SURVEY

Our survey consisted of three main parts—*general, mobile* and *future Web search*—and a fourth part containing standard demographic questions (Fig. 1). For answers expressing a frequency, likeliness or agreement with a given statement, we used 5-point Likert scales. We also posed a number of yes/no, multiple choice and open-ended questions. In total, the survey featured 98 questions of which 20 were optional. However, the number of questions posed was partly answer-dependent, as different decision nodes were present (Fig. 1).

The first part (general Web search) started with questions about the user's preferred search engine, frequency of use and search topics. Following this, we posed a number of question about advertisements on *search engine results pages* (SERPs)—whether users pay attention, how distracting they find them and which number of advertisements they think is tolerable at different positions within the page. After questions about the number of results pages viewed per query, participants were presented with screenshots of four current search interfaces. For each screenshot, we asked for a rating of the interface's appeal and a more detailed explanation.

At the beginning of the second part (mobile Web search), participants had to indicate whether they own a Web-enabled mobile device ①.[1] If so, they were asked which device(s) they own, how frequently they use them and whether they use them for Web search ②. Participants who indicated they use their devices for Web search were redirected to a set of questions about usage frequency, whether they prefer native apps or websites, their satisfaction with mobile search experience and whether they think current search engines are suitable for mobile devices and vice versa. Finally, we asked about the usage of speech recognition for Web search ③, how participants perceived this search experience or why they did not make use of it. Participants who indicated they do not own a mobile device or do not use it for Web browsing were redirected to a set of questions asking for reasons and whether they would use a mobile device for Web search if they owned one / there existed better interfaces.

In analogy to part two, the third part (future Web search) started with a question asking whether the participant owned a novel device beyond mobile ④. If so, they were asked which device(s) they own, how frequently they use them and whether they use them for Web browsing ⑤. The Web browsing part then asked for frequency of use, use of and satisfaction with different novel input modalities and whether the participant had ever performed a Web search on their novel device ⑥. In case they answered "yes", we asked about the perceived search experience and whether they think current search engines are suitable for novel devices and vice versa. Participants who answered "no" to one of the conditional questions (own a novel device, use for Web browsing, has performed a Web search) were presented with questions in analogy to part two. Part three closed with questions about how the participant would imagine a future search interface that is not primarily based on keyboard input and text output (or why they cannot imagine such a thing) and which input modalities they would consider useful.

The survey was prepared as a *Google Form*[2] and provided in a German and an English version. Before publishing, it was revised by five experts working in the search engine industry (one back-end developer, one front-end developer, one designer, one PhD student and one product manager). The survey contained a number of questions, particularly concerning cutting-edge technology and visions of the future, which we assumed to be potentially too elaborate to be answered by the average Internet user in a profound fashion. Because of this, our intention was to address an audience that would be *more tech-savvy than average users*, especially w.r.t. web design and search technology. Thus, we decided to recruit participants through external as well as company-internal mailing lists, social networks and personal contact. In this way, the survey should be seen as a *"semi-expert"* survey, as the number of participants with expertise could be expected to be significantly above average. Each participant who finished the survey received a thank-you gift in terms of a coupon worth 50 Euros for booking a trip on a German travel website.

The structure of the survey allows us to, not only analyse the obtained data as a whole but also separate them into three disjoint sets according to the participants' "tech-savvyness" for more detailed analysis: i.e., the user groups *Desktop* (do not perform Web search on a mobile device; N=19), *Mobile* (mobile searchers, but do not own a novel device beyond mobile; N=68) and *Novel* (mobile searchers who also own a novel device; N=31). Unfortunately, we can only present a selection of our results in the following, due to space contraints. The complete survey is available at `http://goo.gl/TYNoXC` (German) and `http://goo.gl/u7YvCv` (English). The complete translated results can be found at `http://goo.gl/kRgg6k`.

RESULTS

Overall, we were able to collect a total of 118 valid data sets The participants (57.6% male, 42.4% female) had an average age of 29.8 years (σ=8.1). They were mainly German (N=103, 87.3%), with four coming from Austria, two from India, two from Spain, and one from Switzerland, Poland, Russia, Italy, Ireland, France and South Africa, respectively. 23.7% were students, 55.1% had a formal qualification in computer science and 16.1% had one in Web design (whereas only 1.7% stated they have a formal qualification in Web design but none in computer science). 28.9% of the participants stated their work or studies are concerned with search engines. This confirmed our expectations concerning the expertise of our sample and showed that we were able to recruit the intended type of average participant w.r.t. proficiency in web design and search technology. Due to the demographic structure of our test participants, [1] will be the main source of comparison for our results (we consider the weighted average of the age groups 14–29 and 30–49), although it has to be considered that our audience was more proficient than average. In general, our participants surfed the Web for *more than 4 hours* per day ([1]: 197 minutes), mainly for work (97.5%),

[1] In the following, decision nodes will be referenced by circled numbers, as assigned in Fig. 1.

[2] `http://www.google.com/drive/using-drive/` (Sep 18, 2014).

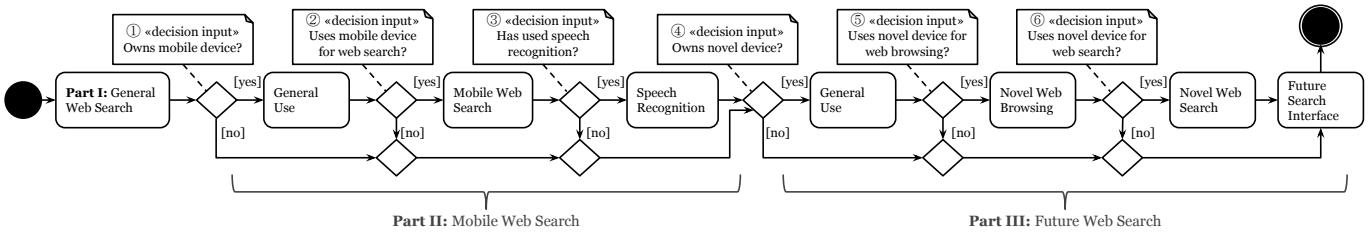

Figure 1. Flow chart of the survey with its different decision nodes. Questions for "no" answerers and demographic questions are omitted for simplicity.

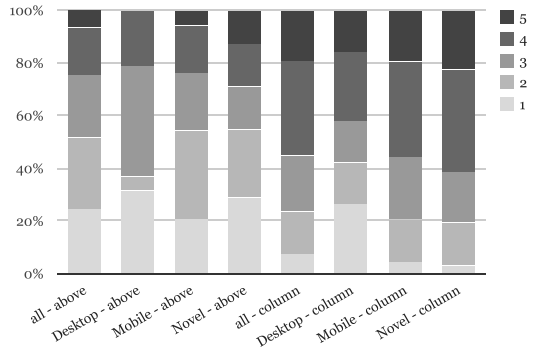

Figure 2. Perception of advertisements *above* search results and *in a separate column next to* search results (1 = very distracting, 5 = not distracting at all).

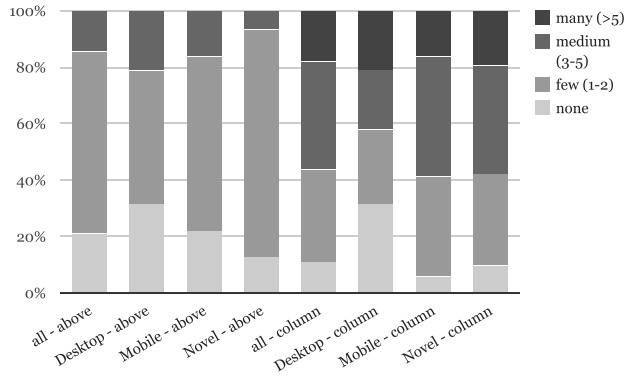

Figure 3. Tolerable number of advertisements *above* search results and *in a separate column next to* search results.

news (75.4%, [1]: 55.2%), social networks (61.9%), shopping (41.5%, [1]: 18.6%) and videos (34.7%, [1]: 45.6%).

Part I: General Web Search

Google.com (90.7%, [9]: 83%) was by far the most popular search engine among the participants, followed by *startpage.com* (2.5%), *ixquick.com* (1.7%) and *ecosia.org* (1.7%). In general, particpants stated they use search engines *several times a day*, mainly searching for facts/knowledge (90.7%), products (66.1%), places (62.7%) and news (52.5%). If they cannot find what they are looking for, they refine their query (54.2%) or continue to the next page of results (45.8%) rather than trying a different search engine (0%). This indicates that users generally trust their search engine of choice. A cumulative 88.1% stated they usually look at two or more pages before abandoning their search, with 17.8% usually looking at more than three pages. This stands in contrast to earlier research which found that users tend to consider only the first ≈10 results [10].

FINDING 1. # CONSIDERED RESULTS PAGES: *In contrast to earlier research (e.g., [10]), users usually* do *consider pages beyond the first page of search results. If they still cannot find what they are looking for, they refine their search query rather than trying another search engine.*

Advertisements. We asked our participants whether they pay attention to advertisments (ads) displayed on SERPs. The vast majority stated they do not (44.9%) or use an ad blocker (42.4%), with only 12.7% noticing ads. This is in line with previous research that found that users are generally blind to advertising (e.g., [8]). Moreover, we asked two questions about the perception of ads at different positions within a SERP. Results are shown in Figures 2 and 3. These underpin that users feel seriously distracted by ads placed above search results, but are much more tolerant towards ads displayed in a separate column next to the results. Also, 41.5% stated they click on ads if they provide what they are searching for. Fig. 2 moreover indicates that users of mobile and novel devices seem to be more tolerant towards ads than desktop PC users. One possible explanation for this could be that more tech-savvy users have better knowledge about how to block unwanted ads (users of ad blockers in group *Novel*: 51.6%; *Mobile*: 42.6%; *Desktop*: 26.3%). A second explanation could be the fact that ads cannot be displayed as excessively on mobile devices due to the limited amount of space.

FINDING 2. ADVERTISEMENTS: *Users tolerate ads on SERPs if they are displayed in an unobtrusive way. Also, almost half of the users click on ads if they are helpful for their search. Ads that demand too much of the results' space and user's attention are generally disapproved.*

Comparison of Search Interfaces. Participants were provided with screenshots of four current SERPs (size 1662×902, logos removed) as retrieved with a desktop browser on August 26, 2014: (1) *qwant.com*, (2) a non-public interface (named "SI2" in the following) shown in Fig. 4, (3) *google.com*, and (4) *duckduckgo.com*.[3] The screenshots showed the initial viewport of the respective Web results page for the query "Albert Einstein" and were chosen due to their significantly different look & feels. We asked to rate the interfaces' appeal on a 5-point scale with an optional explanation. These questions were designed in accor-

[3]Due to limited space, the remaining screenshots can be found at `http://goo.gl/kRgg6k`.

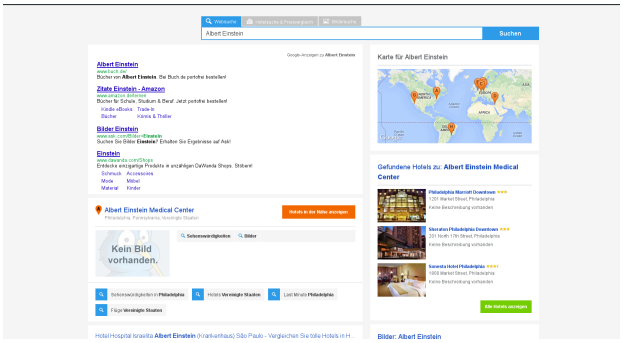

Figure 4. The non-public search interface "SI2" included in the study.

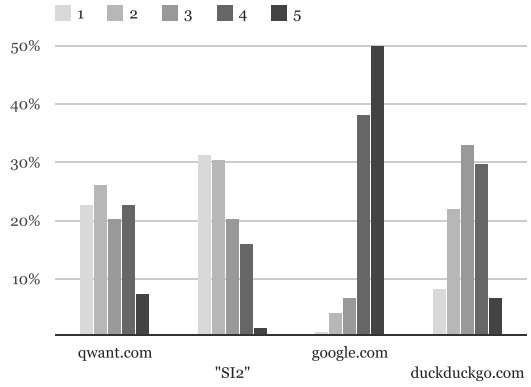

Figure 5. Overall ratings of the four search interfaces (1 = not appealing at all, 5 = very appealing).

dance with [7], who state that users form an opinion about a webpage's visual appeal within 50 ms. The ambiguous measure "appeal" was chosen to ensure non-leading questions and that we could collect a broad, unbiased range of opinions defining a "good" search interface based on users' first impressions. Ratings are shown in Fig. 5. Clearly, Google stands at the top (avg=4.32, σ=.85), followed by DuckDuckGo (avg=3.04, σ=1.07), Qwant.com (avg=2.66, σ=1.27) and "SI2" (avg=2.26, σ=1.12). There are no considerable deviations between the three user groups in this respect.

Concerning the explanations of their ratings, for Qwant, participants mostly stated that they like the grouping of different result types in multiple columns on one page (N=24) and found the interface to be clearly structured (12). In contrast, 52 stated the layout is confusing because of too many results (horizontal + vertical) that only *might* be useful, but were not explicitly demanded. 13 noticed too many types of results. Regarding "SI2", participants in general noticed a clear structure (N=15) and good overview (11) while criticizing the amount and placement of ads (34) and a huge amount of irrelevant information (29). What participants mostly liked about the Google interface were the very clear structure (N=37), the less prominent ads (10) and the info box containing precise and relevant information (41). However, 11 participants explicitly noted that Google is overrated because almost everyone is used to it. Thus, the rating of google.com in Fig. 5 is clearly biased. Finally, concerning DuckDuckGo, partici-

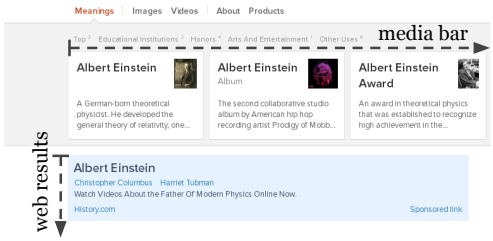

Figure 6. Results in two spatial dimensions, as shown by DuckDuckGo.

pants positively noted the clear (N=22) and minimalistic (5) structure, but were dissatisfied with the huge amount of white space right of the single results column (26) and the confusing/useless horizontal media bar at top (16, see Fig. 6).

FINDING 3. RESULTS PRESENTATION: *Users appreciate a clearly structured look & feel with a carefully balanced information density. They see advantages in the presentation of results from different domains, if they are relevant to their search query and not* just might *be of interest. Ditto for info boxes that intend to answer queries directly on a SERP. Users tend to dislike scanning for information in two spatial dimensions at once (cf. Fig. 6).*

Part II: Mobile Web Search

Of the 118 participants, 108 (91.5%) owned a Web-enabled mobile device. The most popular devices were smart phones (88.1%, [1]: 70.9%), followed by tablet PCs (59.3%, [1]: 33.8%), e-book readers (13.6%, [1]: 6.8%), iPod touch or similar (7.6%) and handheld video game consoles (1.7%). We assume figures to be greater than in [1] due to our more tech-savvy audience. In general, participants stated they user their mobile devices *more than once a day*. 91.7% of mobile users also used their device for Web search (83.9% of all participants). The following percentages are given for this group of participants, i.e., mobile searchers (which comprises the groups *Mobile* and *Novel*).

Mobile search was mostly engaged *multiple times a day* (39.4%), *once a day* (15.2%) or *multiple times a week* (33.3%). Moreover, participants stated they use websites rather than native apps for mobile search (mode=1, median=2; 1=*websites*, 5=*native apps*), which stands in contrast to [2], where a shift towards app usage was observed. However, their diary study was rather qualitative with fewer participants (N=18). Concerning websites, our participants were clearly satisfied with the search experience (mode=4, median=4; 1=*not satisfied at all*, 5=*very satisfied*). Contrary, the search experience with native apps was rated lower (mode=4, median=3).

After these general questions, participants were asked to rate four statements regarding the suitability of mobile devices and touch input for current Web search interfaces and vice versa. Results are summarized in Fig. 7 and show that participants generally agree with all statements; however, with slight advantages for the two statements about *mobile*, as compared to *touch*. There are no considerable differences between user groups. Next, we asked participants whether

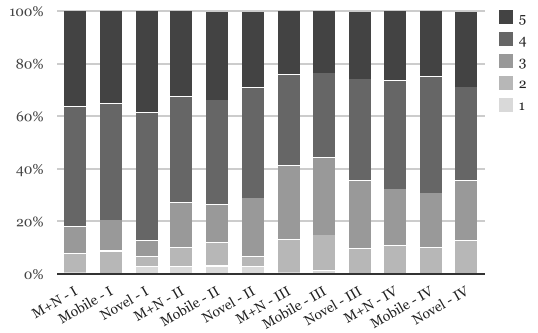

Figure 7. Suitability of mobile and touch for current Web search and vice versa, split by user groups *Mobile*, *Novel* and combined (M+N). I: Current Web search is suitable for mobile devices. II: Mobile devices are suitable for Web search. III: Current Web search is suitable for mobile touch screens. IV: Touch screens are suitable for mobile search. 1 = don't agree at all, 5 = totally agree.

specifically developed interfaces would make Web search with mobile/touch more enjoyable. Like before, a high agreement could be observed for the statements *Specifically designed interfaces would make Web search on mobile devices more enjoyable* (median=4; 1=*don't agree at all*, 5=*totally agree*) and *Specifically designed interfaces would make Web search using touch input more enjoyable* (m=4). This shows that, although participants are generally satisfied with mobile search, there is still room for improvement.

FINDING 4. MOBILE BROWSING: *Mobile devices are widely accepted for Web browsing. Moreover, users like to use familiar interfaces across devices, e.g., the Google* website *on mobile devices rather than a native app.*

Speech Recognition. Of the 99 mobile searchers, 44 (44.4%) stated they had used speech recognition for performing a Web search. 17 (38.6%) of these were from the group *Novel*, which are 54.8% of that group. Fig. 8 shows their satisfaction with the search experience and a prediction whether speech recognition will become the prime input modality for mobile search within five years. While participants were satisfied slightly above average (median=3, mode=4), they were rather undecided about the future of speech recognition (median=3, mode=4), with the *Novel* group being more negative about this (median=3, mode=2). An explanation for this could be that users of novel devices acknowledge the effectiveness of speech recognition but see less use cases with current devices beyond mobile, which mobile-only users cannot judge. Mobile searchers who had not used speech recognition (N=55, 55.6%) were asked to give reasons for that. Mostly, they stated they simply never thought about it (N=20), there is no use for it (14), the functionality is bad (6), they feel uncomfortable (6) or have privacy concerns (6). Next, we asked how likely it would be that they used speech recognition if there were more/better interfaces for this input method. Still, they stated that it would be unlikely (median=2, mode=1; 1=*very unlikely*, 5=*very likely*), giving similar reasons as before—i.e., mainly privacy concerns or feeling uncomfortable talking to a device. The above findings stand in contrast to Hearst's prediction that search interfaces will become more "natural" in the future, with voice replacing text input [4].

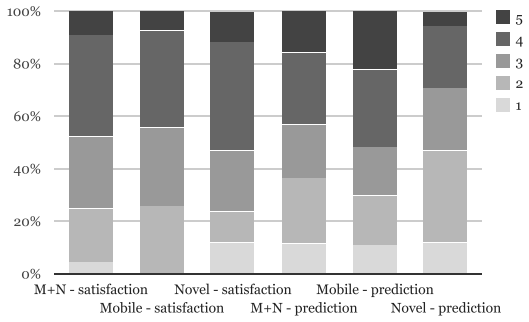

Figure 8. Participants' satisfaction with speech recognition (1 = not satisfied at all, 5 = very satisfied) and their prediction whether speech recognition will dominate within five years (1 = very unlikely, 5 = very likely), split by user groups *Mobile*, *Novel* and combined (M+N).

FINDING 5. SPEECH RECOGNITION: *In general, users are rather negative about speech recognition. Those who already used it are undecided about whether speech recognition will gain importance in the future. Those who have not yet used it primarily feel uncomfortable talking to a device (particularly in public) and have strong privacy concerns.*

The 9 participants who owned a mobile device but did not use it for Web search mostly stated this was because they prefer desktop PCs (N=6), the screen is too small (5), it is too cumbersome (4) and the input modalities are too difficult (3). When asked whether they would use mobile search if there were more/better specifically designed interfaces, they stated this would be unlikely (median=2; 1=*very unlikely*, 5=*very likely*), giving similar reasons as before (too cumbersome, prefer desktop PC, small screen, data plan not sufficient). A total of 10 participants did not own a mobile device. We asked them how likely they would use Web search and specifically designed search interfaces on a mobile device if they owned one. While they said it would be very likely that they used mobile search (median=4.5, mode=5), they stated it would be unlikely that they used specific interfaces (median=2, mode=2). The main reason given was that they prefer to use what they know from the desktop setting. This is in line with the finding in [5], which says that mobile search on high-end phones must be close to the searching experience provided by desktop PCs.

Part III: Future Web Search

At the beginning of this part, we asked the participants whether they owned a Web-enabled novel device beyond mobile, to which 35 (29.7%) answered with "yes" (the following percentages are given for this group of participants). The most popular devices were Smart TVs (42.9%), followed by PlayStation 3 (34.3%), Nintendo Wii (28.6%) and Xbox 360 (20.0%), which they generally used *once a week* (median=2; 1=*less than once a week*, 5=*more than once a day*). Only 5 participants (4.2% in total) stated they use their novel devices for browsing the Web (1× *less than once a week*, 2× *once a week*, 2× *multiple times a week*). This stands in contrast to [1], where 18.1% use video game consoles and 18.4% use TVs for accessing the Internet. One potential explanation could be that in [1], "accessing the Internet" comprises more than Web browsing only, e.g., IP TV or network games

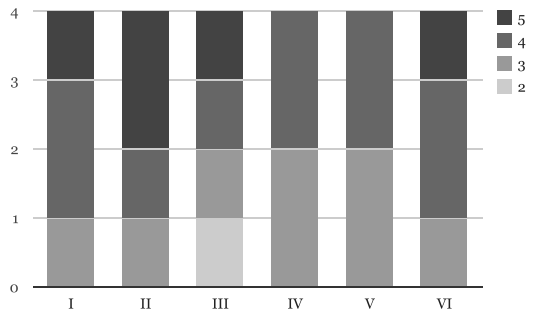

Figure 9. Suitability of novel devices and input modalities for current Web search and vice versa. I: Current Web search interfaces are suitable for novel devices. II: Novel devices are suitable for Web search. III: Current Web search interfaces are suitable for novel input modalities. IV: Novel input modalities are suitable for Web search on novel devices. V: Specifically designed interfaces would make Web search on novel devices more enjoyable. VI: Specifically designed interfaces would make Web search with novel input modalities more enjoyable. 1 = don't agree at all, 5 = totally agree.

(however, this information is not given in their method description). Among the novel input devices used were on-screen keyboards, TV remotes, motion-sensing technology, video game controllers and speech recognition. The 5 participants were generally *satisfied* with the input modalities used. Yet, all of them explicitly noted that the novel technology is not yet optimal to use; two said they prefer regular keyboards. We are aware of the fact that these are *not representative* results, but still indicate a tendency, particularly because of our tech-savvy sample. Already the fact that only 5 participants engage in novel Web browsing is a finding in itself.

FINDING 6. NOVEL BROWSING: *Using a novel device beyond mobile for Web browsing is not very common among users, which seems to be mainly due to the different use cases. Also, users are not satisfied with the available input modalities. Currently, there seems to be no novel device that can cope with the efficiency of regular keyboard input.*

Four of the 5 participants stated that they had used their novel device for Web search (the remaining one stating they found it too cumbersome). Two said they were *satisfied* with the search experience, one was *very satisfied* and one had a *neutral* experience. Like the mobile searchers above, they were asked to rate a number of statements concerning the suitability of novel devices and input modalities for Web search and vice versa. Moreover, we asked whether they think specifically designed search interfaces would lead to a better experience with novel devices / input modalities. Results are summarized in Fig. 9.

30 participants stated they own a novel device but do not use it to browse the Web. Asked for their reasons, 25 stated they prefer to use a desktop PC, tablet PC or smart phone for Web browsing, 21 stated it is too cumbersome, 19 said the input modalities are difficult to use and 13 indicated a poor browsing experience. Thus, we asked how likely it would be that they used their novel device for Web search if they (1) used it for browsing at all and (2) if there were specifically designed interfaces. The majority stated that this would be unlikely in the first (median=2.5, mode=1; 1=*very unlikely*, 5=*very likely*) as well as the second case (median=2, mode=1). The explanations given were—as before—that it is too cumbersome (N=10), novel devices have different use cases, such as gaming and watching TV (6) and that they like to use what they are used to, i.e., desktop/tablet PCs (3). Yet, two participants explicitly noted that they are often using their smart TV anyway and that browsing while lying on the couch is nice. Thus, they would like to use their novel devices with better search interfaces.

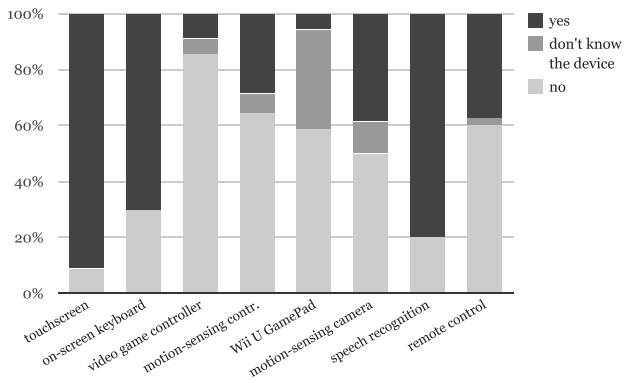

Figure 10. Input modalities participants would like to use with a search interface that is not primarily based on input via a regular keyboard and text output.

FINDING 7. USE CASES: *Currently, the majority of users see no reason for mixing different use cases. This is in line with [1], who found that all-in-one devices are far from being the norm. Yet, it is interesting to note that about 30% of our participants owned at least three Web-enabled devices. [1] report an average of 5.4 Web-enabled devices per household, of which, however, only 2.8 are used.*

We adjusted the above questions slightly (*If you owned a novel device, how likely would it be that you used it for Web search with current search engines?* etc.) and posed them to the participants who did not even own a novel device. From that group, we obtained almost identical results (unlikely that they would use it due to different use case, difficult input modalities etc.)

Yet, one participant made a comment that we want to quote here as it is highly relevant for future interface design: "Video game consoles target 'gamers', therefore search engines running on such devices should also target that audience."

A Future Search Interface. Finally, we asked all 118 participants whether they could imagine to use a search engine that is not primarily based on input via a regular keyboard and text output, to which 70 (59.3%) replied with "yes". We then asked which input modalities they would like to use with such a search engine. The answers are summarized in Fig. 10. As can be seen, users tend to stick to those input methods they already know, as only touchscreens, on-screen keyboards and speech recognition get a majority of "yes" votes.

FINDING 8. CREATURES OF HABIT: *Users prefer to use systems they already know. This accounts for interfaces*

(e.g., Google) as well as devices (e.g., keyboards, touch). There seems to be a high entry barrier for new technology that cannot (yet) convincingly provide added value.

The latter contrasts with participants' earlier comments regarding speech recognition, where they mostly disapproved of that method. This shows that users seem to be seeing potential in speech recognition, given the right use case and circumstances, which strengthens Hearst's prediction [4]. Contrary, participants are rather negative about the usefulness of motion-sensing technology and devices such as the Wii U GamePad for future search interfaces. Additional input modalities that were mentioned included brain–computer interfaces (cf. [3], N=7), image input (4), eye tracking (3), fitness bracelets (1), iPad (1) and Google Glass[4] (1).

FINDING 9. POTENTIAL OF NOVEL SEARCH: *Users generally acknowledge the potential of mobile and novel devices and input modalities for Web search (and vice versa). Although our participants were generally satisfied with mobile search experience, they noticed plenty of room for improvement concerning search interfaces beyond desktop PCs. The latter particularly applies to interfaces for novel devices.*

In a last open-ended question, we asked the 70 participants to imagine and describe a future search interface, trying to be as creative as possible. Again, speech recognition was mentioned twice and eye-tracking, brain–computer interfaces and image input three times each. Participants also described *zoomable user interfaces* (three times), a visual search interface similar to the one described in [6], social search, a building block concept (where one can add new search modes as desired), a mindmap, 3D visualizations, motion-controlled interfaces and touch interfaces that accept gesture input. Moreover, two participants mentioned that future search interfaces must be ubiquitous and must understand natural language input. To conclude this section, the two most detailed and consistent descriptions of a potential future search interface—which also follow entirely different concepts—are given in the following:

"I think about a search term and as soon as I look at the 'search thought' field (that is projected into my field of view via lenses or glasses) and push the button integrated into the ring I wear on my index finger (reachable with my thumb), the search starts. When I don't look at the 'search thought' field, pushing the button searches for the thing I currently focus on (a person, a picture, a text...). The results are then projected into the left side of my field of view (with background if necessary). By pushing the button I select the result I currently focus on."

"I could imagine an interface more like a map [...], that you interact with a remote control or a motion-sensing camera. Search results could be arranged in different categories like pieces of pie going from central in one category to far away in a criteria how much they match the keywords or my interests or something. Maybe also 3D: I often which [*sic*] to exclude keywords, but mostly I find it to time consuming to say: with these words, without these words. So on a 3D object like a dice you could say on the front I write words I am searching for, on the back words that shall not be used and on the side maybe some keywords to give a better direction to my search or interests or something. With one gesture of swiping and a motion sensing camera I could turn the dice and give some keywords more priority."

FINDING 10. A FUTURE SEARCH INTERFACE *realized in the midterm would involve* touch interaction*,* speech recognition *and* familiar technology *that is deployed* across devices*. For example, the Google search, running on a Smart TV that accepts gesture and keyboard input from an iPad. At home, the distributed search interface would be augmented with optional voice input. In public, the interface would be available via a single mobile device.*

REQUIREMENTS SPECIFICATION

Based on our ten findings, we specify the following novel set of general requirements. Current and future search interfaces should:

- **(R1)** FINDING 1 ⇒ provide adequate ranking also for results beyond the initial viewports. If the user cannot find what they are looking for, proper related search inputs should be proposed.
- **(R2)** FINDING 2 ⇒ provide ads in a subtle way. They should accompany the search results rather than demanding their space in the initial viewport. If ads are placed above results, their number should not exceed *two*; if they are placed otherwise, their number should not exceed *five*.
- **(R3)** FINDING 3 ⇒ above all ensure that all displayed information are relevant to the search query. The most relevant piece of information should be immediately identifiable, as form follows function. If applicable, semantic results should answer the query directly in the initial viewport.
- **(R4)** FINDINGS 3, 8 ⇒ not require the user to scan information in more than one spatial dimension simultaneously (cf. Fig. 6). Different categories of results should be selectable rather than displaying all information at once.
- **(R5)** FINDINGS 3, 9 ⇒ make proper use of the available space, particularly w.r.t. increasing display sizes.
- **(R6)** FINDINGS 4, 6, 8 ⇒ leverage the advantages of interfaces familiar to the user. Transition to radically new concepts should happen in small steps. Fallback functionality for legacy input/output modalities should be provided.
- **(R7)** FINDINGS 5, 6, 8 ⇒ always provide an easily reachable alternative to voice input. Users should be properly informed about privacy issues and where it is unproblematic to use speech recognition.
- **(R8)** FINDINGS 6, 7 ⇒ be tailored to the target audience of the devices they run on. For instance, a Web-enabled video game console should provide a search interface that focuses on finding games and information relevant to those. Furthermore, it must be optimized for efficient input with the same device as is used for playing.
- **(R9)** FINDINGS 9, 10 ⇒ support cross-device interaction, i.e., the search interface is distributed and input/output can optionally happen on different devices.

[4] `http://www.google.com/glass/start/` (Sep 20, 2014).

(R10) FINDINGS 9, 10 $\Rightarrow$ be ubiquitous, thus focusing on devices users carry around most of the time. These include, but are not restricted to, mobile devices, devices like Google Glass and fitness bracelets.

(R11) FINDING 10 $\Rightarrow$ consider input/output formats other than text, such as images, music, gestures, 3D visualizations and image-based zoomable user interfaces.

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