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Master Thesis

Ask The Crowd: Crowdsourcing Knowledge Generation

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Zusammenfassung

Mit dem Aufkommen von praktisch allgegenwärtigen, drahtlosen Datennetzen und immer kleineren, mobilen internetfähigen Geräten, ist das Internet zu einer der, falls nicht sogar der meist genutzten Quelle(n) für Informationen in unserem Alltag geworden. Dienste wie Google und Wikipedia sind zu wertvollen und unabdingbaren Werkzeugen der Wissensgewinnung moderner Gesellschaften geworden. Aber das Internet und genannte Dienste stellen nur eine Seite der Medaille: die Infrastruktur. Was allerdings die Inhalte betrifft, kann ein neuerlicher Trend hin zum Outsourcing beobachtet werden: Outsourcing an den Nutzer oder die *Crowd*. Die Stärke von Crowdsourcing liegt in seiner massiven Basis an potentiellen Arbeitern - substantielle Probleme, wie beispielsweise das Erschaffen einer allumfassenden Enzyklopädie, werden in einer gemeinsamen Bemühung gelöst, oft sogar ohne monetäre Vergütung.

Während sich verbreitete Crowdsourcing-Systeme im Wissensbereich auf die Lösung von Problemen konzentrieren, versucht diese Arbeit die außergewöhnliche Fähigkeit des Menschen zu überlegen, verknüpfen und neue Hypothesen zu produzieren zu integrieren. Die Wissenschaft hat gezeigt, dass Nutzer ein wertvolles Werkzeug für Wissensgewinnungs- und Entwicklungsprozesse darstellen und ihre Ideen oft genauso, wenn nicht sogar dienlicher sind als Ideen, die von Experten hervorgebracht wurden. Das Crowdsourcing-System, dass im Laufe dieser Arbeit entwickelt wurde, Ask The Crowd, lagert deshalb sowohl die Erzeugung als auch die Beantwortung von simplen, generalisierbaren Fragen an die Crowd aus. Der vorgeschlagene Wissensgewinnungsprozess wird unterstützt von auf der Seite befindlichen, maschinell erstellten, interaktiven Visualisierungen mit eingesponnenen Konzepten der *Gamification*. Zudem erleichtert eine freie Zugangspolitik, bei der keine Registrierung erforderlich ist, die Nutzer Akquisition.

Das *live*-System wird sowohl quantitativ, basierend auf den produzierten Daten und Seiten-Interaktionen, als auch an Hand einer online Umfrage evaluiert. Ergebnisse deuten darauf hin, dass der vorgeschlagene Ansatz tragfähig ist und die menschliche Fähigkeit Fragen zu formulieren durch den Einsatz von Crowdsourcing-Techniken ausgenutzt werden kann.

Abstract

With the advent of virtually omnipresent wireless data-networks and ever smaller mobile internet devices, the internet has become one of, if not the most queried resource for information of our present day and age. Services like Google and Wikipedia have become valuable and indispensable tools for knowledge discovery in modern societies. But the internet and named services only provide half of the coin: the infrastructure. Concerning the provided content however, a recent trend of outsourcing can be observed: outsourcing to the user, or the crowd. The power of crowdsourcing lies within its massive base of potential workers - substantial problems, such as the creation of an *all-encompassing* encyclopedia, are solved in a collaborative effort, oftentimes even without monetary remuneration.

While commonplace crowdsourcing systems in the knowledge domain focus on the solution of problems, this work also tries to incorporate the extraordinary ability of the human mind to wonder, relate and produce new hypothesis. Science has shown that users are a worthy tool in knowledge discovery and development processes and that their ideas often are equally if not more valuable than the ideas generated by experts. The crowdsourcing system developed throughout this work, Ask The Crowd, therefore outsources the generation, as well as the answering, of simple, generalizable questions to the crowd. The proposed knowledge generation process is supplemented by on-site, machine-generated, interactive visualizations and interwoven concepts of gamification. Additionally an open-access, *no login required*, policy is employed to facilitate user recruitment. The live system is evaluated both quantitative, based on produced data and site interaction, as well as via an online survey. Results indicate that the approach is viable and the human ability to formulate questions can be exploited employing crowdsourcing techniques.

Aufgabenstellung

Title: Ask The Crowd: Crowdsourcing Knowledge Generation

Goal: The goal of this work is to use the power of crowdsourcing to create answers to small and highly focused questions. The main difference to existing question platforms on the internet is that the questions in this work are short and answers are given using predefined choices (no free text). The questions are therefore informative and explorative.

To find out whether crowdsourcing is a good approach to generate such knowledge, a internet platform will be presented during this thesis. The resulting service will be put online and evaluated with real users of the system.

Tasks:

- Literature research: "*crowdsourced knowledge creation*"
- Concept design based on focus groups and brainstorming
- Implementation of the online platform
- Evaluation with real users based on an online questionnaire
- Oral presentations (Disputationsseminar)
- Writing thesis

Ich erkläre hiermit, dass ich die vorliegende Arbeit selbstständig angefertigt, alle Zitate als solche kenntlich gemacht sowie alle benutzten Quellen und Hilfsmittel angegeben habe.

München, 11.November 2013

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1 Introduction

Sometimes a question comes to your mind you would like the whole world to answer. Only a few decades ago¹ this notion seemed far fetched, but the information age we live in today enables us to do exactly this. With the rise of virtually omnipresent internet, ubiquitous computing, ever smaller full fledged personal computers in our pockets, that we literally can pose questions to, we are able to connect and work together on a global scale. We are able to ask questions to a whole world: a world now commonly known as *The Internet*.

The internet revolutionised the world we live in today by enabling everyone with an internet connection to access virtually the knowledge of the world. Not only enables it us to access knowledge, but to communicate, work and share all kinds of things with each other. While *The Internet* itself does not *provide* any information, it merely forms a medium through which we can *browse* through hundreds of millions² of contributions in the form of information and services made by basically anyone who is willing to participate.

Returning to the scenario of our question to the world, we today are able to bring up a web browser and choose between a number of options: We could simply type it right away into our favoured search engine and examine the results. We could also look for an answer in one of today's most comprehensive encyclopedias[38] or we might pose our question directly at one of many websites designed for sharing and exchanging knowledge on both broad (e.g. Yahoo Answers³) and narrow (e.g. a Google Group⁴ for a specific piece of software) spectra of topics. Of course our options do not end here.

All of the mentioned approaches and in fact all of the information the internet makes available to you depends on content/input generated by someone (or something) else. Looking at this from a computer scientific point of view brings two related concepts to mind: *Crowdsourcing* and *User Generated Content*. A website like Yahoo Answers is said to depend on user generated content, since every question asked and every answer given and therefore virtually all the content the site has to offer, is a user contribution.

Crowdsourcing is a term that has gained popularity quite recently, due to the success of projects like Linux [36], Wikipedia⁵ and Mechanical Turk⁶. It describes the act of involving a possibly very large amount of humans (*the crowd*) in the problem solving process. Both concepts do not contradict each other but can be merged very well as is the case with Wikipedia, Yahoo Answers and others. Wikipedia for example tries to solve the problem of an all encompassing encyclopedia. It *crowdsources* this problem by enabling anyone willing to contribute to write an article and add it to the collection. Any article submitted by a user to Wikipedia is by definition user generated content, so we can see how both concepts intertwine.

One of the significant aspects of the human being is her inherent curiosity. Without curiosity and the ability to ask questions, process and relate information we are naturally equipped with, there would be no science. Since the power of the human brain lies not only within the problem solving process, which is what the majority of contemporary crowdsourcing systems utilize, but also within the ability to wonder about (not obviously) related things, the idea of creating, analysing and studying such a system arose.

Such an endeavour faces, a number of problems:

1. How to use this ability to wonder and relate?

¹at the time of this writing the internet is dated to exist for 8093 days \approx 22 years [web10]

²latest official number of active websites at the time of this writing: 633,706,564 [web9]

³<http://answers.yahoo.com/>

⁴<http://groups.google.com>

⁵<http://www.wikipedia.org>

⁶<http://www.mturk.com>

2. How to attract and maintain users and their attention and facilitate user interaction with the site?
3. How to evaluate the experiment and extrapolate knowledge?

The contribution this thesis brings to this picture is the documented and evaluated realization of such a system in a real-life setting. The metaphor of the *question to the world* is picked up and implemented resulting in a website called Ask The Crowd. On Ask The Crowd (abbreviated as ATC) users can pose their question to the world in the form of a survey for the crowd to answer. In contrast to sites like Yahoo Answers and other popular "*question portals*" questions asked within surveys on ATC cannot be answered by free form text but are limited to three types: *numeric*, *predefined* and *(5-point) likert*. This limitation enables automated on the fly interpretation of the



Figure 1.1: Illustration on the landing page of Ask The Crowd

gathered data in the form of basic statistical information and chart visualisations (see figure 1.2) readily available for the user's analysis, to motivate exploration and trigger a potential feedback loop between question generation and answer analysis. Therein the analysis of a survey's results possibly leads to the formation of another question which in turn yields results possibly leading to new questions, yielding results and so on. This feedback loop also contributed to the the artistic design for one of the frontpage images on Ask The Crowd (see figure 1.1), containing the three major participation steps enclosed by an infinity symbol, which represents the feedback loop.

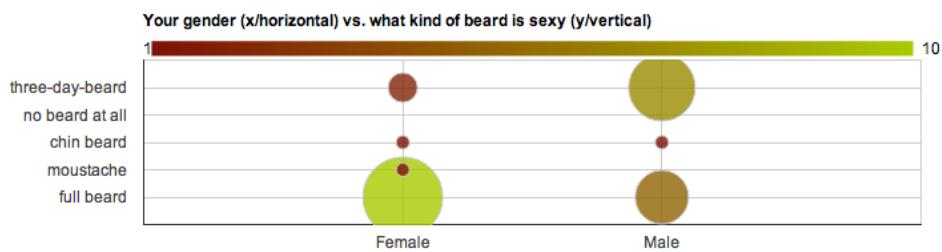


Figure 1.2: Bubblechart visualization on Ask The Crowd

The essential idea behind Ask the Crowd was to build and assess the viability, in terms of participation and usage, of a crowdsourcing system with the task of generating new and interesting knowledge.

New in this context means the established relation between proposed question and inferred answer did not exist, yet.

Interesting in this context, means that the relation is non-trivial, i. e. could not be inferred by common sense and/or previous knowledge easily.

The resulting system, Ask The Crowd, was conceptualized and designed using the interdisciplinary means of media informatics. After the notion was refined and concretized a preliminary focus group study proved the idea valuable and yielded a multitude of ideas and support for the

1 INTRODUCTION

preliminary concept. Subsequently basic interface designs and drafts were created and evaluated in another focus group study. This iterative process lead to the final website design, layout and functionality. Ask The Crowd went live into a public open beta on September 16, 2013 and was evaluated after six weeks with the help of an online survey. The evaluation focussed on:

1. General site usage and utilization
2. Feature Evaluations focusing on usability and usage of
 - The proposed staging system for surveys as main component of the site hygiene mechanism
 - The tools offered for result analysis and knowledge discovery
 - The survey creation process
3. Effectiveness: User satisfaction and knowledge generation

Results indicate that

- the proposed open-access policy and feature set can successfully motivate user recruitment, interaction and engagement with the site.
- crowdsourcing systems utilizing human resources to gather new and interesting knowledge in the form of questions and accompanied answer data are viable, i.e. the human ability to formulate questions can be exploited for crowdsourcing purposes.
- open data and easily accessible tools for analysis thereof work as a catalyst, not only attracting user attention but facilitating analysis and interpretation.
- users appreciate divergent means facilitating survey result analysis.

2 Related Work

This section provides an introduction into **Crowdsourcing** in general and exemplary influential applications (Yahoo Answers, InnoCentive⁷ and Mechanical Turk). Relevant contributions from the fields of Information Systems/Science and Innovation/Product Management are brought into the picture to form the context and foundation for this work.

2.1 Crowdsourcing

Crowdsourcing as a term can be traced back to 2005 when Jeff Howe and Mark Robinson, both working at Wired Magazine, used it in the context of "...outsourcing to the crowd"[50]. This makes it a rather young topic of research. While "*outsourcing to the crowd*" is a relatively vague definition of the term in general another more strict concerning systems like ATC was given by Doan et. al. in 2011[17], by which

"...a system is a C[rowd]S[ourc]ing system if it enlists a crowd of humans to help solve a problem defined by the system owners, and if in doing so, it addresses the following four fundamental challenges: How to recruit and retain users? What contributions can users make? How to combine user contributions to solve the target problem? How to evaluate users and their contributions?"

This very helpful definition, given from a computer scientific perspective, relates to the problems mentioned in the introduction. The general problem defined by the system owner is the generation of knowledge and Ask The Crowd respectively this work, faces all of the mentioned challenges, which underly this work. In their highly informative paper Doan et. al. also establish a classification scheme along nine dimensions they consider the most important, four of which are contained in the definition above:

Nature of collaboration: Can be **explicit**, e.g. explicitly composing articles for Wikipedia, or **implicit**, e.g. implicitly labeling images while playing ESP[57].

Type of target problem: Since the problem the system solves can be anything the system owners define a type can be any abstraction of that problem, examples include but are not limited to evaluating, building a collection of shared items, social networks and artifacts.

Architecture: Can be **standalone**, i.e. the classic crowdsourcing system that has its own user base, or **piggyback**, e.g. a system that uses another system as a content provider like Google's "*Did you mean*" (see figure 2.1).

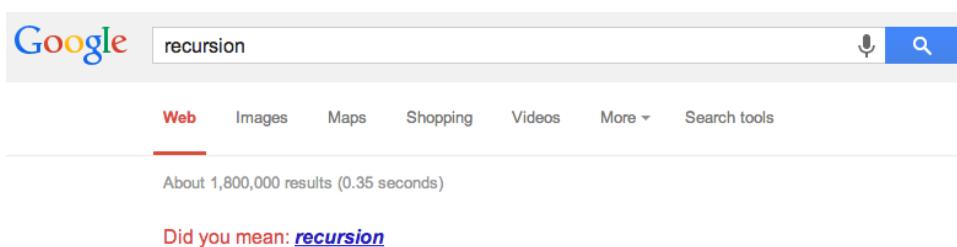


Figure 2.1: Google's "*Did you mean*". Screenshot taken Nov. 7, 2013

User recruitment: Whereas standalone systems need to acquire users, a piggyback system evades this problem.

⁷<http://www.innocentive.com/>

User involvement: The way in which the users can contribute to solve the problem posed by the system owners, examples include but are not limited to evaluating (*e.g. reviewing at Amazon*), sharing (*e.g. videos on YouTube*), networking (*e.g. Facebook*), building artifacts (*e.g. Linux*) and executing tasks (*e.g. SETI*⁸).

Combination of inputs: The way in which user inputs are combined to solve the problem posed by the system owners. Oftentimes this happens only loose or not at all.

Evaluation of users and contributions: The way in which users, respectively their contributions, are evaluated *e.g.* to avoid malicious content or dirty data.

Degree of manual effort in terms of user involvement. Ranges from **low**, *e.g.* clicking on a button to mark something, to **high**, *e.g.* merging articles on Wikipedia.

Role of human users: Users can be **slaves**, *i.e.* the problem is solved using a divide-and-conquer approach, **perspective providers**, *e.g.* each user reviewing an article provides his perspective, **content providers** and/or **component providers**, *e.g.* users in a social network forming a component of that system.

Ask the Crowd according to this scheme can be classified as a standalone CS system featuring explicit collaboration in the form of survey creation and answering. Since it's a standalone system user recruitment is required and topic in different sections throughout this work. The degree of manual effort varies from relatively low, *e.g.* answering a two question survey without free text questions, to high, *e.g.* creating a survey. Users on Ask The Crowd assume multiple roles: They act as slaves helping to solve other users' questions by answering their surveys as well as content providers when creating surveys. Since Ask The Crowd also offers users the ability to comment on and discuss surveys respectively their results, they can act as perspective providers for result analysis, too. In order to provide data integrity, *e.g.* hindering users from answering surveys more than once, users and their contributions require evaluation. Considerations and measures to this end are discussed in detail in section 4.1.1. Finally the problem of combining user inputs to solve the target problem - *knowledge/information generation/extrapolation* - remains. Ask The Crowd offers users means to inspect survey results and automatically calculated statistical values such as mean, median, average, etc. but it does not actually itself produce new knowledge in the form of statements and rules of scientific character and validity. The task of finding such rules and statements is itself crowdsourced to the user, analysing survey results and in the optimal case sharing her new found insights with the community by commenting on the survey results on Ask The Crowd. An in detail inspection of features Ask The Crowd offers for knowledge generation based on a focus group study (*section 3.2: Focus Group Study I*) can be found in *section 4.2: Final Design*.

2.2 Contemporary Example Crowdsourcing Applications

After this formal introduction of crowdsourcing(-systems) in the form of a basic definition and classification, a state of the art context remains to be set. Therefore three example crowdsourcing systems on the web that are topic of ongoing research are introduced: **Yahoo Answers**, **InnoCentive** and **Mechanical Turk**. While all of these systems share many commonalities, each of them employs its own mechanics (*see table 2.1 for an overview*).

⁸<http://setiathome.berkeley.edu/>

Yahoo Answers is one of the most successful english-language crowdsourcing platforms for knowledge sharing[1]. On Yahoo Answers users can pose and answer free text questions on basically any topic (see figure 2.2). Former Yahoo Search employee Walther Eckhart describes it as "...a kind of collective brain - a searchable database of everything everyone knows. It's a culture of generosity. The fundamental belief is that everyone knows something"[1]. The notion of every-

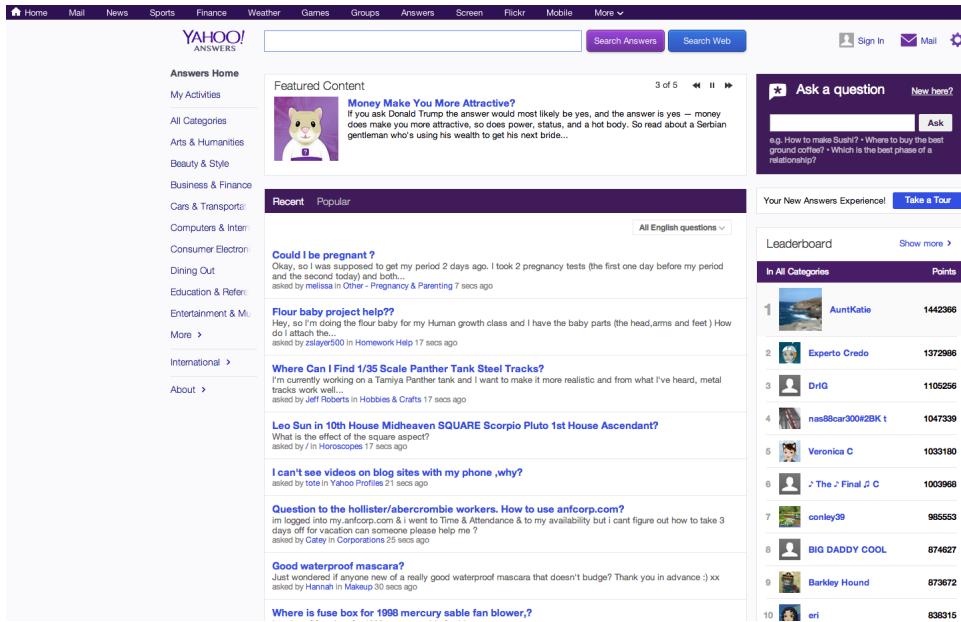


Figure 2.2: Yahoo Answers - Landing Page, screenshot taken Oct. 19th, 2013

one being able to contribute is one of the fundamental ideas of crowdsourcing and in the specific case of Yahoo Answers it concerns answers to (mostly) specific problems of specific users. In the case of Ask The Crowd it concerns rather simple, generalizable questions and answers thereto. Adamic et al.[1] examined Yahoo Answers in a large scale study encompassing more than 8 million answers to over 1 million questions, focusing on user behaviour and question design. One of their key findings when correlating focus, in terms of a users specialization in a limited range of topics, and best answers, i.e. if a users answer is selected as best answer to the question, was that specialists do not outperform non-specialists in answering questions.

This non-obvious realization is exploited by another prime example of knowledge/idea based crowdsourcing services:

InnoCenteive. ⁹ Founded in 2001 InnoCenteive offers so called *seekers* the ability to crowdsource solutions to their scientific problems to *solvers*. Seekers, paying from \$10.000-\$100.000 for solutions, are mainly research and development-heavy companies such as Boeing or DuPont, solvers however are more often than expected "[...] hobbyists working from their proverbial garage [...]" as Howe explains in one of the first works on crowdsourcing[24].

It is this exact notion of non-experts being able to contribute to the global pool of knowledge that fuelled the idea and underlying question for Ask The Crowd: *If non-experts can outperform experts at answering specific questions, maybe they can also contribute with their questions?*

A third well established real life crowdsourcing application that has been subject to research in recent years is Amazon's

⁹<http://www.innocentive.com/>

Mechanical Turk. ¹⁰ Existent since 2005 and named after a 18th century chess-playing machine actually operated by a human being [51], this CS-System enables users to outsource so called micro-tasks, ranging from the transcription of audio records to one-click-surveys, to the crowd. It represents a prime example of a micro-task market:

"...a system in which small tasks (typically on the order of minutes or even seconds) are entered into a common system in which users can select and complete them for some reward which can be monetary or non-monetary (e.g. reputation)."[28]

This definition enables another perspective on Ask The Crowd: it can be seen as a micro-task market as well, each survey representing a human intelligence task (*HIT*), as tasks are called on Mechanical Turk. The definition above also requires a reward of either monetary, as is the case with Mechanical Turk, or non-monetary nature, as employed by Ask The Crowd and discussed in the next and the sections to come.

CS-System	Nature of collaboration	Architecture	User involvement	Target problems	Comments
Yahoo Answers	explicit	standalone	Sharing textual knowledge	Building a collection of shared knowledge	Users as content providers
InnoCentive	explicit	standalone	Solving (scientific) problems	Building a network of external research and development resources	Users as content and component providers.
Mechanical Turk	explicit	standalone	Task execution	Possibly any problem	Users as slaves

Table 2.1: Classification of Yahoo Answers, InnoCentive and Mechanical Turk according to Doan et. al. [17]

2.3 The Human Factor

Crowdsourcing systems rely on human beings to solve problems, therefore the human factor plays an important role in the crowdsourcing-ecosystem and has been subject of research since long before the first notion of crowdsourcing. As early as 1951 Paul Fitts established a list of 11 statements identifying tasks at which humans, respectively machines outperform the other [18] (*see table 2.2*).

This list and more recent lists building on Fitts' work have become known as *MABA-MABA* ("Men Are Better At - Machines Are Better At") or *HABA-MABA* ("Humans Are Better At - Machines Are Better At") lists and serve as a basic guideline for many of todays CS-systems [14]. reCAPTCHA [58] for example exploits human superiority at pattern recognition. The system is build to both serve as a CAPTCHA ("Completely Automated Public Turing test to tell Computers and Humans Apart") and digitalize old prints (*see figure 2.3*). Being employed by a simple JavaScript snippet that communicates with a centralized server-system, reCAPTCHA is able to piggyback on other services like Ask The Crowd, where it serves to verify human users e.g. when posting comments or registering with the site. The client-side script requests a CAPTCHA image from the server composed of an initially unknown part - the text OCR failed to recognize - and

¹⁰<https://www.mturk.com/mturk/>

Humans appear to surpass present-day machines in respect to the following:	Present-day machines appear to surpass humans in respect to the following:
<ol style="list-style-type: none"> 1. Ability to detect a small amount of visual or acoustic energy 2. Ability to perceive patterns of light or sound 3. Ability to improvise and use flexible procedures 4. Ability to store very large amounts of information for long periods and to recall relevant facts at the appropriate time 5. Ability to reason inductively 6. Ability to exercise judgment 	<ol style="list-style-type: none"> 1. Ability to respond quickly to control signals and to apply great force smoothly and precisely 2. Ability to perform repetitive, routine tasks 3. Ability to store information briefly and then to erase it completely 4. Ability to reason deductively, including computational ability 5. Ability to handle highly complex operations, i.e. to do many different things at once.

Table 2.2: Fitts' list from 1951 [18]

a control sequence. Each unknown is sent to multiple clients and their answers are evaluated to extrapolate the unknown word.

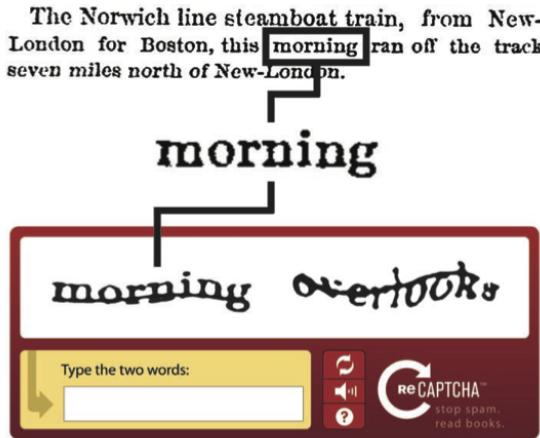


Figure 2.3: The reCAPTCHA system displaying unreconizable words from scanned documents. [58]

A second example for Fitts' statements in todays crowdsourcing landscape is Alonso et al.'s work [2] in which they use Mechanical Turk to crowdsource evaluation tasks to humans. Workers were e.g. asked to rate results of a product search according to their relevance for the search term, which requires, among others, efforts of association, i.e. pattern recognition, and judgement. One of their major concerns, and in fact a concern often proposed by scientists in the field, is worker performance in terms of quality of data and/or task execution. Alonso et al.'s study has shown that even tasks such as relevance evaluation, requiring judgemental effort, can be crowdsourced for a negligible reward while maintaining fair worker quality.

When it comes to harnessing and evaluating potentials among users, Kristensson et. al.'s *Harnessing the Creative Potential among Users* [30] has proven to be a valuable resource to get started. Their insightful study evaluates user generated product ideas for mobile phone services compared to ideas generated by professionals in regard to originality, value and realizability. The findings indicate that:

1. Ordinary users produce more original ideas due to a more divergent style of thinking.

2. Ordinary users produce ideas assessed as significantly more valuable.
3. Professional developers and advanced users produce the most realizable ideas.

They further assert that divergent thinking, i.e. a flexible/unstructured problem-solving-process [21], is key to generating new knowledge and can be facilitated by weak, structured data. Humans need to relate previously unrelated information in order to extract valuable, new connections. Therefore a large set of available information, skills, viewpoints, knowledge, etc. benefits the creative process or as Mumford phrased it: "...the key to creative thought appears to be the combination and reorganization of information and knowledge to advance new understandings and subsequent to this a generation of ideas." [30][42].

Thinking styles of professionals and advanced users however seldomly diverge but converge within the frame of reference [30][34]. Ordinary users with average technical capabilities on the other hand are more likely to generate divergent ideas because of their less constricted frame of reference, e.g. someone who doesn't know the limitations of the iOS API doesn't take them into account when thinking about new mobile services for that platform.

In conclusion diversification, even if reducing overall expertise level, has a positive effect on the outcome due to experts limited style of thinking, which supports the proposed idea of incorporating laymen into the knowledge generation process.

A study analogous to Kristensson et al.'s work was recently conducted by Poetz et al. [48] in which a crowdsourcing process was employed to gather user generated solutions to effective and relevant problems in the consumer goods market. Ideas from both professionals and users were evaluated by executives of the underlying company with respect to similar criteria as in Kristensson et al.'s work including, but not limited to, novelty, customer benefit and feasibility. Their results affirm aforementioned findings of users being a valuable resource for idea and knowledge generation. In their particular case even the feasibility scores of user contributed solutions, though still outperformed by professional contributions, turned out high overall.

The addressed and other current research, e.g. [11], [55], thus suggests that users bear potential for the creative process and that "...knowledge acquisition is the key bottleneck..." [49] concerning research-dependent undertakings. The creative process as it is evaluated within these works however exclusively focuses on users' ability to contribute and help solve rather specific problems or contribute with ideas on a specific topic of interest. Ask The Crowd in contrast tries to motivate users to contribute and in an collaborative effort solve generalizable matters. Nevertheless the issue of how to motivate users to contribute and participate remains.

As mentioned earlier, CS-systems and/or micro-task markets often employ a reward system offering monetary and/or non-monetary remuneration. Like the perviously introduced studies using Mechanical Turk [2][28] showed, monetary rewards can be of negligible value while still sufficiently motivating worker participation. Since monetary rewards do not appear to be of utmost importance many CS-systems employ non-monetary compensation. Non-monetary rewards can be of intrinsic or extrinsic nature. Examples of the latter include reputation points, e.g. as employed on stackoverflow.com¹¹, that represent a user's status among the others. In the case of stackoverflow.com, a question portal for software developers and computer scientists, reputation is primarily earned by answering others' questions, whereby a bonus is earned if one's answer is selected as the best answer by the inquiror (see figure 2.4).

In addition to reputation points stackoverflow and others also commonly attract users motivation through badges (see [4]), which can be earned by completing specific achievements on the site (see figure 2.5). While research has found gamification, i.e. weaving the system problem into a more or less evolved gaming experience e.g. featuring points, badges, scoreboards and/or contests, can motivate user participation and enrich the user experience [15][54][13][16][41], most

¹¹<http://stackoverflow.com/>

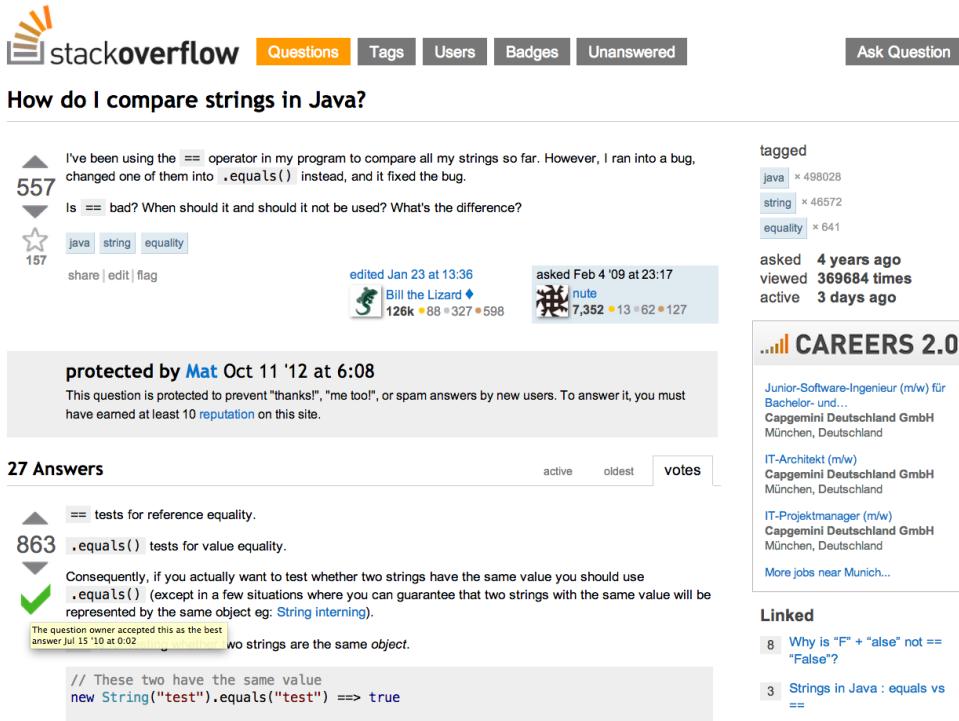


Figure 2.4: Screenshot of a question on stackoverflow.com taken Oct. 21, 2013

research also concludes that "...pleasures of games arise not from such system feedback, but from "meaningful choices" in the pursuance of "interestingly hard goals"" and that "the entity being gamified needs to have some intrinsic value already - a reason for users to engage with it".[15] (see also [4], [26]).

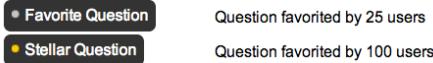


Figure 2.5: Screenshot of earnable badges on stackoverflow.com taken Oct. 21, 2013

With this in mind intrinsic rewards gain highly in importance. While different levels of intrinsic as well as extrinsic rewards may attract different users, i.e. user reaction to motivators is individual, it is favorable for a (self-sustaining) CS-system to reach a state where it stimulates intrinsic motivation to a high degree[30], [48], [31]. The concept and nature of intrinsic rewards is a topic of ongoing research and psychology describes it as:

"[...] a transcendence of ego-boundaries and consequent psychic integration with metapersonal systems." [12]

Kristensson et al. exemplary describe "[users] may be motivated intrinsically by the fact that they are given the opportunity to share their ideas and perhaps influence the services of tomorrow"[30]. The effectiveness of intrinsic motivation was further proven by Lakhani et al. [33] when researching "How open source software works". They examined the reasons behind free, i.e. non-payed, collaboration of users on the basis of the open source Apache webserver software project¹², focusing on the task of field support. They found that "[...] 98% of the effort expended by information providers [i.e. free collaborators providing field support] in fact returns direct learning benefits to those providers". Abstracted this implies that knowledge gain can function as an intrinsic motivator, suggesting that the idea behind Ask The Crowd - offering users to gain knowledge by

¹²<http://www.apache.org/>

formulating a question and composing a survey, therefore themselves generating a *HIT*, as well as answering others' questions and analyzing others surveys' results - enables intrinsic reward and motivation. Further proof for the importance of a CS-system's ability to provide intrinsic satisfaction to attract and maintain users is given in Paolacci et al.'s work "*Running experiments on Mechanical Turk*"[45] wherein the greater part ($\approx 70\%$) of their subject workers reported that the intrinsic value of doing something "*fruitful*" instead of wasting time as a major motivational factor.

While it has been found that users lean towards contributing freely, especially with their peers and given intrinsic motivation[23], Kristennson et al.'s followup study has brought forth seven "*Key strategies for the successful involvement of customers in the co-creation of new technology-based services*"[31] incorporating many of the previously elaborated findings. Though their study focuses on the creation process of new non-virtual products, the strategies found can be adapted to the process of knowledge generation on Ask The Crowd:

1. "*derivation from user situation*": Users tend to form ideas and solutions when experiencing the actual (problem-)situation. This finding corroborates earlier findings [56], [40] wherein mental processes such as learning, inventing, generating ideas and problem solving are shown to be significantly enhanced when exercising related activities, e.g. *learning by doing*.

While Ask The Crowd cannot provide or facilitate any real-life situation, it still remains accessible during many of today's everyday situations. Through virtually omnipresent internet and wireless communication through portable devices, it can be assumed that people have access to Ask The Crowd (at least) within reasonable timeframes of experiencing a situation leading to a question to be posed on the portal.

2. "*derivation from various roles*": Users tend to restructure and refine ideas and solutions when occupying different roles. Roles in this context can be social roles, such as a person's role as parent when at home vs. their role as worker when in the office, or based on specialization and similar criteria, e.g. the role of a designer or the role of a teacher. Roles naturally are strongly related to perspectives and changing perspectives naturally influence perception, facilitating divergence in the thought process, i.e. divergent thinking.

Not only can users assume different roles on Ask The Crowd, e.g. as inquiror, answerer, analyst or perspective provider, but as mentioned before it is potentially accessible to the user when assuming different roles throughout everyday life.

3. "*analytical tools*": Providing users with analytical tools to explore on their own facilitates idea generation. When users are given the opportunity to analyze and extrapolate information and connections on their own, rather than fed information on a statement level, their interpretation thereof tends to be less restricted and therefore more divergent.

As mentioned in the introduction and in accordance to the first focus group study Ask The Crowd offers users not only the ability to inspect survey results in plain data, but visualize them through different, customizable charts to provide for means of analysis. Further details about analytical tools offered by Ask The Crowd can be found in section 4.2: Final Design.

4. "*apparent benefit*": Users tend to contribute ideas when their contribution has apparent beneficial prospects for themselves. This strongly correlates to the previously discussed importance of offering in- and/or extrinsic value to the user. Not only does motivation aid the creative thought process, but psychological research has shown that motivated outperform unmotivated users at creative, inventive and/or innovative tasks [3].

Since this work was funded by the author alone, monetary rewards have not been an option,

whereby non-monetary rewards of extrinsic and intrinsic nature remain to be potentially integrated by Ask The Crowd. Finding out what it would take to motivate user participation on Ask The Crowd therefore was one of the main goals of the **first focus group study**. Study results indicate that simple curiosity can work as a main intrinsic motivator in favor of Ask The Crowd (see section 3.2: Focus Group Study I).

5. "avoiding negative brainstorming effects": The best ideas are created not within "*undifferentiated and directionless "brain-storming" activities*"[31], but originate from real-life experiences. Though *brainstorming-techniques* can be a valuable tool to the creative process, especially concerning quantity and diversification of ideas, they oftentimes result in rather meaningless ideas [19].

Since ATC does not force any kind of brainstorming between users, such effects seem unlikely to occur.

6. "limited expertise": Users with limited expertise do not hinder the creative process, but experienced developers can be limited due to predictable thinking. As shown in various studies mentioned earlier, expertise is not required to produce creative ideas or novel solutions but in fact can form a barrier for the thought process. The more familiar a person is with a specific domain, the more she struggles to generate creative solutions that lie outside of this domain [60].

The open crowdsourcing approach renders any concerns about the expertise level of the end users mute, since it is not limited to any kind of focus group but accessible to anyone with an internet connection. Regarding the demographics including expertise level of contributors to be expected, Paolacci et al.'s work [45] work shows that at least the participants of their experiment on Mechanical Turk reflect the general public population of the United States.

7. "ensuring heterogeneity": A heterogeneous set of users requires and produces a heterogeneous set of ideas and solutions.

It is difficult for a homogeneous group of people, e.g. product developers or computer scientists, to wonder and come up with all possible ideas, problem statements and/or solutions thinkable. This notion is one of the main driving thoughts behind many crowdsourcing efforts, as well as Ask The Crowd as it is in symbiosis with crowdsourcing environments and potentials.

These seven key strategies round up and incorporate many of the insights and findings presented in this section of related work that influenced the approach and delineate a frame of reference for the conception of Ask The Crowd.

3 Ask The Crowd - Concept

This section describes Ask The Crowd's conceptual development from the idea to the design including the two preliminary studies. Starting out with preliminary considerations, a first focus group study was conducted to evaluate the idea and assess motivators and features. Results thereof delineate the site's interaction design and features, disentangling in the visual design phase. Visual designs are once more evaluated within a focus group setting, the results of which conclude this section about the conception of Ask The Crowd.

3.1 Preliminary Considerations

The basic idea for the web service was simple: It should feature the ability to ask questions in the form of surveys, querying parameters which are restricted to predefined or numerical values in order to enable automated statistical analysis. The primary outline for user involvement in the knowledge generation process has therefore been set:

Users on Ask The Crowd contribute to the process and goal of knowledge generation in the broadest sense of the term, by

1. posing questions, conveyed through surveys
2. answering questions by participating at each other's surveys
3. analyzing survey results possibly leading to new questions.

Other preliminary considerations evolved around the question of "*How to get the user involved?*" As suggested by related work, some kind of reward and/or motivational system should be found to entertain users of a crowdsourcing system. Due to limited funds, monetary rewards were omitted, leaving rewards of non-monetary nature for consideration. While intrinsic motivations for user participation on Ask The Crowd were to be assessed within the scope of the **first focus group study**, gamification, following the example of stackoverflow.com, was chosen as viable motivator for assessment as well: offering reputation points and/or badges in reward of creating and answering surveys.

To keep users attracted to the site, it is also necessary to take care of its *hygiene*, i.e. avoid and remove malicious data and content from the site or in simple terms *keep the site clean*. As elaborated by Zhang et al. [61] hygiene factors play as important a role at recruiting and retaining users as motivators. Therefore successful relatable contemporary CS-systems were reviewed in search of suitable examples for data management in this regard. Candidates selected for further assessment during the focus group study were voting/rating systems as e.g. employed on YouTube¹³, reddit¹⁴ or stackoverflow as well as staging systems as employed e.g. on 9gag¹⁵.

Voting or rating systems allow the user to vote for (or against), respectively rate, the content, e.g. give a *thumbs up/down* for it, therefore filtering said content by popularity amongst users.

A staging system then groups intervals of rating-levels. 9gag, a popular platform where users share funny images, for example features the categories/stages *Hot*, *Trending* and *Fresh*, whereby a contribution starts out as *Fresh* and can make its way up to and through *Trending* into *Hot* (see figure 3.1). The intervals grouped in this scheme therefore are *time-dependent* for *Fresh*, since it shows newly submitted contributions, *time- and rating-dependent* for *Trending*, since it displays (relatively) new content that is on the verge of becoming *Hot*, i.e. has a high rating. *Hot* in turn is a *rating-dependent* stage, i.e. it sorts content by rating.

¹³<http://www.youtube.com>

¹⁴<http://www.reddit.com>

¹⁵<http://9gag.com>

Depending on usage frequencies and user participation, real-life examples have shown that a system like this can reliably keep involuntary content from the front pages while again outsourcing tasks to the crowd.

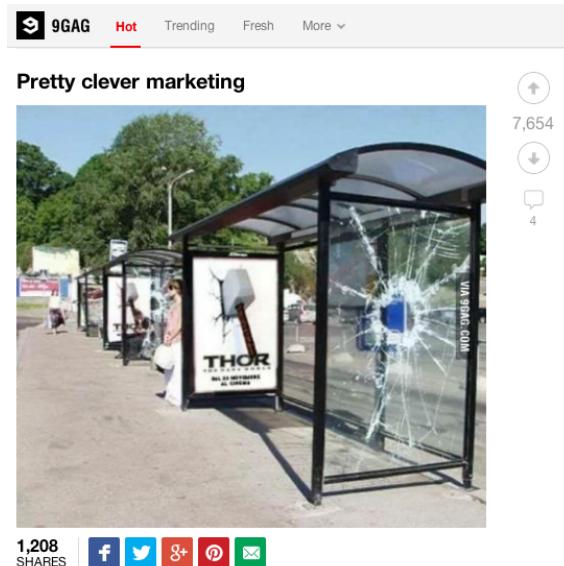


Figure 3.1: Screenshot of 9gag.com taken Oct. 24, 2013

3.2 Focus Group Study I

To evaluate preliminary considerations and discover essential features for Ask The Crowd, a focus group study was conducted. Focus group studies, a form of group interview, explore and gather ideas and opinions on a particular topic focusing on interaction between the participants rather than relying on an interviewer asking questions:

"A focus group study is a carefully planned series of discussions designed to obtain perceptions on a defined area of interest in a permissive, nonthreatening environment. [...] The discussions are relaxed, and often participants enjoy sharing their ideas and perceptions."^[32]

The casual atmosphere and non-interrogational style of focus group studies makes them a premier tool to gather insights on users thoughts, ideas and expectations and they are often used, e.g. in market research, to collect user feedback on projects, products and services [53]. Participants are encouraged to discuss a topic at length among themselves, therefore facilitating unhindered exchange of thoughts, often resulting in valuable data, since users tend to be less reluctant to share ideas among their peers[23]. Research however has also shown that group composition is vital to the success of focus group studies and must therefore be considered carefully [20], [39].

3.2.1 Evaluation objectives

The primary objective of this study was to evaluate the viability of Ask The Crowd in general: *Are people generally interested in such a service and what motivators are needed to attract participation?*

Further topics of interest that were addressed during the focus group study evolved around three major problems:

1. *How to display survey results?*
2. *How to keep the site clean?*
3. *How to create an appealing landing page?*

3.2.2 Group profile

When searching for participants for this focus group we tried to compose a rather homogeneous but still divergent group of potential lead users since those promised most potential for our purpose [31], [39], [40]. Participants were recruited through personal invitation as well as by application in return to either a post on the faculty forums¹⁶ or a post at the Media Informatics group on Facebook.

The final group consisted of six participants, two female, four male, between 23 and 29 years old. Two-thirds of the group were represented by students of computer science, media informatics as well as arts and multimedia. The remaining third were doctoral candidates in different fields of computer science. A summary of collected demographic data can be seen in figure 3.2.

The group can be considered well-versed internet users as well as highly technically educated, experienced and interested. While all participants share a computer scientific background, the different specializations and focuses (*e.g. arts and design, user experience design, interaction design, human computer interaction, and others*) of the participants provided for divergent viewpoints and problem solving approaches.

3.2.3 Procedure & Results

The focus group met in one of the faculty meeting rooms where the participants discussed openly for about one hour. The study was supported by a few powerpoint slides and recorded in writing as well as on video.

After a general introduction to the idea (*codenamed X\$\$\$*) based on three of the major role models (*see figure 3.3*) including the set limitation of "*no free-text answers*", participants were left to discuss what such a portal would have to offer (in the broadest sense) to motivate participation. Solutions and ideas generated by the party featured both extrinsic and intrinsic motivators. The first-mentioned motivation for participation was the natural interest in the answers. The group consented that the inherent curiosity within people serves as a primary intrinsic motivator: *"It bears the potential to generate questions and results that probably wouldn't be created anywhere else"*.

Another intrinsic motivator to use a service like Ask The Crowd elaborated by the group was entertainment value and general appeal to the idea.

The remaining motivators assessed viable by the participants during their discussion can be grouped into (extrinsic) motivational and hygienic factors based on the two factor model for website design proposed by Zhang et al. [61]. Motivators are characterized as features that attract user attention and interaction while hygienic factors, as explained earlier, ensure a pleasant user experience (*see figure 3.4*).

The gamification approach to external motivation was proposed and considered viable by the participants. Rankings of surveys and users were regarded as bearers of high motivational potential. Furthermore achievements (*c.f. [8], [15]*), resulting from specialization, as e.g. employed on Foursquare where users earn titles such as *major* of a particular place by *checking-in*, i.e. verifying their visit via location based services on their smartphones, at that place on a regular basis, were considered legitimate.

The idea is that it is not about checking in at as many places as possible, but about showing dedication for a specific place. While awarding badges for achievements like e.g. creating or answering

¹⁶http://www.die-informatiker.net/topic/Nutzerstudien/Brainstorming_Crowdsourcing_Portal_Amazon_Gutschein_MMI/18206

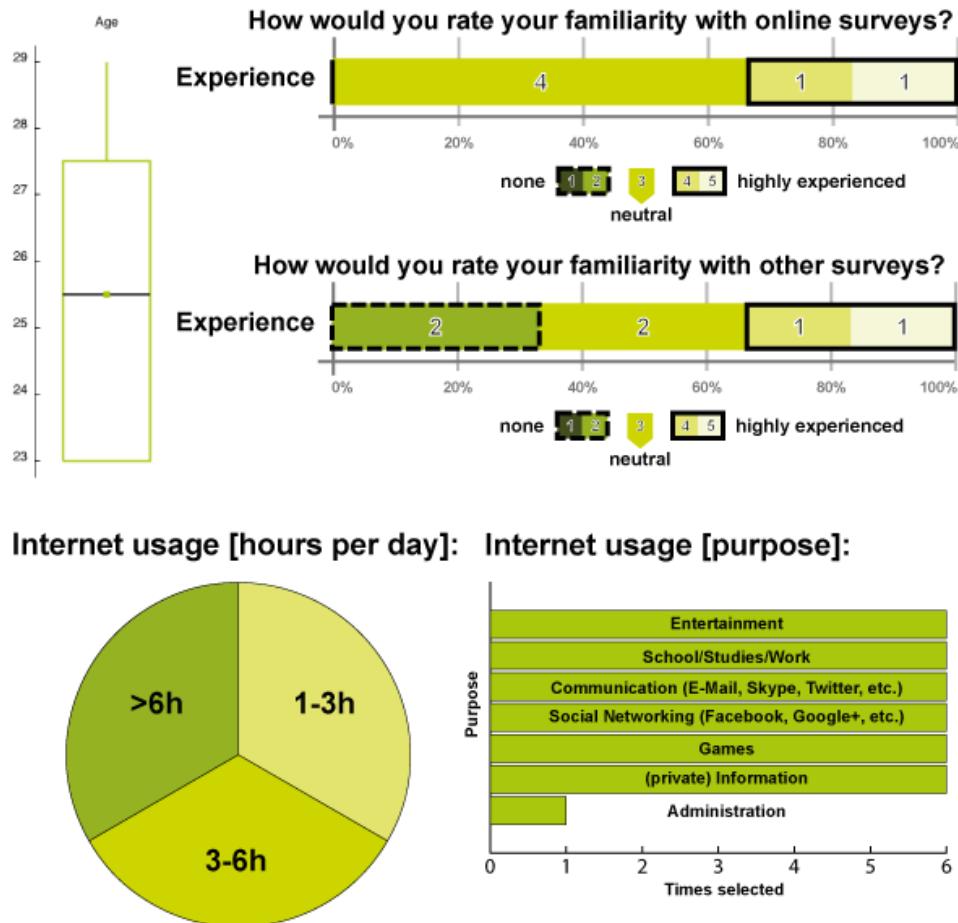


Figure 3.2: Demographic summary of the first focus group

a certain amount of surveys (referring to examples found on stackoverflow) on the other hand was considered counterproductive, since it could delude users to create forged surveys and/or answers on a large scale, therefore compromising data quality. If badges were to be included, they have to meet the requirements of being visually appealing icons, in contrast to the labelled ellipses displayed on stackoverflow, the group concluded.

Another concern the group elaborated actively in this context of user motivation was that creating a survey resembles a task that requires rather high effort and therefore must be conveyed by an *easy*, rather self-explanatory process, avoiding large, overly-detailed forms. To furthermore facilitate survey creation and participation in general, the group suggested a loose community, wherein registration is completely optional, i.e. required for neither survey creation nor participation. Enhancing and personalizing the user experience for registered users, though optional, provides for means to retain users, while eliminating entry barriers. The result of this is a loose community of registered and ad hoc users coexisting in the system.

The idea of a *no-login-required*-policy was directly connected to the remaining features and requirements brought forth by the group, concluding the problem statement of how to motivate user participation: Appropriate counter-measures to bogus surveys and answers need to be implemented to ensure data quality and avert malicious content, while a large community is required to provide a sufficient amount of potential answerers. In this context it was also hypothesized that surveys will need to acquire answers at a fast rate to motivate creation thereof and retain user interest. Participants further saw a need for survey creators to be able to specify a focus group for their surveys, implications of which are picked up at the second major problem statement in



Figure 3.3: Slide shown while introducing the idea of Ask The Crowd during the first focus group study.

discussion: How to display survey results? A summary and categorization following [61] of the major ideas generated by the participants concerning this first topic of discussion can be found in table 3.1.

The next general problem approached during the study was "*How to display survey results?*" Participants came up with an idea for interactive, customizable visualizations of survey results, offering users ways of exploring relations between queried parameters. *"Such visualizations can potentially facilitate engagement in analytical tasks and appeal even to people normally not interested in doing such things."*

Apart from interactive visualizations a data table forms a necessity according to the participants, while there should also be classical graphs, e.g. pie- or barcharts, for general statistical analysis of parameters. Group consensus was that the more flexible and playful user interaction with results takes place, the more interaction will take place.

Another idea contributed by the group was to enable users to upload their own visualizations and interpretations of survey results. *"Crowdsourcing visualizations"* as one participant put it, to which others added the notion of this being a premier candidate for rewards in terms of reputation points and achievements.

Once again bringing the aspect of focus groups for surveys and unwanted participation onto the table, the group concluded that a user must be able to view a survey's results without participating at the survey if she is not part of it's focus group or does not want to participate. As a consequence of viewing a survey's results a user however is no longer permitted to participate in the survey, in order to prevent data bias.

The gap from biased answerers to malicious content and measures towards site hygiene was bridged easily. The group confirmed the methods proposed as part of the preliminary considerations to this study (*see section 3.1*): Ranking surveys in collaboration with a staging system deemed both practical and effective to the participants. Assessing the necessity of a separate rating/voting system in contrast to using survey participation as a rating, participants uttered their concerns that while participation can be indicative of popularity, it is representative for neither popularity nor quality. Study results therefore confirm practiced solutions, suggesting the use of a rating/voting system for surveys intertwined with a staging system.

TABLE 3. Hygiene and motivator features.

	% Diff	χ^2	Features
Motivator	61%	.000	F2-1. High/low level of learned new knowledge and/or skills by doing the surfing activity on the Website.
	58%	.000	F3-1. Presence/absence of use of humor.
	56%	.000	F3-2. Fun/no fun to explore.
	52%	.000	F10-2. Presence/absence of external recognition of the website (e.g., the site won awards, number of times the Website has been visited).
	44%	.000	F10-1. High/low reputation of the Website owner.
	43%	.000	F12-4. Appropriate/inappropriate detail level of information.
	39%	.000	F3-2. Presence/absence of multimedia.
	39%	.000	F12-9. Presence/absence of controversial materials.
	35%	.001	F1-1. The surfing activity has a high/low level of challenge.
	29%	.008	F5-3. Users can/cannot control opportunities for interaction.
	27%	.015	F5-4. Users can/cannot control complexity of mechanisms for accessing information.
	25%	.022	F5-5. Users can/cannot control difficulty level of information to be accessed.
	23%	.042	F12-10. Presence/absence of novel (new) information.
	23%	.042	F6-6. Presence/absence of eye-catching images or title on the homepage.
	19%	.091	F6-3. Visually attractive/unattractive screen layout.
	14%	.185	F1-2. Importance/lack of importance of the surfing activity to the user.
	13%	.251	F4-4. Presence/absence of assurance that user entered data is encrypted.
	3%	.821	F6-1. Attractive/unattractive overall color use.
	1%	.909	F5-2. Users can/cannot control how fast to go through the Website.
Hygiene	1%	.910	F6-4. Attractive/unattractive screen background and pattern.
	3%	.821	F12-7. Complete/incomplete coverage of information.
	8%	.480	F11-1. Biased/unbiased information.
	10%	.359	F10-3. Presence/absence of identification of site owners/designers.
	10%	.365	F4-1. Presence/absence of access requirement.
	11%	.305	F9-2. Structure of information presentation is logical/illogical.
	11%	.352	F11-2. Presence/absence of gender or racial/ethnic biases and stereotypes.
	15%	.169	F4-2. Authorized/unauthorized use of the user's data for unanticipated purposes.
	15%	.174	F12-6. Relevant/irrelevant information.
	18%	.138	F7-1. Presence/absence of indication of system loading/responding time.
	24%	.026	F12-2. Presence/absence of improper materials.
	27%	.015	F4-3. Authorized/unauthorized collection of user data.
	29%	.010	F12-5. Up-to-date/outdated information.
	29%	.010	F5-1. Users can/cannot control order sequence of information access.
	29%	.009	F9-1. Presence/absence of overview, table of contents, and/or summaries/headings.
	34%	.002	F8-2. Effective/ineffective navigation aids.
	39%	.000	F12-3. Accurate/inaccurate information.
	41%	.000	F12-1. Information on the Website stays/does not stay for a period of time.
	41%	.000	F6-2. Sharp/fuzzy displays.
	43%	.000	F7-2. Support/lack of support for different platforms and/or browsers.
	47%	.000	F7-3. Stability/instability of the website availability.
	47%	.000	F6-5. Adequate/inadequate brightness of the screens/pages.
	53%	.000	F8-1. Presence/absence of indicators of the user's location within the Website.
	54%	.000	F8-3. Clear/unclear directions for navigating the Website.
	58%	.000	F12-8. Content that supports/does not support the Website's intended purpose.

Figure 3.4: Classification of website features according to the two factor model based on motivators and hygienic factors elaborated by Zhang et al.[61]

Concluding the focus group study, participants were asked how they would like the landing page to be designed - what features and means of interaction they would like to see when arriving at <http://www.ask-the-crowd.com>. Feedback identified a *clean* design as well as ways to participate and analyze right away as most important factors.

"Users arriving at the site should immediately be able to create and answer a survey, I would not like just a list of surveys right away".

Survey participation *right away* as well as results of popular expired surveys, preferably in the form of visualizations, are premier candidates for the front page of Ask The Crowd according to our study participants. Other ideas included the wish for a "*Random Button*", which when clicked directs the user to a random survey, a "*Hall of Fame*" featuring the most popular expired surveys, easy access to stages/categories ("*like on 9gag*") as well as some means to graphically represent survey participation.

Summing up, the study suggests:

Motivators: The novel approach and feature set bears potential to excite user curiosity and promises entertaining content. This can be supported by intertwining gamification in the form of reputation, rankings, survey ratings and a staging system.

Motivators	Hygiene Factors
<p>Intrinsic:</p> <ul style="list-style-type: none"> • Curiosity • Entertainment <p>Extrinsic through Gamification:</p> <ul style="list-style-type: none"> • Ranking of surveys by answers and popularity • Achievements and User rankings as e.g. employed by Foursquare¹⁷ or stackoverflow <p>Badges were considered counterproductive, reasoning that they could lead users to "<i>mass-answer</i>" surveys irrespective of the respective survey's focus group in order to get, e.g. a badge granted after answering 1000 surveys, yielding low quality answers.</p>	<ul style="list-style-type: none"> • Counter-measures to forged answers and surveys through e.g. validity checks. • Providing options to determine focus groups for surveys • Optional personalization and subscriptions to survey results and summaries (e.g. via E-Mail) • Fast response rate, high reach • Easy, uncomplicated, on-the-fly participation: No registration/login required

Table 3.1: Summary and classification of solutions generated during the first focus group study for the problem of *how to motivate participation* on Ask The Crowd

Hygiene Factors: User experience and access can be enhanced by employing an open access policy, where no registration is required. A high quality of data and content is maintained by evaluation, e.g. through CAPTCHAs and input constraints.

Features such as interactive, customizable as well as user submitted visualizations attract user attention, interaction as well as knowledge discovery and constitute profound subjects for gamification. Other prominent features include a Hall of Fame for expired surveys, a random survey feature as well as right away participation at the landing page.

A visualization of these findings can be found in figure 3.5.

3.3 The Survey Model

After the first study proved the idea valuable, a model had to be established to represent a survey as the central object of information. Since the original idea evolved around the *question to the world*, it was decided to represent a survey by the principal question it was designed to solve. Further each survey is characterized by the following attributes:

- the parameters it queries from the audience. Parameters constitute a name (e.g. *car color*), a type (e.g. *nominal*) as well as other constraints (e.g. *minimum/maximum allowed input value*) and predefined answer choices (e.g. *yellow, green, red*).

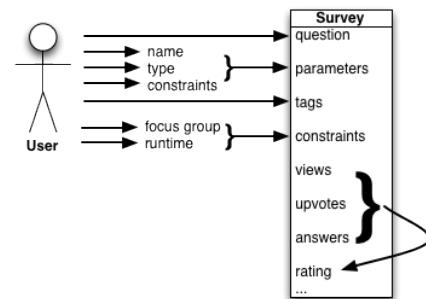


Figure 3.6: The Survey Model

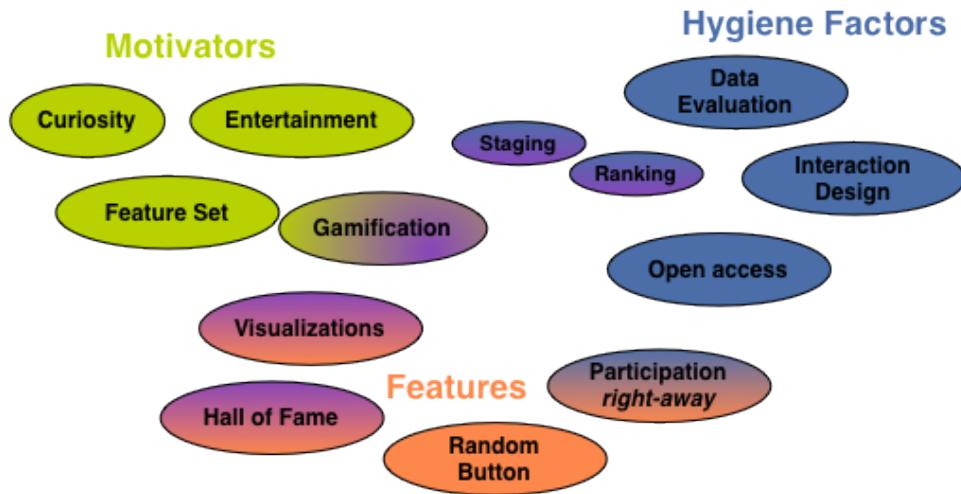


Figure 3.5: Visual summary of the findings of the first focus group study.

- associated tags.
- an optional focus group.
- it's runtime.

Of course the above list is not exhaustive in terms of a survey object's attributes, but represents the information required from the user as input (a technical model can be found in section 4.1: Implementation). Another important attribute of a survey is its rating. This value is used to rank surveys and the unit by which most stages are ordered. A survey's rating is a weighed function of it's number of answers, upvotes and views (see figure 3.6).

As introduced earlier, a survey starts it's lifecycle as *New*, progressing through *Trending* and *Popular* while running, to finally be archived in the *Hall of Fame* when it expires.

3.4 Focus Group Study II

Based on the findings of the first focus group study, visual user interface designs were created incorporating the established survey model (see section 3.3). The drafts were composed drawing ideas from many of the previously introduced crowdsourcing platforms and services on the world wide web. Following standard principles of human computer interaction and interaction design (c.f. [35], [27], [15], [52], [62] and others), the visual as well as the interaction design of Ask The Crowd were subject to an iterative process (see figure 3.7).

As part of this iterative design process a second focus group study was conducted to evaluate and refine the visual design as well as concepts of interactions and features of the site. Practical as well as scientific evidence shown proves this task highly important and it was executed keeping in mind that "[t]he user interface should make it easy for users to contribute[, which] is highly non-trivial." [17].

3.4.1 Evaluation Objectives

Delineated by the feature set identified during the first focus group study, visual user interface designs of Ask The Crowd were created. Starting out with paper and pencil the appearance of the site was outlined to fit the developed theme:

Offering surveys filtered by a staging system similar to 9gag spiced with gamification in the form of reputation and rankings following the example of stackoverflow.

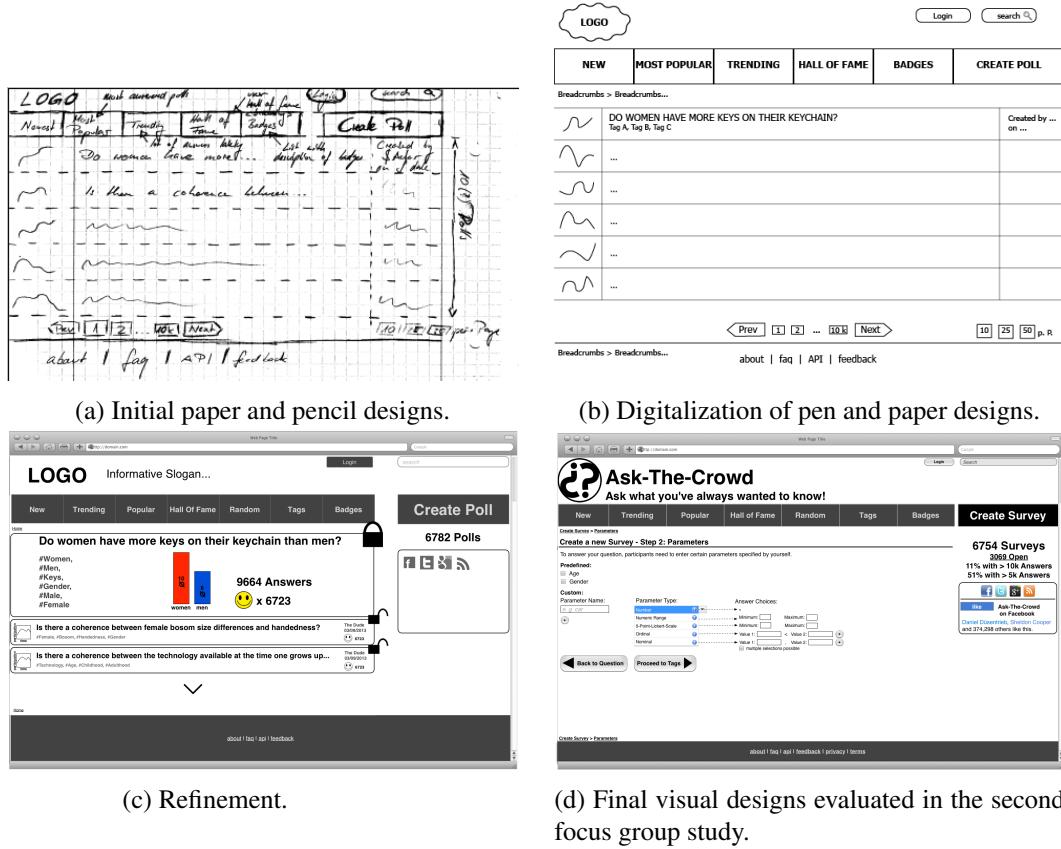


Figure 3.7: Visual user interface design progression.

Various digital drafts were created and refined leading to a preliminary visual design, subject to evaluation in this second study (*see figure 3.8*). Topics of focus were:

The landing page offering direct ways of participation as well as displaying result visualizations (*see figure A.1 in appendix A*).

The staging system featuring a progression from *New* over *Trending* to *Popular* ending in the proposed *Hall of Fame*. (*see figure A.2 in appendix A*).

Categorization of surveys via tags, i.e. keywords[22] (*see figure A.3 in appendix A*).

Visualizations of survey results, exemplary in the form of data tables and treemaps, the latter of which was chosen due to its ability to visually encode multiple (>3) dimensions (*see [5], [25], [47]*) (*see figure A.6-A.7 in appendix A*).

The content model whereby a survey is represented by it's central *question*.

Survey creation through a four step process: (*see figure A.8-A.11 in appendix A*)

1. Formulating the representative question, e.g. *Do women have more keys on their key-chain than men?*
2. Specifying survey parameters, e.g. *Gender and number of keys*.
3. Adding tags
4. Customizing survey runtime and focus group

Goal of the study was to evaluate the drafts regarding:

1. information design, i.e. if users understand how information is represented
2. visual design, i.e. if users find the site attractive
3. interaction design, i.e. if ways of interaction were easy to grasp

The individual designs evaluated during the study can be found in [appendix A](#).

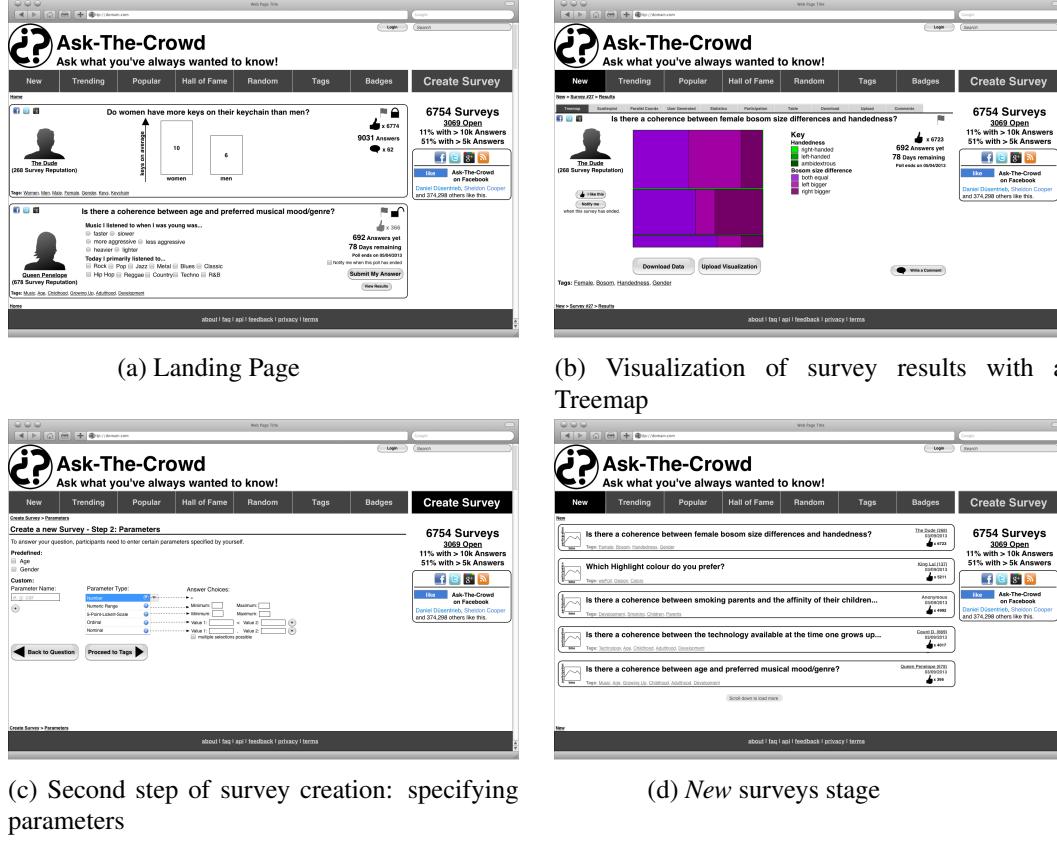


Figure 3.8: Exemplary visual designs evaluated during the second focus group study.

3.4.2 Group Profile

In contrast to the first focus group study, where highly trained lead users experienced in computer scientific related fields were favored at group composition due to their innovative potential, this study's goals demand for less field-related technically educated participants [20], [39]. We therefore tried to solicit possible end-users that can provide insights into how the user perceives the site.

All participants were recruited via personal invitation and the final group constituted five participants, two female, three male, between the ages of 25 and 28. Consisting of two doctoral candidates in fields of biology, an economist (*M.Sc.*), a student of media informatics and a high school teacher, the subjects can be regarded highly educated and well versed internet users (*see figure 3.9*).

3.4.3 Procedure & Results

The informal study took place in the comfortable atmosphere of a living room, where participants were seated around a central screen showing the visual designs one by one (*see appendix A*). After an introduction to the idea the only instruction given was to talk about what they see, i.e. think

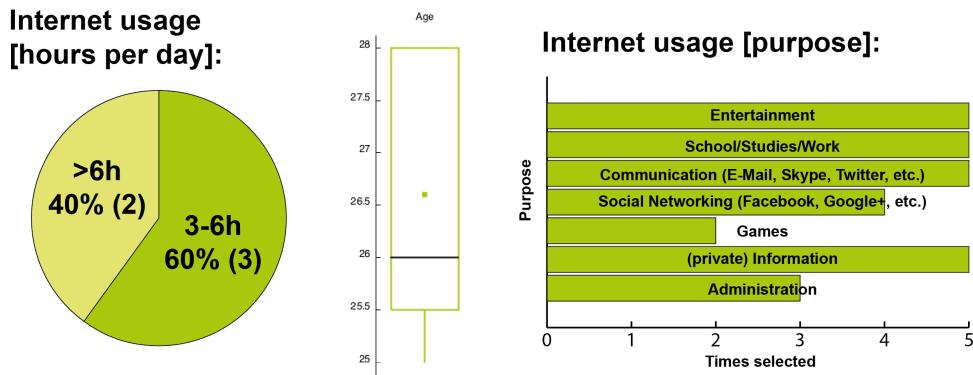


Figure 3.9: Demographic summary of the second focus group

aloud, and give feedback on page functionality and visual design. The session ended after about one hour and was recorded in audio as well as writing.

Participants contributed willingly and were enthusiastic about the chance to help creating and forming a new online service. Reactions to the site and design were mainly positive, functionality was identified easily and content delivery perceived pleasant. Summing up,

- landing page functionality, layout and survey model were perceived intuitive as well as engaging.
- the staging system was considered self-explanatory and familiar.
- ratings, reputation points and badges were acknowledged well-known and encouraging as an incentive.
- features such as focus group settings, notifications and participation graphs, personalized avatar pictures and visual representation of data were welcomed enthusiastic.
- most parts of the survey creation process were rated clear and easy to understand, only step two, though not presenting any problems/difficulties to the group, was considered as "*potentially simplifiable*".

While the majority of the presented site features were understood easily by the subjects, two topics could be identified as requiring further refinement:

1. The second step of survey creation (see *figure A.9*): participants were unfamiliar with the term *likert-scale* (*but familiar with the scale itself*) and found that the five presented parameter types represent too many choices. Furthermore clicking the question mark displayed next to each type in the drop-down box was considered too much effort: choices should either be self-explanatory or additional information should be displayed automatically, e.g. *when hovering a type*.
2. The treemap visualization (see *figure A.7*) was neither familiar, nor completely self-explanatory to the participants. Though they managed to understand the concepts of the treemap visualization without additional help, it required deeper inspection and collaboration among the participants.

Participants reactions to the site were very positive and the study gathered valuable feedback to be incorporated into the implementation of the portal.

4 Ask The Crowd - Realization

Since the implementation of the site contributed a significant part of the work effort of this master thesis, this section serves to outline some of the key aspects to the realization of Ask The Crowd. An overview of used technologies and illustrations of implementation related decisions are given. Concluding this section, the release candidate is presented.

4.1 Implementation

Ask The Crowd was implemented using server-side PHP that generates HTML5, enriched by client-side Javascript and styled via CSS 3 compliant stylesheets (*see figure 4.1*). To store surveys and accompanying information a MySQL-database was used.

Though the timeframe for this master thesis was set to only six months, the portal has grown a significant code-base encompassing nearly 95.000 lines of code¹⁸ and more than 90 images (*see figure 4.2 and <http://youtu.be/NbbNXA9-5FA>*). Apart from the core functionalities provided by the employed programming and scripting languages a number of third party libraries and services were incorporated to facilitate the implementation:

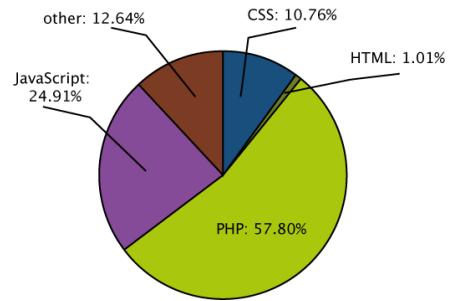


Figure 4.1: Relative share of total lines of code by file type

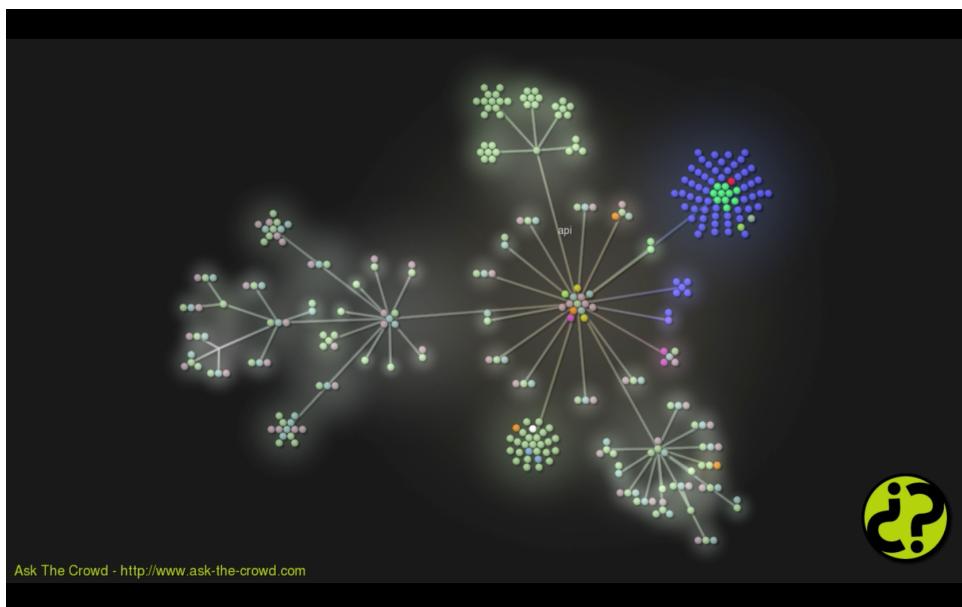


Figure 4.2: Visualization of the source code repository for Ask The Crowd

- The jQuery[web7] javascript library as well as the extending user interface tools library jQueryTools [web11]
- The Likert Plot Visualization provided by M. Maurer [web8]
- The Google Charts JavaScript Library [web4]

¹⁸Determined via `git ls-files | xargs wc -l`

- The Facebook JavaScript API [web2]
- The reCAPTCHA PHP library [web5]
- The twitter-php library [web6]
- The PBKDF2 (Password-Based Key Derivation Function) PHP implementation provided by defuse [web1]

The implementation was based on the findings of the two focus group studies and it was tried to realize as many of the requested features as possible. Alas there was not enough time to incorporate all ideas and features brought up, but to complete a functioning prototype as proof-of-concept.

A simplified overview schematic of the software architectonical layout can be seen in figure 4.3. The two layer architecture contains an object oriented back-end and a mostly imperative front-end. The back-end, constituted by a multitude of PHP Classes, encompasses the primary information objects, *e.g.* *Survey*, *Parameter*, *Choice*, *Visualization*, ... as well as a web API that delegates requests to handler objects for processing.

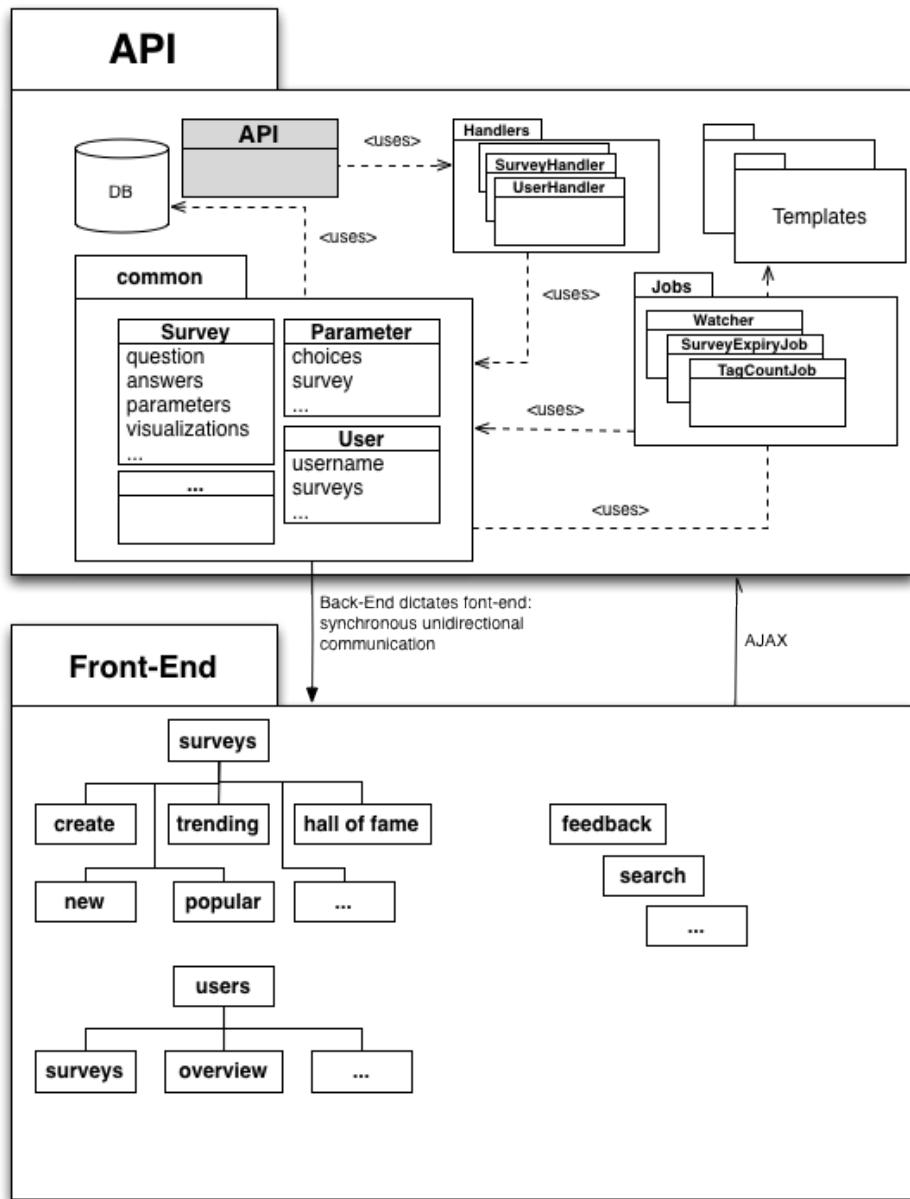


Figure 4.3: Schematic overview of employed architecture: An object oriented back-end dictates imperative front-end scripts, that in turn communicate asynchronously with a web API that delegates requests to the appropriate handlers.

4.1.1 Site Hygiene: Abuse Barriers, Ensuring Data Quality & Privacy Considerations

One of the major decisions a portal such as Ask The Crowd has to take is how to handle privacy, abuse and malicious content. Since the portal offers free participation without the need to register, data quality must be ensured by other means than trusting registered users only. Furthermore, findings suggest to minimize both entry barriers and gathered personal information in order to reach as many potential participants as possible. Though research suggests no inherent need [45], a number of abuse-barriers and content evaluations are implemented on Ask The Crowd.

In order to maintain a clean set of data, i.e. prevent users from answering surveys multiple times, a three factor mechanism decides whether a user is allowed to answer a survey:

1. IDs of answered surveys stored at the client in cookies
2. IDs of answered surveys stored at the server in session storage
3. IDs of answered surveys stored at the server in the database

A user in this context is identified by either logging into the site, i.e. identification via her registered username, or her transport layer address, whereby IP addresses are invalidated after one day to make up for dynamic assignment (*see figure 4.4*).

Apart from checking if a client is allowed to answer a survey via cookies, session storage and a database log, other validations are implemented via CAPTCHAs.

The aforementioned reCAPTCHA system is integrated to verify humans (*if not logged in*) when posting comments, uploading visualizations and registering with Ask The Crowd. These tasks are known to be common targets of bots and other malicious software due to their simple, one-step interaction concept and software architectural layout, e.g. most commenting pages consist of a `<textarea>` and a `submit-<button>`. Creating a survey however, is not subject to verification because it is considered a complex, multi-step interaction. As such it is not an easy target for malicious software, since it i.e. would require an attacker to implement a designated bot, which, at this stage, is presumed unrealistic[7], [6].

All of the measures mentioned so far contribute towards Ask The Crowd's hygiene (*see section 3.1 and section 3.2.3*). Another aspect they have in common is that they are executed and evaluated by the system, i.e. machine tasks (*see section 2.3*). Necessary hygiene-tasks are however not limited to tasks machines are good at, but also include semantic analysis, e.g. checking comments for inappropriate content. One common approach to such problems is to once more crowdsource them via, e.g. a report feature (*see figure 4.5*). Another example for a crowdsourcing approach to content analysis is rating thereof e.g. via voting (*see figure 4.5 below the view count*). As explained earlier users thereby can vote for interesting content, whereby both uninteresting and malicious content is filtered. Thinking of it as a list of content, e.g. videos on YouTube, ordered descending by votes, both uninteresting and malicious content tends to be accumulated at the bottom.

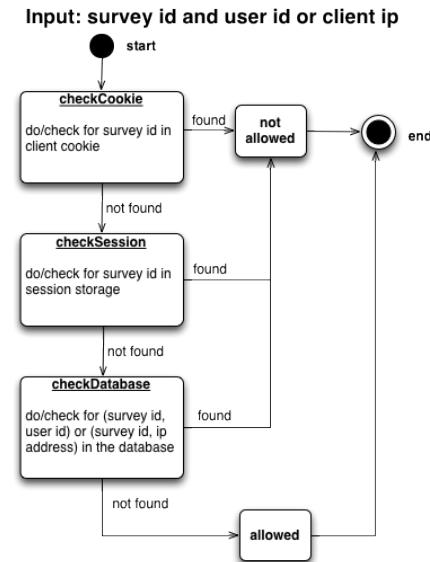


Figure 4.4: Process to determine if a user, identified either by her id or ip address, is allowed to answer a survey, represented by its id.

¹⁹Source video: MMM - The MultiModal Metronome. <http://www.youtube.com/watch?v=9nYjFxxmyPg>

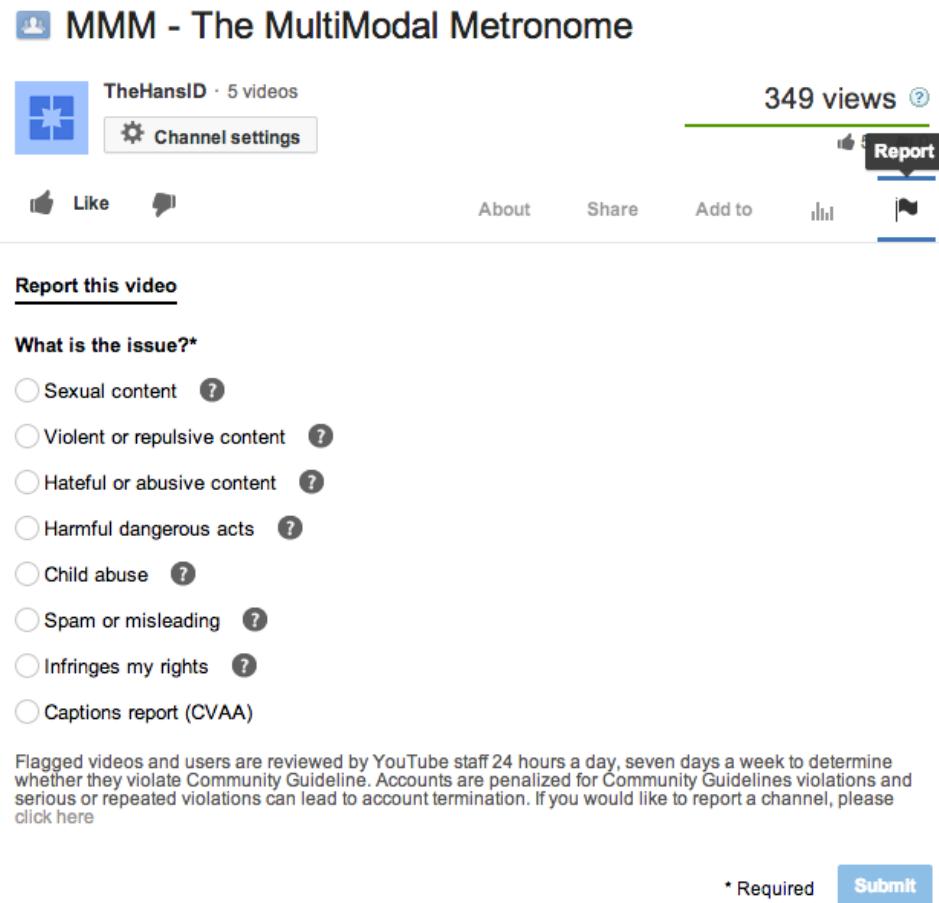


Figure 4.5: Report feature on YouTube. Screenshot taken on Oct. 30, 2013¹⁹

Both approaches are implemented on Ask The Crowd: users can *upvote* a survey if they like it (*and revoke their vote*) and report them if they find them offensive or otherwise inappropriate (*see figure 4.6*). To ensure that users only vote once for each survey, evaluations analogous to the process of determining if a user is allowed to answer a survey are carried out.

Concerning privacy and collected data, Ask The Crowd employs an open-data model for survey results: survey results are free for anyone to download and use. To ensure user privacy no distinct connection between user and given answer is saved. The only relation saved between a user and her answers given to a survey, is that she answered the survey.

The aforementioned features require a subset of user actions on Ask The Crowd to be protocolized in a database log (*e.g. survey creation/answering, login/out, voting, commenting, reporting, registering, verifying, viewing survey results,...*). The log contains fields for user, survey, visualization, comment, report as well as the corresponding action and a timestamp to specify an action (*see listing 1*).

Listing 1: User actions log table

```
// log table for user actions:
actions(user_id , type , survey_id , visualization_id , report_id ,
comment_id , timestamp , ip , forward_ip)
// example entry:
// user with id 1 answered survey with id 62 at 23:04 on Oct. 31, 2013
// from a machine identified by the ip address 87.156.61.238
// no proxy used
```

(1 , 'ANSWER' , 63 , NULL , NULL , NULL , 1383260642 , '87.156.61.238' , NULL)
--



Figure 4.6: Report and voting features on Ask The Crowd.

4.1.2 Motivators: Implementation Details

Apart from hygiene-factors, the other important component to user-satisfying webdesign according to [61] are motivators: features that engage the user, motivate interest, interaction and facilitate a pleasing browsing experience. This section provides an introduction and implementation-related details to some exemplary motivators employed by Ask The Crowd.

The staging system. Ask The Crowd features four distinct stages relating to different viewpoints on a survey's rating and age. As mentioned earlier, a survey's rating is a function of it's answers, views and votes. The weights that are applied to each factor (a , b and c) are subject to change and need to be adapted to the survey population²⁰.

$$\text{Rating}_{\text{Survey}} := a * \|\text{Views}_{\text{Survey}}\| + b * \|\text{Votes}_{\text{Survey}}\| + c * \|\text{Answers}_{\text{Survey}}\|$$

The staging system serves as both hygiene-factor and motivator - it filters surveys and enables users to control content:

1. *New*: All surveys start out as new, i.e. *New* is a list of all surveys ordered descending by creation timestamp.
2. *Trending* is an intermediary stage in which recently created surveys are ordered descending by rating. Current timeframe settings for trending surveys show all surveys created during the last two weeks. Once a survey leaves the trending timeframe it will presumably leave the initial pages shown at *New* and *Trending*. The timeframe can therefore be seen as a *trial-period* for a survey, in which it has to accumulate views, answers and votes in order to reach as many visitors as possible at the next stage.
3. *Popular* is a list of all running surveys ordered descending by rating.
4. *Hall of Fame*: Once a survey expires, it moves into the *Hall of Fame* and is no longer visible at the other stages. The *Hall of Fame*, as a result of the first focus group study, orders expired surveys by their rating, i.e. viewing the most popular expired surveys.

²⁰At the time of this writing weights are set to: $a := 1; b := 3; c := 5$

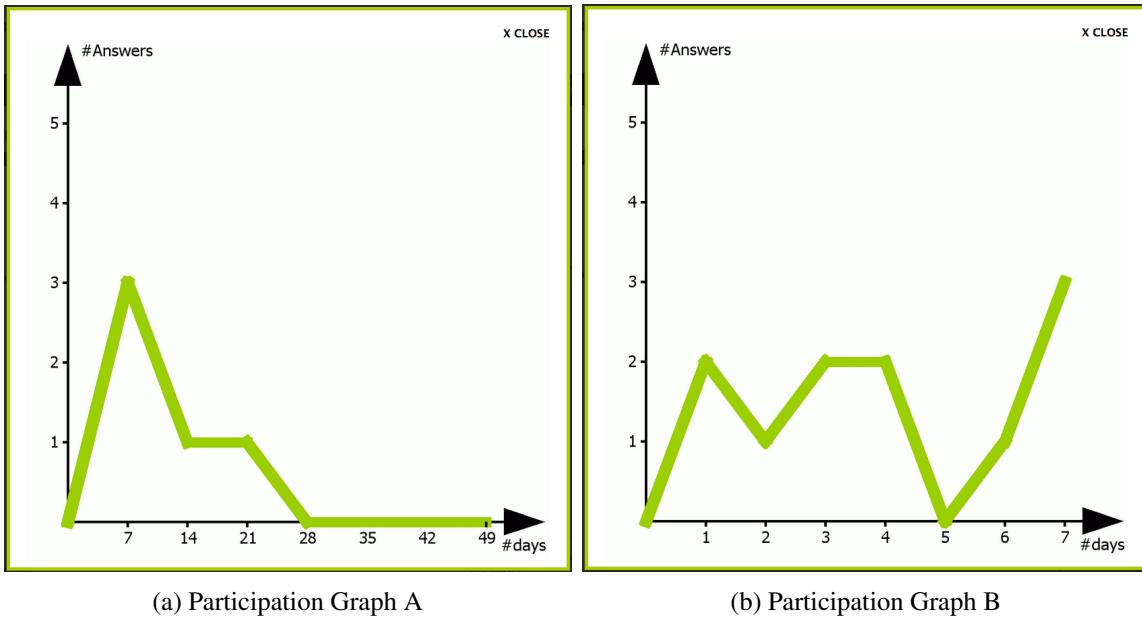


Figure 4.7: Example Participation Graphs from Ask The Crowd

Participation Graphs. In order to represent participation in a survey a dedicated visualization was proposed in the first and then evaluated during the second focus group study: the *Participation Graph*. A survey’s participation graph depicts its participation in terms of answers given over its runtime (see figure 4.7). Since image space is limited and the graph therefore cannot show, e.g. each day in a twenty-year runtime, it was decided to average participation with an adaptive window. For the complete algorithm implemented in PHP, see listing 2 in appendix B.

Performance tweaks. As research has shown, one very important aspect to a website is response time [35], [61]. Since many of the operations carried out on Ask The Crowd require significant calculations and inspection of possibly very large data sets, explicit measures were implemented in accommodation:

1. An elaborate JSON-based Web API, enabling asynchronous communication and interaction with surveys, users and data on Ask The Crowd.
2. A paging system, by which survey results are retrieved pagewise to reduce message size.
3. Expensive operations are carried out using *divide and conquer*-algorithms, examples include the calculation of mean, median and average of parameters.
4. Background jobs carry out database cleaning and other regular tasks such as sending summary emails. A database-based job-system is implemented that achieves background execution basically by sending HTTP-Requests to itself (see figure 4.8). This aggravation was induced by a lack of process control abilities in the PHP programming language.

Due to the tight timeframe for this work, an achievement/badge system had to be left out and remains to be implemented and evaluated in future work. Aspects of gamification that did make it into the prototypical implementation however, are reputation points, awarded to registered users for answering and creating surveys and uploading visualizations, as well as an accompanying leader board where users are ranked by reputation.

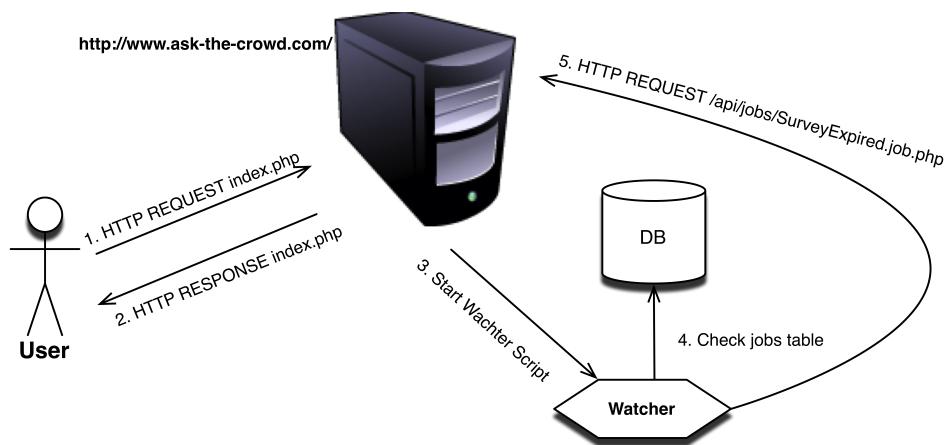


Figure 4.8: Background Jobs on Ask The Crowd: When users issue requests to Ask The Crowd (1), a script (*Watcher*) is executed (3) after sending the client response (2). This script checks the jobs table in the database (4) and issues HTTP requests to execute due jobs in separate processes (5)

4.2 The Release Candidate

The final release candidate went live into public open beta on Sep. 16th, 2013 and is introduced this section. Exemplary site-screenshots are presented and accompanying annotations are given.

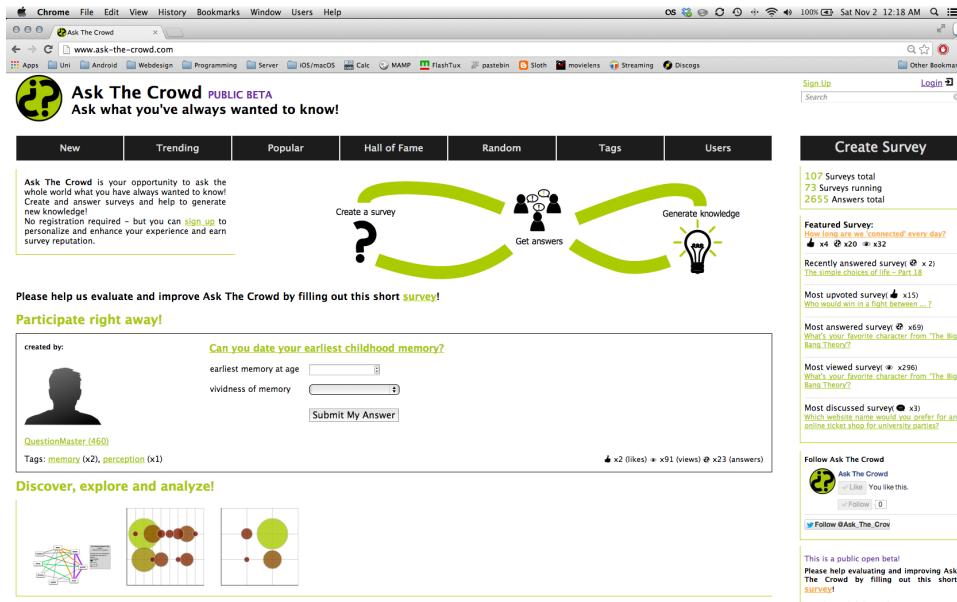


Figure 4.9: Ask The Crowd landing page

Upon arrival on <http://www.ask-the-crowd.com/> the user is presented with the landing page (*see figure 4.9*). Here the user is introduced to the portal by a short paragraph in the top left and an eye-catching image to the top right of the central content area. Below she finds a survey to answer right away, as well as thumbnail images of survey result visualizations that link to the corresponding survey. Both features were the result of the first focus group study (*see section 3.2*) and serve to attract user attention as well as motivate interaction and exploration.

The main content area is framed by the header, containing logo, catchphrase as well as links to registration/login and direct access to the elaborate site search feature and the main navigation at the top. To the right a separate column displays global site statistics (*total amount of surveys, number of running surveys*), as well as a selection of surveys:

- A featured survey, which can be used to promote either a specific survey or set to automatically change to a random running survey on a regular basis, to e.g. enable surveys that are shown at front pages of neither *New* nor *Trending* nor *Popular* to gain attention.²¹
- The survey answered most recently.
- The survey with the most *upvotes*.
- The survey that collected the most answers.
- The most viewed survey.
- The survey that has the most comments associated with it.

²¹The featured survey feature was e.g. used to promote a survey that was created to gather information about an error in the software, that lead to incorrect rendering of the site: <http://www.ask-the-crowd.com/surveys/?survey=32>

All of these fields are updated via AJAX in regular intervals and can change after a user initially loads the site. It was therefore tried to counteract change blindness by utilizing animations upon content changes [44].

Furthermore the right column features social widgets to enhance social interaction [29] and functions as a container for global, public announcements.

From here on the user has direct access to a multitude of information and actions. She can for example explore the different stages (*see figure 4.10*).

Each stage is represented by a list of surveys, wherein surveys that have already been answered

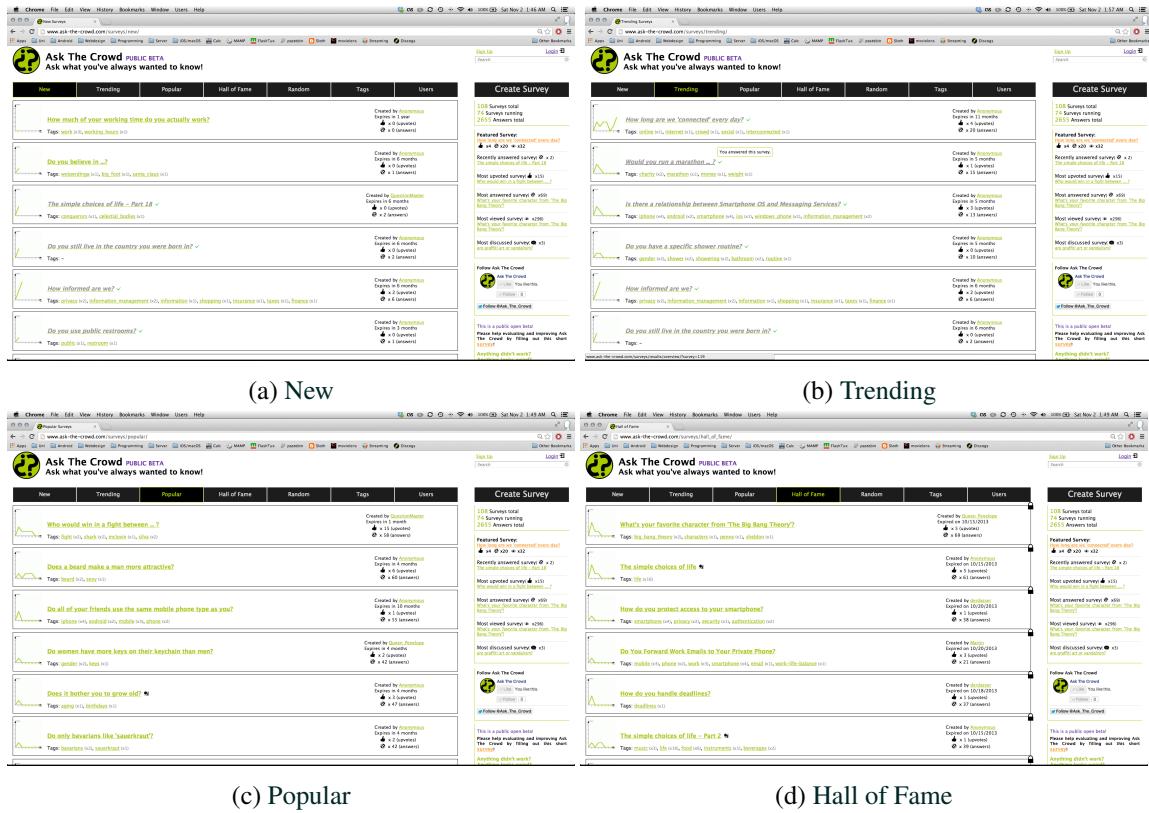


Figure 4.10: The staging system on Ask The Crowd

by the visitor are displayed with distinct font style and marked by a check sign as well as a tooltip for easy distinction (*see figure 4.10b*).

If the user is interested in one of the questions shown, she can click on it to view its details. Depending on whether she has answered the survey in the past or not, she is directed to either the *question* (*see figure 4.11*) or the results overview page (*see figure 4.12*).

Surveys on Ask The Crowd are represented by a three-column-layout, wherein the leftmost column contains static information about the survey, such as creator and runtime. The central column features the main view, e.g. question, results overview, discussion, charts, etc. and the rightmost column is used to display dynamic information, e.g. the number of votes, views and answers for the survey, as well as functional components, e.g. social widgets and subscription features.

After a user participates in a survey or if she chooses not to participate by clicking the "View Results"-link below the "Submit"-button in the question view (*see figure 4.11*), she arrives at the results overview page (*see figure 4.12*) where she can take advantage of on-site result analysis tools. The results overview page provides general survey data, featuring timeframe and partici-

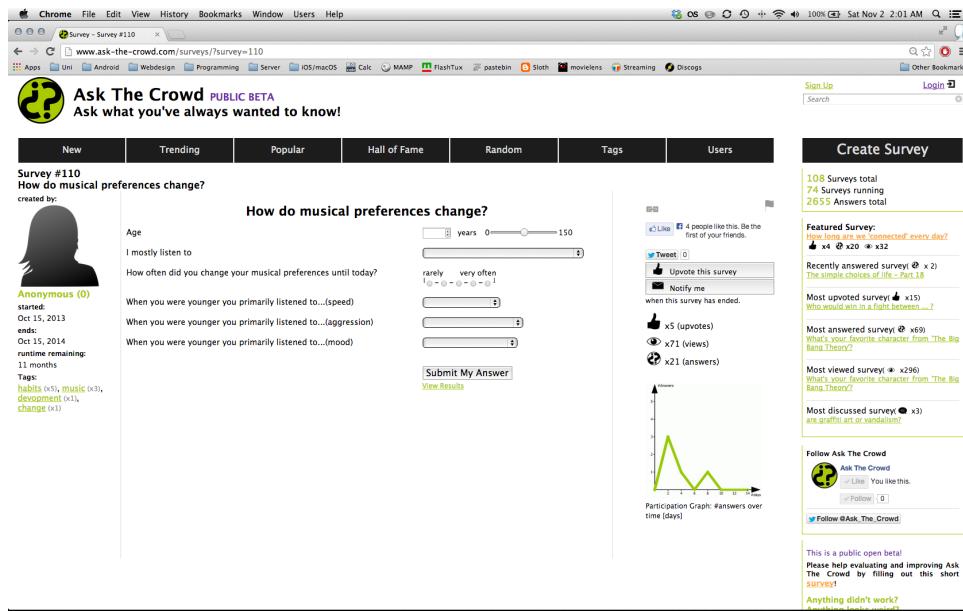


Figure 4.11: Survey #110: How do musical preferences change? - Question view

pation as well as statistics for every single parameter, enriched by visualizations. The presented visualizations contain a participation graph as well as different other visualizations for each type of parameter:

- Likert-Scale parameters are visualized by M.Maurers likertplot[web8]
- Numeric parameters are visualized by *Candlestick Charts*²², i.e. box-plots.
- Nominal parameters are visualized by *Bar Charts*²³.
- Ordinal parameters are visualized by *Pie Charts*²⁴.

Apart from the overview, results can be analyzed by generating interactive *Scatterter*²⁵ and/or *Bubble Charts*²⁶. Users can select which parameter to display on each axis and generate different graphs for comparison and evaluation (*see figure 4.13*). When generating different graphs, the previously generated stay visible, therefore users can i.e. create complete scatterplot matrices of survey results. The general idea for interactive visualizations was proposed by the participants of the first focus group study. Since the second study indicated, that treemap visualizations might be a non-optimal choice due to general lack of familiarity with them, two different, less complex visualizations where chosen for implementation.

In addition to an overview and interactive graphs and in accordance with focus group findings, users are able to upload their own interpretations of survey results to the site as well as comment on and discuss a survey.

The service concept defined earlier (*see section 3*) demands for a third major contribution activity to be offered to the user: the creation of surveys. Ask The Crowd therefore offers the previously introduced four step wizard approach (*see figure 4.14*).

²²<https://developers.google.com/chart/interactive/docs/gallery/candlestickchart>

²³<https://developers.google.com/chart/interactive/docs/gallery/barchart>

²⁴<https://developers.google.com/chart/interactive/docs/gallery/piechart>

²⁵<https://developers.google.com/chart/interactive/docs/gallery/scatterchart>

²⁶<https://developers.google.com/chart/interactive/docs/gallery/bubblechart>

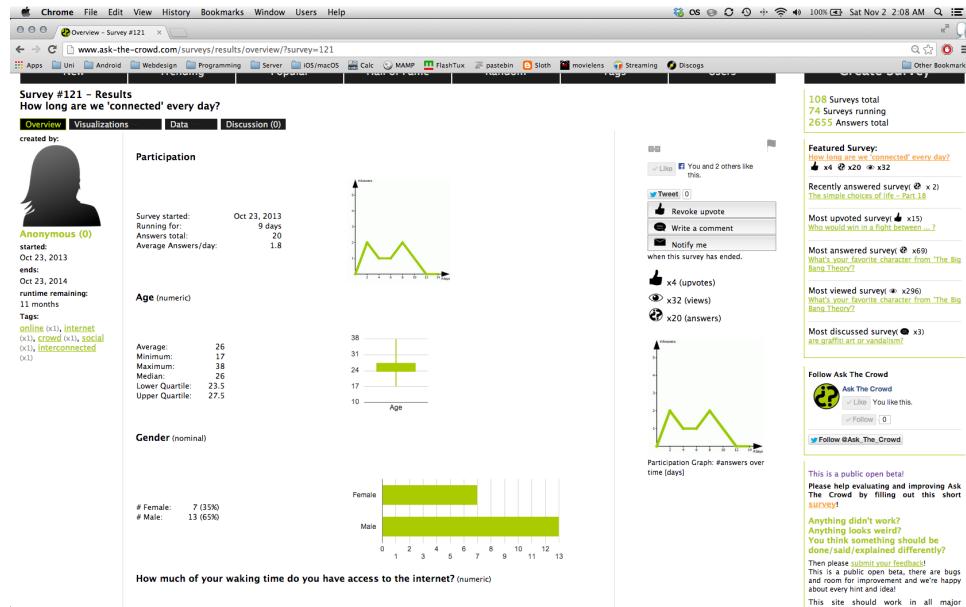


Figure 4.12: Survey #121: How long are we 'connected' every day? - Results overview page

Since participants of the second focus group study found this process to be convenient for the most part, only the second step was revised before implementation. As can be seen in figure 4.15b a tooltip is now shown when hovering over parameter types. Parameter types where simplified by substituting *nominal* and *ordinal* with *predefined* and an additional checkbox to mark *predefined* choices sortable as well as renaming *likert scale* to *5-point-ordered-scale*. To further improve usability of this step, a preview feature was implemented, which, on click, queries the server for a renderable HTML-representation of the parameter at hand. Concluding refinement, means to further specify and constrain numbers were added: Users can specify a unit for the field, as well as restrict the input range (see figure 4.15).

The whole survey creation process is complemented by supporting information displayed in the right column sidebar. A survey summary is constructed while progressing through the steps that features the so called *expected answer rate (EAR)*: an indicator for how likely it is that site visitors will answer the survey at hand. The coefficient takes into account 3 factors:

1. The number of parameters, whereby each choice is counted for predefined parameters. *More parameters are expected to have negative effects, since they represent additional choices [52]*
2. The number of tags added. *Tags are expected to have positive effects, since they facilitate search and classify the survey [59], [43].*
3. If a focus group was defined. *Focus groups limit the audience and therefore naturally reduce the number of answers to be expected*

Based on these 3 factors the EAR classifies the survey into one of three classes: *high, medium or low*.

In addition to the summary, each step during survey creation is also accompanied by similar surveys. Similar surveys displayed at the first three steps focus on surveys with respective similar questions, parameters or tags, while at the final step the resulting intersection of surveys with similar questions, parameters and tags is shown.

Aside from creating surveys and browsing the presented stages, visitors of Ask The Crowd can also search for specific content via either the tagging system or the sophisticated site search.

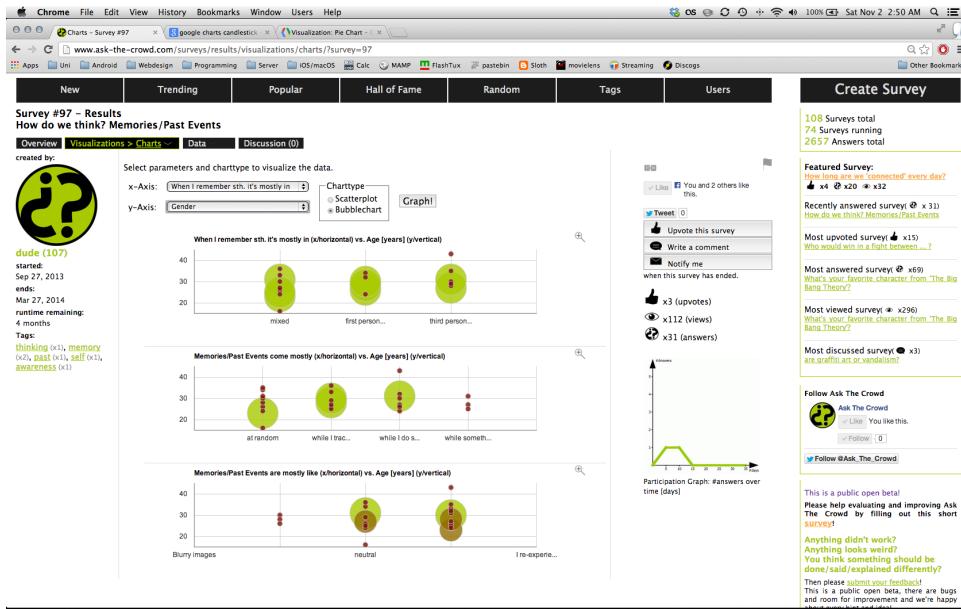


Figure 4.13: Survey #97: How do we think? Memories/Past Events - Bubble Chart visualizations

Tags are used to associate certain keywords with a survey. If a user is interested in surveys concerning a specific topic, she can use this system to find related surveys. By clicking on a tag on Ask The Crowd, the user is presented with a list of all surveys associated with this keyword. A list of all keywords used on any survey ordered by assignment can be also be found and searched on Ask The Crowd at the menu item *Tags*.

The site search function implemented on Ask The Crowd performs a global search for terms and expressions including:

Surveys - inspecting id, question, parameters, choices and tags.

Users - inspecting usernames.

Comments - inspecting comment text.

Tags - inspecting tag text.

Due to the high complexity of search operations, the process is split and executed asynchronously: At first a request is sent to search surveys, then, after a defined timeout the next request is placed to search users, subsequently comments and tags. This pipelining approach enables faster site response and better performance by increased throughput [46].

Concluding this tour around the system, the user profile pages and personalization features remain to be introduced. Once a user completes her registration with Ask The Crowd she is not only eligible to collect reputation, but presented with a number of personalization features and enhanced content. Examples include:

Favorites: Users can add surveys to their favorites to keep track of them, i.e. use them as a bookmarking system. Favorites can be assigned custom tags, which are (*globally*) visible to the assigning user only and enable categorization as well as annotation for convenience and later reference(see *figure 4.16*).

Editable Surveys: If a user signs in before submitting a new survey she has the opportunity to edit it for 30 minutes after creation. The so created survey therefore remains invisible to

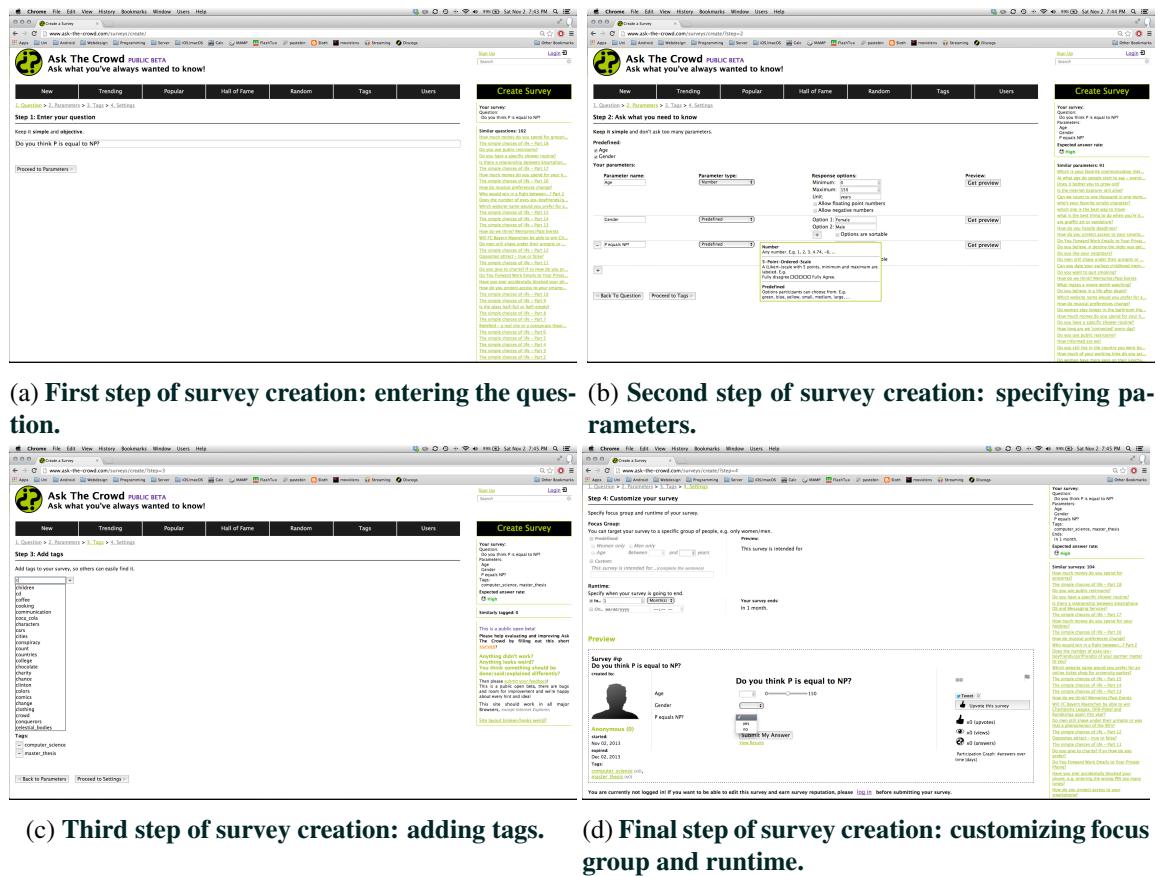


Figure 4.14: Creating a survey with a four step wizzard

other users and can be edited as well as started at any time during this timeframe by the user.

Discussions: Analogous to Favorites, survey discussions can be subscribed to and managed in a user's profile area.

Regular Summary E-Mails: Registered users can subscribe to regular (*daily, weekly, monthly*) e-mail summaries including statistics of their running surveys, favorites as well as updates on subscribed discussions (see *appendix C* for an example).

At the time of this writing the site is reachable at:

- <http://www.ask-the-crowd.com/>
- <http://www.ask-the-crowd.de/>
- <http://www.ask-the-crowd.net/>
- <http://www.ask-the-crowd.org/>

A Facebook Page²⁷ was created for the website to promote it via the social networking platform. Furthermore the platform was connected to Twitter²⁸ and promoted on reddit²⁹. Since there was

²⁷<https://www.facebook.com/pages/Ask-The-Crowd/199312393579800?ref=hl>

²⁸https://twitter.com/Ask_The_Crowd

²⁹http://www.reddit.com/r/startups/comments/1ms2ie/dear_reddit_i_created_this_webportal_offering/

1. Question > 2. Parameters > 3. Tags > 4. Settings

Step 2: Ask what you need to know

Keep it simple and don't ask too many parameters.

Predefined:
 Age
 Gender

Your parameters:

Parameter name: Age	Parameter type: Number	Response options: Minimum: 0 Maximum: 150 Unit: years <input type="checkbox"/> Allow floating point numbers <input type="checkbox"/> Allow negative numbers	Preview: Get preview	Your survey: Question: Do you think P is equal to NP? Parameters: Age Gender P equals NP Tags: computer_science, master_thesis Ends: In 1 month. Expected answer rate: <input checked="" type="radio"/> High
Gender	Predefined	Option 1: Female Option 2: Male <input type="checkbox"/> Options are sortable	Preview: Get preview	Similar parameters: 91 Which is your favorite communication met... At what age do people start to say - every... Does it bother you to grow old? Is the Internet Explorer still alive? Can we count to one thousand in one mont... Who's your favorite Scrubs character? Which one is the best way to travel? What is the best thing to do when you're b... Are graffiti art or vandalism? How do you handle deadlines? How do you protect access to your smartp... Do you believe in destroying the older you get... Do you like your neighbors? Do men still shave under their armpits or... Can you date your earliest childhood mem... Do you want to quit smoking?
P equals NP?	5-Point-Ordered-Scale	Minimum Label: I don't think so Maximum Label: For sure	Preview: Get preview	
Back To Question Proceed to Tags				

(a) Second step of survey creation: parameter preview.

1. Question > 2. Parameters > 3. Tags > 4. Settings

Step 2: Ask what you need to know

Keep it simple and don't ask too many parameters.

Predefined:
 Age
 Gender

Your parameters:

Parameter name: Age	Parameter type: Number	Response options: Minimum: 0 Any number. E.g. 1, 2, 3, 4, 74, ... Number 5-Point-Ordered-Scale A Likert-scale with 5 points, minimum and maximum are labeled. E.g. <input type="checkbox"/> Predefined	Preview: Get preview	Your survey: Question: Do you think P is equal to NP? Parameters: Age Gender P equals NP Tags: computer_science, master_thesis Ends: In 1 month. Expected answer rate: <input checked="" type="radio"/> High
Gender	Number 5-Point-Ordered-Scale	5-Point-Ordered-Scale A Likert-scale with 5 points, minimum and maximum are labeled. E.g. <input checked="" type="checkbox"/> Predefined Options participants can choose from. E.g., green, blue, yellow, small, medium, large, ... Minimum Label: I don't think so Maximum Label: For sure	Preview: Get preview	Similar parameters: 91 Which is your favorite communication met... At what age do people start to say - every... Does it bother you to grow old? Is the Internet Explorer still alive? Can we count to one thousand in one mont... Who's your favorite Scrubs character? Which one is the best way to travel? What is the best thing to do when you're b... Are graffiti art or vandalism? How do you handle deadlines? How do you protect access to your smartp... Do you believe in destroying the older you get... Do you like your neighbors? Do men still shave under their armpits or... Can you date your earliest childhood mem... Do you want to quit smoking?
P equals NP?	5-Point-Ordered-Scale		Preview: Get preview	
Back To Question Proceed to Tags				

(b) Second step of survey creation: parameter types.

Figure 4.15: Usability refinements for step two of survey creation: simplified types and parameter preview.

no budget to advertise the site, we had to rely on our real-life, as well as online social networks to spread the word.

The screenshot shows a user profile page for 'dude's user profile' on the Ask The Crowd website. The top navigation bar includes links for Overview, Favorites (5), Surveys (7), Visualizations (0), Discussions (4), and Activity. The 'Favorites' tab is selected, displaying five survey entries:

- Do all bearded men have thick body hair?** (Created by Anonymous, Expires in 4 months, Liked x 2, Views x 83, Comments x 0)
- Does a beard make a man more attractive?** (Created by Anonymous, Expires in 4 months, Liked x 6, Views x 234, Comments x 1)
- Do all of your friends use the same mobile phone type as you?** (Created by Anonymous, Expires in 10 months, Liked x 1, Views x 188, Comments x 0)
- Is the Internet Explorer still alive?** (Created by Anonymous, Expires in 2 months, Liked x 4, Views x 141, Comments x 0)
- are graffiti art or vandalism?** (Created by PrincessSparkle, Expired on Oct 17, 2013, Liked x 3, Views x 152, Comments x 3)

Each survey entry has 'Remove from favorites' and 'Add Tag' buttons. To the right of the surveys, there is a sidebar with statistics: 109 Surveys total, 74 Surveys running, and 2740 Answers total. It also lists featured, most popular, and most discussed surveys, along with a 'Follow Ask The Crowd' section and a public open beta message.

Figure 4.16: User Profile: Favorites

5 Results

This section presents the data gathered by Ask The Crowd as well as the results drawn from an evaluation survey. After the site ran for four weeks a LimeSurvey [web12] was created to gather user feedback and evaluate the project. This survey was running for another two weeks, yielding a total of six weeks time for data collection.

5.1 Website Performance

This subsection summarizes the data collected by Ask The Crowd in a quantitative way. Statistical insights into survey creation and answering behavior as well as user distribution are gathered to reflect service usage thus far.

5.1.1 Surveys

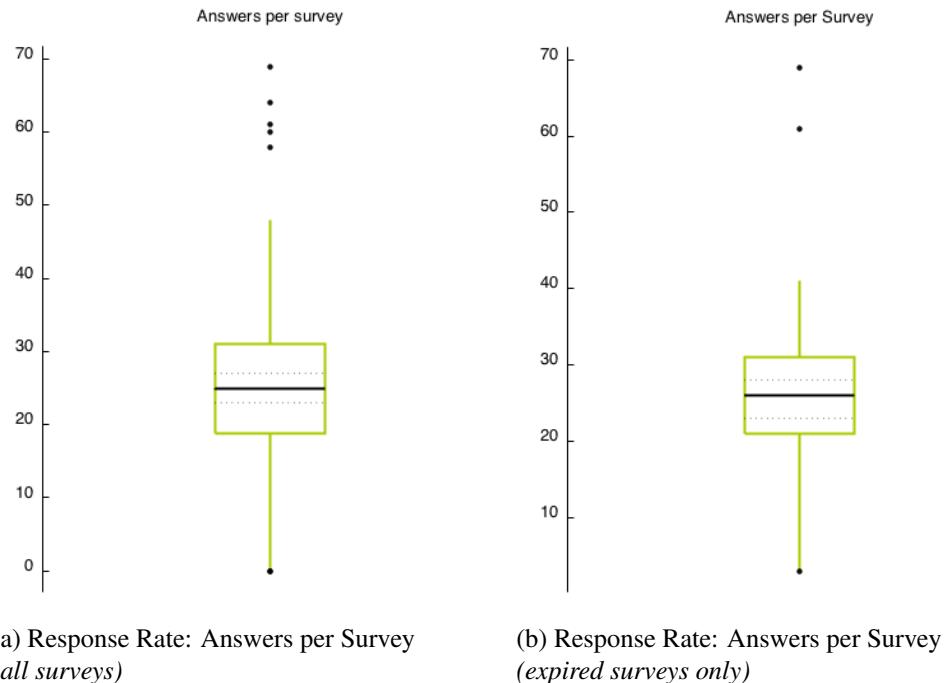


Figure 5.1: Ask The Crowd: Response Rate

Visitors of Ask The Crowd created a total of 106 surveys during this six week period, viewed more than 11.000 times (≈ 108 *views per survey*), 71 of which are still running at the time of this writing. Brought into relation with the lifetime of the site ≈ 2.52 surveys have been created per day. These surveys collected a total of 2733 answers, yielding an average of ≈ 25.78 answers per survey (see figure 5.1a), for the accumulation of which the average survey has ≈ 132.29 days time. While only a few of all surveys achieved more than 50 replies (5), none of the expired surveys had to close without getting an answer (see figure 5.1b), in fact only two of them had to close with less than ten answers. One of them was created by the site owner as part of the debugging process of a layout problem with the initial site³⁰ only to be answered by affected users, the other was a user contribution asking "*Does the number of exes (ex-boyfriends/girlfriends) of your partner matter to you?*"³¹.

90 percent of all expired surveys achieved a response rate of 23 to 28 answers, while another two

³⁰<http://www.ask-the-crowd.com/surveys/?survey=28>

³¹<http://www.ask-the-crowd.com/surveys/?survey=108>

surveys can be identified as significantly outperforming the rest in terms of response rate:

1. The currently most answered survey and *Hall of Fame*-leader: "*What's your favorite character from 'The Big Bang Theory'?*"^{32,33} with 69 answers, 307 views and five upvotes. The survey asks users for their gender as well as favorite character of the series. It ran for 49 days, generating an average of ≈ 1.4 answers per day.
2. The currently third-most answered and first part of a series of surveys: "*The simple choices of life*"³⁴ with 61 answers, 247 views as well as five upvotes and the two first user contributed visualizations (see figure 5.2b and figure 5.2c). It relates antipodes faced in daily life such as "coke vs. pepsi", "left vs. right" and "black vs. white" and ran for 49 days, yielding ≈ 1.2 answers per day.

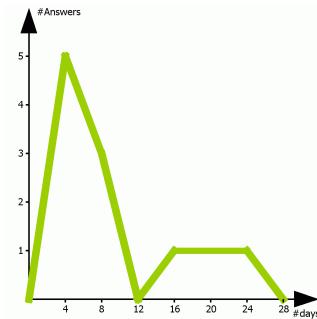
Both surveys also feature an identical participation graph (see figure 5.2a).

As can be seen in figure 5.7 responses oftentimes come in bursts. Results so far indicate spikes at the beginning of survey lifetime with possible followup spikes after about half of its runtime has passed. While some surveys manage to maintain a steady in-flow of responses for a certain period of time (cf. figure 5.7c, figure 5.7f), most of them show individual peaks interspersed with idle periods. When looking at these participation graphs, we must also keep in mind that they are the result of an averaging calculation and therefore do not represent actual participation, but rather highlight trends in the participation time series.

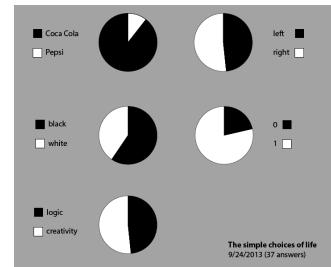
Of all the expired surveys so far, only one (see figure 5.7i) has achieved an average positive response rate over all days of its runtime. Considering the relatively short runtime of 14 days however, this can be considered as within reasonable bounds and therefore constitutes no special case or outlier.

Looking at figure 5.6 we can see that the development of typical surveys follows the image painted by expired surveys: peaks at the start, maintaining a steady inflow for some period and additional spikes later on.

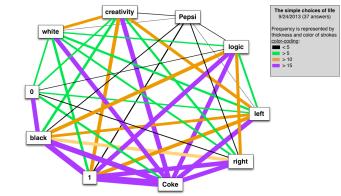
Relating answer-rates to number of parameters and choices queried by the respective survey, we can find that surveys query ≈ 3 parameters on average (see figure 5.4a). The hypothesis of less choices/parameters leading to more answers introduced via the *expected answer rate* (see section 4.2) can not be backed up by current data, as shown in figures 5.4b and 5.4c. Average answers related to both number of parameters and choices shows no clearly identifiable trends. More data is



(a) Participation Graph:
Survey #49: "*What's your favorite character from 'The Big Bang Theory'?*" &
Survey #50: "*The simple choices of life*"



(b) User uploaded visualization: Survey #50: "*The simple choices of life*"



(c) User uploaded visualization: Survey #50: "*The simple choices of life*"

Figure 5.2: Top expired surveys: "*What's your favorite character from 'The Big Bang Theory'?*" & "*The simple choices of life*"

³²'The Big Bang Theory' is a contemporary TV-series that is highly popular among adults [10].

³³<http://www.ask-the-crowd.com/surveys/?survey=49>

³⁴<http://www.ask-the-crowd.com/surveys/?survey=50>

needed for analysis, as most surveys query exactly three parameters, constituted by eight choices, while answer rates of other constellations for comparison remain scarce at this point in time.

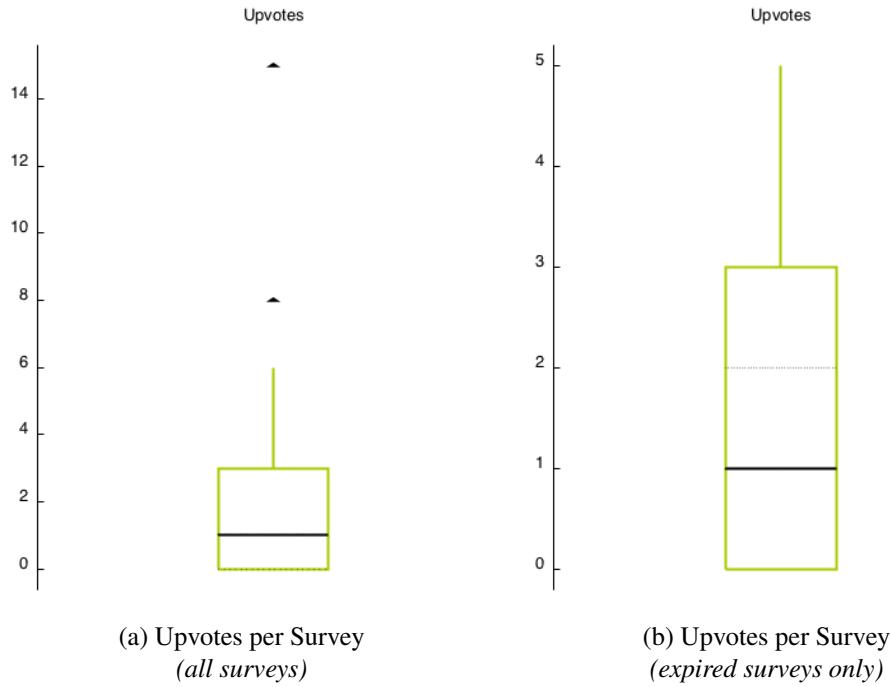


Figure 5.3: Ask The Crowd: Upvotes per Survey

Collectively the 106 surveys accumulated 173 upvotes distributed among 60 surveys, netting an average of ≈ 1.57 votes per survey (see figure 5.3a). Votes collected by expired surveys make up for $\approx 37\%$ of all votes, averaging at ≈ 1.83 votes per survey (see figure 5.3b).

Looking at the questions produced, we are faced by a wide variety of topics (see appendix D for a complete list of questions posed up to the time of this writing). Subjects range from food ("Asian Food Choices"³⁶, "Is there a relationship between preferred soft drink and fast food restaurant?"³⁷) to technical issues ("Is the Internet Explorer still alive?"³⁸, "Is there a relationship between Smartphone OS and Messaging Services?"³⁹) as well as questions of neuroscientific/psychologic nature ("How do we think? Memories/Past Events"⁴⁰, "Can you date your earliest childhood memory?"⁴¹) and paradoxes ("The hen-and-egg problem, what came first?"⁴²).

To get a better overview we can take a look at the 223 distinct tags generated by the crowd. Though tags can be assigned multiple times, surveys were associated with only 2.5 tags on average. When we inspecting the tag cloud visualization in figure 5.5b, it becomes apparent that surveys created by the crowd concentrate around virtually any aspect of life - which coincidentally is the most common tag assigned on Ask The Crowd.

³⁵Each parameter is counted as one choice plus the number of additional choices beyond the first, it offers. E.g. numeric and likert-scale parameters are counted as one each, while a predefined parameter offering the choices *yellow*, *green* and *blue* would constitute a count of three.

³⁶<http://www.ask-the-crowd.com/?survey=85>

³⁷<http://www.ask-the-crowd.com/?survey=44>

³⁸<http://www.ask-the-crowd.com/?survey=45>

³⁹<http://www.ask-the-crowd.com/?survey=118>

⁴⁰<http://www.ask-the-crowd.com/?survey=97>

⁴¹<http://www.ask-the-crowd.com/?survey=93>

⁴²<http://www.ask-the-crowd.com/?survey=46>

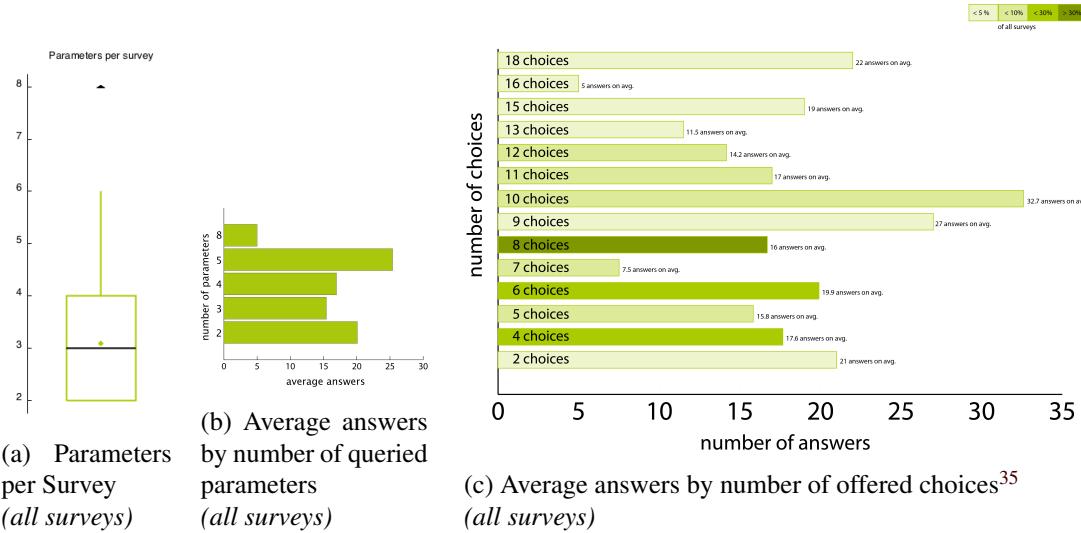


Figure 5.4: Ask The Crowd: Parameters and choices per Survey vs. average achieved answer count.

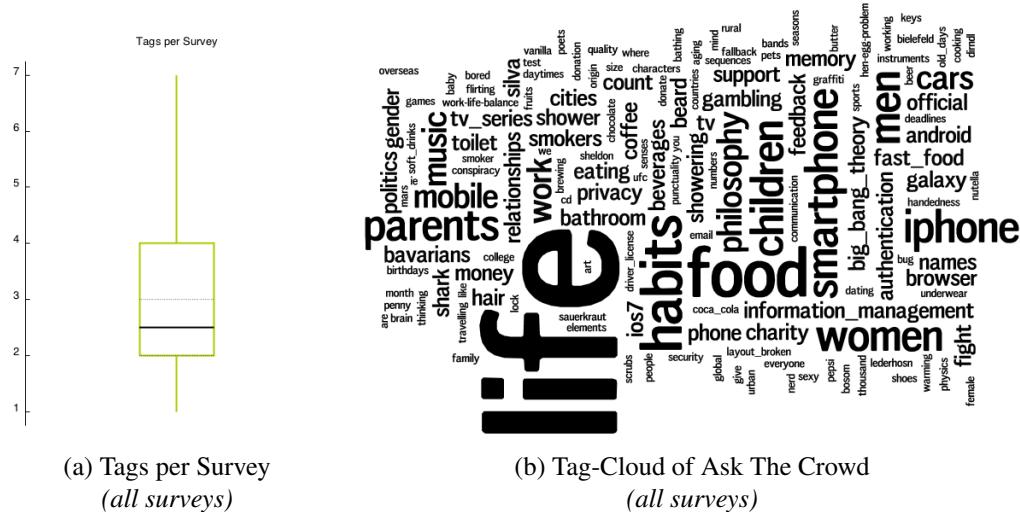


Figure 5.5: Tags on Ask The Crowd

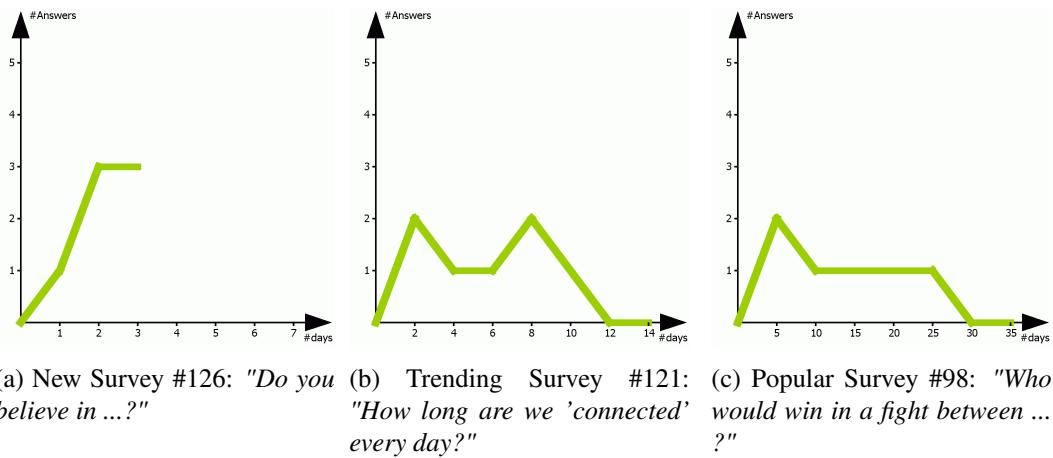


Figure 5.6: Exemplary Participation Graphs drawn from *New*, *Trending* and *Popular*, i.e. running surveys only

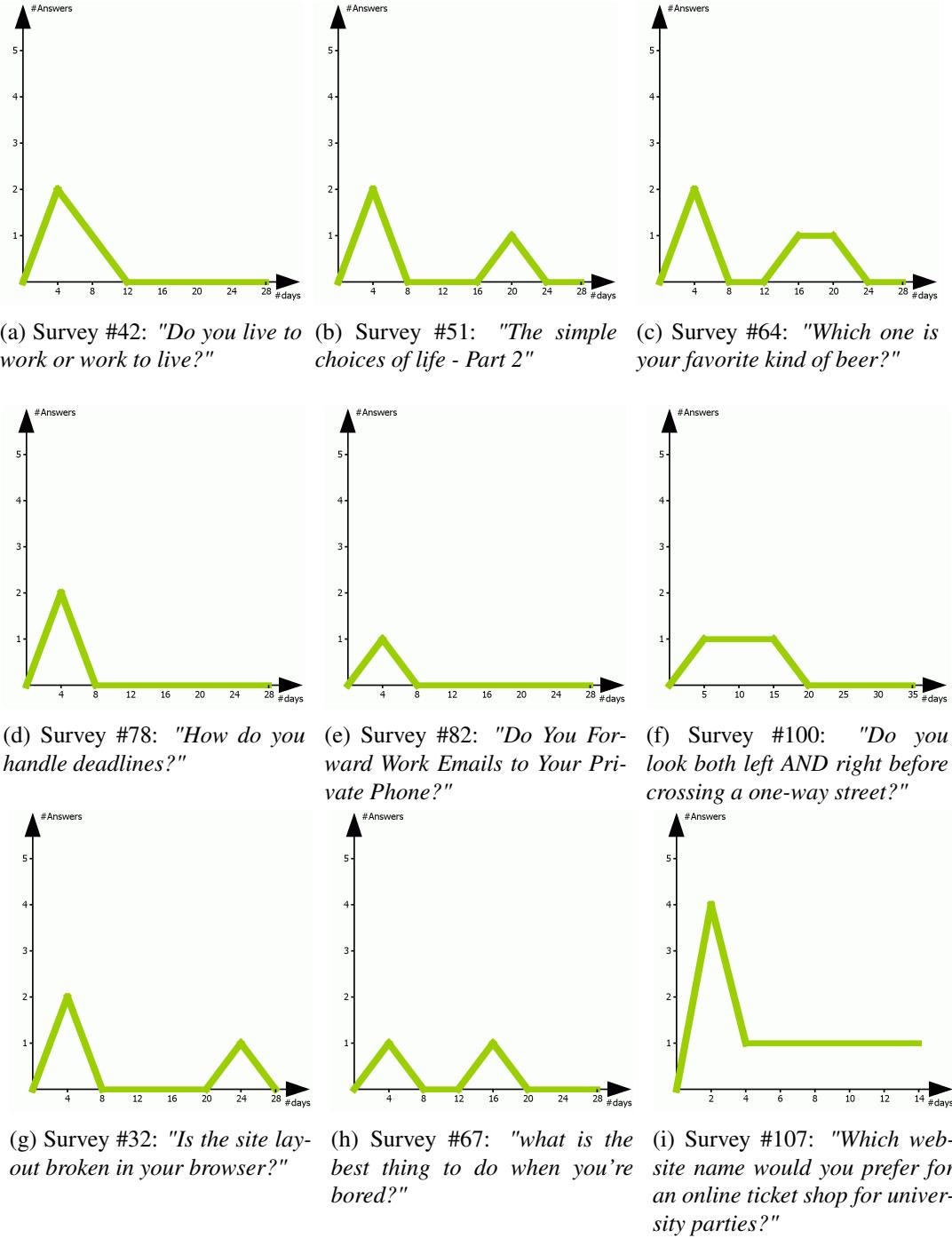


Figure 5.7: Exemplary Participation Graphs drawn from the *Hall of Fame*, i.e. *expired surveys only*

5.1.2 Users

Over the treated timeframe of six weeks 17 users registered with Ask The Crowd, two of them signed up via Facebook. While registered users contributed 47 ($\approx 44\%$) of the total number of surveys, they account for only a fraction of the answers (see figure 5.9). Since each survey is saved in an extra database table and no assumptions about parameter semantics can be made, evaluations involving multiple surveys are hard to execute. Through sampling tests of different surveys a representative age distribution of participants on Ask The Crowd could be extracted, whereby the average user is ≈ 33 years old (see figure 5.8).

Consulting Google Analytics [web3] (see appendix E), we can see that the majority of visitors dial into the page from clients located in Germany (*at the time of this writing* $\approx 92.95\%$). Ask The Crowd however also reaches *foreign* countries, such as the United States ($\approx 2.61\%$), United Kingdom ($\approx 0.78\%$), Russia ($\approx 0.78\%$), Switzerland ($\approx 0.52\%$) and France ($\approx 0.52\%$). We can further assess, that the majority of visitors ($\approx 60.8\%$) are returning, i.e. have visited the site before and return to it, and that aquisition takes place mainly direct and via social networks, i.e. Facebook and Twitter (see figure 5.10).

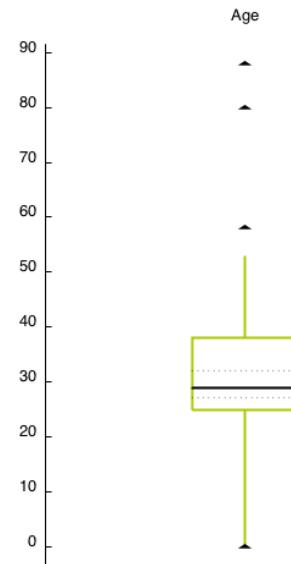


Figure 5.8: Age of participants - sampled from 30 surveys

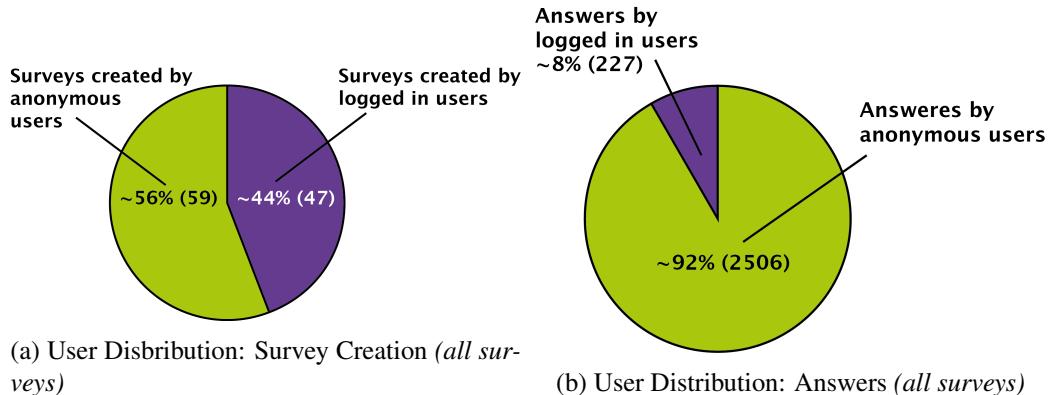


Figure 5.9: Anonymous vs. logged in users

Apart from creating and answering surveys, users contributed a total of five visualizations, whereby four of them were submitted by a single user (*not the author*) and one was uploaded by an anonymous user. Furthermore 24 comments were written discussing survey results or proposing ideas. Apart from commenting on the site, we also received several e-mails reporting bugs and suggesting new features and improvements.

5.1.3 Summary

Ask The Crowd managed to attract international attention and produced a variety of surveys and answers during this rather short evaluation period. Though the open access policy, where no registration is required, makes it hard to determine the total reach of the site, we can consult Google Analytics and see that more than 160 unique visitors where registered for the month of october 2013, while Facebook estimates a weekly reach of between 60 and 200 in the first four

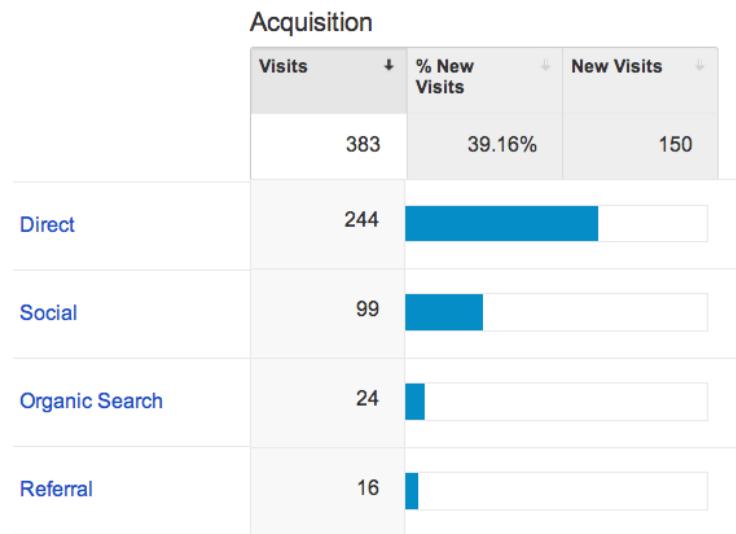


Figure 5.10: User Acquisition according to Google Analytics. Screenshot taken Nov. 3, 2013

weeks (*cf. figure 6.4c*).

Concluding we record that people actively contributed and gathered a significant amount of data.

Apart from this quantitative analysis of data and interaction, Ask The Crowd underwent once more the judgement of the crowd in the form of an elaborate online survey, which is topic of the next section.

5.2 Lime Survey

To gather conclusive insights and feedback about Ask The Crowd's performance through the user's eyes, a final evaluation was carried out using the elaborate open source online survey tool LimeSurvey [web12]. Evaluation goals of the survey include:

Usage: General system usage, how and for what purposes did users consult the website?

Feature Evaluation: Assessment of the staging system as well as the survey creation process and means offered for result analysis.

Goal Evaluation: Were users satisfied using Ask The Crowd? Did they feel that they gained knowledge by using the service?

The survey comprised a total of 92 individual questions and was made publicly available through the faculty networks at https://survey.medien_ifi.lmu.de/index.php/survey/index/sid/735382/newtest/Y/lang/en.

To reach as many participants as possible the survey was announced at the front page of the portal, as well as by multiple posts via Ask The Crowd's Facebook Page. Furthermore the LimeSurvey was promoted at the faculty Facebook Group⁴³ and the faculty forums. To further maximize participation of registered users, they were invited via email to participate at the evaluation. After two weeks we could gather 19 complete as well 19 incomplete responses, the former of which are evaluated herein.

5.2.1 Demographics

Of the 19 exploitable responses to the LimeSurvey, 11 stem from male, 8 from female participants (*figure 5.12a*). Their age ranges between 19 and 32 years (*figure 5.11*) and, with an average of ≈ 26 significantly exceeds the average user age extrapolated from samples of surveys on the site (*see figure 5.8*). While the majority of the participants are students, a significant $\approx 37\%$ is constituted by employees (*figure 5.12b*). Since educational background can be important when considering the topic of knowledge generation and people's interest therein, it constituted a required question in this survey. As can be seen in *figure 5.12c*, the audience can be considered highly educated, since the majority acquired at least a Bachelor's degree, while none of the lower end options ("No schooling completed", "Nursery school to 8th grade" and "Some highschool, no diploma") were selected at all. A summary of LimeSurvey demographics can be found in *figure 5.12*.

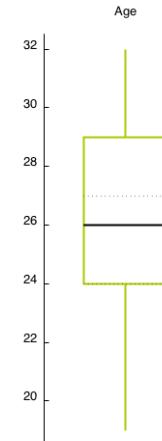


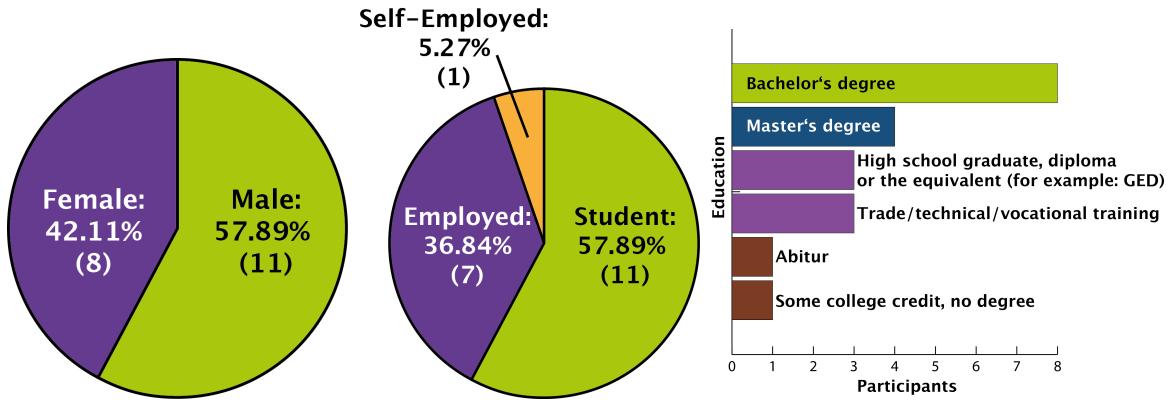
Figure 5.11:
Age distribution
of LimeSurvey
participants

5.2.2 General Usage

The second block of questions was designed to find out about how and for what purpose(s) users engage with Ask The Crowd. Findings show, that people visit the site mostly for entertainment and information (*see figure 5.13a*). To further assess usage frequencies of individual parts of the website, participants were first asked to sort parts of the website according to the time spent using them (in descending order) and what parts they used most to find the information they were looking for.

Interestingly answers to the second questions rank *Popular* and *Trending* as primary focal points when it comes to finding information, while the *Search*, as a designated function for this purpose, is used least often. Tags on the other hand appear to be still a non-primary but frequently used

⁴³<https://www.facebook.com/groups/mimuc/>



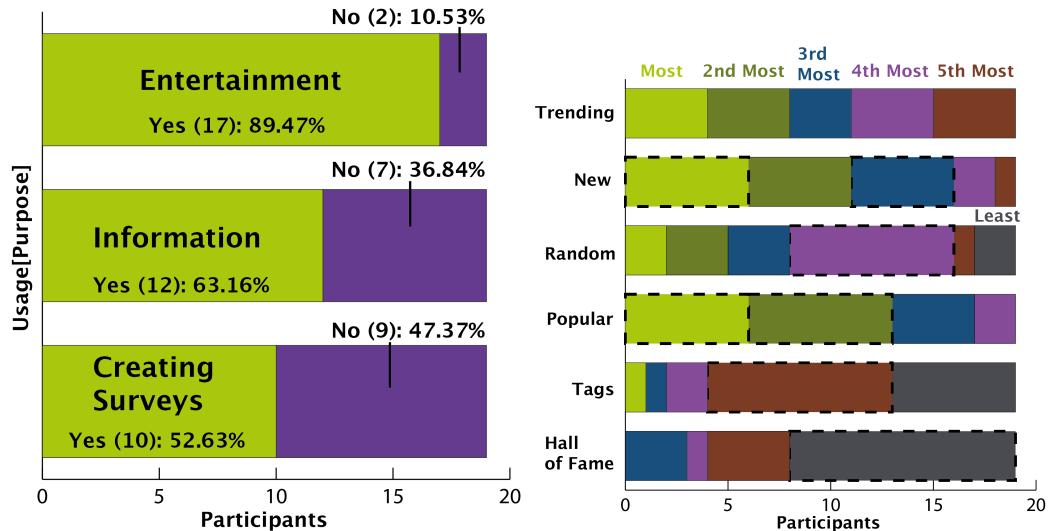
(a) Gender distribution of LimeSurvey participants (b) Occupation distribution of LimeSurvey participants (c) Educational background of LimeSurvey participants

Figure 5.12: Demography of LimeSurvey participants

tool for information seeking (*cf. figure 5.13b and figure 5.14*).

These findings indicate that users mostly *browse* the site in contrast to, e.g. fetching only a specific piece of information. When incorporating Google Analytics data (*see figure 5.15*), we can further see that most visitors start their journey through the website from *New*.

Apart from usage frequencies this block also queried participants for the perceived difficulty of



(a) What did you use Ask The Crowd for? (checkboxes, multiple selections possible) (b) Please sort the following parts of the website with respect to the amount of time you spent using them (start with the one that you used most). (ranking)

Figure 5.13: Usage purpose and time spent

general tasks on the website. Results identify no major difficulties for the tasks: (*Please rate how easy it was to do the following. (1 = very hard, 5 = very easy)*)

1. Navigate around the site (*mean: ≈ 4.21*)
2. Find the information/feature you were looking for (*mean: ≈ 3.89*)
3. Create a survey (*mean: ≈ 3.95*)

5 RESULTS

5.2 Lime Survey

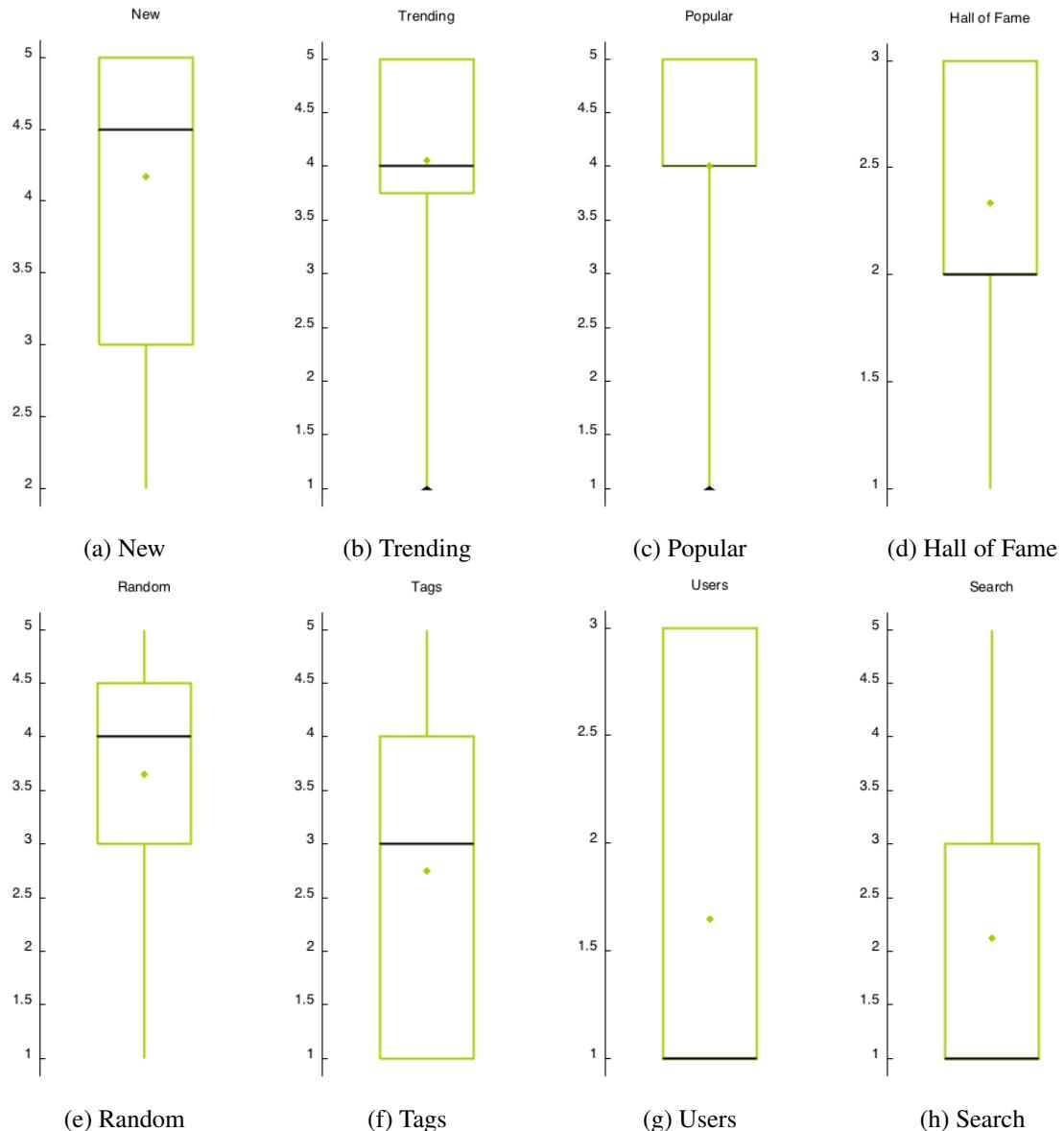


Figure 5.14: **Information seeking:** Please indicate to which degree you used the following to find what you were looking for on Ask The Crowd. (5-point likert scale; 1 = never; 5 = very often)

4. Answer a survey (*mean: ≈ 4.74*)
5. Register with the site (*mean: ≈ 3.89*)
6. Inspect survey results (*mean: ≈ 3.89*)

For visualizations of these findings see figure F.1 in appendix F.1.

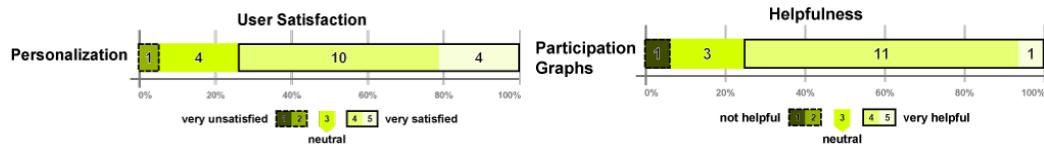
Concluding the evaluation of general usage, participants were asked if they registered with the site, both via Facebook or directly, if not: *why not?* and if so, how satisfied they were with the personalization features.

Of the 19 participants the narrow majority ($10 \approx 52.63\%$) are registered users of Ask The Crowd, two of which signed in via Facebook. Of the remaining nine anonymous users, the majority stated "*no registration required*" and similar as the reasons for not registering directly with the site, whereas the reason for not using the Facebook Login can be identified as virtually consonant



Figure 5.15: User behavior after arrival on the landing page of Ask The Crowd according to Google Analytics. Percentages in Bubbles indicate the relative share of visitor clicks. Screenshot taken Nov. 3, 2013

distrust into Facebook's handling of private information (*see appendix F.2*). As can be seen in figure 5.16a participants in general were satisfied with personalization features offered on Ask The Crowd.



- (a) How satisfied were you with the personal- (b) Please indicate how helpful you found
ization features? (5-point likert scale; 1 = very participation graphs. (5-point likert scale; 1 = not
unsatisfied, 5 = very satisfied) helpful, 5 = very helpful)

Figure 5.16: User satisfaction with personalization features & Perceived helpfulness of participation graphs

5.2.3 Feature Evaluation: Staging System

Following the evaluation of general site usage, question blocks concerning selected features had to be answered. The first of which dealt with components of the staging system.

To identify the helpfulness and potential to attract attention of participation graphs as means of conveying one of the factors to the weighed rating function, participants were asked if they noticed them and, if so, how they rate their helpfulness. Results show that the outweighing majority ($16 \approx 84.21\%$) has recognized participation graphs and found them helpful (*see figure 5.16b*).

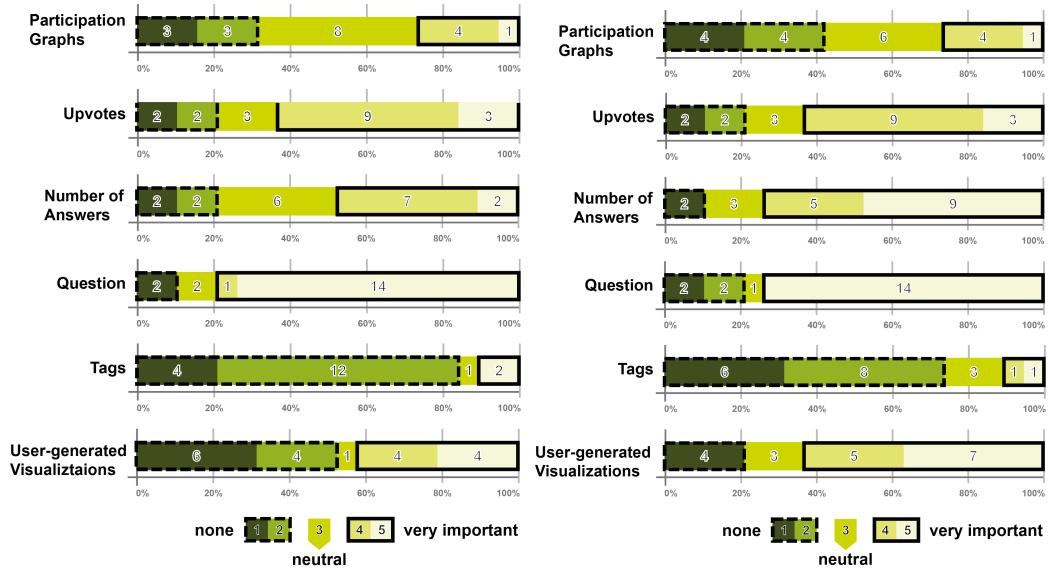
Another crucial element to the staging system and the survey ratings, are *Upvotes*. It was therefore evaluated if users embrace their ability to influence site content by voting for surveys and what factors contribute to their decision to both participate and inspect a survey. Answers reveal that the majority ($12 \approx 63.16\%$) did make use of their ability to influence survey ratings and that *Upvotes* have significant impact on their decision to both partake and analyze surveys (*see figure 5.17*). As to be expected a survey's formulated question has most influence on both decisions, followed by answers and votes. Tags appear to be least important to both decisions, while a recognizable difference as a decisive factor can be linked to user-generated visualizations. While they, respectively their presence for a survey, do not have significant impact on participants decision to partake at a survey, they gain in importance when it comes to result analysis.

5.2.4 Feature Evaluation: Survey Creation

The next aspect to evaluate was survey creation. Participants were first asked if they (*tried to*) create(d) a survey on Ask The Crowd, which eleven ($\approx 57.89\%$) of the 18 participants affirmed. When asked for the reason for not creating any surveys, the eight *observers* mainly blame a lack of questions while one participant also mentiones that "*It's more fun to answer questions and explore results*" (*see appendix F.3 for a full list of answers to this question*). The eleven *survey-authors* were further queried for ease of use and helpfulness of selected process features and steps:

5 RESULTS

5.2 Lime Survey



- (a) Please rate the effect of the following on your decision to participate at a survey on Ask The Crowd. (5-point likert scale; 1 = none, 5 = very important)
- (b) Please rate the effect of the following on your decision to view a survey's results. (5-point likert scale; 1 = none, 5 = very important)

Figure 5.17: Effect of features on user decision to participate & analyze.

Please indicate how easy it was to do the following: (5-point likert scale; 1 = very hard, 5 = very easy)

1st step of survey creation: Formulating your question ($mean \approx 4.36$)

2nd step of survey creation: Specifying the parameters for your question ($mean = 4.00$)

3rd step of survey creation: Adding tags to your survey ($mean \approx 4.82$)

4th step of survey creation: Specifying the runtime of your survey ($mean \approx 4.36$)

4th step of survey creation: Specifying a focus group for my survey ($mean \approx 4.1$)

Please indicate how helpful the following were while creating a survey. (5-point likert scale; 1 = not helpful, 5 = very helpful)

1. Parameter preview ($mean \approx 4.18$)
2. The survey summary shown during the creation process ($mean \approx 3.9$)
3. Similar surveys shown as you created your survey ($mean \approx 2.4$)
4. The expected answer rate ($mean \approx 3.3$)
5. Survey preview ($mean \approx 4.8$)

Answers identify no fatal difficulties during the survey creation process, but approve the wizard step concept with additional comments such as "It's quite simple...not too overloaded with infos and features." and "short and simple steps, possibility to add tags, preview function" (see appendix F.3). Concerning the perceived helpfulness of supporting functions we can recognize the preview

functions and the survey summary as most helpful, while similar surveys and expected answer rate provided less help to our participants. Feedback on possible improvements of the process was scarce and contained the wish for a *quick survey*-feature, where all steps are united in simplified form onto one single page, as well as a request for additional error messages.

5.2.5 Feature Evaluation: On-site Result Analysis

Concluding the evaluation of site-features, tools and interfaces for result analysis remain. Focal points in this block of questions were the machine-generated interactive charts as well as user uploaded visualizations.

We began the investigation by determining how many of our participants actually used the chart visualizations, which eleven ($\approx 57.89\%$) affirm and then asked those who did to rate the helpfulness of both, *Scatter-* and *Bubblechart* visualizations (see figure 5.18a & figure 5.18b).

Results clearly show, that *Bubblecharts* are perceived highly and significantly more helpful for

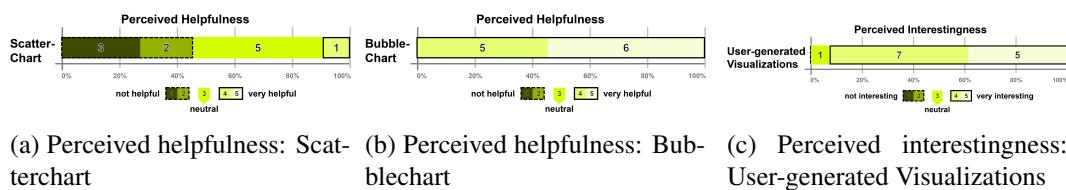


Figure 5.18: **Chart-Visualizations:** Please rate how helpful you found the charts. (5-point likert scale; 1 = not helpful, 5 = very helpful) & Did you find the user generated visualisation(s) interesting? (5-point likert scale; 1 = not interesting, 5 = very interesting)

result analysis than *Scattercharts*.

Analogous to the charts, participants were asked if they viewed user-generated visualizations, which 13 ($\approx 68.42\%$) did, and how interesting they found them (see figure 5.18c). To get further insights on user-contributed visualizations we inquired if participants thought enabling others to upload visualizations was a good idea, which the majority ($15 \approx 78.95\%$) confirmed.

When asked for reasons behind their opinion, proponents' arguments primarily dwell around *different viewpoints and perspectives* that are brought into the picture, while opponents, name *changing data*, i.e. *visualizations uploaded at a certain point during survey runtime are (probably) rendered invalid once more answers arrive*, and *concerns about the uploaded content* ("who knows what they upload") as reasons for their opinion (see appendix F.4 for a complete list of answers). It must be noted, that the four opponents of user-generated visualizations on the site, also did not look at them.

When relating the perceived helpfulness of features for result analysis offered on Ask The Crowd (see figure 5.19) we can see that user-generated visualizations, supported by charts and the results overview page, form what is perceived as the most helpful means for result analysis offered on the site, while, according to our participants, the obligatory data table as well as user comments perform significantly worse in that regard.

Concluding the assessment of on-site result analysis tools, participants were asked what, if anything, they liked about the way survey results are presented on Ask The Crowd and if they had any improvements to suggest. Feedback, opposed to improvements concerning the survey creation process, was sizeable and suggests that the divergent means for result analysis offered are appreciated. We received positive feedback on the chart as well as user-generated visualizations conflating in several requests for more charts displaying more dimensions (see appendix F.4 for a complete list of responses).

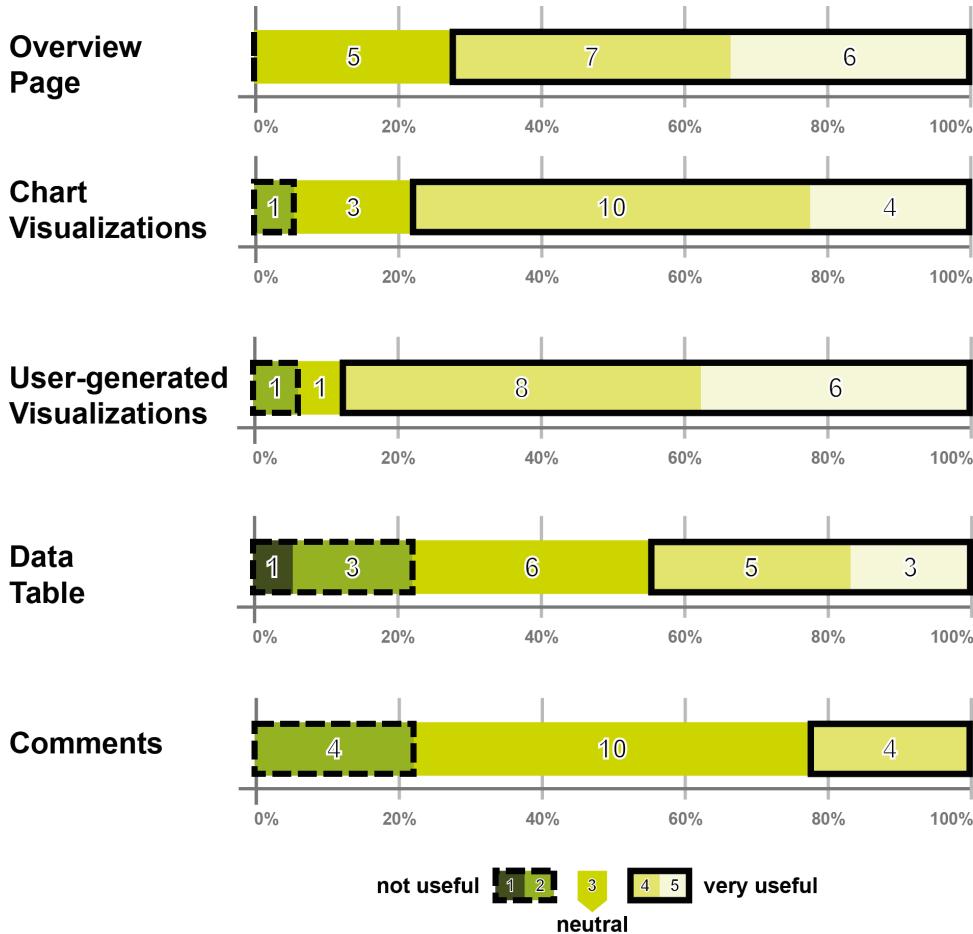


Figure 5.19: **Perceived Usefulness of result analysis tools:** Please rate how useful you found the following when inspecting a survey's results. (5-point likert scale; 1 = not useful, 5 = very useful)

5.2.6 General Evaluation & Knowledge Generation

The final part of the survey dealt with general problem statement and service evaluation. Starting out we asked participants for any feature or information they miss on the site:

Is there any feature you miss on Ask The Crowd?

Suggested features include:

1. Private surveys
2. The ability to reference charts when commenting
3. The ability to order surveys, e.g. by answers, upvotes, views, ...
4. A new stage, ordering surveys by ascending expiry date, i.e. featuring surveys that end soon.

Most of them, i.e. sortable surveys and an expiry-stage, were mentioned multiple times by independent participants. In contrast to the rich feedback received on the first question, the question regarding missing information yielded virtually no results (*see appendix F.5 for a complete list of answers to this question*).

Next we assessed if users found they had gained knowledge in the broadest sense by using Ask The Crowd respectively features provided therein (*see figure 5.20*). Responses show positive resonance concerning perceived knowledge gain through Ask The Crowd and its features. We can see that both user-generated as well as on-site chart-visualizations can be identified as the premier

tools for knowledge generation.

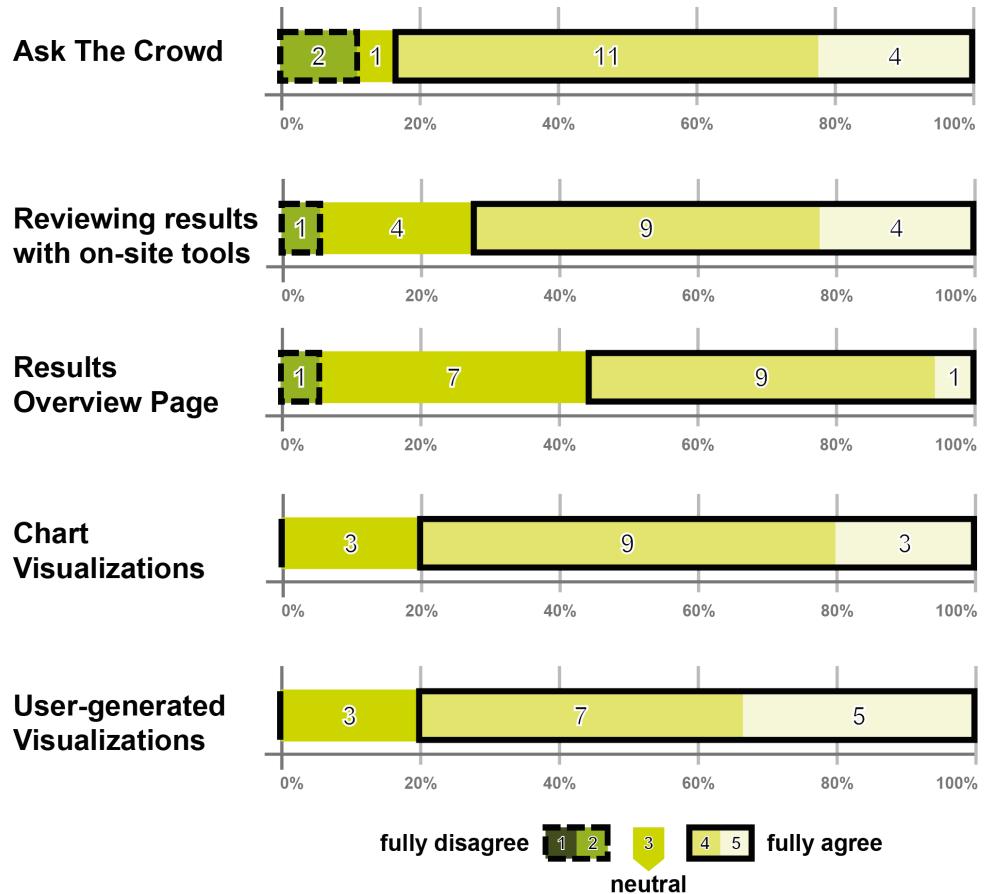


Figure 5.20: Knowledge Generation: Please indicate to what extend you agree or disagree with the following statements. (5-point likert scale; 1 = fully disagree, 5 = fully agree): I was able to gain findings/insights/knowledge/information by (top to bottom) 1. using Ask The Crowd. 2. reviewing survey results using the means provided on Ask The Crowd. 3. viewing the results overview page. 4. using the chart visualizations (bubble- & scatterchart). 5. user generated visualizations.

Concluding this question-block and ending the survey users were asked to assess strengths and weaknesses of Ask The Crowd, yielding a multitude of valuable feedback:
Where do you see strengths of Ask The Crowd and what did you like about it?

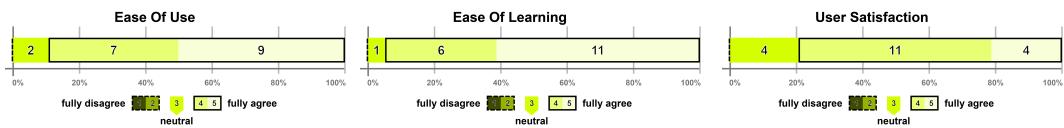
- "Easy to use, open access for anyone, no registration required, fancy charts I can check results right away and don't have to build myself!"
- "strengths: easy access to the crowd. like: easy to use, visualizations, browsing questions"
- "the visualizations and pre-set parameter types are a USP"⁴⁴
- "easy to use, no registration required, browsing questions"
- "good for simple questions and fast feedback"

⁴⁴Googling "define USP" yields Unique Selling Proposition: An aspect of an object that differentiates it from similar objects.

While a lot of positive feedback could be gathered (*for a complete list of answers see appendix F.5*), participants were also not shy criticizing Ask The Crowd:

Where do you see weaknesses of Ask The Crowd and what did you not like about it?

- "it only supports simple questions"
- "it might become too messy in the future and a lot of questions were kind of boring and did not really try to find out something in particular. rather, they were just random questions..."
- "Far too much information at one time. Keep it simple!"
- ""not many users, yet. can't make elaborate surveys"



- (a) Ask The Crowd is easy to use.
(b) Ask The Crowd is easy to learn.
(c) Please indicate how satisfied you were using Ask The Crowd.
(5-point likert scale; 1 = very unsatisfied, 5 = very satisfied)

Figure 5.21: **Ease of Use and Learn/User satisfaction:** Please indicate to what extend you agree or disagree with the following statements. (5-point likert scale; 1 = fully disagree, 5 = fully agree)

5.2.7 Subsumption

LimeSurvey results provided valuable insights for the evaluation of Ask The Crowd. The 19 participants provided further insights into usage behaviour, supporting a primarily non-targeted, information-seeking usage scenario, *i.e. the service is used by browsing through the stages*.

The staging system and its components (*cf. participation graphs, voting system*) are embraced by most participants, survey responses even include the request for an additional "*expires soon*"-stage.

The employed wizard-approach to survey creation was proven pertinent and easy to use. Single features could be identified as more valuable (*e.g. survey summary, preview functions*) than others (*e.g. similar surveys*).

While *Bubblecharts* and the interactive, on-site visualization-approach in general received highly positive feedback, *Scattercharts* were classified obsolete and user-generated visualizations, though strongly supported by the majority of the participants, remain subject to concerns of facilitating distorted data representations.

Users indicate that they gain *findings/insights/knowledge/information* in the broadest sense by using the service, respectively components thereof and therefore support the goal of crowdsourcing knowledge generation.

While not all feedback is of positive nature, valid concerns and limitations were highlighted. The simple nature of the proposed survey model induces practical limitations to question design complexity, or, to say it in participants' terms: *it only supports simple questions*.

6 DISCUSSION

6 Discussion

Looking at the results, we see that Ask The Crowd attracted a significant number of users (*see section 5.1.2*) that contributed a noteworthy amount of questions (*see section 5.1.1*). Reactions to the site and its features were generally positive and enthusiastic.

The fact that not many users registered with the site, but contributed anonymously, can be interpreted in several ways, e.g.:

1. either the (extrinsic) motivational value of provided personalization features and reputation is questionable, at least in its current form,
2. or a success for the open-access policy.

The first notion however is weakened by evaluation results, whereby users were mainly satisfied with personalization features (*see figure 5.16a*). On the other hand, many comments on what participants liked about Ask The Crowd explicitly included the open-access policy, providing evidence of appreciation and supporting the approach. While this policy has shown to facilitate user recruitment, it must also be kept in mind that it requires trust into as well as collaboration and sympathy for the subject among the users, in order to maintain a (perceived) high quality of service in terms of *motivational* and *hygienic* characteristics.

It can also be seen as proof for the intrinsic value provided by the portal, since a service, independent of its accessibility, needs to offer value in order to acquire users.

Site visitors made their interest and motivation obvious by contributing not only more than 100 surveys and over 2600 answers in only six weeks, but even created sophisticated visualizations (*see figure 6.2*) and discussions on the site.

LimeSurvey results indicate, that users are able to extract and gain knowledge using Ask The Crowd (*see figure 5.20*). Looking at the different means for knowledge discovery provided on the site, we see that while none of them can be identified as useless, their ratings differ significantly from each other (*see figure 5.19*). The comparison shows that user-generated visualizations are rated most useful, followed by the chart visualizations and the overview page. When trying to find reasons for this, we can argue that user-generated visualizations, since they are specially tailored to one specific survey, obviously provide a way to convey recognizable relations easily, while charts require tinkering.

Concerning the chart visualizations in turn, we can identify the *Scatterplot* as obsolete (*see figure 5.21*). It is rendered redundant, probably because the information it can represent is completely included and extended by a third dimension within the *Bubblechart*. Participants of the LimeSurvey expressed however that they embrace the functionality provided by the charts and that additional visualizations, conveying more dimensions are wanted.

Some questions, for example *What's your favorite character from 'The Big Bang Theory'*?⁴⁵, which currently leads the Hall of Fame, do however not necessarily benefit from the addition of the third dimension. They are arguably presented more expressive when reduced to only two variables (*see figure 6.1*). We can therefore come to the conclusion that, since the usefulness of a visualization depends on what we are trying to visualize and/or express, the judgement given by the LimeSurvey participants also depended on their frame of reference, i.e. the surveys and the way in which they viewed them. Expressed differently: *the different analysis tools perform differently well depending on purpose and data*.

The results of the first focus group study and LimeSurvey show that it requires further research and investigation to determine which additional visualizations are suitable to our purposes and which are not. What we can however determine is, that the divergent means offered for result analysis are appreciated and employed by our users for knowledge discovery.

⁴⁵<http://www.ask-the-crowd.com/surveys/results/overview/?survey=49>

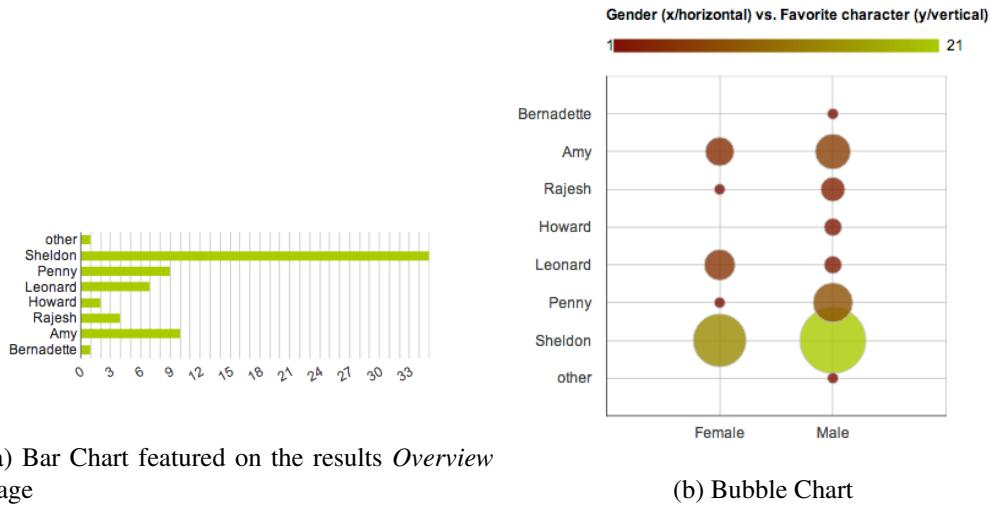


Figure 6.1: **Overview vs. Charts:** Survey #49: *What's your favorite character from 'The Big Bang Theory'?*

Combining LimeSurvey results with the participation on the web portal we can conclude that the goal of crowdsourcing knowledge generation can, in theory, be achieved. What remains questionable however, is the quality of achieved knowledge.

In the introduction we defined our measure for achieved knowledge by the characteristics *new* and *interesting*. Looking at the broad variety of topics inquired on Ask The Crowd (*see appendix D*), most of them can be considered new and interesting according to our definition, but many may also be conceived irrelevant. However, the relevance of every question finally lies within the eye of the beholder - and, as most of us were taught as little kids: *there are no dump questions*.

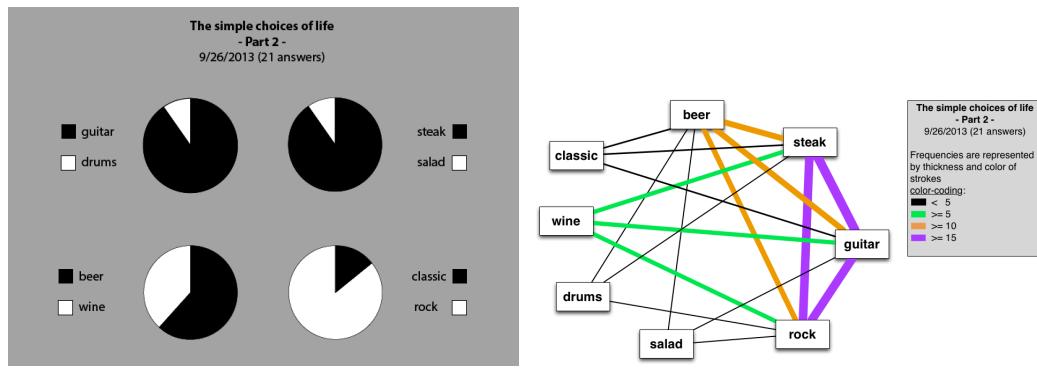
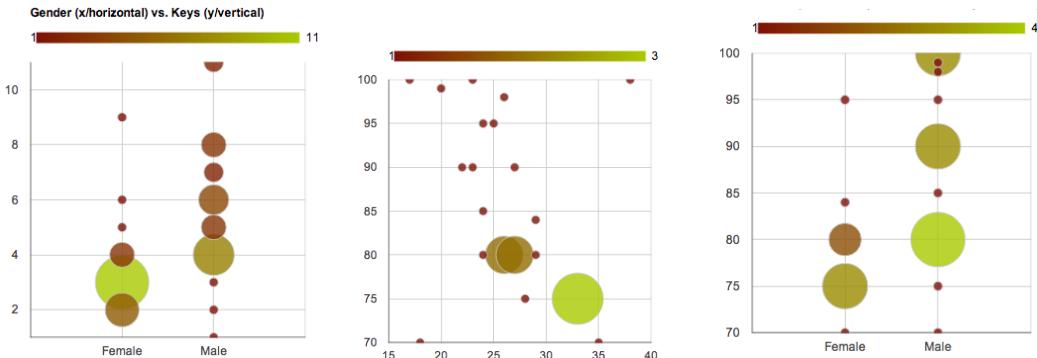


Figure 6.2: User contributed visualizations on Ask The Crowd.

What did users of Ask The Crowd find out then? Inspecting some of the highly rated surveys, we can find that, at the time of this writing, men seem to have more keys on their keychain than women, which tend to have about three keys (*see figure 6.3a*). Further someone inquired on the rather interesting topic: *How long are we 'connected' [by the internet] every day?*. Findings suggest that that we are *connected* at least 70% of our waking time, while men tend to stay *online* longer than women (*see figure 6.3c*). Note that these findings support our introductory claim of Ask The Crowd being accessible at a large degree of our time (*see sections 1 and ??*).

6 DISCUSSION

To name a third example, results so far indicate that growing up in rural areas results far more often in the grown-up having a drivers license, than growing up in urban or big city environments. Data so far even suggests, that being raised in a big city more often than not results in no drivers license⁴⁶.



(a) Survey #8: *Do women have more key on their keychain than men?*^a Bubblechart visualization. Screenshot taken Nov. 5, 2013, survey running for 52 days collected 46 answers.

(b) Survey #121: *How long are we 'connected' every day?*^a Age x/horizontal-axis vs. How many key on their keychain than are we 'connected' every day? Bubblechart visualization. Screenshot taken Nov 5, 2013, survey running for 13 days, collected 24 answers.

(c) Survey #121: *How long are we 'connected' every day?*^a Gender x/horizontal-axis vs. How much of your waking time do you have access to the internet? y/vertical-axis Bubblechart visualization. Screenshot taken Nov 5, 2013, survey running for 13 days, collected 24 answers.

^a<http://www.ask-the-crowd.com/surveys/?survey=8>

^a<http://www.ask-the-crowd.com/surveys/?survey=121>

^a<http://www.ask-the-crowd.com/surveys/?survey=121>

Figure 6.3: Example surveys on Ask The Crowd

Another interesting development that could be observed during this six-week period were evolving series of surveys, e.g. *The simple choices of life*⁴⁷.

The series relates *choices* of philosophical as well as everyday nature, such as "*coke vs. pepsi*", "*logic vs. creativity*", "*Love vs. Friendship*" and "*Milky Way vs. Andromeda*"⁴⁸. The interesting aspect about the series is not only the dichotomic nature of the questions, but also that it can be seen as follow-up questions, providing evidence for sophistication and interest.

Concerning the development of surveys in terms of participation, we can observe peaks at the beginning of almost any survey on Ask The Crowd, which can be explained by a *novelty effect*: the tendency for high initial performance when new technology/information is publicized in response to increased interest and attention therein [37]. Follow up spikes might be caused by promotion by the survey author, e.g. if she popularizes it via social networks to her friends or the result of overlapping, regular intervals at which users visit the site, respectively the survey.

While we have difficulties tracing author promotion and individual recurrence intervals of users, spikes can be associated to promotion activities by the site owners, e.g. after a survey caught renewed attention when it was promoted via the Ask The Crowd Facebook Page. When inspecting the participation graph of our current Hall of Fame leader again - Survey #49: *What's your favorite character from 'The Big Bang Theory'*? (see figure 5.2a) - we can see that the second spike, or plateau in this case, starts with a raise in answers from 12-16 days after survey

⁴⁶<http://www.ask-the-crowd.com/surveys/?survey=31>

⁴⁷<http://www.ask-the-crowd.com/search/?q=the%20simple%20choices%20of%20life>

⁴⁸Referring to the gravitationally bound systems of celestial bodies, also known as galaxies.

creation. Inspecting the survey, we can see that it was created on Sep 15, 2013, which determines the timeframe for the initial rise in answers leading to the second peak to Sep 27 - Oct. 1, 2013. Coincidentally, this survey, among others, was promoted via the site's Facebook page within this timeframe (*see figure 6.4b*).



(a) Facebook Posts statistics, Sep 25 - Oct 4, 2013.



(b) Facebook Post promoting Ask The Crowd surveys, Sep 29, 2013.

Country	People Reached
Germany	284
United States of America	7
Hong Kong	4
Canada	3
Austria	2
France	2
United Kingdom	2
Albania	1
Spain	1
United Arab Emirates	1

(c) Facebook Reach statistics

Figure 6.4: Facebook Promotion of surveys on Ask The Crowd. Screenshots taken Nov, 4, 2013.

As stated by one of the LimeSurvey participants, the portal still lacks enough users to unfold its potentials or be representative, but it also is still very young and not fully developed, i.e. a beta version. As with any crowdsourcing endeavour, it is crucial for Ask The Crowd to attract the right audience [48] and varying phases of user in- and outflow are to be expected [9]. Current results indicate that the formation of a community has just begun and is in progress, promising a basis for further research.

In accordance with LimeSurvey participants we conclude that Ask The Crowd has proven a valuable tool to assess simply-designed questions. Response rates of the current survey population indicate potentials in finding out about characteristics of, as well as trends and environmental conditions of the user population.

6 DISCUSSION

The site can serve as yet another online repository for user data, as well as a service facilitating research and analysis.

6 DISCUSSION

7 Conclusion & Future Work

We have conceptualized, implemented and evaluated a crowdsourcing system for knowledge generation according to scientific methods. After the initial idea of a crowdsourcing platform for knowledge generation was proved valuable within a first focus group study (*see section 3.2*), the service interface was designed and subject to further evaluation (*see section 3.4*).

As the outcome of our work we propose a CS-System that faces the key challenges proposed by Doan et. al. [17] with the following approaches:

What contributions can users make? Users can contribute to the knowledge generation process by posing their question to the crowd and answering questions of other user. Knowledge discovery is further facilitated by offering users means for on-site analysis and contribution as well as discussion of own findings.

How to recruit and retain users? An open-access policy, renouncing from requiring contributors to register with the service, is employed successfully, minimizing entry barriers and motivating user participation. Only non-monetary reward systems are employed and results identify an intrinsic motivational value inherent to the service.

How to combine user contribution to solve the target problem? User contributions to individual surveys are combined within divergent tools and views offered for result analysis. Combination of user contributions is however not limited to automated processes, but survey data can be download and combined by anyone willing to do so, i.e. the process is complemented by an additional crowdsourcing channel.

The superset of user contributed questions is combined and conveyed by a staging system featuring the four different stages *New*, *Trending*, *Popular* and *Hall of Fame*, which reflect the survey life-cycle. Further associations between information objects are enabled via a tagging system, and combinations can be extracted by employing the sophisticated site search. All of the resulting usage scenarios are reflected in the presented data.

How to evaluate users and their contribution? Because of the open-access strategy alternative ways for user evaluation were implemented. Since only aggravating the malicious intents, but not capable of fully preventing directed, sophisticated and intentional attacks, our strategy rather relies on the honesty of the user referring to and confirming others' findings, that show no inherent need for more strict measures [45]. The *non-free-text-survey-parameter* model by itself literally defines mosts parameters while the only (*data-affecting*) form of *free-form-input*, namely numeric parameters, can be constricted in both range and field as well as associated to a unit.

Evaluating the resulting web service, we have shown that not only the human ability to solve, but also the capacity to formulate questions can be exploited by crowdsourcing-systems (*see section 5*). Though the data produced so far is too scarce to be representative and reflects only a relatively small community, the basis for further investigations was hereby layed.

We have shown that on-site result analysis tools, as well as an open-access policy can function as motivators and catalysts for user recruitment. Evidence has proven that user interest in and intention to participate within the proposed knowledge generation process can be achieved by minimizing entry barriers and facilitating result analysis via automated on-site tools.

While this work represents the foundation of a new crowdsourcing system with the purpose of knowledge generation, it also provides many opportunities for future work. Further research is needed to review appropriateness of different information visualization techniques for integration within the system. The system not only serves as a platform for the evaluation of existing visualizations in this crowdsourcing context, but according to our evaluation participants also bears potential to facilitate the development of new visualizations.

Potentials for future work are not limited to information visualization but include many aspects of human computer interaction, e.g. developing descriptive and predictive models and theories of interaction within this newly generated scenery of problem generation in contrast to solution. The introduced measure for a survey's probability to be answered (*cf. expected answer rate, section 4.2*) requires more data and separate evaluation and further refinement as well as many other features of the site. There are many opportunities to contribute to and extend this work - it is still in prototypical stage and, in a sense, poses more questions than it answers.

"To raise new questions, new possibilities, to regard old problems from a new angle, requires creative imagination and marks real advance in science."
(Albert Einstein)

Contents of attached CD

/ask_the_crowd The crowdsourcing system:

- a visualization of the implementation.
- *src/* the source code of Ask The Crowd.

/data/ Data gathered throughout this work:

- the Google Analytics usage report in PDF format.
- the LimeSurvey data in Excel format.
- the demographics survey of the first focus group study in PDF format.
- protocols of the first and second focus group study as well as supplementing audio/video footage.

/thesis This thesis:

- a digital copy of this thesis in PDF format.
- *images/* a digital copy of all images used within this work in PNG format.
- *presentations/* all presentations accompanying this work in Keynote and PDF format.
- *references/* all digitally available references quoted throughout this work in PDF format.
- *src/* the L^AT_EX-source for this work.
- *websites/* digital copies of relevant websites in PDF format.

Appendices

A Visual Designs evaluated during the second focus group study

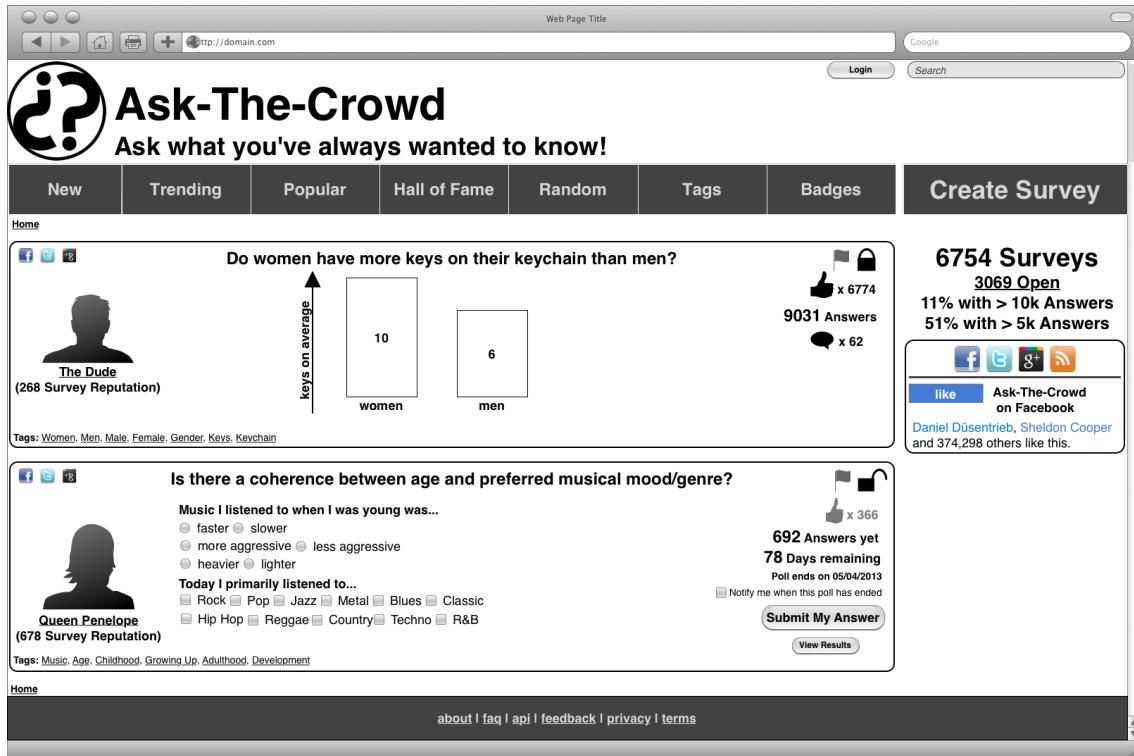


Figure A.1: Visual design of the landing page

The screenshot shows the Ask-The-Crowd website interface. At the top, there's a navigation bar with links for 'New', 'Trending', 'Popular', 'Hall of Fame', 'Random', 'Tags', and 'Badges'. On the right side of the header, there's a button for 'Create Survey'. Below the header, a section titled 'New' displays five recent surveys. Each survey card includes a small chart showing participation over time, the survey title, the asker's name and timestamp, and a thumbs-up icon indicating the number of likes. The surveys listed are:

- Is there a coherence between female bosom size differences and handedness?** Asked by The Dude (268) on 03/09/2013, 623 likes.
- Which Highlight colour do you prefer?** Asked by King Lui (132) on 03/09/2013, 5211 likes.
- Is there a coherence between smoking parents and the affinity of their children...** Asked by Anonymous on 03/09/2013, 4992 likes.
- Is there a coherence between the technology available at the time one grows up...** Asked by Count D. (669) on 03/09/2013, 4017 likes.
- Is there a coherence between age and preferred musical mood/genre?** Asked by Queen Penelope (678) on 03/09/2013, 366 likes.

At the bottom of the page, there's a link to 'Scroll down to load more' and a footer with links for 'about | faq | api | feedback | privacy | terms'.

Figure A.2: Visual design of the category *New Surveys*

The screenshot shows the Ask-The-Crowd website interface, specifically the 'Tags' page. The layout is similar to the main page, with a navigation bar at the top and a 'Create Survey' button on the right. Below the header, a 'Tags' section features a search bar labeled 'Search for tag' and a dropdown menu for 'sort by: Name | Popularity'. A large list of tags is displayed, each preceded by a small icon and followed by a count in parentheses. The tags include: Adulthood (x 98), Age (x 423), Albinism (x 8), Bosom (x 39), Buddhism (x 11), Change (x 143), Childhood (x 86), Children (x 75), Color (x 112), Design (x 407), Development (x 399), Ego (x 187), Fact (x 221), Female (x 335), Gender (x 567), Growing Up (x 241), Gun (x 173), Handedness (x 24), Holiday (x 47), Ice (x 1), Jabber (x 56), Karma (x 38), Keychain (x 3), Keys (x 29), Lube (x 7), Male (x 90), Memory (x 73), Men (x 487), Music (x 681), Naked (x 6), Oligarchy (x 2), Parents (x 16), Pirate (x 3), Queue (x 2), Real Estate (x 17), Smoking (x 94), Summer (x 279), Technology (x 799), Temple (x 19), University (x 398), Vegan (x 405), wePoll (x 249), Wolf (x 26), Women (x 551), Xercles (x 1), Yahoo (x 262), and Zombie (x 12). To the right of the tag list, there's a summary of survey statistics: 6754 Surveys, 3069 Open, 11% with > 10k Answers, and 51% with > 5k Answers. Below this summary is a 'like' button for the Facebook page, which is associated with Daniel Düsentrieb, Sheldon Cooper, and 374,298 others. The footer contains links for 'about | faq | api | feedback | privacy | terms'.

Figure A.3: Visual design of the *Tags*-page

The screenshot shows the 'Badges' page of the Ask-The-Crowd website. At the top, there's a navigation bar with links for 'New', 'Trending', 'Popular', 'Hall of Fame', 'Random', 'Tags', 'Badges', and 'Create Survey'. Below the navigation is a search bar labeled 'Search for badge'. A list of badges is displayed, each with an icon and a description:

- Star:** Created a survey that made it into the Hall of Fame. +50 Survey Reputation.
- FAQ-Guru:** Visited every section of the FAQ. +5 Survey Reputation.
- Devil's Advocate:** Answered 666 Surveys. +66 Survey Reputation.
- Visualizer:** Posted first visualisation. +50 Survey Reputation.
- Marathoner:** Visited the site for 30 days in a row. +30 Survey Reputation.
- Hipster:** Survey liked by 200 people. +20 Survey Reputation.
- Player:** Earned 10 Badges. +10 Survey Reputation.
- Commentator:** Commented on 20 different Surveys. +20 Survey Reputation.
- Creator:** Created first survey. +20 Survey Reputation.

A link 'Scroll down to load more' is visible at the bottom of the badge list. On the right side, there's a summary of survey statistics: '6754 Surveys', '3069 Open', '11% with > 10k Answers', and '51% with > 5k Answers'. Below this is a social sharing box for Facebook, Twitter, Google+, and RSS, with a note that Daniel Düsentrieb, Sheldon Cooper, and 374,298 others like the page.

Figure A.4: Visual design of the *Badges*-page

The screenshot shows a survey question page. The title is 'Is there a coherence between female bosom size differences and handedness?'. A note says 'This survey is intended for women only.' Below the title, there are two dropdown menus: 'Bosom size difference' (left bigger, right bigger, both equal) and 'Handedness' (left-handed, right-handed, ambidextrous). To the left, there's a user profile for 'The Dude' (268 Survey Reputation) with buttons for 'I like this' and 'Notify me'. A graph on the right shows participation over time, with a peak around 78 days remaining. The survey has 692 answers and ends on 05/04/2013. On the right side, there's a summary of survey statistics: '6754 Surveys', '3069 Open', '11% with > 10k Answers', and '51% with > 5k Answers'. A social sharing box for Facebook, Twitter, Google+, and RSS, with a note that Daniel Düsentrieb, Sheldon Cooper, and 374,298 others like the page.

Figure A.5: Visual design of the question page of a survey

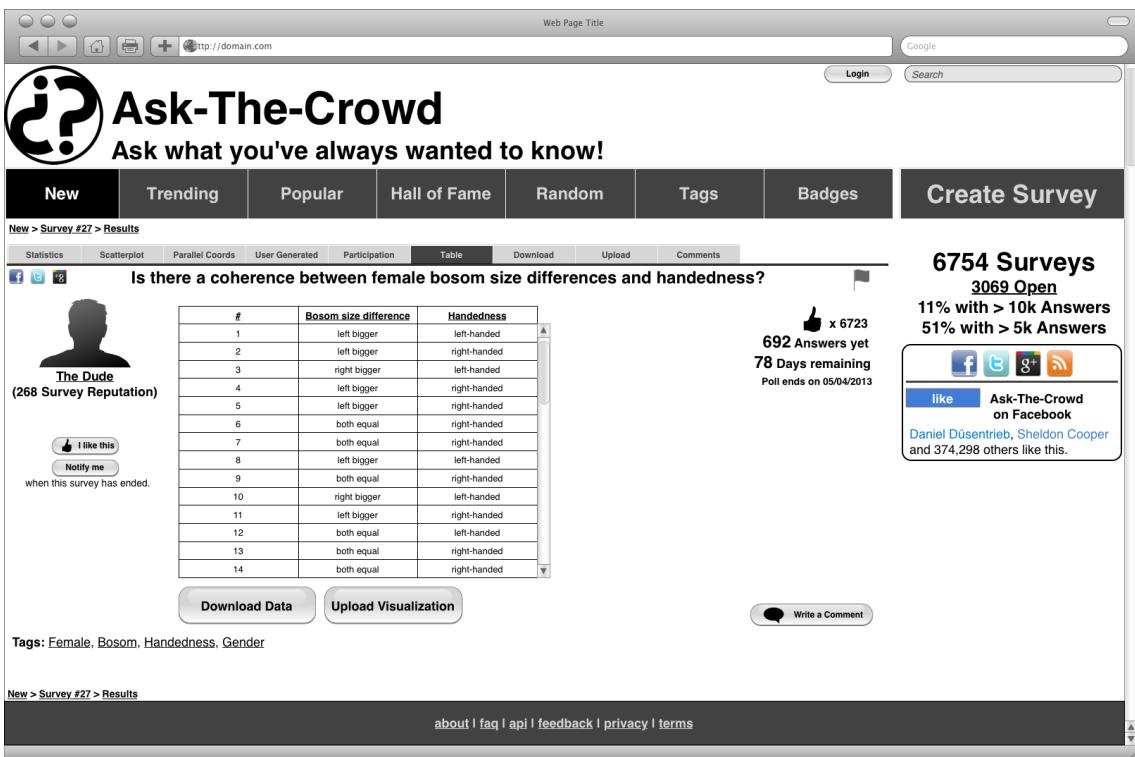


Figure A.6: Visual design of a page displaying a data table of survey results

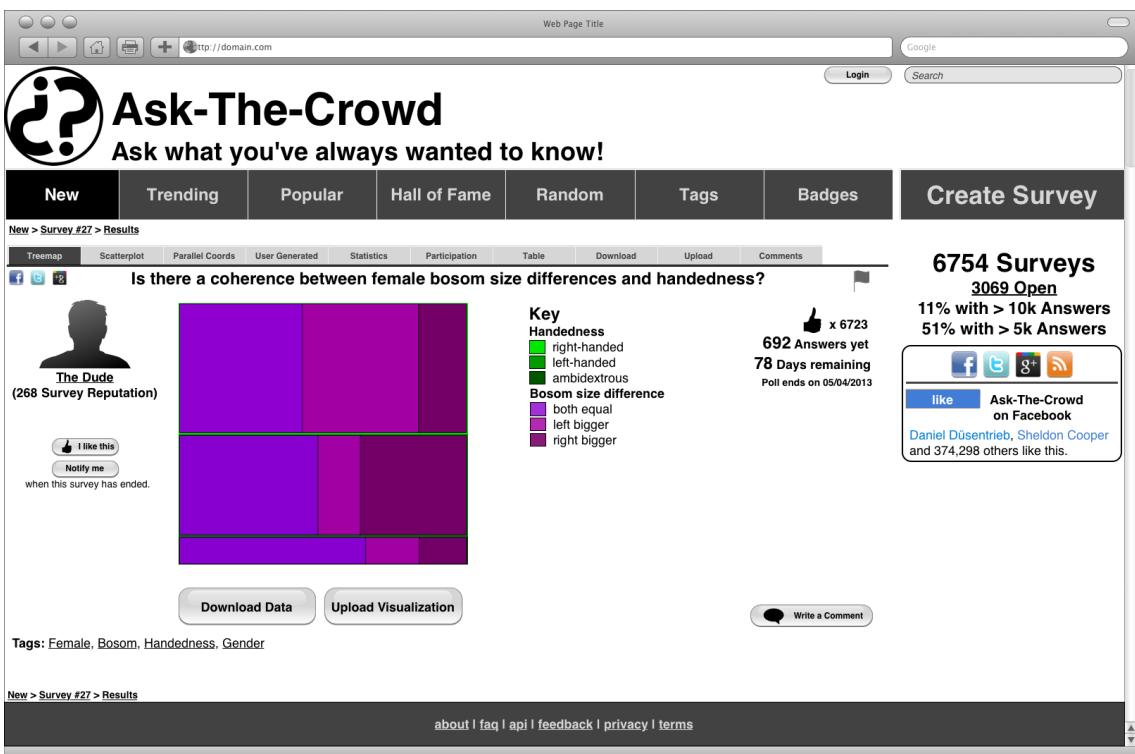


Figure A.7: Visual design for a treemap visualization of survey results

The screenshot shows the Ask-The-Crowd homepage with a navigation bar at the top. Below the navigation, a large header features a question mark icon and the text "Ask-The-Crowd" followed by "Ask what you've always wanted to know!". A "Create Survey" button is prominent. The main content area is titled "Create a new Survey - Step 1: The Question". It includes a text input field for the question and a "Proceed to Parameters" button. On the right side, there's a sidebar with statistics ("6754 Surveys", "3069 Open", etc.) and social sharing links. The footer contains links like "about", "faq", "api", "feedback", "privacy", and "terms".

Figure A.8: Visual design of the first step of survey creation: entering the question

This screenshot shows the continuation of the survey creation process. The header and navigation bar are identical to Figure A.8. The main content is titled "Create a new Survey - Step 2: Parameters". It includes a section for "Predefined" parameters (Age, Gender) and a "Custom" section where a parameter named "e.g. car" is being defined. The "Parameter Type" dropdown is set to "Number", and the "Answer Choices" section shows fields for minimum and maximum values. Below this are sections for "Numeric Range", "5-Point-Lickert-Scale", "Ordinal", and "Nominal" types. At the bottom are "Back to Question" and "Proceed to Tags" buttons. The sidebar and footer are also present.

Figure A.9: Visual design of the second step of survey creation: specifying parameters

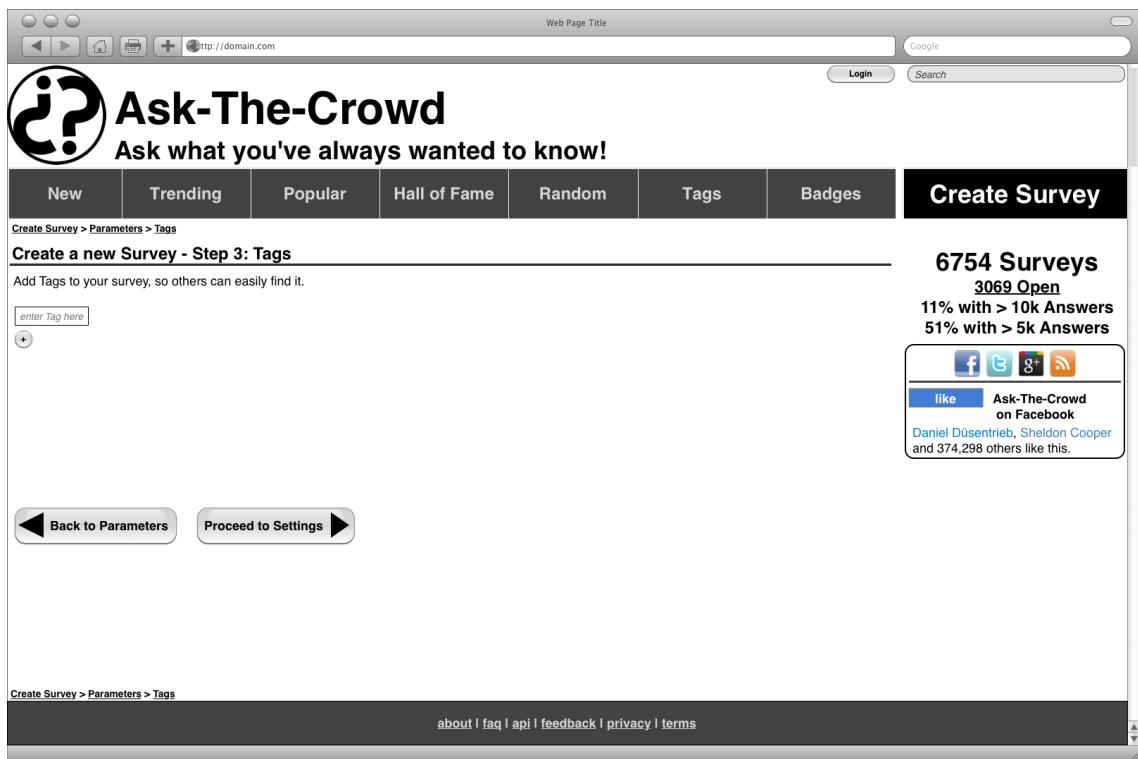


Figure A.10: Visual design of the third step of survey creation: adding tags

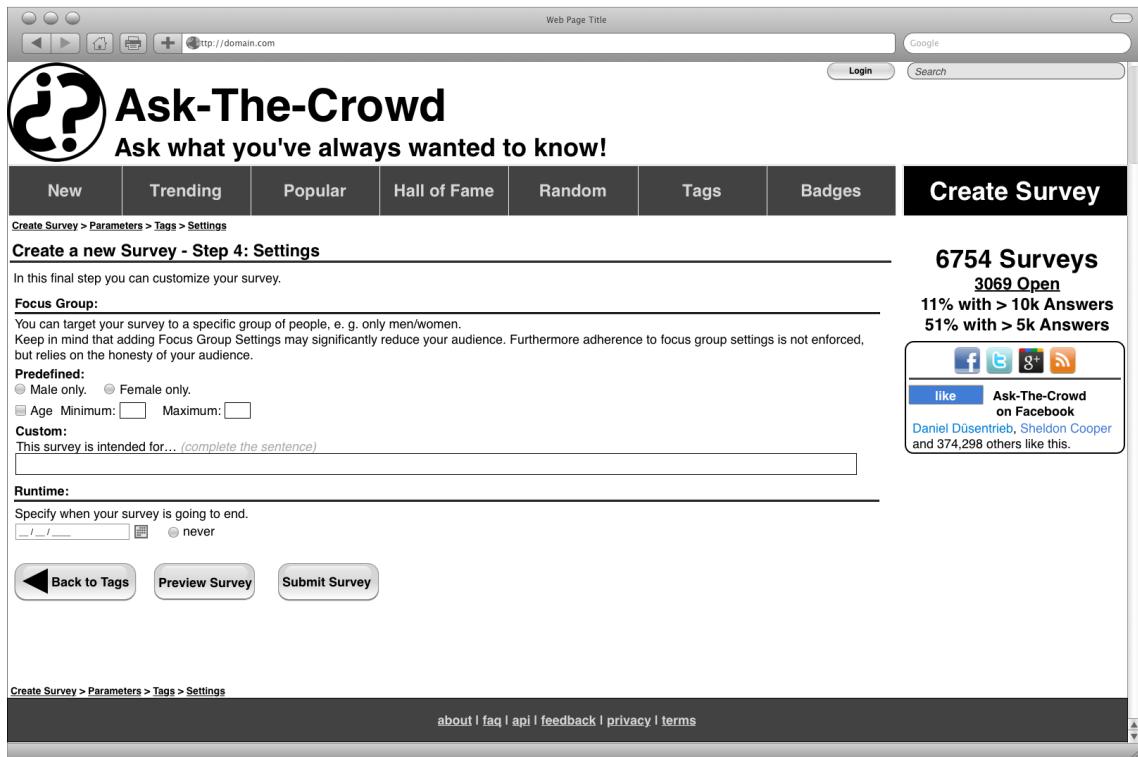


Figure A.11: Visual design of the fourth step of survey creation: customizing focus group and runtime

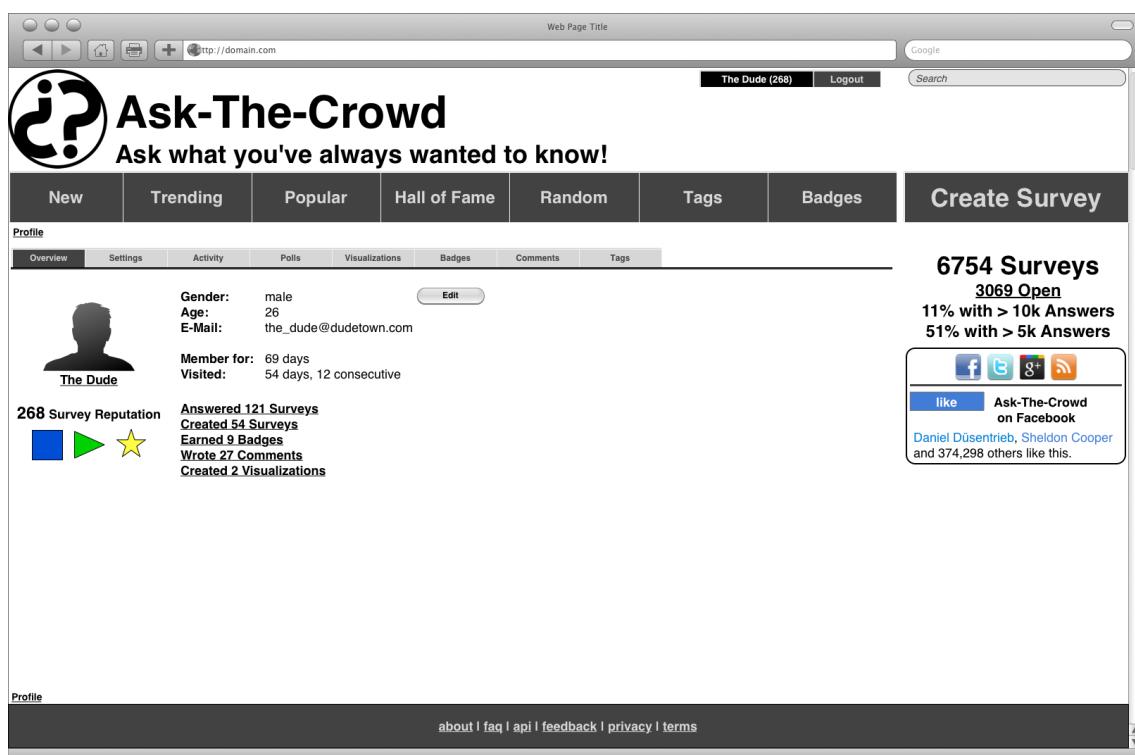


Figure A.12: Visual design of a user profile page

B Participation Graph Algorithm

Listing 2: Algorithm for participation graph generation in PHP source code as implemented on Ask The Crowd

```
1 <?php
2 /**
3 * Survey->createParticipationGraph()
4 * Create the participation graph of a survey object.
5 */
6 public function createParticipationGraph(){
7     $result = FALSE;
8     // surveys created for preview do not have any data and no
9     // id -> no participation graph
10    if(isset($this->id)){
11        /**
12         * FETCH DATA
13         */
14        $dbh = dbConnect();
15        // fetch numer of answers by date
16        $query = $dbh->prepare("SELECT COUNT(timestamp) AS
17            count, date FROM survey_" . $this->getID() . "
18            GROUP BY date ORDER BY date ASC");
19        if($query->execute()){
20            $data = $query->fetchAll(PDO::FETCH_ASSOC);
21        }
22        $dbh = NULL;
23        // fill up data array if necessary
24        $oneDay = 60 * 60 * 24;
25        $current = strtotime(date('Y-m-d', $this->
26            getCreated()));
27        $i = 0;
28        $today = strtotime(date('Y-m-d', time()));
29        $newData = array();
30        $dataLength = count($data);
31        $sum = 0;
32        while($current <= $today && $current <= $expired){
33            // fill up past days
34            if($i > $dataLength - 1 || $current <
35                strtotime($data[$i]['date'])){
36                $newData[] = array('count' => 0, '
37                    date' => date('Y-m-d', $current));
38            } else {
39                $newData[] = $data[$i];
40                $sum += (int)$data[$i]['count'];
41                $i++;
42            }
43            $current += $oneDay;
44        }
45        $data = $newData;
46        $dataLength = count($data);
47        if($dataLength === 0){ // no answers yet
48            $data[] = array('count' => 0, 'date' =>
49                date('Y-m-d', $today));
50            $this->averageAnswersDay = 0;
51        } else {
```

```

45             $this->averageAnswersDay = round($sum /
46                                         $dataLength, 1);
47         }
48         // check what to draw
49         $dataToDraw = array();
50         $maxAnswers = max($data);
51         $maxAnswers = (int)$maxAnswers[‘count’];
52         if($dataLength > 7){
53             // averaging needed since we only display 7
54             // data points in the graph!
55             $maxAnswers = 0;
56             $daySteps = round($dataLength / 7);
57             $window = $daySteps * 2;
58             $dataToDraw = array();
59             $dataStart = 0;
60             $dataEnd = $window;
61             for($i = 0; $i < 7; $i++){
62                 $sum = 0;
63                 for($j = $dataStart; $j < $dataEnd
64                  && $j < $dataLength; $j++){
65                     $sum += $data[$j][‘count’];
66                 }
67                 $dataStart += $daySteps;
68                 $dataEnd += $daySteps;
69                 $average = floor($sum / $window);
70                 if($average > $maxAnswers){
71                     $maxAnswers = $average;
72                 }
73                 $dataToDraw[] = $average;
74             }
75         } else {
76             foreach($data as $row){
77                 $dataToDraw[] = $row[‘count’];
78             }
79         }
80         // $data is no longer needed at this point -> free
81         // the memory
82         $data = NULL;
83         if($maxAnswers === 0){ // no answers yet
84             $maxAnswers = 100;
85         }
86         /**
87          * DRAWING
88          */
89         $graph = imagecreatetruecolor(
90             PARTICIPATION_GRAPH_SIZE_LARGE,
91             PARTICIPATION_GRAPH_SIZE_LARGE);
92         $white = imagecolorallocate($graph, 255, 255, 255);
93         $black = imagecolorallocate($graph, 0, 0, 0);
94         $green = imagecolorallocate($graph, 153, 204, 0);
95         // draw background
96         imagefill($graph, 0, 0, $white);
97         // initialize font
98         $fontFile = $_SERVER[‘DOCUMENT_ROOT’] . ‘/common/
99             tahoma.ttf’;
100        $ttfDimensions = imagettfbbox(24, 0, $fontFile, ‘0’,
101            );

```

```

95      $ttfWidth = $ttfDimensions[2] - $ttfDimensions[0];
96      $ttfHeight = $ttfDimensions[1] - $ttfDimensions[7];
97      /**
98      * COORDINATE SYSTEM
99      */
100     // Y-Axis
101     imagesetthickness($graph, 5);
102     imageline($graph, AXIS_MARGIN,
103               PARTICIPATION_GRAPH_SIZE_LARGE - AXIS_MARGIN,
104               AXIS_MARGIN, AXIS_MARGIN - 10, $black);
105     $YArrow = array(
106         AXIS_MARGIN, 10,
107         AXIS_MARGIN - (AXIS_MARGIN / 3),
108         AXIS_MARGIN + 10,
109         AXIS_MARGIN + (AXIS_MARGIN / 3),
110         AXIS_MARGIN + 10
111     );
112     imagesetthickness($graph, 1);
113     imagefilledpolygon($graph, $YArrow, 3, $black);
114     // 5 markers per axis
115     $exactStep = $maxAnswers / NUM_Y_STEPS;
116     $pixelStep = ceil((PARTICIPATION_GRAPH_SIZE_LARGE -
117                         AXIS_MARGIN - 10) / 6);

118     $roundTo = 1;
119     $YAxisMarkers = array();
120     if($exactStep >= 10){
121         $roundTo = 10;
122     } else if($exactStep >= 100){
123         $roundTo = 100;
124     } else if($exactStep >= 1000){
125         $roundTo = 1000;
126     } else if($exactStep >= 10000){
127         $roundTo = 10000;
128     }
129     $pixelYStep = $pixelStep / (ceil($exactStep /
130                                 $roundTo) * $roundTo);
131     for($i = 1; $i <= NUM_Y_STEPS; $i++){
132         $markerText = ceil($exactStep / $roundTo) *
133             $roundTo * $i;
134         if($roundTo >= 1000){
135             $markerText /= 1000;
136             $markerText .= 'k';
137         }
138         $markerY = PARTICIPATION_GRAPH_SIZE_LARGE -
139                     AXIS_MARGIN - ($i * $pixelStep);
140         imagesetthickness($graph, 5);
141         imageline($graph, AXIS_MARGIN -
142                   MARKER_LENGTH, $markerY, AXIS_MARGIN,
143                   $markerY, $black);
144         imagettftext($graph, 24, 0, AXIS_MARGIN -
145                     MARKER_LENGTH - (strlen($markerText) *
146                     $ttfWidth) - TEXT_MARGIN, $markerY +
147                     ($ttfHeight / 2), $black, $fontFile,
148                     $markerText);
149     }

```

```

137     imagettftext($graph, 24, 0, AXIS_MARGIN + (
138         AXIS_MARGIN / 3), 10 + $ttfHeight, $black,
139         $fontFile, '#Answers');
140     // X-Axis
141     imageline($graph, AXIS_MARGIN,
142             PARTICIPATION_GRAPH_SIZE_LARGE - AXIS_MARGIN,
143             PARTICIPATION_GRAPH_SIZE_LARGE - AXIS_MARGIN -
144             10, PARTICIPATION_GRAPH_SIZE_LARGE - AXIS_MARGIN
145             , $black);
146     $XArrow = array(
147         PARTICIPATION_GRAPH_SIZE_LARGE - 10,
148         PARTICIPATION_GRAPH_SIZE_LARGE -
149             AXIS_MARGIN,
150             PARTICIPATION_GRAPH_SIZE_LARGE -
151                 AXIS_MARGIN - 10,
152                 PARTICIPATION_GRAPH_SIZE_LARGE -
153                     AXIS_MARGIN - (AXIS_MARGIN / 3),
154                     PARTICIPATION_GRAPH_SIZE_LARGE -
155                         AXIS_MARGIN - 10,
156                         PARTICIPATION_GRAPH_SIZE_LARGE -
157                             AXIS_MARGIN + (AXIS_MARGIN / 3)
158 );
159     imagesetthickness($graph, 1);
160     imagefilledpolygon($graph, $XArrow, 3, $black);
161     $daysDimensions = imagettfbbox(24, 0, $fontFile, '#days');
162     imagettftext($graph, 24, 0,
163             PARTICIPATION_GRAPH_SIZE_LARGE -
164                 $daysDimensions[2] - $daysDimensions[0]) - 10,
165                 PARTICIPATION_GRAPH_SIZE_LARGE - AXIS_MARGIN + (
166                     AXIS_MARGIN / 3) + ($daysDimensions[1] -
167                         $daysDimensions[7]), $black, $fontFile, '#days')
168                 ;
169     $pixelXStep = ceil((PARTICIPATION_GRAPH_SIZE_LARGE
170             - AXIS_MARGIN - 10) / 8);
171     imagesetthickness($graph, 5);
172     if($dataLength > NUM_X_STEPS){
173         $markerText = $daySteps;
174     } else {
175         $markerText = 1;
176     }
177     $fromX = AXIS_MARGIN;
178     $fromY = PARTICIPATION_GRAPH_SIZE_LARGE -
179             AXIS_MARGIN;
180     for($i = 1; $i < 8; $i ++){
181         if($i - 1 < count($dataToDraw)){
182             $toX = $fromX + $pixelXStep;
183             $toY =
184                 PARTICIPATION_GRAPH_SIZE_LARGE -
185                     AXIS_MARGIN - ($dataToDraw[$i -
186                         1] * $pixelYStep);
187             imagelinethick($graph, $fromX,
188                 $fromY, $toX, $toY, $green,
189                 GRAPH_THICKNESS);
190             $fromX = $toX;
191             $fromY = $toY;
192         }

```

```

165         imageline($graph, ($i * $pixelXStep) +
166             AXIS_MARGIN,
167             PARTICIPATION_GRAPH_SIZE_LARGE -
168             AXIS_MARGIN, ($i * $pixelXStep) +
169             AXIS_MARGIN,
170             PARTICIPATION_GRAPH_SIZE_LARGE -
171             AXIS_MARGIN + MARKER_LENGTH, $black);
172         imagettftext($graph, 24, 0, ($i *
173             $pixelXStep) + AXIS_MARGIN - ((strlen(
174             $markerText) * $ttfWidth) / 2),
175             PARTICIPATION_GRAPH_SIZE_LARGE -
176             AXIS_MARGIN + TEXT_MARGIN +
177             MARKER_LENGTH + $ttfHeight, $black,
178             $fontFile, $markerText);
179         if($dataLength > 7){
180             $markerText += $daySteps;
181         } else {
182             $markerText++;
183         }
184     }
185
186     $rootPath = $_SERVER['DOCUMENT_ROOT'] . '/surveys/
187         participationGraphs/';
188     $result = imagegif($graph, $rootPath . $this->getID
189         () . '_large.gif');
190     $smallGraph = imagecreatetruecolor(
191         PARTICIPATION_GRAPH_SIZE_SMALL,
192         PARTICIPATION_GRAPH_SIZE_SMALL);
193     $regularGraph = imagecreatetruecolor(
194         PARTICIPATION_GRAPH_SIZE,
195         PARTICIPATION_GRAPH_SIZE);
196     imagecopyresampled($smallGraph, $graph, 0, 0, 0, 0,
197         PARTICIPATION_GRAPH_SIZE_SMALL,
198         PARTICIPATION_GRAPH_SIZE_SMALL,
199         PARTICIPATION_GRAPH_SIZE_LARGE,
200         PARTICIPATION_GRAPH_SIZE_LARGE);
201     imagecopyresampled($regularGraph, $graph, 0, 0, 0,
202         0, PARTICIPATION_GRAPH_SIZE,
203         PARTICIPATION_GRAPH_SIZE,
204         PARTICIPATION_GRAPH_SIZE_LARGE,
205         PARTICIPATION_GRAPH_SIZE_LARGE);
206     $result &= imagegif($smallGraph, $rootPath . $this
207         ->getID() . '_small.gif');
208     $result &= imagegif($regularGraph, $rootPath .
209         $this->getID() . '.gif');
210     imagedestroy($graph);
211     imagedestroy($smallGraph);
212     imagedestroy($regularGraph);
213     if($result){
214         $this->participationGraphCreated = TRUE;
215     }
216 }
217
218 return $result;
219
220 ?>

```

C Example Summary Email

Ask The Crowd <noreply@ask-the-crowd.org> October 20, 2013 9:22 PM
To: hp@ask-the-crowd.com
Your Ask The Crowd Summary

Hello dude

This is your dayly Ask The Crowd Summary!

Your surveys:

[Is there a relationship between female bosom size difference and handedness?](#)

Answers:	21	Average answers per day:	0.5
Likes:	6	Comments:	0
Visualizations:	0	Views:	162

[Is there a relationship between handedness and origin?](#)

Answers:	26	Average answers per day:	0.7
Likes:	0	Comments:	0
Visualizations:	0	Views:	121

[How do we think? Memories/Past Events](#)

Answers:	24	Average answers per day:	1
Likes:	3	Comments:	0
Visualizations:	0	Views:	95

[Site Layout Broken?](#)

Answers:	3	Average answers per day:	0.1
Likes:	0	Comments:	0
Visualizations:	0	Views:	126

This survey has ended on Oct 14, 2013

[Is the site layout broken in your browser?](#)

Answers:	27	Average answers per day:	0.7
Likes:	1	Comments:	1
Visualizations:	0	Views:	196

This survey has ended on Oct 14, 2013

Your favorites:

Do all bearded men have thick body hair?

Answers:	12	Average answers per day:	0.3
Likes:	2	Comments:	0
Visualizations:	0	Views:	79

Does a beard make a man more attractive?

Answers:	48	Average answers per day:	1.3
Likes:	5	Comments:	0
Visualizations:	0	Views:	190

Do all of your friends use the same mobile phone type as you?

Answers:	47	Average answers per day:	1.3
Likes:	0	Comments:	0
Visualizations:	0	Views:	165

Is the Internet Explorer still alive?

Answers:	34	Average answers per day:	0.9
Likes:	4	Comments:	0
Visualizations:	0	Views:	125

are graffiti art or vandalism?

Answers:	32	Average answers per day:	0.9
Likes:	3	Comments:	3
Visualizations:	0	Views:	135

This survey has ended on Oct 17, 2013

Happy asking!

The Ask The Crowd Team

You can customize the interval between summary-emails or turn off auto-generated summary messages at your Ask The Crowd profile page.

This is an auto-generated message. Please don't reply to this message. © 2013 [Ask The Crowd](#)

D Surveys on Ask The Crowd

Question	Rating	Answers	Views	Upvotes
What's your favorite character from 'The Big Bang Theory'?	662	69	302	5
Who would win in a fight between ... ?	623	60	278	15
Does a beard make a man more attractive?	572	64	234	6
The simple choices of life	559	61	239	5
Do all of your friends use the same mobile phone type as you?	481	58	188	1
How do you protect access to your smartphone?	439	38	246	1
Do women have more keys on their keychain than men?	409	44	183	2
Do You Forward Work Emails to Your Private Phone?	399	21	285	3
Do only bavarians like 'sauerkraut'?	387	44	161	2
How do you handle deadlines?	385	37	197	1
Does it bother you to grow old?	377	47	133	3
The simple choices of life - Part 2	370	39	172	1
Which one is your favorite kind of beer?	366	41	146	5
Do children adopt bad habits from their parents? Part 1 - Smokers	365	38	175	0
Is the Internet Explorer still alive?	358	41	141	4
Is global warming real?	358	48	118	0
Is the site layout broken in your browser?	347	27	209	1
Is there a little nerd in you?	335	37	135	5
Do children adopt bad habits from their parents? Part 4 - Punctuality	330	32	170	0
Asian Food Choices	329	37	132	4
Is there a relationship between preferred soft drink and fast food restaurant?	329	38	136	1
Bielefeld - a real city or a conspiracy theory?	324	40	112	4
are graffiti art or vandalism?	321	32	152	3
Is there a relationship between handedness and origin?	314	35	139	0
The hen-and-egg problem, what came first?	309	33	144	0
Is there a relationship between female bosom size difference and handedness?	305	24	167	6
How to name my baby?	303	31	145	1
Do you live to work or work to live?	300	30	144	2
The simple choices of life - Part 4	298	27	160	1

Table D.1: Surveys on Ask The Crowd - Part 1

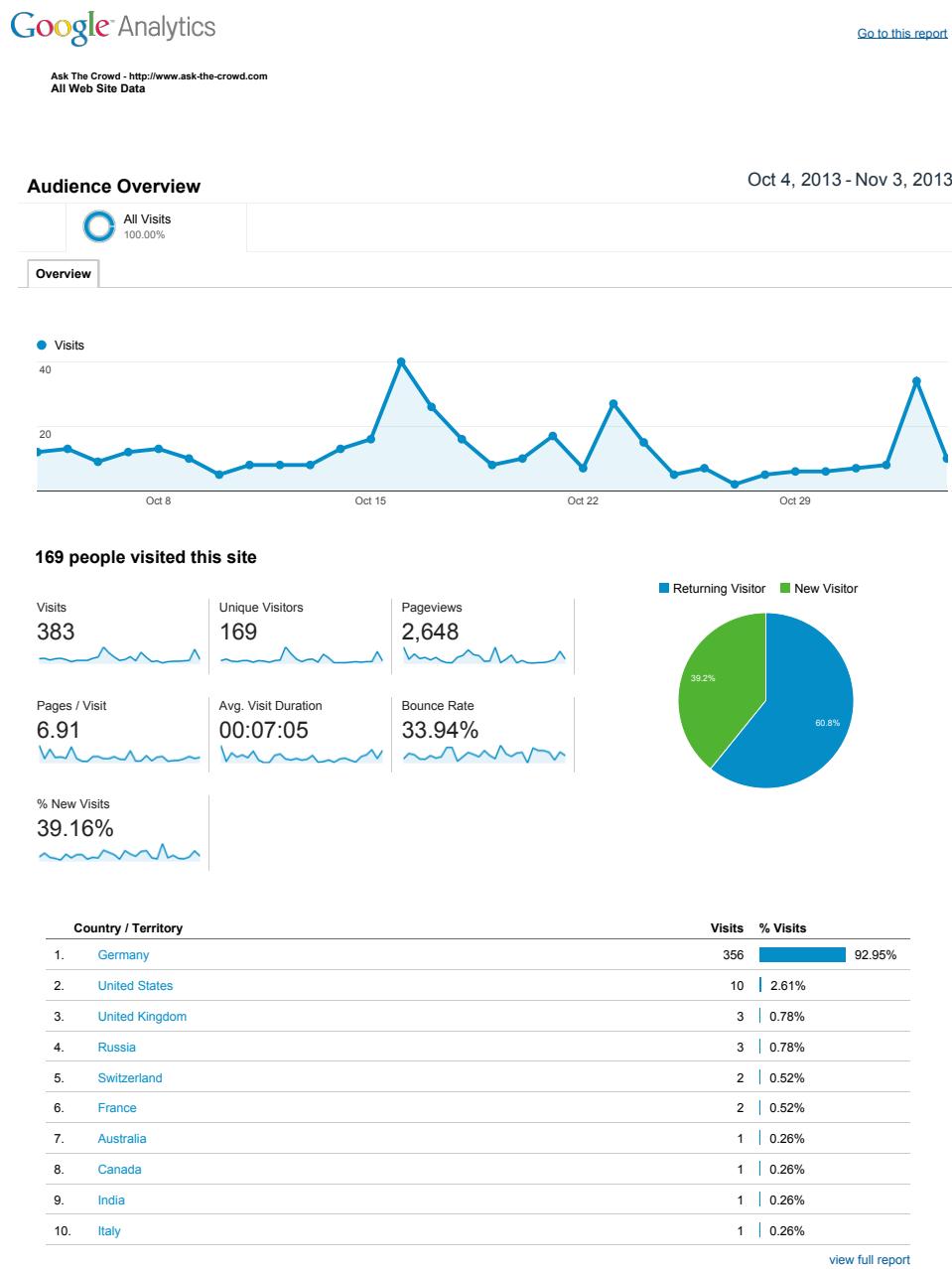
Question	Rating	Answers	Views	Upvotes
Are coffee drinking habits related to brewing methods?	293	27	149	3
Which website name would you prefer for an online ticket shop for university parties?	289	30	127	4
Nutella - with or without butter?	283	34	113	0
How do we think? Memories/Past Events	283	32	114	3
The simple choices of life - Part 3	281	28	141	0
The simple choices of life - Part 5	275	27	140	0
Do you still buy CDs?	275	29	127	1
Do you still watch TV? What do you use to watch the following?	275	29	127	1
Is the ownership of a drivers license related to growing up in a rural area?	273	31	118	0
Do you always change your underwear after having a shower?	267	33	102	0
which one is the best way to travel	260	30	107	1
Do you lock the toilet door at home?	259	27	124	0
what is the best thing to do when you're bored?	259	28	107	4
Where to go after school?	256	29	111	0
Do you wanna live on Mars?	254	28	114	0
Do children adopt bad habits from their parents? Part 3 - Fast food	250	23	135	0
The simple choices of life - Part 6	250	25	125	0
Who would win in a fight between...? Part 2	237	27	78	8
Number systems - which numerical sequence does affect you most of all?	236	27	95	2
flirting - who should make the first move?	232	24	100	4
Do children adopt bad habits from their parents? Part 2 - Late risers	230	20	130	0
Do you prefer taking a bath or having a shower?	229	27	94	0
Do you look both left AND right before crossing a one-way street?	228	31	67	2
The simple choices of life - Part 14	223	30	73	0
Can you date your earliest childhood memory?	220	24	94	2
The simple choices of life - Part 13	219	30	69	0
The simple choices of life - Part 10	219	23	98	2
Where are you right now?	219	28	79	0
Can we count to one thousand in one month?	219	23	95	3
does size matter when it comes to those things ?	216	23	92	3
At what age do people start to say - everything was better in the old days?	212	27	71	2
Will FC Bayern Muenchen be able to win Champions League, DFB-Pokal and Bundesliga again this year?	211	15	130	2
The simple choices of life - Part 7	211	20	111	0
The simple choices of life - Part 12	209	26	76	1
The simple choices of life - Part 15	206	27	71	0
Is the glass half-full or half-empty?	204	20	104	0
Do you believe in destiny the older you get?	204	23	80	3
Are you too lazy to cook?	202	19	107	0

Table D.2: Surveys on Ask The Crowd - Part 2

Question	Rating	Answers	Views	Upvotes
Is humanity mature enough to rule ... ?	202	25	77	0
The simple choices of life - Part 9	201	21	96	0
The simple choices of life - Part 11	198	25	70	1
Do you like your neighbors?	194	22	81	1
How do musical preferences change?	194	21	71	6
Do women own more shoes than men?	192	21	87	0
What's your favorite character from 'The League'?	191	21	68	6
Opposites attract - true or false?	191	24	68	1
Have you ever accidentally blocked your phone, e.g. entering the wrong PIN too many times?	191	21	86	0
Do you think the following tv series should be renamed to ... ?	190	22	65	5
who's your favorite scrubs character?	178	18	88	0
Do you believe in a life after death?	177	23	62	0
How do you like iOS 7?	176	15	98	1
The simple choices of life - Part 8	174	19	79	0
The simple choices of life - Part 17	172	24	52	0
What makes a movie worth watching?	170	25	42	1
The simple choices of life - Part 16	169	25	44	0
Do all bavarians own a Dirndl or a Lederhosn?	168	17	83	0
How long are we 'connected' every day?	166	22	44	4
Which is your favorite communication method?	160	17	75	0
Do you give to charity? If so How do you prefer?	152	11	91	2
Site Layout Broken?	149	3	134	0
Do all bearded men have thick body hair?	149	12	83	2
Would you run a marathon ... ?	147	19	49	1
Is there a relationship between Smartphone OS and Messaging Services?	122	15	38	3
Do women stay longer in the bathroom than men?	120	14	50	0
Can we count to one thousand in one year?	114	17	26	1
How do you like the new/changed functions in iOS7?	105	6	75	0
Do men still shave under their armpits or was that a phenomenon of the 90's?	103	6	73	0
How much money do you spend for your hobbies?	102	13	37	0
Do you have a specific shower routine?	98	12	38	0
Do men care about?	86	7	48	1
How informed are we?	81	9	27	3
Does the number of exes (ex-boyfriends/girlfriends) of your partner matter to you?	81	9	36	0
Do you want to quit smoking?	75	10	25	0
Do you think you can communicate with your family pet?	57	7	19	1
Do you lock the toilet door at home?	53	7	18	0
The simple choices of life - Part 18	29	4	9	0
Do you still live in the country you were born in?	26	4	6	0
Do you believe in ...?	26	4	6	0
Do you use public restrooms?	9	1	4	0
How much of your working time do you actually work?	4	0	4	0
How much money do you spend for groceries?	0	0	0	0

Table D.3: Surveys on Ask The Crowd - Part 3
88

E Google Analytics Report - Audience Overview



F LimeSurvey Data

F.1 General Usage - Ease of Use

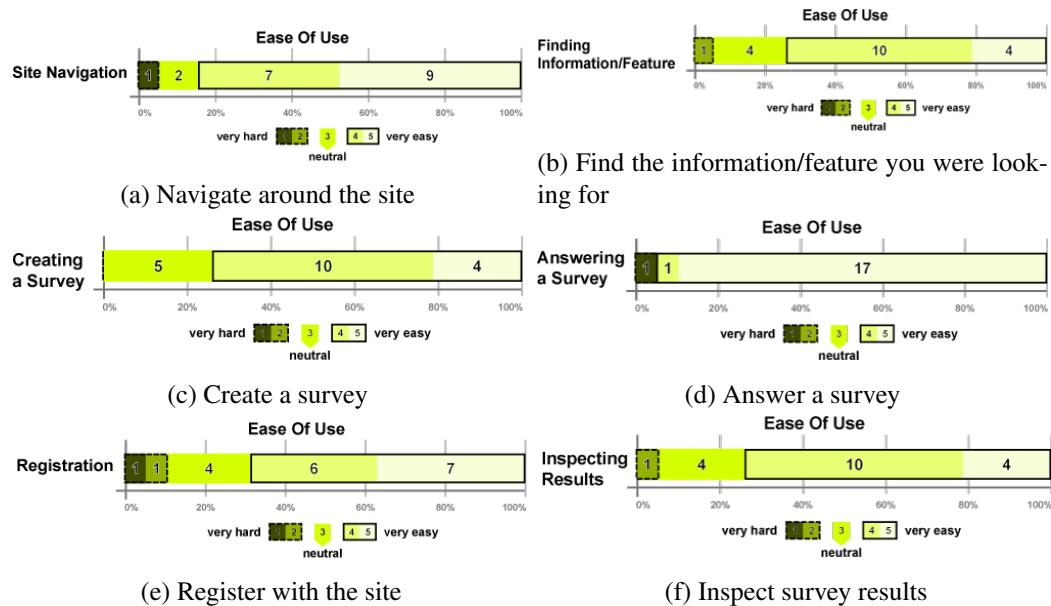


Figure F.1: Please rate how easy it was to do the following. (5-point likert scale; 1 = very hard, 5 = very easy)

F.2 General Usage - Registration With the Site

Why did you not sign up for Ask The Crowd?

1. "No need yet"
2. "ich meld mich grundsätzlich nicht bei (solchen) seiten an. das liegt nicht an der seite, sondern an meiner grundsätzlichen einstellung gegenüber dem internet ;)"
3. "no registration required"
4. "no need"
5. "I didn't want to ask a question."
6. "no need"
7. "because I can participate without registering"
8. "It's not required"

Why did you not sign in with Facebook?

1. "Registered at Ask The Crowd."
2. "I don't trust Facebook."
3. "privacy reasons"
4. "Never do"

5. "I don't remember. Was it available from the start?"
6. "hab ich noch nie irgendwo gemacht. liegt auch hier nicht an deiner seite"
7. "I don't do that"
8. "privacy"
9. "didn't wanna give out all my info"
10. "I don't like connecting with Facebook."
11. "don't trust it"
12. "I don't use Facebook sign in"
13. "don't use FB login"

F.3 Feature Evaluataion - Survey Creation

Please tell us why you did not create a survey.

1. "nothing to ask... ;)"
2. "No need yet"
3. "mir ist keine frage eingefallen bzw. wie vorher schon gesagt: ich mach selten aktiv bei seiten mit"
4. "could not think of anything yet"
5. "I had no question in my mind at that time."
6. "don't know what to ask"
7. "It's more fun to answer questions and explore results"

Is there anything you liked about the way a survey is created on Ask The Crowd?

1. "It's quite simple...not too overloaded with infos and features."
2. "short and simple steps, possibility to add tags, preview function"
3. "wizard steps, survey preview"
4. "No Error messages wile creating a survey. Didn't show preview and no idea why? No explanation of terms used in creating a survey."
5. "few, simple steps/expected answer rate"
6. "simple steps"

Is there anything that can be improved about the way a survey is created on Ask The Crowd?

1. "Something like a "quick survey" feature would be nice, where you don't have to go through all the steps separately, but have it all, maybe simplified, on a single page."
2. "title of the question vs question itself was confusing"
3. "Add error messages if a preview or a survey can't be created. A gif (or running circle) that shows, that system is running or calculating so you know system reacts to your request (no preview -> is system still calculating or does not react to request of preview)"
4. "No Error messages while creating a survey. Didn't show preview and no idea why? No explanation of terms used in creating a survey."
5. "few, simple steps/expected answer rate"
6. "simple steps"

F.4 Feature Evaluataion - On-site Result Analysis

Why do you think letting others upload their visualizations is a good idea?

1. "It helps sharing findings and knowledge and one can point out things."
2. "because others can provide another or new viewpoint to the data"
3. "it's inspiring and might lead to a new classification of data viz"
4. "da können spannende dinge bei rauskommen. vlt ist auch was künstlerisches dabei. daten anschaulich darzustellen ist nicht einfach und dabei die masse der internetnutzer einzubeziehen halte ich für eine sehr gute idee. (außerdem sind die bestehenden visualisierungen nicht soooo mega)"
5. "e.g. to provide other viewpoints"
6. "they are interesting"
7. "More interaction, interesting discussions"
8. "other perspectives"

Why do you think letting others upload their visualizations is not a good idea?

1. "Because number of responses, and thus results, will change. Therefore the uploaded results represent old data."
2. "Can't answer this question."
3. "who knows what they upload"

Is there anything you liked about the way survey results are displayed on Ask The Crowd?

1. "The charts are cool!"
2. "different presentations (overview, visualizations ..)"
3. "die zusammenfassung find ich gut. da wo max age und so steht"
4. "The view of your layout was displaced with all chars. They overlapped each other."
5. "very easy to read"
6. "the charts are cool, can toy around with them. user generated is cool too. overview page has good info"
7. "different presentations and possibility to set x and y axis for bubblecharts/scatterplots by yourself"

Is there anything you think should be improved about the way survey results are displayed on Ask The Crowd?

1. "More/other charts! The scattercharts seem a bit redundant."
2. "i think combining the parameters to view them in a single chart would be awesome. right now, correlations are hard to see."
3. "ich find sie auf den ersten blick nichtssagend. die schrift links ist nicht gut strukturiert. bei langen antwortmöglichkeiten rutscht ein teil in die nächste zeile und insgesamt entsteht ein sehr undurchsichtiges bild. es sieht unstrukturiert und lieblos aus, so wie man sich statistiken vorstellt. wenn du die massen erreichen möchtest, sollten die ergebnisse viel ansprechender dargestellt werden. ich hab auch ehrlich gesagt gar nciht gecheckt, dass ich verschiedene visualisierungen anzeigen kann. ich hatte nicht das bedürfnis die ergebnisse anders anzeigen zu wollen. wenn ich ein ergebnis sehen will, dann möchte ich auf den ersten blick möglichst viel erfassen. auf einer spaß-webseite will ich mich nicht intensiver mit statistiken beschäftigen, sondern eben nur oberflächlich zum bespaßen"
4. "I use a safari browser and the layout did not work with the results. Fix this problem and all chars will be usefull."
5. "no"
6. "In the beginning I thought the participation graph displays the results, so I was confused. I think the results are more important than when people participated. Personally, I'm not interested in that."
7. "more/other graphs. scatter-thingy seems a bit redundant with bubblecharts"
8. "interactive visualizations would be nice to have"

F.5 Goal Evaluataion

Is there any feature you miss on Ask The Crowd?

1. "Private surveys would be nice. Other than that: more charts, and the ability to reference charts when posting a comment - or comment on visualizations...anything in that direction."
2. "maybe a results category, 'order by' (answers, upvotes, views ...) function"

3. "a category: expiring soon"
4. "Built in Column-Charts for results"
5. "no"
6. "To many charts. Can't see a sense in some of them like the bars. How are they chosen? I like the pie chart, though. The layout is not always working (it is sometimes overlapped). And a respond if system is calculating and some error messages with associated correction suggestions (where the mistake I made so I can't see preview / result) A possibility to correct some settings after the survey is created (or a manual to do so if it does exist)."
7. "order surveys by upvotes/answers/runtime ..."
8. "no"
9. "Corelating the results. Knowing which of the people saying yes to the first question answered yes to the second."
10. "Sort by expiry"
11. "sort/order by function"
12. "sort function"

Is there any information you miss on Ask The Crowd?

1. "Not that I can think of right now."
2. "es ist fast ein bisschen viel information. aber wenn die schöner/ansprechender gestaltet wird ist es in ordnung. im ergebnisbereich ist viel plaintext, dass wirkt abschreckend"
3. "no"

Where do you see strengths of Ask The Crowd and what did you like about it?

1. "Easy to use, open access for anyone, no registration required, fancy charts I can check results right away and don't have to build myself!"
2. "strengths: easy access to the crowd. like: easy to use, visualizations, browsing questions"
3. "the visualizations and pre-set parameter types are a USP"
4. ""es hat das potential, das thema statistiken auf eine unterhaltsame art an die menschen zu bringen. es ist ja egl ein eher abschreckender bereich, aber durch spannende + kreative fragen kann hier interesse geweckt werden, auch bei leuten, die nicht viel mit mathe+statistik anfangen können. mit gefallen die witzigen fragen. dafür braucht man kreative nutzer, aber die haben das potential der seite sehr guten inhalt zu generieren! man kann auch immer wieder mal reinschaun, wird bestimmt nicht langweilig :)"
5. "A lot of different charts. Good to see quick result. But a missing tool to adjust the charts (what is shown in this pie charts)"
6. "easy access for everybody"
7. "i like the questions"
8. "I like the interactivity and how simple it is to answer questions."

9. "good for simple questions and fast feedback"
10. "easy to use, no registration required, browsing questions"

Where do you see weaknesses of Ask The Crowd and what did you not like about it?

1. "Sometimes it's hard to formulate the question and parameters, but I can't see a fix for that. Maybe subquestions with parameters would be a good feature to add. Also support for mobile is quite bad atm."
2. "a lot of surveys were not worth looking at them. it looked like the people who have created them made them up just to do you a favor ;)"
3. "it only supports simple questions"
4. "it might become to messy in the future and a lot of questions were kind of boring and did not really try to find out something in particular. rather, they were just random questions..."
5. "etwas, was nicht funktioniert: während einer sitzung kann ich eine umfrage nur einmal machen, das ist gut so. wenn ich erneut auf die seite gehe, dann kann ich wieder an allen umfragen teilnehmen. das verfälscht die ergebnisse. außerdem weiß ich dann nicht an was ich schon teilgenommen habe. und ich kann die ergebnisse einer umfrage erst nach mehrfachen klicks sehen und muss bestätigen, dass ich die umfrage nicht machen möchte. das mindert das entertainement, weil ich drei(?) klicks von der übersicht zum ergebnis brauch"
6. "No error messages of information about system status (system is calculating or not reacting at all) Layout does not work on all bowsers (safari)' Quick tutorial for newcomers."
7. "elaborate surveys are not possible"
8. "i don't"
9. "Far too much information at one time. Keep it simple!"
10. """not many users, yet. can't make elaborate surveys"

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