# Gamification Framework for Personalized Surveys on Relationships in Online Social Networks

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***Abstract*—The estimation of psychological properties of relationships (e.g., popularity, influence, or trust) only from objective data in online social networks (OSNs) is a rather vague approach. A subjective assessment produces more accurate results, but it requires very complex and cumbersome surveys. The key contribution of this paper is a framework for personalized surveys on relationships in OSNs which follows a gamification approach. A game was developed and integrated into Facebook as an app, which makes it possible to obtain subjective ratings of users' relationships and objective data about the users, their interactions, and their social network. The combination of both subjective and objective data facilitates a deeper understanding of the psychological properties of relationships in OSNs, and lays the foundations for future research of subjective aspects within OSNs.**

## I. Introduction

In recent years, online social networks (OSNs) became increasingly popular. Facebook is currently the largest OSN having more than 1.1 billion monthly active users [1]. As OSNs are centered on relationships and comprise communication and information exchange of any form, they are well suited for connecting real life friends. In 2011, Hampton et al. [2] stated that already 54% of United States Internet users were on Facebook and 40% had friended all of their closest confidants in an OSN. Nowadays, OSNs are an essential component in maintaining relationships with friends. However, in contrast to the real life, OSNs also make it possible to study these relationships by providing much information about users' attributes, friends, and interactions.

Understanding aspects of personal relationships is important and can be beneficial in various fields. As a figurative example presented by Tran et al. in [3], knowledge about trust between persons could be used to develop an effective spam filter. Models of these aspects (e.g., trust) can be inferred from objective information from OSNs. However, this is a vague approach as the aspects of users' relationships are affected by complex psychological processes. Such processes are rooted inside persons and can only be assessed subjectively. Typically, surveys are used for that purpose, but they have some major drawbacks. First, users have to be motivated to participate, second, participation is very time consuming, and finally, asking about all friends is infeasible.

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In this work, a framework for personalized surveys in OSNs is presented. It allows to ask users' subjective opinions on relationships with their friends. At the same time objective data about the users, the structure of their social network, and their interactions can be obtained. This allows for a combination of both subjective and objective information, facilitating a more detailed and more accurate analysis of relationships. As a survey on psychological aspects of relationships is a serious and a cumbersome task, the framework follows a gamification approach to make it more appealing. The presented framework is highly flexible, is able to run various surveys, and is integrated into Facebook as a gamified app. Hence, "app" and "game" are used interchangeably throughout this paper.

Section II gives an overview of current related work on psychological studies in OSNs, as well as gamification. In preparation of the framework and the app, several design advices, which focus on gamification aspects, could be derived and are presented in Section III. In Section IV, the subjective assessment game is described in detail. Section V outlines some preliminary results. As the application was not rolled out yet, Section VI discusses the current state of the game and open questions.

## II. Related Work

To the best of our knowledge, only few subjective psychological tests have been conducted in OSNs so far. Krotoski [4] investigated how attitude and behavior change can be predicted from information about avatars in Second Life. Thereby, an online survey was carried out among users of this social network to obtain information about them and their personal social network. Friggeri et al. [5] used a Facebook app to examine a user's personality and how it influences the nature of the user's social network. Users were provided with a personality test to find out about their openness, conscientiousness, extraversion, agreeableness, and neuroticism.

Psychological aspects of relationships, e.g., popularity, influence, or trust, are of special interest and much research was conducted in this field (e.g., [6], [7], [8]). However, almost all of these works try to infer results from objective information like personal data or interaction traces. There has been little work on a subjective assessment of these psychological properties, mainly due to the size and complexity of such a survey.

Similar to Rafelsberger and Scharl [9], we combine gamification and social networks to encourage user to participate in the psychological assessment tests. Gamification describes the use of game design elements in non-game contexts [10] and

can help to increase motivation, participation, and interaction duration even for standard tasks [11], [12]. The idea of gamification has been used in the design of various scientific applications, e.g., for image tagging [13], improving natural language questions in search engines [14], populating ontologies [15], or to assist solving complex biological problems [16], [17]. Recently also more and more commercial application and services, like FourSquare[1] or StackOverflow[2], use gamification techniques like badges or points to foster user interactions and contributions

## III. Design Advices

In preparation of the framework, targeted goals, functional requirements, and possible issues were analyzed. Among the key metrics for the framework are answering time, data quality, and spreading of the survey. Several promising design advices were elaborated which are described in this section. However, a quantitative analysis of the key metrics and benefits remains future work.

### A. Do it in Facebook!

The integration of the assessment framework into Facebook has several benefits and is highly recommended. Facebook has a large user base and many users spend much time in this social network and use it as a main communication medium. Thus, users can be asked directly where interaction is happening. As the subjective test is a Facebook app, it is just one click away of users' normal Facebook usage, and can be conducted without the need for leaving Facebook. Another benefit of the integration is the social experience of an app. With the help of the Facebook Graph API, personalized questions including names and profile pictures can be generated and ease the assessment procedure. Additionally, the Facebook Graph API allows for accessing information about the participants and the underlying social network which facilitates the analysis of the subjective ratings with respect to objective data (e.g., personal data, user interactions) and social network effects.

Moreover, Facebook offers several app and game-related features which help to increase app diffusion without external efforts. First, app usage is prominently included in the news feed. This means, many friends of an app user see that the user is playing the subjective assessment game. Second, users have the possibility to spread the app among their friends and invite them to use the app. Finally, the newly released Game API allows a deeper integration of games into Facebook. It is now possible to save scores, rankings, and achievements in Facebook which enables users to brag about their game results and makes the game more prominent. All these functionalities lay the foundations for a viral spreading of the app and help to increase the number of participating users.

### B. Appeal to Intrinsic Motivation!

The success of using our framework depends heavily on the cooperation of the users. Users shall use and spread the app, users shall disclose their personal data, and users shall provide high quality answers. Therefore, the app needs to motivate the users to cooperate. Instead of relying only on external rewards for cooperation like money, which might turn the game into work, our framework shall be developed in order to appeal to intrinsic motivation. This means, the app is designed in order to encourage users' cooperation out of the game itself. It has to be noted that the game also offers extrinsic rewards like scores, rankings, and achievements. However, they only support users' motivation, whereas the main goal, i.e, users' cooperation, is reached by intrinsic rewards.

Intrinsic motivation is associated with interest, enjoyment, and inherent satisfaction [18]. The presented game incorporates these properties by the following means: First, users can access an evaluation of their own answers. This motivates them not only to answer questions, but also to answer them truthfully, in order to get to know something about themselves. Second, the game includes fun questions about friends which are not related to any subjective assessment. This shall lighten the seriousness of the psychological tests and make the game more fun. Third, users can access information about participating friends, and their friends' answers to questions about them. This appeals to curiosity and encourages users to spread the app among their friends in return for more insights into their relationships. Finally, the game provides insights into their social network data. Users are motivated to disclose their data, i.e., grant permissions to the app for retrieving the data, which are analyzed and presented to them.

To put it in a nutshell, this game does not oblige users to answer questions, invite their friends, or disclose their data. Yet it provides incentives which appeal to users' intrinsic motivation to do so. Compared to extrinsically motivated approaches like typical surveys, this makes it much easier to attract users, profit from user cooperation, and collect valuable data.

### C. Ensure Valuable Results!

Conducting a survey in combination with gamification mechanisms makes it especially important to ensure the quality of ratings, as users may not be aware of the seriousness of the questions. Incentives to provide truthful answers are necessary and were already treated in the previous section. However, there still might be users who intentionally or unintentionally pollute the collected data. Therefore, it is important to constantly monitor the rating quality of a user by different metrics and to provide feedback to him. If the quality score of the user drops below a certain threshold, additionally a warning should be displayed which explains what lead to the low score. If the user unintentionally provided debased or wrong answers, he is reminded to answer reliably and encouraged to increase his quality score again. In case the quality drops even more, the test provider is free to announce or apply penalties like locking of gifts, or simply exclude this user's data from the result analysis.

As this survey is a game which has no defined end and users' play time cannot be predicted in advance, a sophisticated question selection algorithm has to be implemented. Many psychological aspects of relationships can be assessed by one or few main questions, but can only be examined in depth with several or many questions. Therefore, questions should be split into a broad and a specific assessment. Main questions should be posed frequently about as many friends as possible,

[1] https://foursquare.com/ Accessed: Sep. 2013
[2] http://stackoverflow.com/ Accessed: Sep. 2013

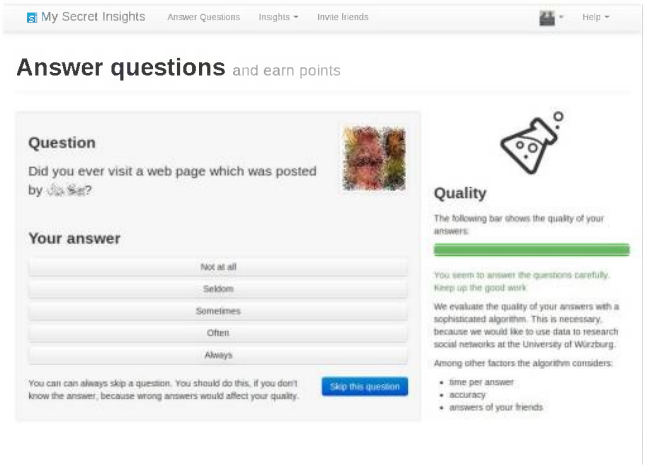


Fig. 1. Main page of app including menu bar, survey panel, and feedback panel (showing quality feedback). Name and profile picture were blurred for privacy reasons.

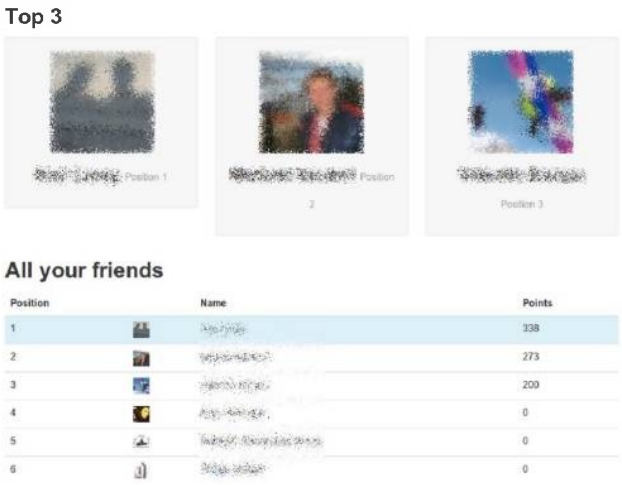


Fig. 2. A completely unlocked ranking of earned points. Names and profile pictures were blurred for privacy reasons.

for whom these questions were not answered yet. This results in a broad data coverage and enables basic analyses of the investigated property. To get a deeper understanding of a relevant property, a specific assessment should be conducted. As this requires a much higher number of questions per friend to reach a high data validity, only a small subset of friends should be selected. After sufficient questions about this subset of friends have been answered, it is possible to add more and more friends. Thus, also the specific assessment expands slowly, but always maintains an acceptable amount of ratings per relationship for in depth analyses. The presented two-way approach of broad and specific assessment makes it possible to obtain a useful data set even for users which abandon the app early.

## IV. Framework

The Facebook Graph API and integration for apps was used to create a gamified app, i.e., a Facebook game. The app is described as follows: *With this app you can find out more about yourself and your friends. You answer questions about your friends, earn points, and use these points to gain insights to your social network.* The objective of the game is to answer as many questions as possible and earn points with these answers. Each question is about a specific friend and can be answered by clicking on one of several answer options. The main page of the app which includes menu bar, survey panel, and feedback panel is depicted in Figure 1. At the beginning and after certain amounts of points, users can select new friends to answer specific questions about. To provide users with incentives to answer question, it is possible to unlock gifts with earned points. These gifts provide insights to the user's social network and other game-related statistics like rankings.

### A. Gamification

Gamification is used to encourage users to answer as many questions as possible. Therefore, game-design elements are used almost everywhere in the app. In detail, the app is centered around points which can be earned by answering questions. In return, these points can be used to unlock gifts. In order to keep users interested and participating, as many gifts as possible are offered which can be unlocked frequently to provide the users a sense of achievement and to avoid boredom. In the beginning, features of the user interface have to be unlocked. This introduces the concept of gifts to the users and makes the interaction with the app more comfortable.

Then, gamification elements like rankings, scores, and leaderboards are available which allow users to compare with others and aim to spark users' competitiveness. Some of these gifts are staggered and contain several levels of information which have to be unlocked one after another. For example, for rankings, first, a user can unlock his own score, then, his own position, then, the positions of his friends, and eventually, the scores of his friends. The final ranking gift for earned points is shown in Figure 2.

Finally, insights to specific information about the users' social network, or about answers to the subjective tests can be unlocked. The insights target users' curiosity to learn new information about themselves and about their friends. Such gifts are feed insights, i.e., statistics about friends' postings or likings on a user's own wall, like comparisons, i.e., the page likes of a friend are compared to own page likes, and the friendship graph, i.e., a visualization of the social network of a users' friends. Moreover, the app offers to show answers of the subjective assessment test. Thereby, a user can find out how he thinks about a friend (aggregated answers) and what his friends think about himself (average of aggregated answers). The aggregation of answers depends on the particular psychological test which is running, and thus, must be customized for each new test.

All these gifts only show information about a restricted number of friends. Some gifts are applicable to friends who were selected by the user and about whom he already answered questions. Others only show information about participating friends, i.e., friends that use the app themselves and participate in the subjective assessment test. This means, gifts and their information content are growing with the number of selected

friends (i.e., the number of answered questions) or the number of participating friends. Thus, gifts do not lose their value and encourage users to return to previously unlocked gifts as they might show new insights. Furthermore, users are encouraged to answer more questions and to invite more friends to participate in the subjective assessment test.

### B. Test User Acquisition and Quality Assurance

As the assessment test shall be conducted by many test users in order to retrieve more data, several promotion mechanisms were integrated. To attract new users, particularly friends of existing users, Facebook's request feature was employed prominently in the menu bar and friend selection panel. This feature allows and encourages users to invite their friends from everywhere within the app without leaving the current page. On clicking the invite button, a simple dialog appears in which the user can select the desired friends and submit the invitation.

Additionally, bragging, i.e., the ability of the app to post on behalf of the user, was integrated. Therefore, the app can trigger a Facebook dialog which proposes a status post on the user's own wall. One option to make use of this mechanism is to suggest a status post every time the user unlocks a new achievement. This can help to get friends interested in the app, as the status post contains a link to the app and shows the game's benefits, e.g., a description and a picture of the unlocked gift.

As the test is conducted in an unsupervised environment, the quality of obtained answers has to be assured. It has been shown by Suri et al. [19] that users tend to cheat in paid online tasks, even if the expected gain is rather small. In our case, gamification elements like earning points could also tempt users to gain points faster by giving debased or wrong answers. To prevent this behavior, several mechanisms for quality assurance in subjective users studies [20] were integrated into the framework. First, the framework is able to recognize suspicious clicking patterns, e.g., very fast clicking of always the first answer option. Second, if applicable, the answers of a user about a friend can be compared to his (intra-rater reliability) and others' (inter-rater reliablity) previous answers about this friend. Finally, some questions can be intentionally repeated to check the consistent rating of the users. The app features a quality feedback panel which presents the user his current quality score. This score can be composed from different metrics and can be customized for each test. The app is able to warn users if their score is too low and explains any subtractions. Thus, the participants get immediate feedback on their rating performance and can improve their rating behavior.

Another problem which has to be addressed is that users can stop using the app at any time. As the framework tries to assess subjective aspects of relationships, a user regularly would have to answer several questions per friend to achieve an acceptable data quality. A straightforward approach which randomly selects questions and friends is not feasible because many users would not answer enough questions per friend. Thus, the framework allows for a two-way question selection algorithm which covers a broad assessment for all friends and a specific assessment for a small increasing subset of friends. The broad assessment includes only a few so called main questions which target the assessed property in general and are asked about randomly selected friends. Thereby, a coarse estimation of the property distribution can be obtained. On the other hand, the specific assessment contains more specific questions which ask in detail about the relevant property. These specific questions are asked only about a small set of friends. This set contains friends which were selected by the users themselves (to cover preferred friends), which are also using the app (to achieve a high data density), and which are selected randomly (to increase data variety). The used question selection algorithm can be adaptive and try to maximize information gain per question, which means, for example, that the amount of questions about a friend who received consistent answers is reduced, and friends who received highly varying answers are covered by more questions. In the same adaptive way, consistency questions can be selected by the algorithm. This shall reduce assessment times, improve the quality of results, and accelerate the detection of unreliable users.

### C. Facebook App

Facebook apps are stand-alone web applications which are connected to Facebook by the Facebook API. They are integrated into Facebook with an inline frame which points to the app's actual URL. This way, the app can be hosted on any externally accessible web server but appears to be part of the Facebook website. The Facebook Graph API is a RESTful[3] JSON[4] API and can thus be accessed with HTTP requests. The inline frame integration into Facebook and the RESTful interface impose little restrictions and enable to use various technologies to build Facebook apps.

The framework and the Facebook app are implemented with PHP and MySQL on an external web server. Zend Framework 2[5] is used to enable a fully object-oriented design and a Model-View-Controller architecture. The created framework solely relies on the Graph API and accesses it with the help of the Facebook PHP Software Development Kit. The Graph API enables developers to retrieve Facebook user data, e.g., personal data, news feed, or page likes, if the user granted the respective permissions to the app. In order to avoid scaring new users off, the app does not request all permissions during the installation. Instead, only personal data and friendships have to be granted. To get more revealing permissions from the user, insight gifts which evaluate and visualize the user's data were created. When the user tries to access a newly unlocked insight gift, the respective permissions are requested. This offers the advantage that the user is fully aware of the permissions' benefit at this point and, thus, is more likely to grant it to the app. During computation of the insight gift on the web server, all data can be saved on-the-fly. An example gift visualizing which users recently commented the user's postings is shown in Figure 3.

The framework is designed as flexible as possible and queries all necessary data from or saves it to a MySQL database running on the external web server. Thus, whole tests and single questions can be added, changed, and deleted in production by altering the respective tables. The framework

[3]Representational state transfer (REST)

[4]JavaScript Object Notation

[5]http://framework.zend.com/ Accessed: Sep. 2013


Fig. 3. Insight gift visualizing which users recently commented the user's postings. Names were blurred for privacy reasons.

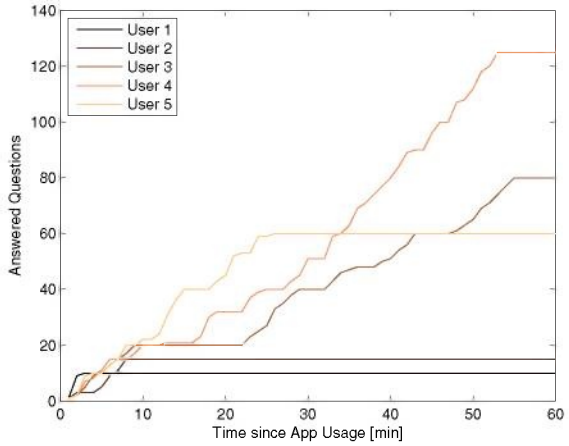


Fig. 4. Progress of players in the first 60 minutes after app installation.

is modular and encapsulates all essential mechanisms in order to be free to change or add components or features to the framework. This makes it possible, for example, to change the quality metrics or to add new gifts in the future.

## V. Preliminary Results

In this section, preliminary results of the framework are outlined. As the app is not rolled out yet, only results from in-development tests can be presented which do not allow for quantitative statements. However, they already show the potential of the gamification framework and provide a first impression of the eventually achievable data quality. Five persons tested the app extensively and provided feedback as well as error reports. Thereby, these initial users answered 1006 questions within a total testing time of 5 hours. The testing resulted in the storage of data about 1286 Facebook users and 5601 connections between them. All test users maintained a high quality score and did not receive any quality warnings.

Figure 4 visualizes the number of answered questions of each user within the first 60 minutes after app installation. It shows the time since app installation in seconds on the x-axis and the number of answered questions on the y-axis. It can be seen that all users started to answer immediately. While User 1 and 2 were early testers and stopped answering before achieving 20 points, the three others continued answering. They achieved at least 60 questions and one user even managed to answer more than 120 questions within the first hour of

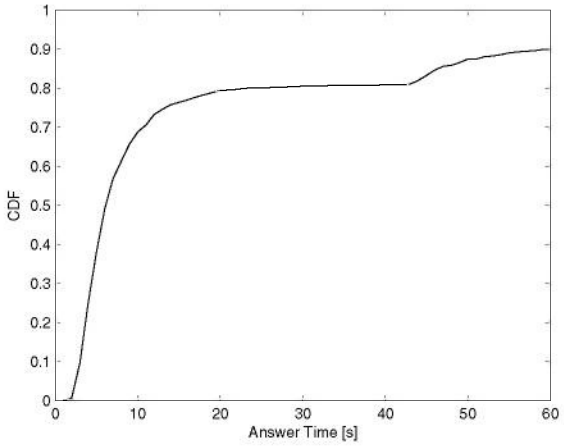


Fig. 5. Cumulative distribution function of the time per answer.

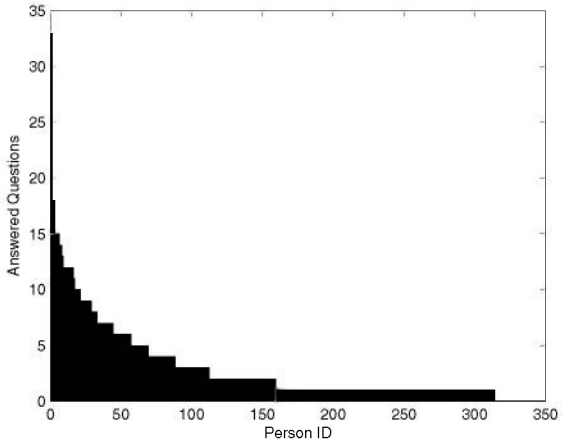


Fig. 6. Number of answers per person.

usage. Several plateaus where the number of answers did not increase for several minutes can be seen. Some of them are located at 20, 40, and 60 answers, which is due to the fact that achieved gifts can be accessed then. These results show that the app enables users to answer questions at a steady pace. Furthermore, the app provides enough incentives to make the game interesting to users and attach them to the game.

Figure 5 shows the cumulative distribution function of the time needed per answer (i.e., the time between two consecutive answers). It can be seen that less than 10% of questions were answered within 3 seconds. Furthermore, 70% of all questions were answered within 10 seconds and almost 80% of questions were answered below 20s. These results prove that users can answer questions fast, which was one goal of the framework. The remaining higher answer times are either due to selection and adding of users for specific assessment which occurs at regular intervals, or visits to unlocked insights, which all correspond to the plateaus of Figure 4.

In Figure 6, the number of obtained answers per Facebook user can be seen. The y-axis shows the number of answers

per person, and the x-axis shows these persons in descending order. It can be seen that the implemented question selection algorithm covered 314 of the 1286 users, on whom the test users were surveyed by the broad assessment. Moreover, a subset of users was selected for the specific assessment, and the number of answered questions for these persons grows fast. As not only the users but also the app selects friends for specific assessment, this effect is intensified. For example, the person with the most questions, being a test user and friend of all other test users, was covered by the specific assessment of all other test users. All in all, it is possible to quickly get results for a broad set of persons while obtaining accurate results for selected users.

Finally, the five test users were asked about their subjective experience with the game. All users confirmed that the app was very easy to use and appealing. All users were interested in the provided insights into their network data and willing to answer questions in return. Their first opinions showed a positive tenor and complimented the app. However, only after more persons have used the app, it will be possible to both objectively and subjectively evaluate the success of the framework design.

## VI. Discussion

In this work, a flexible framework for personalized surveys on relationships in OSNs was presented. It was developed as a Facebook app and follows a gamification design. The integration into Facebook allows for the collection and storage of objective data like personal information, interactions, and a subgraph consisting of all app users, the friends of these users, and all connections between them. Therby, the app is able to provide a real life OSN dataset for the analysis of relationships. But unlike previous approaches which estimated psychological properties only from such objective data, in this game, users are asked directly to rate their own relationships.

Thus, the outstanding advantage of our approach is the possible combination of both subjective and objective data. It facilitates a deeper understanding of the psychological aspects of relationships in OSNs as correlations can be investigated and new models can be derived. Therefore, the presented framework establishes the basis for future research on both the structure, interactions, and relationships within OSNs, especially taking subjective aspects into account.

Currently, the app, which is called "My Secret Insights", is running in Facebook's sandbox mode where it can only be accessed by the developers. However, as described in this paper, the app is ready to launch, and a first psychological survey was created. As next step, the app will be submitted into Facebook App Center for review and become visible for all Facebook users soon.

Some open scientific questions, which can be examined with this framework, remain: *Which elements or mechanisms increase users' willingness to participate in surveys, disclose their personal data, and spread the tests? What is the effect of a specific gamification element? How to implement an effective question selection algorithm? How to compute the quality score and set the quality threshold?* To answer these questions and get a deeper understanding, more research is needed in this promising area in the future.

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