

ECrowd: Enterprise Crowdsourcing for Training Cognitive Systems using the Workforce

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1 Crowdsourcing in an Enterprise Environment

Crowdsourcing has become a mainstream process for gathering ground truth data in order to build knowledge bases, and for the training, testing and evaluation of machine learning algorithms. In this process, small human annotation tasks are performed by people from all over the world in return for a small fee. The increased benefits of this crowdsourcing in terms of cost, time and annotation quality have been shown in previous work [5].

Although the benefits of using crowdsourcing in a corporate environment have been explored [6], its application in practice has been limited. The reason for this is twofold: employees have no incentive to perform tasks as they cannot get paid as reward, and crowdsourcing tasks can also not be sent to external annotators as companies often deal with confidential data. However, as artificial intelligence and, specifically, supervised machine learning algorithms become more common, so does the need for annotated data. In this paper we introduce a platform for enterprise crowdsourcing called ECrowd, that we a) aim to employ to get a better understanding on how enterprise mobile crowdsourcing (EMC) could be sustainably adopted in a traditional work environment, b) use for gathering training data for Cognitive Systems, and c) build on to create business applications. Our video demonstration of ECrowd is available at <https://vimeo.com/233505376> with password *ecrowd*.

2 ECrowd: Platform and Methodology

Our enterprise crowdsourcing application ECrowd is a platform in which mobile enterprise crowdsourcing applications and tasks can be instantiated and managed. Its back end is built with the Spring Framework to support a website front end for administrative purposes. It is designed to support the creation of custom EMC applications by allowing an administrator to have control over most of the aspects that compose a mobile application. The mobile front end is using Cordova, AngularJS and Ionic, which allows for the usage of standard web technologies and works as a container that interfaces between them and the native device capabilities while also supporting activity-awareness capabilities based on the Core Motion framework offered by the OS environment.

In order to understand crowdsourcing use in an enterprise environment, we have been using ECrowd for several experiments, building promising results as new features into subsequent versions of the platform. We have been looking into various topics relevant to enterprise crowdsourcing: comparing nudging strategies [2], gamification elements to investigate user engagement [1], user modeling (ongoing), and the privacy aspects of data handling in enterprise crowdsourcing [4].

To study engagement, we have been conducting experiments at several large Dutch organisations, with several hundred participants from various departments, for a duration of typically two months. Participants were asked to install appropriate versions of the application that a) were generated to match the design guidelines of the company, b) contained several tasks types to achieve a good level of task diversity, and c) corresponded in functionality to the research questions being addressed.

We also conducted experiments on probable causal relationship between different gamification elements and the quality and user engagement in enterprise crowdsourcing. We were interested in how different enterprise environments mediate the effect. We deployed qualitative research procedures to gain an understanding of the player types that exist in an enterprise environment and also discover a possible enterprise application for which crowdsourcing could be used. Along with the player types, we complement our findings with previous research done within IBM [3], to motivate and validate the selection of the gamification elements which will be used for our experimental study.

3 Results and Conclusion

The engagement study provided novel insights about: 1) the time slots and context when employees are more likely to interact with their mobile devices and perform crowd work; and 2) the type of crowd work that employees would be willing to perform during a working day. The results of our survey confirm the result of other exploratory studies performed in other environments and companies, but give additional insights on the types and duration of tasks preferred by employees. ECrowd enabled the implementation of notification strategies with varying temporal distribution and activity awareness. We found that timely notifications can foster participation and retention, that there were significant differences among treatment groups in terms of participation and retention. The outcome of the experiment was in contrast with the survey results, as activity awareness lead to lower participation and retention.

In the gamification experiments, we found that based on Bartles theory of player types, the qualitative exploratory analysis affirmed for the enterprise environment the suggestion of non mutually exclusive player type characteristics. More importantly, by combining our qualitative research results with those of previous studies on gamification in the enterprise, we were able to show the preference of employees in competitive and collaborative game dynamics. These results funneled our explanatory research, for which we deployed a gamified mobile crowdsourcing application which combines competitive and collaborative game mechanics. We used our experimental tool to verify its use in into two large multinational enterprises for an observational interval that lasted two months. Together with the engagement study this has shown that enterprise crowdsourcing is possible through mobile interaction and gamification.

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References

- [1] Grigorios Afentoulidis. Gamification in enterprise crowdsourcing. *TU Delft, (Thesis)*, 2017.
- [2] Sarah Bashirieh, Sepideh Mesbah, Zoltán Szlavik, Robert-Jan Sips, Judith Redi, and Alessandro Bozzon. Nudge your workforce. a study on the effects of task notification strategies in enterprise mobile crowdsourcing. In *Proceedings of 25th International Conference on User Modelling, Adaptation and Personalisation. (UMAP 2017)*, Bratislava, Slovakia, July 2017. Springer.
- [3] Laurentiu Catalin Stanculescu, Alessandro Bozzon, Robert-Jan Sips, and Geert-Jan Houben. Work and play: An experiment in enterprise gamification. In *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing*, pages 346–358. ACM, 2016.
- [4] Camiel Steenstra. A privacy aware infrastructure for an inclusive enterprise at ibm. 2016.
- [5] Benjamin Timmermans, Lora Aroyo, and Chris Welty. Crowdsourcing ground truth for question answering using crowdtruth. In *ACM Web Science 2015*. ACM, 2015.
- [6] Maja Vukovic and Claudio Bartolini. Towards a research agenda for enterprise crowdsourcing. *Leveraging applications of formal methods, verification, and validation*, pages 425–434, 2010.