7] introduced the term opportunistic browsing that refers to “the continuous but largely unconscious monitoring and filtering of information with the potential to trigger more purposeful behaviour” (p. 363). They suggested that this kind of browsing is ubiquitous in everyday life and new systems and artifacts supporting this kind of browsing should be studied. In relation to this concept Li and Dillenbourg [19] coined the term opportunistic search and explained it as a phenomenon occurring in meetings where “people may spontaneously seek information for certain terms that they encounter unexpectedly either from meeting conversation

or resources (paper documents or other objects in the surroundings) available in the meeting environment”.

In their paper, they explored opportunistic search meeting support systems by testing touch-sensitive tabletop designs for brainstorming settings. These designs used Wizard of Oz for speech recognition for transcribing conversations. They found that the search results based on the conversation context showing the related Wikipedia pages and images seemed to be working better as it presented a simple interface for results and offered visual representation of the conversation. Although, the Glance Mug adopts a similar approach for presenting the search results, our research differs as we wanted to understand what kind of experience a tangible interface could offer for opportunistic search.

Subtle Interaction

Anderson et al. defines subtle interaction as “providing input to, or receiving output from, systems without being observed” [2]. The researchers implemented four device prototypes that enabled users perform some actions during meetings without exposing themselves to the others. One of these was a coffee cup with a flat display placed on the bottom that enabled the users to read messages. In a limited way, the study of Anderson et al. shows that the coffee mug form factor has potential in encouraging subtle interaction. However, the mug was controlled by interacting with a smartphone. Our Glance Mug differs as it offers both input (touch-sensitive surface) and output (inner display) in a single device, which presents a direct and unified interaction. This way, we could explore the potential of an augmented mug as a tangible interface for subtle interaction.

Augmented Mugs and Tangible Interaction

Although coffee mugs are well-known social artefacts, there are not many studies or products that explored the potential of mugs as interactive devices. The earliest effort is The Media Cup developed by Gellersen et al. which is an augmented ceramic coffee mug prototype with diverse sensors placed on the bottom [3]. It was able to sense its motion, perceive the temperature of the liquid it held and share these data with other devices around. The researchers' main aim was to design a cup that was able to connect to a network of devices and talk to them. Although they tried to capture human gestures with the cup (drinking and fiddling), they did not explore or discuss its potential to support collocated social interactions.

Interactive mugs designed specifically for social interaction are rare. One of them is Lover's Cups that allow two people in different places to communicate with each other [8]. The prototype of the device could sense the liquid level, sipping and shaking action and it used LED illumination as an output method to display information. Although this project considers the cup as a potential interface for interpersonal communication, its focus is on supporting remote social interactions. In this sense, our study differs from others as

we examine the role of an augmented mug in a face-to-face social setting. Another noticeable artefact is Paulig Muki. It is a coffee mug with a flat e-ink display on the outer surface that was designed for both direct and remote social interaction [25]. The mug allows people to send each other images via its app. The image sent by a friend is shown on the mug display as fresh coffee is poured in. This project is an example of how an ordinary mug could propose novel forms of interaction with people by using gestures intrinsic to the mug, such as pouring coffee. However, compared to the Glance Mug, it is limited in terms of direct contact as it does not exploit hand gestures performed on/with the mug (drinking, grasping, tilting, revolving) that could introduce novel ways of manipulating the content for social interaction.

Mugshots is another salient project that focuses on both remote and collocated interactions [17]. It is inspired by the theory of Goffman that uses theater metaphor to explain why people act differently in public and private spaces, that correspond respectively to the front and the back stage [13]. The researchers' aim was to facilitate the switching between public and private performance by proposing a mug interface for communication. In private mode, this mug shows images sent from friends and family in the small, flat LCD display on the outer surface. When the user passes to the public space, the display shows an image preloaded by the user via web/smartphone interface. The researchers also mentioned how these displayed images triggered conversation. Although this project explores how an augmented mug displaying images could affect social interaction, it does not provide any input method on the mug itself like the Glance Mug. Our study also differs from the Mugshots as it addresses subtle interaction potential of the mug in social encounters.

Coffee Cup Reading Paradigm for Mug Interactions

Previously Borutecene et al. studied how the cup and saucer were used by fortune-tellers and examined the cup reading phenomenon from an HCI perspective [5] as this centuries-old socio-cultural experience is tightly related to nonverbal interaction and physical manipulation of handheld artefacts. The researchers proposed that the cup and saucer could be considered as tangible interfaces to explore interactive handheld systems for enhancing social interaction. They also conducted a comprehensive investigation on how fortune-tellers physically engaged with the cup during the sessions. As a result, they derived 11 characteristics that could be a reference for user interactions with handheld cylindrical devices with an inner display [6]. In designing the Glance Mug, we were inspired by this study as it provides a base for exploring the design of augmented mugs in terms of form factor and tangible interaction. Although the Glance Mug differs from the coffee cup mentioned in the study in terms of its purpose and various aspects such as visual content and dimensions, we took into consideration three characteristics related to the interaction with the artefact from the coffee cup study: *Touching*,

Contact with the Cup and *Interrupting Contact with the Cup*. *Touching* referred to the participants' continuous tactile interactions with the outer surface of the coffee cup. These included rubbing or poking, or tapping gestures. In the Glance Mug, we created touch-sensitive areas around the mug that would enable users to perform gestures with fingers. *Contact with the Cup* and *Interrupting Contact with the Cup* referred to the participants' tendency to hold the cup in one hand most of the time during the practice. Inspired by this finding, we arranged the touch-sensitive areas close to the mug handle to make single-hand interaction easier and allow users to still perform communicative gestures with the free hand during the conversation. According to the study, the participants also tended to hold the coffee cup also with both hands if they were examining the visual content inside. Keeping this behavior in mind, we employed two touch-sensitive stripes to cover the entire brim of the mug. This way, the users could involve both hands to perform touch-gestures by positioning them on the sensors around the mug.

GLANCE MUG

The Glance Mug is a 3D printed augmented mug prototype equipped with a small flat display on the inner wall and touch-sensitive areas around the surface (Figure 2). The mug continuously listens to the conversation during meetings and whenever the mug holders need to look up information related to the content (e.g., name, concept, location) they tap on the mug to trigger search. Then, the mug rewinds 9 seconds and converts the audio recording into text by using Google Speech API [26]. After receiving the speech-to-text output, the mug processes this textual data as query with an algorithm to search the web. In the end, the display shows the related title, description and Wikipedia summary received from Google Knowledge Graph Search API [27] and presents the first five image results from Google. It allows users to see and browse these search results instantly on the inner surface of the mug. Users can browse through the results by performing swipe gestures on the outer surface of the mug. Triggering another search updates the display to show new results. At this stage of the research, the mug is not suitable for drinking and cannot contain any liquid as the material we used for 3D printing was not food safe and the electronic components might get damaged. It was also the case in [2] in which the researchers obtained fruitful results in their study on subtle interactions. Likewise, in our study this state of the prototype was sufficient for us to gather user reflections on the mug prototype.

Touch-sensitive Interface for Search and Navigation

We placed the touch-sensitive areas as stripes on the outer surface: two of them were horizontal around the brim and one was vertical on the user side, close to the handle. These are used for swipe gestures. The horizontal stripes are responsible for browsing through images and Wikipedia summary. In addition, tapping/pressing gestures applied on the edge of the stripe towards the handle triggers search.

The vertical one is used to browse different search terms derived from the conversation.

Graphical User Interface

We placed a small and low-resolution flat display on the inner surface of the mug. A simple GUI was designed to minimize the information load, showing only the most essential elements: title (query), description, Wikipedia summary and one image for each frame (Figure 2). The title was shown in the gray stripe while the textual/visual content was displayed underneath. The interface also shows feedback messages in this gray section when a search is triggered or when there is no result. We used Verdana typeface as it was designed to increase the readability for low-resolution screens. The GUI was using a slide animation to show the passage between one content and the other (e.g., from the Wikipedia description scene to the scene with the coffee cup visual shown in the Figure 2). We decided to use a slight movement to notify the user whenever a change occurred on the screen.



Figure 2. Glance Mug GUI. Wikipedia summary on the left and images from Google on the right.

USER STUDY

In order to test the Glance Mug, we designed a study by organizing 15 minute one-to-one meetings at the university in which two students talked about the experience of going abroad as an exchange student. We published a call within the university for those who wanted to apply for an exchange program and for those that have already had such experience. As our inspiration was the previous research on Turkish coffee fortune-telling, a traditional advice-giving practice, we chose an advising setting for our study. We thought that this setting would provide a suitable context to look up some information such as countries, places, universities to reply questions, make conversation or extend arguments. Our main aim in conducting this user study was to understand what people would think of the interaction mechanism and opportunities that the Glance Mug proposed, and whether they could use it while interacting with another person in a social setting.

Our meeting sessions have been grouped into two series according to the challenges we faced during the user study. Although touch-gesture recognition and GUI components

of the mug performed well in the pilot sessions, speech recognition results failed most of the time to correspond to the actual content produced during the conversation. Although the prototype did not work in a stable manner, it did not prevent the participants to have hands-on experience with the augmented mug concept and they were motivated to give feedback. At this point, instead of dedicating our time to solve the technical issue for the speech recognition, we preferred to handle it with Wizard of Oz (WoZ) method. This way, we were able to make the system work in a more stable manner and organized another series of sessions. Below we first describe the experimental setup, procedure and participants that comprehend both sessions, then explain them in detail.

Participants

In total, 30 right-handed participants took part in our study. Fifteen of them were the users of the mug (4 males, $M_{age}=23.33$) and 15 were their partners in the conversation (5 males, $M_{age}=21.6$).

Experimental Setup

Two participants sat in a face-to-face position at the round table in a room. We placed a camera behind each participant to frame their face, body movements and the Glance Mug. Although we could not put coffee in the Glance Mug for technical and safety reasons, we were still offering coffee or tea to the other participant to maintain a balance in terms of mug presence on the table. We gave an informed consent form to all participants but we did not present the details of the user study as it might have created a bias. Yet, we gave them debriefing right after the sessions. All sessions were conducted by two researchers and were video recorded. After the sessions each researcher held a semi-structured interview with each of the participants. As thank-you gifts, we offered participants a voucher for a coffeehouse in the campus.

Procedure

We wanted the mug users to play with and familiarize with the Glance Mug concept for a while before the sessions. Therefore, we invited the participants, advisor students, who would use the Glance Mug to the study room 15 minutes earlier than the others. After giving the informed consent form, we introduced our prototype to the users. We explained what the Glance Mug would do, made a demonstration of how it works, and we asked them to try to use it during the meeting. We also mentioned that the other participants, advisee students, did not know about the Glance Mug yet we did not guide the advisors to conceal or expose the mug. After this briefing, we let them play with the mug until the other participants arrived. When the other participants came, we offered them coffee/tea and asked them to talk for about 15 minutes. During the meetings, there was no researcher in the room. At the end, we concluded the sessions by holding interviews with each participant in separate rooms.

FIRST SERIES: PILOT SESSIONS

We conducted these sessions by using the actual speech recognition system implemented in the Glance Mug. 12 students participated in this series and we organized 6 sessions. We conducted the first half of these sessions by giving the mug to advisee students, and the other half to the advisors. This allowed us to observe whether one group tends to use the mug more often. However, we could not find any visible differences. As we based our research on the previous work on Turkish coffee fortune-telling, we thought that our study should follow the setting of this traditional advice-giving practice where it is the advisor that uses the cup during interaction. Therefore, after these preparatory sessions we started giving the Glance Mug to the students with an exchange experience who can be considered in the role of an advisor in the meetings.

SECOND SERIES: WIZARD OF OZ SESSIONS

These were the sessions we conducted after having technical issues with speech recognition results. Eighteen students participated in this series and we organized 9 sessions. The Wizard of Oz (WoZ) is a method to manually operate some features of a system that cannot be implemented at an ideal level, or currently technologically impossible. By using the WoZ method we imitated the desired speech-to-text output and did the search operation manually for the Glance Mug. These sessions allowed us to create a more stable experience with the mug and thus helped us obtain more reliable user feedback.

USER REFLECTIONS FROM BOTH SESSIONS

In this section, we report the user response gathered from the semi-structured interviews. We took into consideration the interviews conducted with all the mug users in 15 sessions. In 3 sessions, the partners knew that there would be an augmented mug involved in the study, but were not aware of the mug's functions or what it was used for. We still involved the users of the mug in these sessions in our analysis because the subtlety that the mug provided was not our only interest; we were also interested in overall user experience of the mug.

Interpersonal Communication and Subtle Interaction

An interesting aspect of the Glance Mug was its influence on the language of the user. One participant (P13) believed the mug changed her style of speech. Instead of using generic nouns such as "city", "home", or "school", she tended to use more proper nouns such as city or university names. She also repeated the words of her partner when she wanted to search for them on the mug. It is exciting that an augmented mug demonstrated a potential of creating new forms of conversation. One participant (P14), who had shared the contents of the mug with his partner at the beginning of the session, believed that this created a momentary bond among them and acted as an ice-breaker. Interestingly, his partner reported the same feeling when asked about how the conversation went. Adding a sound system to the mug was suggested by four participants so that the mug could play videos and sounds or read the

search results out loud. For example, another participant (P7) who had lived in Australia reported that he would like to play some Australian accent videos for his advisee so that she could get a grasp of what to expect. The same participant also stated that he would not need such a mug as he would use his smartphone to look up information. Yet, he added that the mug would be helpful when there is a need for secrecy. Overall, we see that the mug was considered as an artefact that could contribute to conversations in different ways.

The partners in 3 sessions, who knew that there would be an augmented mug involved in the study, did not notice an unusual or suspicious activity on the users' side. In the remaining 12 sessions where the partners were oblivious to the mug, only 3 of the users declared to the partners that they were using an augmented mug. Two of them (P9, P14) reported that they wanted to be honest and talk about the mug they have. The other one (P15) said that she felt the need to try and involve the mug in the conversation because of its mere presence. One other participant (P7) reported that he was going to share the contents of the mug with his partner, but the right time never came to do so. He was planning to show some images from the city where he studied in Australia. Remaining 8 participants kept the mug's function a secret. Although they had the freedom to share the mug's actual content with their advisees, these users chose to keep it to themselves. Their reasons for keeping it secret were that they wanted to see whether they would be able to use it secretly, or that there was no need to involve the mug in the conversation.

As a result, secrecy was introduced into the dialogue where one party withheld the information from the other. None of the partners became aware of the mug use during the meeting. However, seven participants reported it was hard to maintain eye contact with the advisees while trying to use the mug covertly and this made them feel uncomfortable. Since they were sitting alone in a room with their advisees with whom they had just met, they did not have much opportunity to direct their gaze elsewhere during the conversation. They found the mug demanding too much of their gaze and attention that they struggled to keep concentrated on the dialogue they were engaged in. In this sense, the mug seems to be more comfortable to use in crowded contexts where the users would be more free with their gaze direction. Yet, a demanding mug might still be helpful in one-to-one encounters. For instance, one participant (P12), who is energetic by nature, started playing with the mug triggering random search to erase her boredom and divert her attention from the conversation that felt stuck at a certain point. This is an example of how the experience presented by the mug could change depending on the personalities.

Opportunistic Search and Use Cases

Majority of the participants appreciated the concept and tried to use the Glance Mug during the conversation. Our

mug prototype did not always bring the desired search results during the user studies; however, this did not always result in negative outcomes. There was even a case, while trying the Glance Mug for the first time before the session, one of the participants (P8) was happy seeing unrelated results as she was learning new things. There were different reasons for which the users did opportunistic search. One participant (P11) argued that the mug helped her materialize her thoughts and made her remember her memories during the conversation. Similarly another participant (P7) reported that he did not search for the things he did not know, but for those he already knew and remembered. Two participants (P7, P10) mentioned that they did not feel the need to use the mug for facts since they talked about their personal experiences, so searching the net was not a priority for them. One participant (P14) wished the mug displayed all the words for each search so that the users could navigate and choose the ones they need as it was not easy for him to understand beforehand which words the mug would pick each time. Similarly another participant (P13) wished the mug displayed all the search results so that she could navigate among that information after the actual conversation. She said that she would put “bookmarks” on the search results she liked so she could come back to them whenever she wants. Another participant (P14) said that he wished the mug could hold liquid which would make him more excited about it.

When we examined the use-cases suggested by the participants, we found that they referred to its potential of supporting interaction in formal encounters: business meetings, seminars, and academic discussions were among the most common suggestions. Users believed that they could easily look up small pieces of information they missed in such seminars without creating social discomfort. Another use-case suggestion was presentations where one could quickly retrieve needed information, also to reply questions directed by the public, and control the presentation slides via their mug.

Physical Structure and Gestural Interaction

The general form of the mug was appreciated by almost all participants. They reported finding the shape, weight and appearance appropriate for its purpose. The most common criticism regarding the form was directed towards the placement of the screen: eight participants reported that it was hard to see the lower end of the screen while the mug was simply positioned on the table. Participants either had to lean over the mug or tilt it towards themselves to get a better view. As a solution to this problem, participants suggested the screen to be inclined upwards towards the eye level of the user. There was an interesting comment pointing out the fixed position of the screen; one participant (P15) reported that she normally holds mugs with her left hand so the Glance Mug felt reverse to her. She would like to hold the mug with her left hand, reversing the mug, and would therefore like the screen to be on the opposite side of the mug. Placement of gesture sensors were also found

usable by most of the participants. Most of the participants believed swipe gestures felt natural and comfortable. However, they believed the swipe sensors and search button did not provide enough feedback to notify the user that they have been pressed. Five participants reported that they could not understand whether they had hit the button correctly because there was no way of understanding whether they had done it right. Moreover, four participants suggested that the search button could be moved to the side facing them or to the top of the handle, where pushing it could be more seamless and easier.

DISCUSSION

Below we analyze and discuss the current and potential design space of the Glance Mug, and the user reflections through Hornecker and Buur’s *Tangible Interaction Framework*. We explain the themes of the framework briefly in the beginning of each section.

Grasping the Opportunity for Search

The first theme of Hornecker and Buur’s framework is *Tangible Manipulation*. It refers to the bodily interaction with physical objects equipped with computational resources, that is the users are able to control the computation by directly manipulating objects. [15]. The Glance Mug presents the users information gathered from the conversation context. In the space where the coffee is poured, the users see the digital representation originated from the on-going conversation. The users’ fingers are in direct contact with the outer surface and the handle when they grasp a mug. The touch-sensitive stripes around the Glance Mug take advantage of this bodily relationship to provide access to the content inside. To trigger a search, or manipulate the textual and visual content represented on the inner display, the users do not need another device to act on, but the mug itself. This way, the Glance Mug couples the intrinsic physical function of the mug (holding liquid) with the new one (holding information). In a similar way, the everyday touch on the mug’s surface is transformed into meaningful gestures to instantly search and navigate the digital representations of the conversation content.

We believe that this coupling, together with the concealing form factor of the mug, enabled the users to perform opportunistic search and engage with the Glance Mug without provoking any doubt in their partner. Even those participants that were aware of the mug did not notice the movements of the mug user or did not understand how the mug worked. Although in some sessions the mug did not work in a stable or continuous manner, our user study was an opportunity to have an understanding about the degree of subtlety that the mug could offer. We found the results encouraging as we conducted the study in a real-life setting and did not dedicate much time to polish the 3D printed mug case. Being an everyday object, the Glance Mug should also be considered as a personal object that can be customized and individuated [1]. For instance, with a

knitted mug sleeve it can reflect different styles and identities, and this way can be distinguished among others. Although the current prototype does not allow, using tea or coffee as an ingredient to the interface would add another layer to the tangibility and expressiveness of the Glance Mug. For example, triggering search can be coupled with the drinking gesture and the level of coffee can reveal the representations on the display sip by sip. Similarly, the movement of the liquid inside the mug can be controlled by hand gestures (e.g., figdeting, revolving, inclining) for navigation or selection purposes [12].

Ambiguity Enables Privacy and Subtlety

Spatial Interaction refers to the fact that tangible interfaces occupy real space in the world and the users interact with them by moving in real space [15]. The Glance Mug is an object that can be moved freely in space. We can talk about two main physical spaces for the Glance Mug. The first one is the encompassing space in which the users grasp the mug and move it. This mobility allows the users to adjust the view of the content inside according to their head and body posture that helps them reduce the physical effort to follow textual and visual output presented. Moreover, this handheld object mediates the transition between the private spot (where interaction with the artefact occurs) and the public spot (where interaction with the interlocutor occurs) of the users. These two spots can also coincide sometimes in which the users share the mug with the others. In this case, the private becomes public and the digital content is enjoyed as a shared element of the conversation. In the Mugshots study, this transition is performed digitally by the users through the mug interface (switching to public/private mode) in separate places [17]. In the Glance Mug case, this transition occurs in the same place and time, and it is performed physically by the users through their behavior (showing the mug display to the interlocutor). In this regard, the privacy or disclosure of the Glance Mug depends on the users' bodily interaction as the others cannot know exactly whether the users look at a visual information, a blank screen, or the coffee. This gives room for the users to perform opportunistic search with subtlety. The Glance Mug introduces an ambiguity that allows both sides to maintain the social interaction without feeling interrupted or disruptive. Ambiguity has been discussed extensively in HCI and is considered as a powerful design element. In this case, ambiguity of context originated from the obscuring mug form factor creates a meaningful space of uncertainty and thus an alternative to the activity-exposing smartphone interaction for opportunistic search [11].

The second space, related to the surrounding one, is the inner space of the mug that is normally used to hold liquid. Because of the technological limitations, we currently present the content only on one side of the mug and this prevents the users to freely revolve or tilt the mug, as long as they do not want to expose their activity. With a flexible or embedded screen the entire inner surface of the mug can

become a visual space for displaying the content [28]. This would help solve the handedness issue one of the participants mentioned (**P15**). In such a circular display, the visuals can re-position themselves around the inner surface according to the hand in use so that the content is not exposed towards the other interlocutors and it is physically comfortable to use with the preferred hand.

Privileged Access to the Search Content

Embodied Facilitation refers to the physical and procedural structure of tangible interfaces that influence user actions and behavior, and consequently shape social configurations [15]. We can say that the Glance Mug presents the digital representations in an unconventional way, that is on the inner surface of the mug. The form factor of the Glance Mug enables people to have privacy in meetings when needed as the interlocutors cannot exactly know whether the user is looking at an information or the liquid inside. Contrary to smartphone use in a meeting, which is perceived as rude or associated with working on tasks not related to the meeting, handling a coffee mug refers in the first place to the act of drinking [16,18]. When we consider this in terms of the subtle interfaces framework [2], we can describe the Glance Mug as an artefact that (a) provides functions beyond its appearance (*device visibility: disguised*); (b) enables interactions observable but perceived as normal behaviors (*interaction observability: disguised*); (c) prevents the others to know about the ongoing task (*task transparency: opaque*).

These qualities of the design and the form factor allowed us to explore how the users would behave with such an artefact in social interaction. The users have the chance to keep the content for themselves or reveal to and share them with the others in the conversation. In this regard, the form factor of the mug is marked by a level of privacy and access threshold. The users have the privileged access to the content basically for two reasons: they own the mug (in case it is a personal artefact) and they are physically the closest person to the mug. While this proximity eases the access for the users it also limits the access points for the others to the content presented. In this sense, also the movement of the mug in space regulates the privacy and access points as this can manipulate the proximity too. In any case, the Glance Mug has a single and narrow access point by nature as the mugs are not designed to be used by two people at the same time. The access threshold can be lowered only by the user intention by exposing the mug. The others might only know about the content if the users express it verbally or show the mug display to them. As it happens in the fortune-telling practice, the mug can be shared between the interlocutors for communication purposes. The users can share the content with the others to show something that would contribute to the conversation (see the account of **P7** on Australian accent videos and city images)

Impressions and Extensions of a Conversation

Expressive Representation refers to how digital functions and data are physically represented in tangible interaction, often implemented by combination of materials and digital elements [15]. The Glance Mug transforms the voice input (physical form) into textual and visual output (digital representation) and offers impressions and extensions of the conversation. These are displayed on a flat screen placed on the inner surface. The topics and concepts produced verbally during the conversation might not always stimulate our senses and appear in front of our eyes. The mug, displaying textual and visual representations of these conversational elements plays a stimulating role in this sense. This way, it provides the user with textual and visual material to learn about an unknown concept, extend a known one, share with the interlocutor, or just for distraction. As the users can trigger search at any point in the conversation, the Glance Mug opens the way to getting stimulated by doing random search for unexpected results. This serendipity adds playfulness to the conversations and might be a trigger for people to talk or learn new things. **(P8, P12)**. User reflections also indicated that support for opportunistic search is not only limited to display information instantly. A suggestion was to keep the log of search results and make them available after the meeting as well **(P13)**. Therefore, the search history is expected for a detailed view later as opportunistic search results cannot be exploited in a comprehensive manner at the moment of search. This way, the Glance Mug could extend the momentary impressions beyond the meeting into new spaces of the users, both physical and virtual (e.g., social media, personal archive etc). In this sense, it is also interrelated to the *Spatial Interaction* theme.

Although most of the participants preferred to keep the mug to themselves, trying to use it for subtle interactions, they had difficulty in maintaining eye contact with the partners while interacting with the mug. As we have seen, the distracting visual attraction of the mug is not always a negative aspect as it also has the potential to prevent boredom during the conversation as indicated by **P12**. However, when this is not the intention, communication problems might arise. The most challenging part with an augmented mug for face-to-face interaction is that it divides the attention between the visual content (re)presented inside and the conversation in progress. The visual representation of the content is designed to have as less elements as possible to lower the cognitive load during the social interaction. However, the user reflections demonstrate that it was not sufficient for a fluent communication. In this regard, using vibrations or temperature change as haptic feedback for search and navigation gestures might reduce the attention required to notice whether these gestures are triggered or not. This challenge could also be extended to represent search results. Yet, employing different materials and medium for representing data [14], that is Multisensory Data Representation (e.g., gustation, haptic etc), would be

more suitable as single type of representation, except the visual one, might offer less precision or guidance to communicate the desired information (e.g., understanding by taste where a certain building is located in the city).

CONCLUSION

We designed the Glance Mug, a 3D printed ordinary-looking mug that listens to the conversation and, when triggered by touch, it performs an online search based on the actual conversation content. Our aim was to explore the potential of the Glance Mug in supporting opportunistic search and subtle interaction during meetings. We conducted an exploratory user study with the mug to gather user reflections about the experience it offers and to identify challenges and opportunities for the design of augmented mugs. The user study revealed that the participants appreciated the augmented mug concept and the mug allowed the users to perform opportunistic search in subtlety whenever they wanted. Furthermore, we noticed that the users, although they were not guided by us to hide the mug's functions, tended to keep the mug and content to themselves. We interpreted this as a result of the mug form factor that implies secrecy and subtle use because of its concealing physical structure. These outcomes indicate the Glance Mug's potential to be used during meetings without attracting much attention or suspicion. However, the users found it difficult to maintain eye contact in social interaction while performing search and navigating the results. This challenge can be addressed by employing different sensory channels for giving feedback on the actions (e.g., triggering search) and representing search results.

Our two main contributions are (1) designing and prototyping the Glance Mug and testing it in real-life setting; (2) analyzing it through Hornecker and Buur's Tangible Interaction Framework to discuss the current and potential design space of the Glance Mug and user reflections. The analysis yielded 4 salient traits of our mug prototype: (a) *Grasping the Opportunity to Search*; (b) *Ambiguity Enables Privacy and Subtlety*; (c) *Privileged Access to the Search Content*; (d) *Impressions and Extensions of a Conversation*. These traits incorporate the challenges and opportunities that would shed light on the design of similar augmented mugs for supporting co-located social interaction. In addition, these design directions we shared in the Discussion could also be helpful in reflecting on the behaviors of augmented everyday objects in social contexts. For future work, we are revising the mug based on the user reflections and implementing speech recognition. As next step, we plan to involve the iterated prototype in a group meeting setting with other mobile devices for a comparative study in terms of opportunistic search and subtle interaction experience as well as social acceptance.

ACKNOWLEDGMENTS

Left blank for anonymity.

REFERENCES

1. Aloha Hufana Ambe, Margot Brereton, Alessandro Soro, and Paul Roe. 2017. Technology Individuation: The Foibles of Augmented Everyday Objects. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (CHI '17), 6632–6644. <https://doi.org/10.1145/3025453.3025770>
2. Fraser Anderson, Tovi Grossman, Daniel Wigdor, and George Fitzmaurice. 2015. Supporting Subtlety with Deceptive Devices and Illusory Interactions. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (CHI '15), 1489–1498. <https://doi.org/10.1145/2702123.2702336>
3. Michael Beigl, Hans-W. Gellersen, and Albrecht Schmidt. 2001. Mediacups: experience with design and use of computer-augmented everyday artefacts. *Computer Networks* 35, 4: 401–409. [https://doi.org/10.1016/S1389-1286\(00\)00180-8](https://doi.org/10.1016/S1389-1286(00)00180-8)
4. Tilde Bekker and Janienke Sturm. 2009. Stimulating Physical and Social Activity Through Open-ended Play. In *Proceedings of the 8th International Conference on Interaction Design and Children* (IDC '09), 309–312. <https://doi.org/10.1145/1551788.1551869>
5. Ahmet Börütecene, İdil Bostan, Tilbe Göksun, and Oğuzhan Özcan. 2016. Informing Design Decisions for Advice Mediating Handheld Devices by Studying Coffee Cup Reading. In *Proceedings of the 9th Nordic Conference on Human-Computer Interaction* (NordiCHI '16), 7:1–7:10. <https://doi.org/10.1145/2971485.2971523>
6. Ahmet Börütecene, İdil Bostan, Gülben Şanlı, Çağlar Genç, Tilbe Göksun, and Oğuzhan Özcan. 2017. Coffee Cup Reading as an Inspiration for Looking into Augmented Mugs in Social Interaction. In *Design, User Experience, and Usability: Understanding Users and Contexts* (Lecture Notes in Computer Science), 199–218. https://doi.org/10.1007/978-3-319-58640-3_15
7. Oscar de Bruijn and Robert Spence. 2001. Serendipity within a Ubiquitous Computing Environment: A Case for Opportunistic Browsing. In *UbiComp 2001: Ubiquitous Computing* (Lecture Notes in Computer Science), 362–369. Retrieved January 14, 2017 from http://link.springer.com/chapter/10.1007/3-540-45427-6_31
8. Hyemin Chung, Chia-Hsun Jackie Lee, and Ted Selker. 2006. Lover's Cups: Drinking Interfaces As New Communication Channels. In *CHI '06 Extended Abstracts on Human Factors in Computing Systems* (CHI EA '06), 375–380. <https://doi.org/10.1145/1125451.1125532>
9. Karen Church, Antony Cousin, and Nuria Oliver. 2012. I Wanted to Settle a Bet!: Understanding Why and How People Use Mobile Search in Social Settings. In *Proceedings of the 14th International Conference on Human-computer Interaction with Mobile Devices and Services* (MobileHCI '12), 393–402. <https://doi.org/10.1145/2371574.2371635>
10. Jared Donovan and Robb Mitchell. 2010. Social Contraptions and Embodied Interaction. In *Proceedings of the 12th ACM International Conference Adjunct Papers on Ubiquitous Computing - Adjunct* (UbiComp '10 Adjunct), 403–404. <https://doi.org/10.1145/1864431.1864458>
11. William W. Gaver, Jacob Beaver, and Steve Benford. 2003. Ambiguity As a Resource for Design. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '03), 233–240. <https://doi.org/10.1145/642611.642653>
12. Luc Geurts and Vero Vanden Abeele. 2012. Splash Controllers: Game Controllers Involving the Uncareful Manipulation of Water. In *Proceedings of the Sixth International Conference on Tangible, Embedded and Embodied Interaction* (TEI '12), 183–186. <https://doi.org/10.1145/2148131.2148170>
13. Erving Goffman. 1959. *The Presentation of Self in Everyday Life*. Anchor, New York, NY.
14. Trevor Hogan and Eva Hornecker. 2017. Towards a Design Space for Multisensory Data Representation. *Interacting with Computers* 29, 2: 147–167. <https://doi.org/10.1093/iwc/iww015>
15. Eva Hornecker and Jacob Buur. 2006. Getting a Grip on Tangible Interaction: A Framework on Physical Space and Social Interaction. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '06), 437–446. <https://doi.org/10.1145/1124772.1124838>
16. Shamsi T. Iqbal, Jonathan Grudin, and Eric Horvitz. 2011. Peripheral Computing During Presentations: Perspectives on Costs and Preferences. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '11), 891–894. <https://doi.org/10.1145/1978942.1979073>
17. Hsin-Liu (Cindy) Kao and Chris Schmandt. 2015. MugShots: A Mug Display for Front and Back Stage Social Interaction in the Workplace. In *Proceedings of the Ninth International Conference on Tangible, Embedded, and Embodied Interaction* (TEI '15), 57–60. <https://doi.org/10.1145/2677199.2680557>
18. Lisa Kleinman. 2007. Physically Present, Mentally Absent: Technology Use in Face-to-face Meetings. In *CHI '07 Extended Abstracts on Human Factors in Computing Systems* (CHI EA '07), 2501–2506. <https://doi.org/10.1145/1240866.1241031>
19. Nan Li and Pierre Dillenbourg. 2012. Designing Conversation-context Recommendation Display to Support Opportunistic Search in Meetings. In *Proceedings of the 11th International Conference on Mobile and Ubiquitous Multimedia* (MUM '12), 12:1–12:4. <https://doi.org/10.1145/2406367.2406382>
20. Bruno Nadeau and Amanda Williams. 2009. Tactful Interaction: Exploring Interactive Social Touch Through a Collaborative Tangible Installation. In

Proceedings of the 3rd International Conference on Tangible and Embedded Interaction (TEI '09), 147–152. <https://doi.org/10.1145/1517664.1517700>

21. Jay Vidyarthi, Alissa N. Antle, and Bernhard E. Riecke. 2011. Sympathetic Guitar: Can a Digitally Augmented Guitar Be a Social Entity? In *CHI '11 Extended Abstracts on Human Factors in Computing Systems (CHI EA '11)*, 1819–1824. <https://doi.org/10.1145/1979742.1979863>
22. Cogi - Beyond Notes. Retrieved January 14, 2017 from <https://cogi.com/>
23. Vessyl. Retrieved June 14, 2016 from <https://www.myvessyl.com/>
24. Yecup: Your Perfect Wireless Smart Mug. Retrieved June 14, 2016 from <http://yecup.org/>
25. Paulig Muki. Retrieved February 8, 2016 from <http://www.pauligmuki.com/index.php?lang=en>
26. Speech API - Speech Recognition. *Google Cloud Platform*. Retrieved January 16, 2017 from <https://cloud.google.com/speech/>
27. Google Knowledge Graph Search API | Knowledge Graph Search API. *Google Developers*. Retrieved January 16, 2017 from <https://developers.google.com/knowledge-graph/>
28. Intel shows off a light-up smart mug, because why not? *Engadget*. Retrieved February 8, 2016 from <http://www.engadget.com/2014/01/07/intel-smart-mug-concept/>

III

CONCLUSION



7. Research Contributions

In this dissertation, we presented our research that examined Turkish coffee fortune-telling as an inspiration for designing object-mediated advice interactions. During the course of the doctoral research, we conducted several studies whose outcomes were reported in three full papers, which create the body of this dissertation. The outcomes of these studies met our expected results mentioned in the beginning of the dissertation and they are shown in this section with the abbreviation [ER] next to the related contributions. Below we summarize and list our contributions within each paper.

Contribution C1: Examining Turkish coffee fortune-telling and proposing design considerations for handheld devices for advice interaction
[Publication Paper A]

We conducted an extensive literature review on Turkish coffee fortune-telling, considered as a practice of advice-giving, to understand the actors, artefacts, and the social interaction it offers. Our readings covered a broad range of materials from scholarly works to artistic expressions that took the coffee and fortune-telling as the central subject matter. We discussed these materials in relation to the human-computer interaction field, in particular to tangible interfaces and social computing. In this regard, we studied for the first time a traditional form of object-mediated advice interaction, Turkish coffee fortune-telling practice, as a source of inspiration to inform design decisions for advice mediating handheld devices. Following our readings on the phenomenon, in order to observe the practice in depth, we organized and videotaped cup reading sessions with fortune-tellers. By coding and analyzing the advice messages and nonverbal cues (gestures, gaze and contact with objects), we derived **7 design considerations** for potential handheld devices to be used in advice settings. Following this phase, we held a **participatory design workshop** to see what kind of devices could be shaped by taking into account these considerations. At this workshop, product designers, interaction designers and potential users collaborated in groups and proposed **6 device concepts**. These concepts showed us what type of interaction mechanisms, as well as input and output methods, could be used for advice settings in social contexts.

Specific contributions:

- Studying for the first time a traditional form of object-mediated advice interaction, Turkish coffee fortune-telling practice, as a source of inspiration to inform design decisions for advice mediating handheld devices.
- Identifying advice messages, and the related nonverbal behavior (gestures, gaze, contact with objects) of the fortune-tellers as advice-givers. [ER]
- Seven preliminary design considerations for potential handheld devices for advice interaction. [ER]

- Six device concepts inspired by the preliminary design considerations. [ER]
- Interactions mechanisms as well as input and output methods preferred for advice settings in social contexts.

Contribution C2: Deriving characteristics for handheld cylindrical objects and understanding their generalizability [Publication Paper B]

Following the studies reported in Paper B, we continued by coding and analyzing the fortune-tellers' physical engagement with the cup, a cylindrical artefact, during the entire session. We examined what kind of gestures they performed with/on the coffee cup and the nonverbal interaction space around them. As a result, we derived **11 characteristics** related to the interaction with handheld cylindrical objects (HCO). We wanted to see whether these characteristics could still be observed when the cultural dimension of the practice was covered. In order to have a preliminary idea about the effect of such a cultural dimension, we designed the cup reading sessions in a storytelling form with Turkish speaking and English speaking participants. We did not use any intentional reference to the coffee fortune-telling in structuring and describing the sessions. We found that the participants demonstrated most of the 11 characteristics. Although this indicates that ***the characteristics might not be culture-specific***, thus generalizable to a wider audience, further research is required to prove this. In the end, we also proposed **two scenarios** inspired by the characteristics we derived. One of them refers to an advising encounter between a professor and a student while the other is about how an augmented mug could become an interface for alternative exploration of the quantified-self data.

Specific contributions:

- Eleven characteristics derived from the analysis of the fortune-tellers' nonverbal engagement with the coffee cup (4 Common Manipulative Gestures, 5 Object-positioning Styles and 2 Idiosyncratic Behaviors). [ER]
- Exploration of the potential generalizability of the characteristics to non-Turkish users by an experiment across cultures. (met the expected result). [ER]
- Potential scenarios for advice mediating handheld devices inspired by the 11 characteristics.

Contribution C3: Designing and testing the Glance Mug prototype [Publication Paper C]

Inspired by the 11 characteristics we obtained in the previous study on the use of coffee cup in fortune-telling sessions, we **designed and prototyped the Glance Mug**, an augmented coffee mug. This mug was conceived as a supportive artefact for the advisors in one-to-one meetings. It was designed to enable them to perform opportunistic search while interacting with the mug in

a subtle way by hand gestures. We **deployed the Glance Mug in a real-life advising setting** and tested it with 30 students organizing 15 pairs of one-to-one advising meetings. This study enabled us to see the actual user experience with the Glance Mug. It provided us with user feedback on its physical design, gestural interaction, display and graphical user interface. The users tried to employ the mug during the conversation and they appreciated the concept. The study helped us identify the challenges regarding the social interaction such as maintaining eye contact. Although this might seem as a negative aspect, it could also be considered as an opportunity for users that tend to avoid their eyes from the interlocutor. For instance, the Glance Mug could present a mitigating visual space where the users could direct their gaze at in difficult moments of a conversation. Most of the users kept the mug for themselves without getting noticed while interacting with it. This demonstrated the high potential of subtlety the Glance Mug offered. This user study provided us with meaningful feedback to revise the Glance Mug for further studies. On the other hand, we analyzed the Glance Mug by using Hornecker and Buur's Tangible Interaction Framework [15] to reveal its potential for enhancing social interaction and identify, by the help of the user reflections, challenges and opportunities for the design of augmented mugs. The analysis yielded 4 salient traits of our mug prototype: (a) Grasping the Opportunity to Search; (b) Ambiguity Enables Privacy and Subtlety; (c) Privileged Access to the Search Content; (d) Impressions and Extensions of a Conversation. These traits incorporate the challenges and opportunities that would shed light on the design of similar augmented mugs for supporting co-located social interaction. In addition, these design directions we shared could also be helpful in reflecting on the behaviors of augmented everyday objects in social contexts.

Specific contributions:

- Proposing and crafting an augmented mug prototype, the Glance Mug. [ER]
- Receiving user feedback for the input and output methods of the prototype. [ER]
- Revealing the potential of the prototype in supporting opportunistic search and subtle interaction. [ER]
- Identifying the challenges of the prototype in relation to the social interaction. [ER]
- Identifying the salient traits of the prototype regarding the current and potential design space. [ER]

8. General Conclusions and Future Work

In this dissertation, we presented a comprehensive investigation of a traditional advice-giving practice, Turkish coffee fortune-telling. Our aim was to explore its interaction mechanism and artefacts to gather inspiration for designing handheld devices to be used in face-to-face advice-giving situations in informal settings.

We grounded our research on the empirical study conducted with the fortune-tellers at the very beginning, which provided us with several hours of audiovisual material to code and analyze. Through a detailed examination of these recordings, we revealed important verbal and nonverbal behavior of the fortune-tellers that could be helpful in exploring novel input and output methods and mechanisms for handheld devices for advice interaction. Following this, we introduced our findings to designers and potential users in order to observe what kind of interactive systems they would trigger. The outcomes of this workshop process enabled us to see a range of design possibilities for advice mediating handheld devices with various form factors and interaction styles. In the next study, narrowing our focus on the fortune-tellers' continuous interaction with the coffee cup allowed us to conduct more specific observations regarding the physical engagement with the central artefact of the practice. As a result, we derived 11 characteristics related to the interaction with handheld cylindrical objects (HCO). We also designed an experiment across cultures to understand whether these characteristics were specific to Turkish culture or not. The participant groups showed similarities in following the characteristics however further research is required to prove that these are not culture-specific.

The 11 characteristics we derived through these observations, and the previous design considerations, constituted the basis for our prototype, the Glance Mug. This prototype enabled us to put the users in direct contact with our concept and make them experience it in a real-life advising encounter. This way, we obtained user reflections that emerged from the actual usage of our prototype, and identified the challenges and opportunities that the Glance Mug offers. In addition, we analyzed our mug prototype through Hornecker and Buur's Tangible Interaction Framework to have an understanding of the current and potential design space of augmented mugs for social interaction. This analysis provide design directions also for augmented everyday objects in social contexts as the salient traits we identified can be mapped to similar tangible interfaces. Our findings would inform the iterative design process of the Glance Mug as well as the discussion on the design of handheld devices for advice interaction. Moreover, our research approach and process, centered around the exploration of a socio-cultural phenomenon as a resource for design, could also provide a framework for similar studies. It demonstrates how a traditional practice could inform the design of interfaces that address current challenges in interacting with people and information.

As a next step, we expect to make the Glance Mug work independently from the Wizard of Oz (WoZ) system and at the same time to revise it, following an iterative approach, by using the data we gathered from the user studies. This would also enable us to evaluate the performance of the artefact and obtain quantitative user data. In addition, a detailed examination of video recordings for nonverbal behavior with the mug would be an important step to elicit potential touch and mid-air gestures. A flexible display that would create a smooth visual spot on the entire inner surface of the mug would help us exploit its curved nature better and explore novel interaction techniques for content sharing and privacy challenges in augmented mugs.

As a part of our future research agenda, we also want to exploit the coffee cup reading tradition as a lens through which we can explore design directions for narrating and visualizing the quantified-self/lifelogging data in social interaction by the help of handheld devices. The coffee ground shapes, the unreal personal data, that cup readers try to interpret in fortune-telling would correspond to the real data accumulated in time by activity trackers, social media posts and personal audiovisual archive. The similarity between these two practices is interesting to examine as the ambiguity of the coffee ground shapes and the narrative structure in fortune-telling tradition could inspire novel ways of presenting and sharing lifelogging data in various contexts.

9. Bibliography

1. Stefanía Ægisdóttir and Lawrence H. Gerstein. 2000. Icelandic and American Students' Expectations About Counseling. *Journal of Counseling & Development* 78, 1: 44–53. <https://doi.org/10.1002/j.1556-6676.2000.tb02559.x>
2. Aloha Hufana Ambe, Margot Brereton, Alessandro Soro, and Paul Roe. 2017. Technology Individuation: The Foibles of Augmented Everyday Objects. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (CHI '17), 6632–6644. <https://doi.org/10.1145/3025453.3025770>
3. Fraser Anderson, Tovi Grossman, Daniel Wigdor, and George Fitzmaurice. 2015. Supporting Subtlety with Deceptive Devices and Illusory Interactions. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (CHI '15), 1489–1498. <https://doi.org/10.1145/2702123.2702336>
4. Edna Aphek and Yishai Tobin. 1990. *The Semiotics of Fortune-telling*. John Benjamins Publishing Company, Amsterdam; Philadelphia.
5. Tilde Bekker and Janienke Sturm. 2009. Stimulating Physical and Social Activity Through Open-ended Play. In *Proceedings of the 8th International Conference on Interaction Design and Children* (IDC '09), 309–312. <https://doi.org/10.1145/1551788.1551869>
6. Tim Wyatt Brown Jocelyn. 2010. Design Thinking for Social Innovation. *Development Outreach* 12, 1: 29–43. https://doi.org/10.1596/1020-797X_12_1_29
7. Oscar de Bruijn and Robert Spence. 2001. Serendipity within a Ubiquitous Computing Environment: A Case for Opportunistic Browsing. In *UbiComp 2001: Ubiquitous Computing* (Lecture Notes in Computer Science), 362–369. https://doi.org/10.1007/3-540-45427-6_31
8. Karen Church, Antony Cousin, and Nuria Oliver. 2012. I Wanted to Settle a Bet!: Understanding Why and How People Use Mobile Search in Social Settings. In *Proceedings of the 14th International Conference on Human-computer Interaction with Mobile Devices and Services* (MobileHCI '12), 393–402. <https://doi.org/10.1145/2371574.2371635>
9. Jared Donovan and Robb Mitchell. 2010. Social Contraptions and Embodied Interaction. In *Proceedings of the 12th ACM International Conference Adjunct Papers on Ubiquitous Computing - Adjunct* (UbiComp '10 Adjunct), 403–404. <https://doi.org/10.1145/1864431.1864458>
10. Peter Heinrich, Mehmet Kilic, Felix-Robinson Aschoff, and Gerhard Schwabe. 2014. Enabling Relationship Building in Tabletop-supported Advisory Settings. In *Proceedings of the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing* (CSCW '14), 171–183. <https://doi.org/10.1145/2531602.2531697>
11. Michael S. Horn. 2013. The Role of Cultural Forms in Tangible Interaction Design. In *Proceedings of the 7th International Conference on Tangible, Embedded and Embodied Interaction* (TEI '13), 117–124. <https://doi.org/10.1145/2460625.2460643>

12. Eva Hornecker and Jacob Buur. 2006. Getting a Grip on Tangible Interaction: A Framework on Physical Space and Social Interaction. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '06), 437–446. <https://doi.org/10.1145/1124772.1124838>
13. Kris Kissman. 1990. The role of fortune telling as a supportive function among Icelandic women. *International Social Work* 33, 2: 137–144. <https://doi.org/10.1177/002087289003300205>
14. Lisa Kleinman. 2007. Physically Present, Mentally Absent: Technology Use in Face-to-face Meetings. In *CHI '07 Extended Abstracts on Human Factors in Computing Systems* (CHI EA '07), 2501–2506. <https://doi.org/10.1145/1240866.1241031>
15. Nan Li and Pierre Dillenbourg. 2012. Designing Conversation-context Recommendation Display to Support Opportunistic Search in Meetings. In *Proceedings of the 11th International Conference on Mobile and Ubiquitous Multimedia* (MUM '12), 12:1–12:4. <https://doi.org/10.1145/2406367.2406382>
16. Susan Orpett Long, Glenda Susan Roberts, and Satsuki Kawano. 2014. *Capturing Contemporary Japan : Differentiation and Uncertainty*. University of Hawai'i Press, Honolulu. Retrieved December 24, 2015 from <http://libunix.ku.edu.tr/validate?url=http://0-search.ebscohost.com.libunix.ku.edu.tr/login.aspx%3fdirect%3dtrue%26db%3dnlebk%26AN%3d746976%26site%3deds-live>
17. Bruno Nadeau and Amanda Williams. 2009. Tactful Interaction: Exploring Interactive Social Touch Through a Collaborative Tangible Installation. In *Proceedings of the 3rd International Conference on Tangible and Embedded Interaction* (TEI '09), 147–152. <https://doi.org/10.1145/1517664.1517700>
18. Emine Gürsoy Naskali. *Türk Kahvesi Kitabı*. Retrieved April 27, 2017 from <http://www.pandora.com.tr/urun/turk-kahvesi-kitabi/241278>
19. Philipp Nussbaumer, Inu Matter, and Gerhard Schwabe. 2012. “Enforced” vs. “Casual” Transparency – Findings from IT-Supported Financial Advisory Encounters. *ACM Trans. Manage. Inf. Syst.* 3, 2: 11:1–11:19. <https://doi.org/10.1145/2229156.2229161>
20. Susanne Schmidt-Rauch and Philipp Nussbaumer. 2011. Putting Value Co-creation into Practice: A Case for Advisory Support. 138. Retrieved from <http://aisel.aisnet.org/ecis2011/138>
21. Dag Svanaes and William Verplank. 2000. In Search of Metaphors for Tangible User Interfaces. In *Proceedings of DARE 2000 on Designing Augmented Reality Environments* (DARE '00), 121–129. <https://doi.org/10.1145/354666.354679>
22. Jay Vidyarthi, Alissa N. Antle, and Bernhard E. Riecke. 2011. Sympathetic Guitar: Can a Digitally Augmented Guitar Be a Social Entity? In *CHI '11 Extended Abstracts on Human Factors in Computing Systems* (CHI EA '11), 1819–1824. <https://doi.org/10.1145/1979742.1979863>