Exploring Smartphone User Needs and Preferences Towards Making Major Online Purchases

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Abstract

Recent studies have shown that 80% of Americans are online shoppers with 50% using smartphones to make purchases. (Pew, 2018) Smartphone characteristics are appealing to many shoppers because they are portable, interactive, instantly accessible and provide real-time product descriptions, reviews and price comparisons to support consumer's information needs. Our study focused on active duty military personnel researching online VA home loans and lenders, a major purchase activity for most people. Using a mobile ethnography screen and audio recording tool, subjects recorded their smartphone home loan research activities while searching and vocalizing their VA home loan journey. One hundred ninety-three ethnographies were collected paired with 14 semi-structured interviews. Findings indicate that to support an online major purchase journey, users have specific device preferences for that journey as well as relying on distributed cognition tools as research support. Study results suggest there are drawbacks of using smartphones to support major purchases online.

Key words: smartphone, user preferences, major online purchasing, information searching

Exploring Smartphone User Needs and Preferences Towards Making Major Online Purchases

According to the Pew Research Center, almost 95% of Americans now own a cellphone. Smartphone ownership has increased to 77% from 35% since research was first conducted in 2011 (Pew, Mobile Fact Sheet). In addition, nearly 75% of U.S. adults now own desktop or laptop computers. Pew also reports that just "over one-in-ten American adults are "smartphone-only" internet users – meaning they own a smartphone, but do not have traditional home broadband service." (Pew, Mobile Fact Sheet) The survey finds that close to 80% of Americans are now online shoppers with at least 50% using a smartphone to make online purchases. As a form of social support and validation, online ratings matter to American consumers. Pew reported that 80% review online ratings when buying something for the first time. In fact, 50% stated that "customer reviews help 'a lot' to make consumers feel confident about their purchases and to make companies be accountable to their customers (45%)." (Pew, Online Shopping and e-Commerce) through the open discussion and review process by peers.

Americans use their smartphones to inform financial decisions. The Consumer and Mobile Financial Survey (Federal Reserve, 2016) state that adoption of mobile financial service information continues to increase. Most consumers reported that having a smartphone provided ease of access and convenience as a significant reason for adoption. In addition, mobile phones can provide instant information to help consumers make more immediate and potentially better-informed financial decisions.

Smartphones offer the option of instantaneous, "on the go" information anytime and anywhere a network connection exists. As internet sales continue to increase, e-commerce customers have certain performance expectations and preferences. A user centered interface is critical for success whether it be for mobile or laptop applications. Mobile commerce

applications have design specific challenges because their screen sizes are smaller than desktops and they can operate in low band-width locations causing time lags for graphics and downloads.

According to Tarasewich (2003), characteristics to keep in mind when designing mobile interfaces are a) environment (location, physical properties, brightness and noise levels; b) participants (expectations, personal properties, mental and physical health; c) activities (tasks and goals of participants and environmental conditions; and d) interactions (co-locations, social and group situations, and participant relationships (p. 59). Potential solutions to improve user interfaces are minimal-attention interfaces, context awareness, biometrics, security and data privacy (Tarasewich, 2003).

Founded in 2003 and located in Columbia, MO, Veterans United (VU) is an American based home loan company focused on providing Veterans Administration (VA) assisted home loans to current or former American military personnel which includes both the Reserves and National Guard. VU provides a number of online services and tools to support potential home loan clients through their information journey and was the original inspiration for this pilot study. This pilot project is focused on Veterans Administration (VA) home loans and user smartphone needs and preferences through that major online purchase decision journey as they decide on a lender for a VA home loan.

Problem Statement

Multiple VA home loan lenders provide an array of online services and tools to support users and their VA loan information journey. VU provides a number of tools including mortgage lender comparison tables, mortgage and interest rate calculators, along with a number of educational resources. VU presented the research team with a problem related to their mortgage lender comparison tool, that smartphone conversion rates were not performing as hoped. Based

on analytic data, a variety of users were clearly interacting with the tool using both desktop/laptop and smartphone devices, but there was a significant discrepancy with users being much less likely (by more than 50% according to VU's internal google analytic data) to move forward with the conversion process when using smartphone devices. When further investigating this issue, the phenomenon was not isolated to this tool exclusively with the discrepancy presenting itself with numerous other VU tools as well. This finding focused on user smartphone needs and preferences as opposed to desktop/laptop needs and preferences related to their online research journey. As online consumer purchase behavior and habits continue to grow, our study focused on consumer research behavior and their journey's related to a major purchase (those purchases typically receiving tax deductions), the interactive tools they rely on to support that knowledge gathering and how using either smartphones or desktop/laptops devices may differ in its support for such an activity.

While ample research on e-commerce and mobile platforms exist, most of it pertains to retail or minor purchasing behaviors focusing on consumer behavior and trustworthiness (Troutman & Timpson, 2008; El-Kiki & Lawrence, 2008; Ngai & Gunasekaran, 2007). There is very little research on how smartphone applications and web platforms support (or not) consumer's performance needs when researching or attempting to conduct major purchases (those purchases typically receiving tax deductions) online. As online consumer purchase behavior and habits continue to grow, our study focused on consumer research behavior and their journey's related to a major purchase, the interactive tools they rely on to support that knowledge gathering and how using either smartphones or desktop/laptops devices may differ in its support for such an activity.

We specifically focused on motivated participants seeking Veterans Administration (VA) home loans (home loans guaranteed by the US government for US military personal who meet specific criteria) for purchasing a home in the immediate future.

This research project investigated online user research approaches, tools and supports, relationships between smartphone and desktop device interaction preferences, and performance needs related to major purchase decisions and online behavior as part of their journey experience. Our research questions included:

1. What online information search strategies are utilized when using a smartphone to inform a major purchase decision?

2. What smartphone applications and website functions support online information needs related to major purchase decisions?

3. How does either a desktop/laptop or smartphone support online information needs related to major purchase decisions?

Theoretical Framework

The primary theoretical framework utilized is rooted in Engestrom's (1987, 1999) proposed activity theory system model which has been extensively utilized within industry and real-world practices (e.g. Blackler, 1993; Miettinen & Virkkunen, 2005; Jarzabkowski, 2010; and Dochy et al, 2012). It outlines different approaches of interactively mediating three-way relationships between "object", "subject" and "community", tools or instruments, rules, and division of labor. Drawing from "Making HCI Theory Work: An Analysis of the use of Activity Theory in HCI Research" (inspired by Engestrom's model), the shaped framework was activity theory as a conceptual framework for thematic analysis of consumer research activities and

supports when searching for VA home loan information using either a smartphone/mobile device or a desktop/laptop (See Figure 1).

Context was used to frame meaningful human activity, tool mediation for artifact comprehension and for understanding the activity systems, contradictions, tensions and breakdowns. This conceptual framework also provides a basis for design exploration and analysis to better understand interactive technological artifacts and the daily contextual roles with users (Clemmensen et al, 2016). Figure 1 shows three levels of activity theory: technological, individual and community.
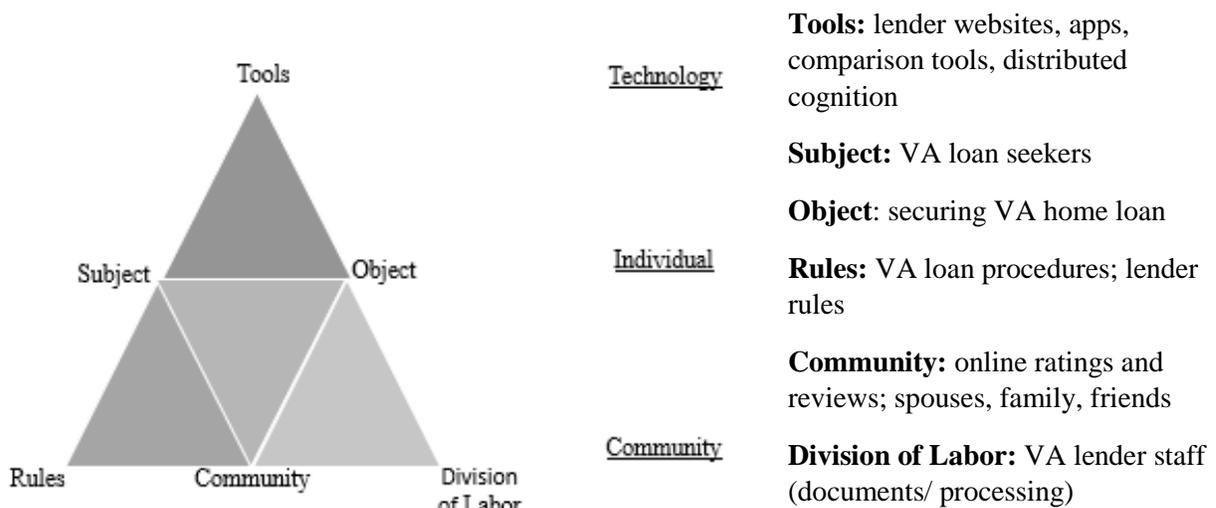
Tools: lender websites, apps, comparison tools, distributed cognition

Subject: VA loan seekers

Object: securing VA home loan

Rules: VA loan procedures; lender rules

Community: online ratings and reviews; spouses, family, friends

Division of Labor: VA lender staff (documents/ processing)

Figure 1. Levels of Activity Theory that influence smartphone use for major purchases.

Methodology

The research design for the study was a qualitative approach that included both a mobile ethnography (Muskat, Muskat & Zehrer, 2017) and a semi-structured interview (Blandford, 2013). We recruited a sample of the target population who were compensated for their participation upon completion of the study. The data collection process took approximately two

weeks for participants to complete the screener, on-boarding, mobile ethnography tasks, and

interview. (See Table 1)

Table 1
Methodology Table

Research Questions	Data Collection Method	Data Analysis
What online information search strategies are utilized when using a smartphone to inform a major purchase decision?	Mobile Ethnography: Think Alouds Semi-Structured Interviews	Mobile Ethnography: Think Alouds = Thematic Analysis Semi-Structured Interviews: Interviews = Thematic Analysis
What smartphone applications and website functions support online information needs related to major purchase decisions?	Mobile Ethnography: Think Alouds Semi-Structured Interviews	Mobile Ethnography: Think Alouds = Thematic Analysis Semi-Structured Interviews: Interviews = Thematic Analysis
How does either a desktop/laptop or smartphone support online information needs related to major purchase decisions?	Mobile Ethnography: Think Alouds Semi-Structured Interviews	Mobile Ethnography: Think Alouds = Thematic Analysis Semi-Structured Interviews: Interviews = Thematic Analysis

Participants

Participants were recruited using the services of two online research sites, "Respondent"

and "User Interviews." From these sites, 60 participants were screened for the project using a

participant screener (See Appendix A.1) designed to look for specific relevant details related to

US military service (loan eligibility), their current home buying status (current motivation) and

their use of a smartphone (study object). Both men and women of varying age ranges were

solicited. Of those 60, twenty-six were chosen after an initial phone interview. Twenty-four

participants were asked to complete the consent form (See Appendix A.2) and were on-boarded

to the study by Skype interview where the study details were introduced and initial questions

were answered. Using both telephone and Skype to connect with participants provided a more

personalized contact point in hopes of developing a rapport to provide additional study

connection and engagement. A total of fourteen participants finished the study requirements (See

Table 2).

Table 2:
Characteristics of Participants (N = 14)

ID	State	Gender	Age Range	Education	Military Branch	Home Buying Status	Device Preference
2753	California	Male	18-29	Masters	Army	Searching	Laptop
2775	New York	Female	30-39	PHS/ Training	Army	Searching	Smartphone
1875	Spain	Male	18-29	Bachelors	Air Force	Searching	Laptop
2736	California	Male	30-39	Bachelors	Army	Searching	Smartphone
2232	Oregon	Male	18-29	PHS/ Training	National Guard	Searching	Laptop
2203	Florida	Male	30-39	PhD	Army	Searching	Laptop
1685	Texas	Female	18-29	Bachelors	Army	Not Started	Laptop
1505	Oregon	Male	40-49	Bachelors	Air Force	Not Started	Laptop
1313	Pennsylvania	Male	30-39	Masters	Army	Searching	Laptop
1260	Virginia	Female	30-39	Masters	Air Force	Not Started	Smartphone
1576	Florida	Male	30-39	PhD	Air Force	Not started	Smartphone
2698	Wisconsin	Female	30-39	Masters	Army/ National Guard	Not Started	Laptop
1402	Texas	Male	18-29	Bachelors	Army	Not Started	Laptop
1517	Pennsylvania	Female	18-29	Bachelors	Army	Searching	Smartphone

Mobile Ethnography Data Collection

The mobile ethnography component was designed using the framework outlined in

Muskat, Muskat and Zehrer (2017). The research dimensions include: role of researchers, focus

of research, data collection, and data analysis (Muskat et al., 2017, p. 7-9). We considered each

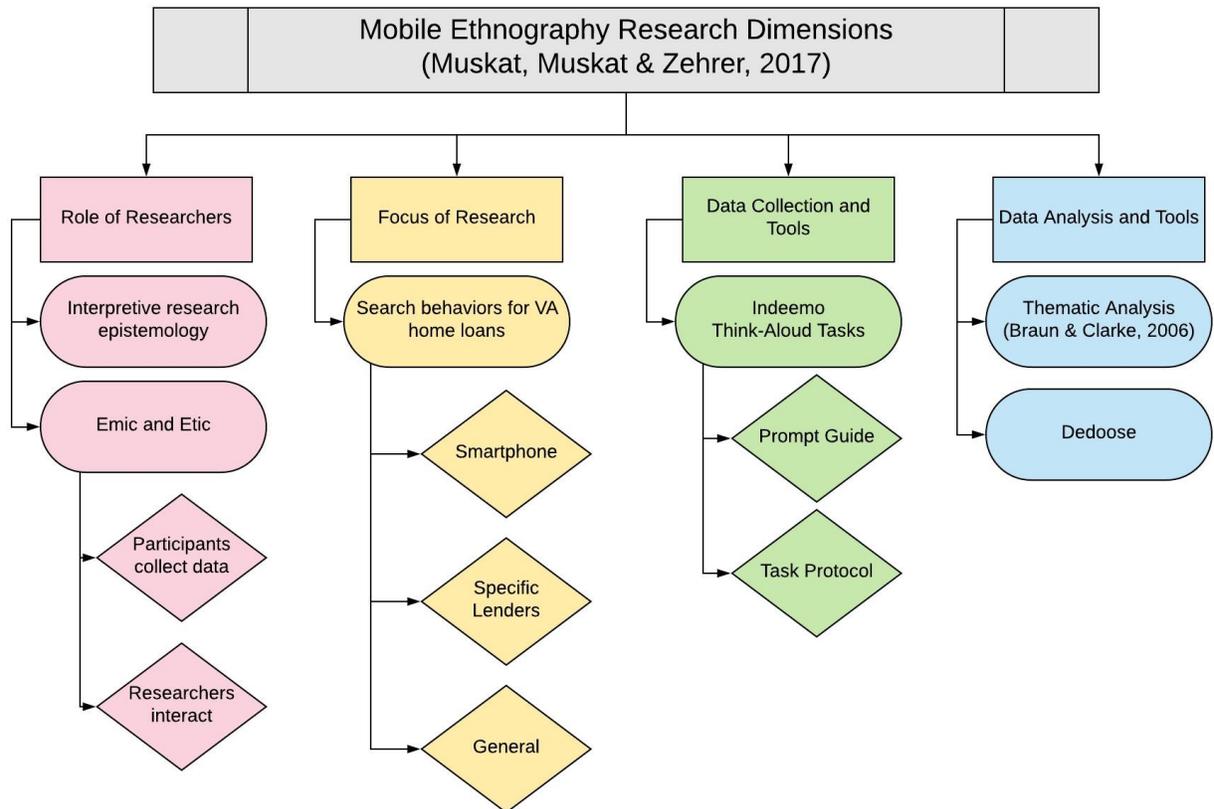of these facets in the initial stages of the research design process (See Figure 2).

Figure 2. Mobile ethnography research dimensions.

Role of researchers. Before designing the ME tasks, the research team met and

discussed the extent our involvement in the data collection process. We decided to use an

approach that combined both etic and emic elements, meaning we would mostly monitor and

observe the tasks (etic), but would work with participants when we felt compelled to ask for

clarification or more information (emic). The participants were the ones to produce the data,

while the research team worked to guide their journeys to capture the search behaviors aligned

with our research questions.

Focus of research. The phenomena of study were searching behaviors and supports used

related to smartphones, general VA home loans, the Veterans United mobile website, and

additional Veterans United resources (e.g., loan comparison tool and mortgage calculator). The

tasks were structured in order for participants to start with general searches, and work their way

toward the more specific searches on the Veterans United mobile site. In addition to their

behaviors and utilized supports, we were interested in their attitudes, feelings, and reactions to

what they were experiencing.

Data collection tools. To collect think aloud data during the mobile ethnography,

it was necessary to incorporate a mobile application that would record both on-screen actions as

well as record the think-alouds. We utilized Indeemo, a mobile application primarily used by

companies to study their customers' behaviors (Indeemo, 2018). Indeemo allows its users to

create screen recordings with simultaneous recorded voice overs and screenshots. These screen

recordings are uploaded to a dashboard accessible to the research team in order to monitor

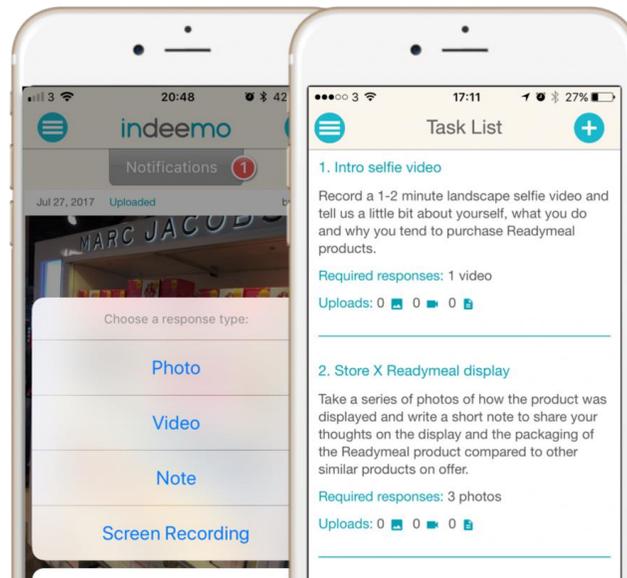progress. This is an example of the Indeemo interface. (See Figure 3)

Figure 3. Indeemo mobile ethnography app.8

Participants were provided a Think Aloud Prompt Guide (See Appendix B.1) for

guidance and inspirational use during the mobile ethnography tasks. The guide had 14 total

prompts organized in a unique layout and font design for users to more easily visually sort

through the prompts while actively performing their mobile task. Prompts focused on their user

journeys, devices, information needs, tools, supports and reactions. They were also encouraged

to provide their own unique thoughts which may have stepped outside of the think aloud guide.

The participants completed eight tasks total (See Appendix A.3) and were provided

detailed instructions regarding the specific activities. Tasks were presented in a sequential

fashion, one after the other with new task details only learned once previous tasks were

completed. Through the Indeemo platform, participants were given task prompts and instructions

to guide their activity paired with think aloud reminders to help verbally articulate their journey.

The final ethnography task focused on a specific VA home loan vendor tool.

Data analysis tools. Once the screen recordings were uploaded, they were transcribed

using Temi, an automatic transcription service. We used DeDoose to review, code, analyze, and

interpret the findings for both the mobile ethnography and the semi-structured interview

transcripts.

Semi-Structured Interview Data Collection

A semi-structured interview (Blandford, 2013) having a predetermined set of open ended

questions to elicit open ended responses was developed (See Appendix A.4). The questions and

their open-ended nature allowed for the exploration of additional themes and responses

expressed by the participants. In support of the high level research questions, the insight

generation goals of the interview were all related to the actual, optimal, behavioral, attitudes-

feelings and beliefs of a) gathering the user reflective experiences of smartphone & mobile

website use which help/hinder and inform/support home loan information seeking needs; b)

gathering the user reflective experiences of smartphone & mobile website versus desktop and

website use which help/hinder and inform/support home loan information seeking needs: c) how

smartphones and mobile sites support (or not) the information seeking behavior of VA home loans; and d) how smartphones and the Veterans United mobile site and tool support (or not) support the information seeking behavior focused on Veterans Administration home loans.

Data Analysis

We used an inductive approach and thematic analysis to analyze and interpret the data. (Braun & Clark, 2006; Braun, Clarke & Terry, 2012) All audio from the recorded mobile ethnography screens and semi-structured interviews were transcribed for the 14 participants. 14 interview transcriptions totaled 411 minutes with the average post interview being 29 minutes. 193 mobile ethnographies were transcribed totaling 893 minutes with the average mobile participant ethnography being 64 minutes (See Table 3).

Table 3
Data Collection Descriptive Statistics

Data Type	Total Data Pieces	Total Minutes	Average Time/Participant
Mobile Ethnography	193	893	64
Semi-Structured Interview	14	411	29

Rooted in the research questions, a priori conceptual constructs and sub-constructs were generated (See Table 4) to provide guidance to the thematic coding schemes (White & Marsh, 2006).

Table 4
A Priori Constructs and Sub-Constructs

Construct	Searching Strategies	Function Supports & Tools	Information Needs	Device Needs & Supports	Purchase Decision Complexity
		Support		Desktop/Laptop - Supports - Limitations	Minor Purchases
Sub-Constructs	-		-		
		Hinder		Smartphone/Mobile - Supports - Limitations	Major Purchases

Using those research question-based a priori constructs, two participant interviews and mobile ethnography journeys were selected based on their perceived richness and range of information. Through recursive coding cycles (two total), the participant data informed a thematic code scheme consisted of 63 codes (See Appendix C.1).

DeDoose was utilized to apply the coding scheme to all of the transcription data. Utilizing DeDoose's training center feature, research team members practiced coding on sample excerpts to evaluate the consistency of excerpt code application. That process was used to improve application consistency for interrater reliability performance. At completion of the coding process, 1,805 excerpts were selected with 4,422 codes applied. Qualitative saturation was reached (Mason, 2010), where the same themes were consistently reoccurring with no new emergent themes. Utilizing a code co-occurrence approach in DeDoose, the excerpts, applied codes and patterns were then analyzed and clustered into meaningful themes which provided insights into the original research questions.

Findings

Upon completing the excerpts coding, there were four emerging themes from the data analysis (See Table 5).

Table 5
Data Analysis Emergent Themes

Themes
1. Users have specific device preferences of using either a desktop/laptop or smartphone to research their major purchase research needs
2. Users who practice in-depth major purchase research prefer desktop/laptops
3. Smartphones support initial research for major purchase journeys
4. Most users use distributed cognition tools to support their major purchase research journeys

Interpretation: Themes One through Three

Informing all three research questions, the first three themes demonstrated that users have very specific device preferences based on their type of major purchase research activity when utilizing their search strategies, interacting with smartphone applications and website functions and supporting their information needs.

User search strategies depended on the type of research they preferred, either in the moment-based on demanded immediacy or that of a more deliberate extended research and information gathering approach. Those who consistently preferred information immediacy, stated a strong preference of using their smartphones for its convenience of providing in the moment information. They utilized their phones when "on the go" in between daily activities to satisfy their moment of information need on a variety of topics. A representative sample excerpt demonstrating this dynamic comes from participant 2753:

> I use my smartphone to look up just about anything and everything. Sometimes I may just be looking for one piece of information. This is typically contact information like an address, phone number, or email. It may be a reservation number or a confirmation number that I am looking for. Sometimes I am researching. I might be looking up information for ideas that I have; planning a birthday party, wedding, vacation, etc. Lastly, I might be using mobile websites to pay bills, book appointments, or make purchases in between other things I'm doing throughout the day. (Interview)

Those who consistently preferred more extended time periods of research focus preferred utilizing desktop/laptops. This is mainly due to a reported increase of performance capacity which included screen size, system speed and an increased ability to easily multitask

simultaneously between a variety of activities to process a larger load of information. Screen size was a significant factor in support of simultaneous multi-tasking. This representative sample except demonstrating this dynamic is from participant 1685:

> On a smartphone, it's very difficult to quickly and efficiently navigate between multiple tabs / websites / resources. In addition, the smaller screen size and need to use mobile websites can make some tools and graphics more difficult to see and interpret. That's why I prefer using a laptop. (Interview)

In one instance, a user stated an initial preference of using a smartphone for any and all activity including researching major purchases, However, after this study experience the participant changed her opinion about the capability of being able to use a smartphone for a major purchase decision. These excerpts from participant 1517 show her change of opinion.

Initial Opinion: Pro-Smartphone:

> Using a smartphone helps support any of my purchases including major purchasing decisions. It's super convenient, provides faster and more easily accessible information, allows me to make quick comparisons, use multiple browsers, and simultaneously screenshot and almost instantly capture any photos or data that I want expedited access to in the future. (Mobile Ethnography)

Changed Opinion: Pro-Desktop:

> I'm more opinionated about wanting to use a desktop now than I was previously after doing the study because there was a lot of things I was trying to do that it just, I felt very limited when I was doing it through my phone. I'm like, it came to like looking at different tables and stuff on the um, you know, veterans united website. I'm like comparing the comparison table. I felt like that's something that I

want to pull up and be able to see the whole thing which was much easier on the

desktop. (Interview)

Another interesting finding, we observed was of those who preferred to use desktop/laptops,

almost all would integrate the use of a smartphone into the major purchase research journey. It

was consistently used as a research starting point to initially inform and support their information

needs as well as being used in between use of their desktop/laptops for more in depth research.

This representative excerpt example of using a smartphone as a research starting point comes

from participant 1875:

Uh, but me as a consumer, my iPhone exists for my convenience only. It's not my

primary tool for anything. And so if I'm sitting in a waiting for somebody to, to

uh, join me at a restaurant or something like that up on my phone and to start

doing some entry level research into something I want. Um, and a lot of times I'll

scroll through and do a lot of reading that way and sometimes I just start there,

but ultimately, I don't like the limitation that I have there. It's harder to type, it's

harder to see things. It's harder to put two or three things on the phone window, at

the same time. (Interview)

Interpretation: Theme Four

Theme four speaks to the distributed cognition (DCog) tools regularly utilized by the

participants. DCog is a cognition concept proposing that knowledge is distributed to other

individuals, objects and tools to lessen an individual's cognitive processing load and support ease

of information recall (Berndt et al, 2015). In this context, DCog refers to online tools. A variety

of DCog online tools were utilized to save information participants deemed important in their

research journey to return to at a later point and/or to share with others. DCog tools include,

email, taking phone screenshots, Notepad, Evernote, Google Docs and social media tools among

others. A representative DCog excerpt sample demonstrating this dynamic comes from

participant 2736:

> I tend to save allot of the information by screenshots that save in my picture albums on
>
> my phone. I also send website links to my personal email or text message to be able to
>
> access/print at a later time. I also use my "notes" app to make notes, jot down websites so
>
> that I can access or print information from later. (Interview)

Implications for HCI

The meaningful aspects of activity theory focus of this study is the consumption of

information and how either smartphones or desktops help mediate the discovered artifacts within

the activity. Contradictions, tensions and breakdowns present themselves between different user

information consumption preferences and how smartphone or desktops applications/websites

support, or not, those preferences. This study findings suggest; a) a recognition of different user

profiles between the way they consume information on either smartphone or desktop/laptop

devices and their associated applications/websites; b) the importance of considering "tethered

systems" which promote and maintain and a connected information experience between devices

and potential user profile types; and c) the importance of considering the utilization of online

DCog tools used by those different user types to support returning to their chosen information.

Savio and Braiterman recommend ten heuristics for the mobile design environment. The

focus of their research was design practices around mobile people not mobile devices. Savio &

Braiterman, 2007) Our study reaffirmed their heuristics for mobile design:

Table 6

Savio and Braitemann's Heuristics

Heuristics
1) Mobile interactions must be user-driven.
2) Mobile derives from desktop computing and previous user models.
3) Mobile requires ease of use with small screens.
4) Mobile users want simplicity not disruption from the user experience.
5) Mobile users have constant "companions" with their devices.
6) Mobile users want experiences to link to other devices.
7) Mobile interactions may be cursory to the end goal objective.
8) Mobile users trust peer marketing the most.
9) Mobile users expect GPS to enhance their experiences.
10) Mobile phones are not limited to the processing capabilities but rather become a "dumb terminal" with further processing carried out elsewhere in the network.

Concluding Recommendations

Based on this study's emerging themes and their implications to answer its research

questions, the following concluding recommendations can be made:

User Types, Device Preferences & Information Consumption

The study suggests there may be specific user types in terms of how they consume

information on different devices (smartphone vs desktop/laptop) related to major purchase

information activities. Future studies could delve into this dynamic for enhanced understanding

on user behavior types related to major purchase information journeys and supporting

performance tools. Enhanced behavior type understanding may provide future recommendations

related to an information design framework based on user and device types and the

interaction/interface designs supporting that information framework. The framework mode of

functionality and information design could be triggered by device type to serve user needs.

Tethered Systems

Tethered systems refer to those system applications and websites which are able to retain

and share user account information across a variety of device channels including both

smartphones and desktop/laptop platforms. While some application and system designs may not

have a need for a tethered systems approach supporting a user activity and experience, this study

suggest users utilize different device channels to support research journey's related to major

purchase decisions. A tethered system approach supporting a user's major purchase journey

would allow them to have a more seamless information experience across channels where they

could save, share and return to information to help conveniently support their decision-making

process. This type of tethered system could support users whether they were engaged in a

research activity of immediacy or an in-depth one.

Distributed Cognition Support

Throughout this study's data, distributed cognition tools are consistently relied upon as

references tools to support a user's online research journey related to major purchases.

Anticipating user utilization of DCog tools, systems design considerations could include,

incorporating functions which accelerate the DCog process (such as cutting and pasting) of using

outside DCog tools, providing internal DCog system tools so users do not have to use outside

DCog sources or if a tethered system approach is utilized, providing a more robust DCog tool set

and functionality which reflects the range of user preferences.

Project Scope

The bounded scope of this project included a major purchase focus and within that, VA home loans. Another bounding aspect were the participants as only those who were qualified and seeking VA home loans whom formed the participant base. The research questions also served as a bounding mechanism to shape the instruments for collecting data to answer those study questions.

Limitations

Limitations of the study include a sole focus on the VA home loan seekers. Had VA home lender support personnel been included in this study, more insight into backend support details could have been explored and how those support activities do (or do not) support VA home loan seekers. While a SUS questionnaire focused on a specific VU tool (lender comparison chart) was administered, it's findings were not included in this report. Some participants could not find the lender comparison chart or they viewed the wrong tool, each instance impacting the SUS data collection. This data set was also not provided in this study because it had no impact or bearing based on our research questions. Another limitation was depth of data analysis. Additional qualitative process rigor could have been applied when generating code themes and subthemes based on the research question constructs and a more thorough recursive data analysis process. A more comprehensive data analysis could have provided additional specific system recommendations for implementation. Finally, a limitation related to the DeDoose qualitative analysis software presented itself. During the study analysis phase, DeDoose discovered a major software issue which hampered its ease of operation and speed of use. Transcriptions also needed to be reviewed and corrected due to numerous errors discovered.

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Appendix A

Instruments

A.1 Screener Instrument

Gender

> M
>
> F
>
> Other

Age-Ranges

> 17 or younger- D
>
> 18-24 years old- Q
>
> 25-34 years old-Q
>
> 35-44 years old-Q
>
> 45-54 years old-Q
>
> 55-64 years old-Q
>
> 65-74 years old-Q
>
> 75 years or older-Q

What is your military status?

> Active Duty - Q
>
> National Guard/Reserves - Q
>
> Veteran/Retired- Q
>
> No Military Service- DISQUALIFY

What are your plans to buy a home?

> I plan to buy a home within 6 months- Q
>
> I plan to buy a home in 6 months to a year- Q
>
> I plan to buy a home after a year or more- D
>
> I plan to buy a home but not sure when- D
>
> I have no plans to buy a home- D

Other- D

Would you use a mobile smartphone to look for home loan related information?

Yes- Q

No- D

Have you ever used a VA home loan?

Yes-Q

No- Q

Would you be available over multiple study activities (survey, screen shares and interview) over the course of 1 week?

Yes-Q

No- D

A.2 Consent Form

Project Title: Exploring Differences in Mobile and Desktop User needs, Preferences and Habits Towards Online Purchasing Behavior

Consent Form *(Participant over 18 y/o)*

Researcher's Name(s): Shann Bossaller, Michele Kroll, Devon Whetstone

INTRODUCTION

You are being asked to participate in a research study. When you are invited to participate in research, you have the right to be informed about the study procedures so that you can decide whether you want to consent to participation. This form may contain words that you do not know. Please ask the researcher to explain any words or information that you do not understand.

You have the right to know what you will be asked to do so that you can decide whether or not to be in the study. Your participation is voluntary. You do not have to be in the study if you do not want to. You may refuse to be in the study and nothing will happen. If you do not want to continue to be in the study, you may stop at any time without penalty or loss of benefits to which you are otherwise entitled.

This research is funded by Veterans United.

WHY IS THIS STUDY BEING DONE?

This research is being conducted to determine how the Veterans United mobile web application can be improved to better meet the information needs of those searching for Veteran Administration home loans on smartphone devices.

WHAT AM I BEING ASKED TO DO?

Your participation in this study is for the purpose of research. This will be 100% remote from your home or work mainly using your smartphone. We will be collecting the following types of data in multiple sessions:

1.   4 total recorded performance sessions while using a smartphone.

2.   1 Anonymous Usability Questionnaire (can be taken on any device).

3.   1 recorded Individual Interview (using smartphone and Skype).

Recorded Performance Sessions

Your smartphone screen will be recorded as you look for home loan information over 4 sessions. While looking for this information you will be speaking out loud discussing your experiences and thoughts. The audio from your speaking out loud will be transcribed for later analysis. If for any reason you are uncomfortable during the session and do not want to continue, you may end the session and leave at any time. It is for data collection only.

Usability Questionnaire

At the end of your third recorded performance session, you will receive a link to a 10 question Likert survey questionnaire to complete. If for any reason you are uncomfortable during the session and do not want to continue, you may end the session and leave at any time. It is for data collection only.

Interview

The individual interview usually will last between 30-45 minutes and will be audio recorded. If for any reason you are uncomfortable during the session and do not want to continue, you may end the session and leave at any time. It is for data collection only.

CONFIDENTIALITY

In addition, if photographs, audiotapes or videotapes were taken during the study that could identify you, then you must give special written permission for their use. In that case, you will be given the opportunity to view or listen, as applicable, to the photographs, audiotapes or videotapes before you give your permission for their use if you so request.

Results of the study may potentially be submitted to professional publications. Your name will not be included in any report nor will your name be associated with any data collected in the project. Photos will be blurred to protect any identifying information. Each participant will have an ID number assigned so identity is not disclosed. The key will be kept separately in the PI's locked office and cabinet.

HOW LONG WILL I BE IN THE STUDY?

This study will take approximately two months to complete from March through April, 2018. You can stop participating at any time without penalty.

WHAT ARE THE BENEFITS OF BEING IN THE STUDY?

Your participation can benefit the usability and information experiences of US military personnel when they are seeking Veterans Administration home loan information when using a mobile phone. This could make looking for such loans more convenient and simple or US military personnel.

WHAT ARE THE RISKS OF BEING IN THE STUDY?

Interviews will be audio recorded so some participants might feel uncomfortable.

WHAT ARE THE COSTS OF BEING IN THE STUDY?

There is no cost to you.

WILL I BE COMPENSATED FOR PARTICIPATING IN THE STUDY?

Yes. $150 gift card is available for those who complete the study.

If you decide to end your participation during the study you will be awarded the amount up to your participation phase.

WHAT OTHER OPTIONS ARE THERE?

You have the option of not participating in this study, and will not be penalized for your decision.

WHO DO I CONTACT IF I HAVE QUESTIONS, CONCERNS, OR COMPLAINTS?

Please contact *Shann Bossaller, sb5g5g@mail.missouri.edu* if you have questions about the research. Additionally, you may ask questions, voice concerns or complaints to the research team.

WHOM DO I CALL IF I HAVE QUESTIONS OR PROBLEMS?

If you have any questions regarding your rights as a participant in this research and/or concerns about the study, or if you feel under any pressure to enroll or to continue to participate in this study, you may contact the University of Missouri Campus Institutional Review Board (which is a group of people who review the research studies to protect participants' rights) at (573) 882-9585 or umcresearchcirb@missouri.edu.

A copy of this Informed Consent form will be given to you before you participate in the research.

I have read this consent form and my questions have been answered. I know that I can remove myself from the study at any time without any problems.

A.3 Mobile Ethnography Task List

Task list introduction: *(write a short intro here to explain the overall project and what they will need to do the next n days)* *We will add the moderator contact details here so the respondent can contact you if needed.*	Welcome to our project! Thank you for joining – We look forward to receiving your uploads and what you discover! You will have multiple objectives which will include: • **Conducting online VA loan research as you normally would while using your smartphone and the Indeemo application.** • **"Thinking Aloud" while conducting your VA Loan research.** • **Posting multiple screen recording videos and screenshot pictures of your experiences.** • **Broadly Searching for VA Loan Information & Lenders of interest to you.** • **Selecting potential VA Loan Lenders.** • **Exploring a Specific VA Loan Lender Site.** Keep in mind that each **Screen Recording Video** can be a maximum of **10 minutes** long. Feel free to upload more videos for each task as you see fit. Also, any additional screen shots and captions of particularly interesting points or confusing points are more than welcome**!**

Task title	Looking for VA Loan information and Thinking Aloud
Task description	We would like you to thoroughly search **for any and all VA home loan information, services and tools on different websites** you think best supports your information research journey and capture this using the Indeemo Screen Recording functionality. During your search, please think aloud while consider the following: • **Search as you normally would for VA loan information.** • **Broadly search for anything helpful in your VA loan research journey.** • **Please report your experiences by "thinking aloud".** Perform multiple searches for VA loan information until you've confidently settled on potential VA loan lenders who meet your needs and know why you've selected them. **Please have the think aloud guide available to reference.** Feel free to upload more than 4 Screen Recording videos along with screenshots with captions to help further illustrate your point.
Required Responses	4 Videos
Start date / time	
End date / time	

Task title	Discuss VA Loan Lender Choices
Task description	Take a Screen Recording where you revisit the best VA lenders you identified during your VA loan search and tell us the following:

	• **Discuss why you selected each vendor.**
	• **What helpful features did they offer to help your research journey?**
	• **What made them trustworthy enough to seriously consider?**
	• **How confident are you of using them?**
	Please have the think aloud guide available to reference.
	Feel free to upload more than 1 Video along with screen shots and captions to help further illustrate your point.
Required Responses	1 Video
Start date / time	
End date / time	

Task title	**Discuss Specific VA Loan Lender**
Task description	Take a Screen Recording where you revisit the VA lender that provided the most positive impression through your search and show us the highlights.
	Was it:
	• **Specific site features?**
	• **Specific VA Loan Information?**
	• **Specific site design?**
	• **Specific Educational information?**
	Refer to the Think Aloud guide to help guide your discussion.
	Feel free to upload more than 1 Video along with screen shots and captions.
No. of and type of responses	1 Video
Start date / time	
End date / time	

Task title	**Looking for any VA Loan Information and Commenting**
Task description	For this task we would like you to **focus exclusively on the Veterans United site** and thoroughly **search for any and all VA home loan information, services and tools** that you're interested in and support your information research journey. Capture this using the Indeemo Screen Recording functionality.
	For iPhone owners:
	Copy this link https://www.veteransunited.com and paste it into the built in Indeemo browser after selecting the Screen Recording functionality.
	For Android owners:
	Copy this link https://www.veteransunited.com and start the Screen recording functionality on Indeemo. Open your preferred browser on your mobile, paste in the link.
	During your search, please think aloud while consider the following:
	• **Search as you normally would for VA loan information.**
	• **Broadly search for anything helpful in your VA loan research journey.**
	• **Please report your experiences by "thinking aloud".**
	Refer to the Think Aloud guide to help guide your discussion.

	Feel free to upload more than 3 Videos along with screen shots and captions to help further illustrate your point.
No. of and type of responses	3 Videos
Start date / time	
End date / time	

Task title	**Discuss Specific Veterans United Site Issue**
Task description	Take a Screen Recording where you revisit the **Veterans United site** and show us the most unfavorable aspect encountered through your search. best VA lenders you identified during your **Veterans United site search** and tell us the following: Was it: • **Specific site features?** • **Specific VA Loan Information?** • **Specific site design?** • **Specific Educational information?** **Refer to the Think Aloud guide to help guide your discussion.** Feel free to upload more than 1 Video along with screen shots and captions to help further illustrate your point.
No. of and type of responses	1 Video
Start date / time	
End date / time	

Task title	**Veterans United Education Resource**
Task description	**Focusing on the Veterans United site ONLY**, find the **educational resources** page and thoroughly use it. Capture this using the Indeemo Screen Recording functionality. For iPhone owners: Copy this link https://www.veteransunited.com and paste it into the built in Indeemo browser after selecting the Screen Recording functionality. For Android owners: Copy this link https://www.veteransunited.com and start the Screen recording functionality on Indeemo. Open your preferred browser on your mobile, paste in the link. While recording your activity on the **educational resources** page talk us through the following: • **How does this tool compare to other mortgage calculators you've seen or used?** • **How helpful is this mortgage calculator?** • **Was calculator easy to understand?** • **How could the mortgage calculator be improved?** • **How would you use this information on your research journey?** **Refer to the Think Aloud guide to help guide your discussion.** Feel free to upload more than 1 Video along with screen shots and captions to help further illustrate your point.

No. of and type of responses	1 Video
Start date / time	
End date / time	

Task title	Veterans United Mortgage Calculator
Task description	**Focusing on the Veterans United site ONLY**, find the **mortgage calculator** page and thoroughly use it. Capture this using the Indeemo Screen Recording functionality. For iPhone owners: Copy this link https://www.veteransunited.com and paste it into the built in Indeemo browser after selecting the Screen Recording functionality. For Android owners: Copy this link https://www.veteransunited.com and start the Screen recording functionality on Indeemo. Open your preferred browser on your mobile, paste in the link. While recording your activity on the **mortgage calculator** page talk us through the following: • **How does this tool compare to other mortgage calculators you've seen or used?** • **How helpful is this mortgage calculator?** • **Was calculator easy to understand?** • **How could the mortgage calculator be improved?** • **How would you use this information on your research journey?** **Refer to the Think Aloud guide to help guide your discussion.** Feel free to upload more than 1 Video along with screen shots and captions to help further illustrate your point.
No. of and type of responses	1 Video
Start date / time	
End date / time	

Task title	Veterans United Comparison Tool
Task description	**Focusing on the Veterans United site ONLY**, find the **lender comparison** page and thoroughly use it. Capture this using the Indeemo Screen Recording functionality. For iPhone owners: Copy this link https://www.veteransunited.com and paste it into the built in Indeemo browser after selecting the Screen Recording functionality. For Android owners: Copy this link https://www.veteransunited.com and start the Screen recording functionality on Indeemo. Open your preferred browser on your mobile, paste in the link. While recording your activity on the **lender comparison** page talk us through the following: • **How does this tool compare to other comparison tools you've seen or used?** • **How helpful is this comparison tool?** • **Was comparison tool easy to understand?** • **How could the comparison tool be improved?** • **How would you use this information on your research journey?** **Refer to the Think Aloud guide to help guide your discussion.**

	Feel free to upload more than 1 Video along with screen shots and captions to help further illustrate your point.
No. of and type of responses	1 Video
Start date / time	
End date / time	

Task title	**Survey: Veterans United Comparison Tool**
Task description	**After viewing the comparison tool: Please go to take the survey found on this link:** **https://missouri.qualtrics.com/jfe/form/SV_enPXaQfOIEpWEBv** After you have completed the survey, please respond to this task with a Note saying Complete.
No. of and type of responses	1 Note
Start date / time	
End date / time	

Completion message *This is a **mandatory** message that appears at the end of the task list telling the respondents what will happen when they finish the fieldwork* **.** *This will be shown at the footer of all task lists. For sequential task lists, it will be shown once the last task is complete.* *For scheduled task lists, a date and time will be required (next field below)*	Thanks again for joining our project! We look forward to viewing your posts. We may be in contact via Indeemo with some comments / questions on your responses so please be sure to switch on notifications for Indeemo. We will be in contact re next steps. Thanks.
Display Date / Time *(applicable for scheduled task lists only)*	

A.4 Semi-Structured Interview

Warm Up:

First of all, can you tell me what you thought about the Indeemo app? Did you like using it? Are there features that could be improved on it?

>Can you think of any differences between using a desktop versus a smartphone when **looking for something to buy online?**

>Can you think of any differences of using desktops versus smartphones when it comes to buying something important? (Actuals/Behavioral/Beliefs)

>>Please explain how you use both types of devices, any similarities and/or differences**.**

Let's talk about your first broad search for VA home loans.
https://www.valoans.com/compare-lenders/

>When looking for VA home loan home information online, tell me how you searched for and found that information on your smartphone. (Behavioral/Exploratory)

>When you found information you were interested in, what did you do with it?

>>Potential Probe: For instance, do you save any of the information you found? (Behavioral/Actuals)

>Did you encounter any tools or information sources you found helpful or useful during your search? (Behavioral/Beliefs)

>>If yes: "Tell me more about those things"

>>If no: "Please tell me why"

>Did you ever feel like you couldn't find the information you needed on your smartphone? (Attitudes-Feelings/Actuals)

>>If Yes "Tell me a little more about that"

>Did you ever feel the desire to use a desktop/laptop when looking for VA home loan information? (Attitudes-Feelings/Actuals)

>>If Yes "Tell me a little more about that"

Let's look at the Veterans United Lender Comparison Tool

>What's your visual impression of the comparison tool? For instance, tell me about the layout. How does it make you feel? (Actuals/Attitude-Feelings)

>Do you think this tool is a useful on a smartphone? (Actuals/Attitude-Feelings)

>>Why or Why Not?

Is there anything you DON'T like about like about it? (Actuals/Attitude-Feelings)

Do you trust the information you found on this page? (Beliefs/Attitude-Feelings)

(Why or why not?)

How would you use the information you found on the comparison page? (Behavioral/Actuals)

Is there anything you would like to be able to do with the information you learned on it? (Behavioral/Exploratory/Optimals)

Can you think of any ways that it (/compare tool) could be improved? (Exploratory/Optimals)

Would it be helpful to save this information to revisit later? (Behavioral/Exploratory/Optimals)

Let's talk about your overall experiences when using a smartphone to look at home loan related information.

Do you have a spouse or partner you're working with to find a VA home loan and home?

If Yes:

How do you work together to find and share information with each other?

Can you think of any ways to better support working with each other through this process? (Tools? Sharing?)

When seeking home loan information, can you remember any difficulties or frustrations seeking the information you needed on your smartphone? (Beliefs/Actuals)

If you can't find the information you need on a smartphone, what other devices or resources would you utilize and why? (Actuals/Beliefs/Attitudes-Feelings)

What do you think are the ADVANTAGES of using a smartphone & mobile site versus a desktop to search for a VA home loan? (Beliefs/Attitudes-Feelings)

What do you think are the DISADVANTAGES of using a smartphone & mobile site versus a desktop to search for a VA home loan? (Beliefs/Attitudes-Feelings)

Thinking back to all of your activity, what should a smartphone device & mobile site/app be able to ideally do to help you find the information you need for major purchases? (Beliefs/Exploratory/Optimal/Attitude-Feelings)

Closing:

If they prefer desktop over mobile, explore what would make them want to use mobile more.

Appendix B

Materials

B.1 Think Aloud Prompt Guide

Instructions: Reference during your recorded journey

Journey: What are you looking for/ Where are you going**? WHY?**

 Desktop/Laptop: Would this be better utilized on a desktop/Laptop? **WHY?**

Using Smartphone: Is the smartphone helpful with your current focus? **HOW and WHY?**

 Using Ease: How difficult (or easy) is this to use with your smartphone? **WHY?**

Site Design: Does the site help your research goals? **How** and/or **WHY?**

 Understanding Ease: How difficult (or easy) is this to understand? **WHY?**

Trust: Do you trust this information? **WHY?**

 Improvement: Does this need to be improved? **HOW and WHY?**

Missing: Is information, support, tools or anything else missing?

 Problems: What do you think is a problem? **WHY?**

Save: Is there information you wish to save? **HOW and WHY?**

 Tools: Is this tool helpful or not? **HOW and WHY?**

SUGGESTIONS: What suggestions do you have for (any) improvement? **HOW and WHY?**

 Liked: What did you like? **WHY?**

Appendix C

Results

C.1 Coding Scheme from DeDoose

Searching Strategies
- Searching
- Information Discovery
- Capuring/Saving Information
- Information Sharing
- Returning
- Information Avoidence
- Research Type
  - Cursory
  - In Depth

Veterans United
- Aesthetic Related
- Interaction/Interface Realted
- Process Realted

Function Supports
- Functions Support
- Functions Hinder
- Function Design Considerations

Tools
- Searching Tools
- Mental
- Saving/Capturing Tools
- Home Loan Tools
- Tool Design Considerations

Information Needs
- Immediacy
- Anti-Needs
- Social Support
- Information Design Consideration

Smartphone
- Smartphone Support
- Smartphone Limitation
- Smartphone Design Consideration

Desktop/Laptop
- Desktop/Laptop Support
- Desktop/Laptop Limitation

Purchase Decision Complexity
- Complex Decision Making
- Simple/Less Complex Decision Making

Reactions
- Frustration
- Satisfaction
- Dissatisfaction
- Expectation
- Confidence
- Indifference
- Trustworthiness/Credibility

Emergent/Misc
- Concern
- Confusion
- Empowerment
- Suggestion
- Innovation
- Needed Improvement
- Source
- Inforamtion Overload
- Vendor

Indeemo
- Indeemo Impressions
- Indeemo Problems

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"Interacting with Computers: The Interdisciplinary Journal of Human-Computer Interaction, is an official publication of BCS, The Chartered Institute for IT and the Interaction Specialist Group."

"Interacting with Computers (IwC) was launched in 1987 by interaction to provide access to the results of research in the field of Human-Computer Interaction (HCI) – an increasingly crucial discipline within the Computer, Information, and Design Sciences. Now one of the most highly rated journals in the field, IwC has a strong and growing Impact Factor, and a high ranking and excellent indices (h-index, SNIP, SJR)."

"Topics covered include: HCI and design theory; new research paradigms; interaction process and methodology; user interface, usability and UX design; development tools and techniques; empirical evaluations and assessment strategies; new and emerging technologies; ubiquitous, ambient and mobile interaction; accessibility, user modelling and intelligent systems; organizational and societal issues."