Role Fulfilment Model for Motivating Participation in Mundane Crowdsourcing Tasks

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Abstract

Some of the major problems lead to the failure of crowdsourcing, like low response rate and unqualified submission, are related directly to the participants' lack of motivation. However, it is not well understood how incentives influence crowdsourcing participation. This paper proposes a role fulfilment model from a sociological perspective to understand motivation in crowdsourcing. According to the requesters' expectation, the participants should take the roles of workers. It means that they should respond effectively in a satisfied quality with serious attitude towards the tasks. However, especially for mundane crowdsourcing tasks, the participants are less likely to take ownership of the tasks. Based on the related role requirements of fun, reward and killing time, they will be less likely to treat tasks seriously. To resolve the role conflict, the proposed role fulfillment model helps participants feel more involved in a close- knit task oriented group. The experiment results support that such an approach can enhance the participants' motivation in crowdsourcing.

Keyword: role theory; role fulfilment model; crowdsourcing

I. INTRODUCTION

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Crowdsourcing refers to an online, distributed problem- solving and production model involving open-source practice [1], [2], [3], [4]. Crowdsourcing outperforms the traditional industries with improved efficiency and reduced cost. It has several obvious advantages: (1) aggregating vast of crowd wisdom with an acceptable cost [5], (2) involving diverse participants and opinions [6], (3) offering a facilitate to exchange ideas [7], and (4) avoiding the waste of time on unnecessary communication and compromise [5].

Some famous crowdsourcing platforms, such as Amazon Mechanical Turk (mTurk), offer a marketplace for online work. The requesters post tasks and offer compensations while the participants (a.k.a. workers) can contribute to the tasks. Some of the tasks, such as logo design, require specialized skills. Others are open to all without special requirements. For example, a website may invite diverse people to assess its human computer interaction design via crowdsourcing. We refer to the latter category of crowdsourcing tasks mundane tasks. The participants who respond to this kind of tasks do not need to possess specific skills. Corresponding to this fact, these participants are not motivated by factors such as to develop their abilities. In order to motivate participation in mundane crowdsourcing tasks, existing approaches mostly focus on providing workers with incentives according to various considerations [8], [9], [10], [11], [12], [13], [14], [15]. In this paper, we explore the impact of organizing workers into teams to play different roles on their motivation to participant. Brabham [1] emphasized in his understanding about the agenda for crowdsourcing research that we need to understand how members of the crowd feel about their roles in the crowdsourcing process. This paper tries to understand the participants' motivation in crowdsourcing from a sociological perspective. We introduce the concept of role to

understand crowdsourcing workers' motivation. The absence of traditional roles, such as peers, around a member of the crowd can lead to conflict between role requirements of the individual and role expectations from the requester. This conflict will negatively impact the worker's motivation and participation in crowdsourcing.

In this paper, we propose the Role Fulfilment Model (RFM) to solve the role conflict while try to understand the relationship between the fulfilment of absent roles around workers and their motivations in crowdsourcing. We focus on mundane crowdsourcing tasks where diverse participants work towards a single goal (the task) with little compensation. These participants can be seen as a task organization group.

The rest of this paper is organized as follows. Section II introduces related studies of motivation in crowdsourcing. Section III describes the RFM and how it can help resolve the role conflict and enhance the participants' motivation. Section IV describes the experiment design, and analyzes the results. The paper concludes with a summary of the potential applications of the RFM in crowdsourcing and gives an overview of future research directions.

II. RELATED WORK

Motivation research aims to explain the factors driving people to take a certain course of action [16]. It is a popular area of research in crowdsourcing due to the fact that the lack of high quality responses is a major cause of inefficiency in crowdsourcing [17]. A crowdsourcing service provider who builds the task marketplace must strive to build good relationships with the crowd. The organization must study the daily activities of the crowd in the platform. This can be an effective way to make the participants respond to the tasks proactively with serious attitude.

Current motivation research in crowdsourcing categorized motivation into two types: 1) intrinsic motivation and 2) extrinsic motivation. The former is generated by the participants' internal decision-making processes. Intrinsic motivations include fun, sense of accomplishment, and killing time [1]. Another form of intrinsic motivation is community based motivation such as social

interaction, charity and customer loyalty to the requesters or the crowdsourcing platform [18]. Extrinsic motivation rooted from people's desire to achieve something in the environment [17]. The most common extrinsic motivation is payoff. This payoff can be monetary (e.g., money or vouchers) [1], [18], [19] or non-monetary (e.g., skill improvement) [1], [18].

Specific to mundane task crowdsourcing, since it is always unrelated to any specialized skill, there are few participants motivated by skill development, work opportunity, or keeping in touch with the industry trends. Therefore, non-monetary extrinsic motivation can hardly motivate the workers. Besides common intrinsic motivation and money, we focus on the sense of accomplishment and the social communication motivation in this paper. Furthermore, we propose more detailed metrics based on the role theory.

III. ROLE FULFILMENT IN CROWDSOURCING

A. Preliminaries

Role theory uses the item of role to describe and analyze individuals' behaviors in social interactions. Role is a basis for individuals in a society to communicate with each other. Roles reflect norms, attitudes, contextual demands, negotiation, and the evolving consideration of situation which are commonly understood by all members of a society [20], [21], [22]. The understanding of his/her role can affect an individual's goal, and behavior pattern [23]. This effect happens through the interaction and compromise among the role requirement and self-concept of an individual and the role expectation from the society or organization to which the individual belongs [24]. McClelland [25], [26] proposed the theory of achievement motivation within a small group of people who work together to complete a specific task. This theory emphasized the close tie aiming to achieve a common goal within the group of people. This kind of groups can be an entrepreneurial organization or other types of groups with similar institutional architecture. Group role motivation is generated based on McClelland's theory. It

defined several role requirements in a healthy and effective group [27]. The following three can be applied to crowdsourcing:

1) Affiliation Requirement: As social animals, human beings are used to work together. They have the desire to interact socially and cooperate with others, especially their peers. Psychological and management studies offered evidence that the lack of interaction may jeopardize both group work and group members' emotion [27].

2) Acceptance Requirement: Group members have the de- sire to identify their roles in the society. A stable and acceptable role can make the individuals feel an increased sense of belonging [28]. Furthermore, individuals need the sense of being reaffirmed by someone else from the same group to feel safe [29]. This support is mutual. While the group satisfies the members' role requirements, the group members can find and take their roles more smoothly [30]. This positive relationship between the group and its members can enhance motivation and enhance effectiveness [31].

3) Feedback Requirement: Group members need to get feedback from peers and the environment to make understand whether they are doing well. This can be manifested as the establishment or termination of trust relationships [32], [33], [34]. Otherwise, they may feel uncertain about their work process and quality. Besides this, they also desire favorable attitudes from their peers. These interactions can stimulate positive emotions and enhance group members' motivation [35].

B. The Role Fulfilment Theory

The majority of motivation studies in crowdsourcing focus on the relationship between the participants and the work or the crowdsourcing platform. They ignore the social aspect of working in crowdsourcing which can be explained by the motivation studies in role theory.

The integration of role requirements of an individual in an organization can be abstracted as the role he/she would like to play in the organization. For example, if someone desires to control

the process of team work and organize the coworkers, that means he would like to take the role of the "leader" in the group. The organization will also have expectations on the individuals' behaviors and attitudes. Those expectations coalesce into the role which the organization would like a member to take up.

The coherence between these two roles on one individual is the key toward building a positive relationship between the individual and the organization. According to the role theory, the common beliefs and understanding of the members' roles can lead to both individuals' feeling of comfort and the effectiveness of the group. Otherwise, when the roles which the group would like the members to take conflict with the members' role expectations, the organization will face disruptions.

In crowdsourcing, the unqualified work and low response rate are products of a worker's role conflict. To the requesters, the role of each participant is "worker". The worker is expected to perform effectively with high quality, take responsibility for their work, and complete the tasks in a timely manner. However, because of the online and individualized working environment, lack of understanding about the task and the requester, and unfamiliarity with the task content, the participants often not perceive themselves as workers in the traditional sense. This is especially the case for mundane tasks due to the boring task content and the lack of technical requirement. In this case, the participants may see themselves as unrelated "passers" who does the tasks just to kill time and earn some payoffs.

When the participants consider themselves as "workers" just as the requesters intended, he/she will hold a different set of role requirements. For the majority of the individuals, their understanding and requirements of the role of worker comes from their working experience in the traditional industries. Based on this origin, the work will require affiliation and feedback from the peers, and acceptance from the group. In other words, the "worker" needs to feel that they are working in a group with some others. The logical framework of the RFM is summarized by Figure 1. By matching workers' role requirements with the requesters' role

expectations, workers could be better motivated to perform mundane tasks. With the RFM, we conduct an empirical study to investigate if the above hypothesis holds.

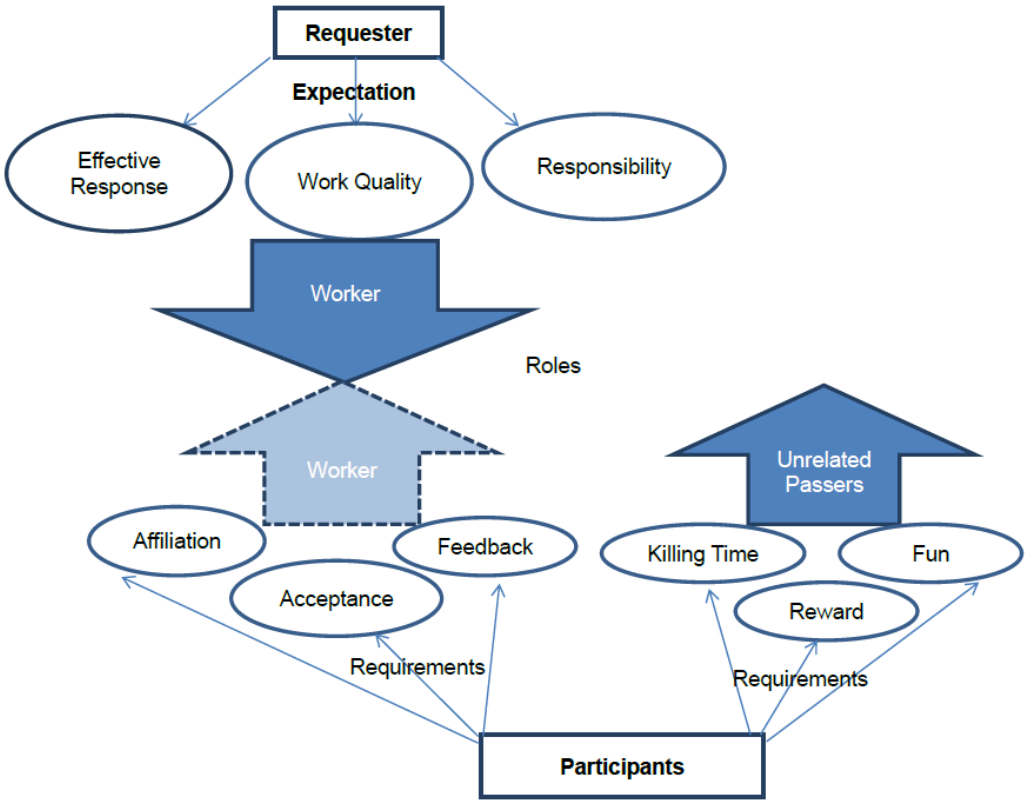

Figure 1 the logical framework of the Role Fulfilment Theory (RFM) for crowdsourcing mundane task

III. EMPIRICAL EVALUATIONS

According to the proposed RFM, we designed a crowd- sourcing open call to ask the participants to label pictures. We released the task on one of the most popular social networks– Weibo (www. weibo.com) – which can be regarded as the Chinese equivalent of Facebook. Notice that not all the role requirements are conscious [27]. Individuals are either not willing to talk about it, or are not aware of the different types of motives. Therefore, studies in this field need to be able to extract these motivations indirectly instead of asking direct questions.

A. Experiment Design and Evaluation Metrics

Our empirical study consists of the following steps:

1) Step 1: Design a mundane crowdsourcing task (Task1). Participants are presented with pictures and asked to label the emotions expressed by the given pictures. The task is simple and requires no specialized skill. The emotional strength shall be expressed on a scale between 0 (none) and 5 (extremely strong). The options for the emotions are Ekman's six basic emotions (i.e. happy, sad, angry, bored, surprised, and excited) [36]. An example of the task is shown in Figure 2. At the end of the task, the participants are also required to report their opinions about the task.

2) Step 2: Design the second task (Task 2). The nature of Task 2A is very similar to Task 1 but with different pictures. To support the further comparisons, we designed another task (Task 2B) with the same content as Task 2A. However the latter one contains a statement at the beginning stating that "This is teamwork and some other participants will proceed based on your answers." Furthermore, we insert several questions, such as "Would you like to be a leader in your team?" into the labelling work to remind them that they are collaborating with others.

3) Step 3: Release Task 1 on Weibo.

4) Step 4: We separated the participants in Task 1 equally and randomly into two Groups A and B. Then, we sent Task 2A to Group A and Task 2B to Group B.

5) Step 5: We spelt out the requirements of "worker" to Group B with the purpose of getting them to feel that they are working in a target oriented group. We used a controlled Weibo ID to play the role of their peers. This ID communicated with the participants in Group B with the information about their process, the complaint about the task, and other feedbacks. During this communication, we attempt to provide a way to satisfy the requirements of affiliation and feedback of peers, and acceptance of the group for participants in Group B.

6) Step 6: Collect the responses to Task 2.

Figure 2 An example task. The task asks a participant to label the presence and strength of various emotions in the picture. Options for the emotions include “happiness”, “sadness”, “anger”, “boredom”, “surprise”, and “excitement”.

To understand whether the participants can satisfy the role expectation of the requester, we need to analyze their response effectiveness, and responsibility. We use a combination of self-report and performance observation to measure these two factors:

1) Response Effectiveness: We measure the response effectiveness by comparing the response rates between Group A and Group B.

2) Responsibility: At the end of each task, the participants need to answer a multiple choice question “What does this work mean to you?” The choices are: “I regard the work as a game”; “I regard the work as a serious task”; “I regard the work as a burden”; “Nothing, I was just killing time”. This answer is used to assess their attitude toward the tasks. Furthermore, we embed a same mistake in both Task 2A and Task 2B. The scale under one of the pictures is 2–7 instead of the normal version of 0–5. If the worker pays enough attention to the questions, they can find this problem easily. We can use the report rate of this error to measure their sense of responsibility.

The better the performance as reflected by these metrics, the stronger the evidence of role fulfilment and motivation among crowdsourcing participants.

B. *Results*

The experiment was run on Weibo for one week. At the end of Task 1, 40 participants returned valid responses. They are all Chinese. Thirty two (80%) of them are female while eight (20%) are male. The age and gender distributions of the participants are shown in Figure 3.

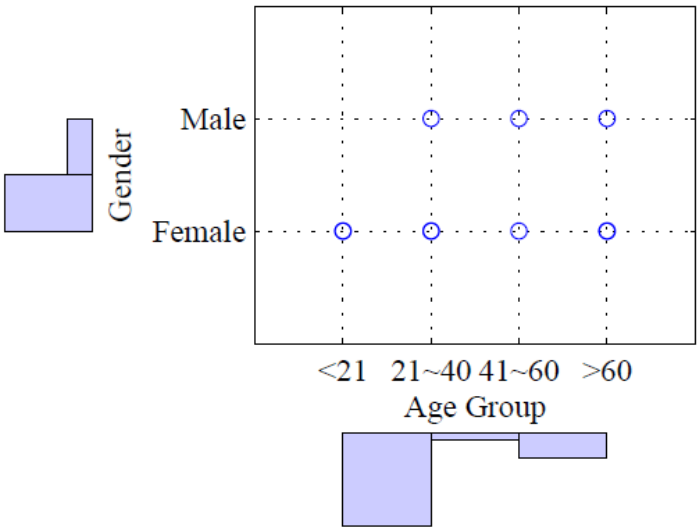

Figure 3 The demographics of the study participants

We then divided the 40 participants randomly into two groups of 20 each, and sent Group A Task 2A and Group B Task 2B. At the end of Task 2, 8 out of the 20 participants in Group A submitted their work. The response rate is 40%. Meanwhile, 16 out of the 20 participants in Group B submitted their work. The response rate from Group B is 80%, which doubles that of Group A. The distribution of the number of responses to Task 2 across different age groups is shown in Figure 4.

To understand the participants' sense of responsibility, we analyze their answers to the survey question "What does this work mean to you?". The distribution of perceptions by participants from different age groups for Task 1, Task 2A, and Task 2B are shown in Figure 5, 6 and 7, respectively. The participants who regard the task as a serious work can be regarded as a statement of responsibility to the group. It can be observed that the percentage of participants

with serious attitude in Task 2A is 12.5%. This number is close to the one in Task 1 (15%). At the same time, more than 56.25% of participants regard Task 2B as serious work. This shows significant evidence that, when the people believe they are playing a certain role in a team, they are more likely to take the mundane crowdsourcing task seriously.

Furthermore, 3 participants in Task 2B reported the mistake purposely embedded in the test question while no one in Task 2A reported it. This result can also support our hypothesis that Group B who believed that they were playing a role in a team working on Task 2 show more sense of responsibility.

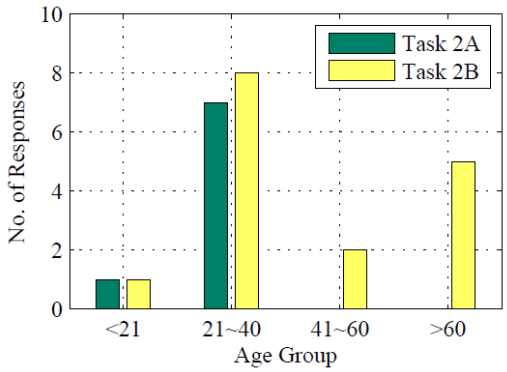

Figure 4 The distribution of responses to Task 2A and 2B by participants

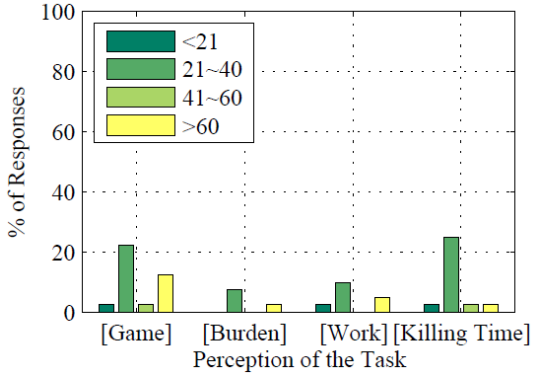

Figure 5 The distribution of perceptions by participants (Task 1).

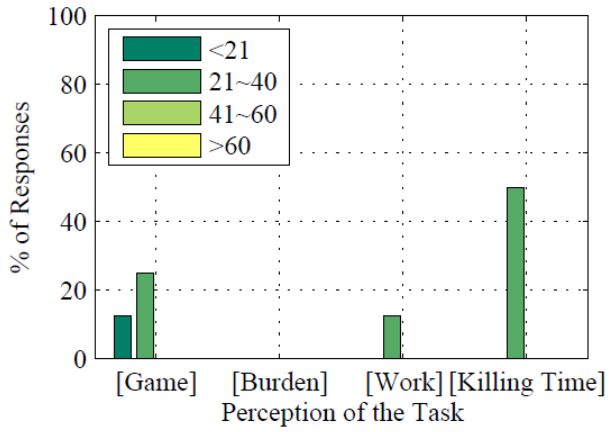

Figure 6 The distribution of perceptions by participants (Task 2A).

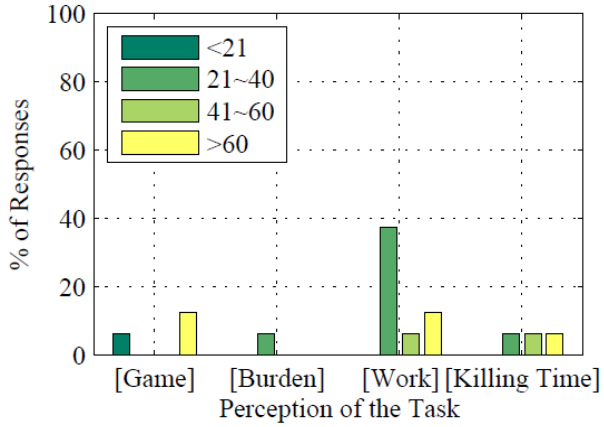

Figure 7 The distribution of perceptions by participants (Task 2B).

C. *Discussions*

By cross-analysis, we found that the RFM reaches is the most effective for people in the age group 21–40. Within this age group, only 13%–15% of participants regard Task 1 or 2A as serious work. For Task 2B, 60% of participants aged 21 to 40 regards the task as serious work. A possible reason behind this observation may be that this age group contains working age people who are most familiar with and keen to teamwork. The environment and mental model from their daily life influence their behaviors in crowdsourcing.

We also found that the RFM did not work well within the younger group under 21 years old. It maybe because that people in this age group tend to be students who are more accustomed to working individually instead of playing significant roles in teams.

V. CONCLUSIONS AND FUTURE WORK

Fulfilling the participants' role requirements as workers can address their role conflict in crowdsourcing. These requirements include affiliation to a group, acceptance by a group, and feedback from the peers and the environment. The harmony between role expectations from the requesters and the role requirements from the participants can motivate and lead to a more productive crowdsourcing environment. Through a real- world empirical study, we demonstrate that by infusing the proposed RFM as a motivation mechanism in crowdsourcing participants' attitude towards the mundane tasks become more conducive for achieving good quality work.

In subsequent research, we proposed to include more variables in the RFM into the empirical study. We need to investigate the influence of personal factors such as age, gender, personality, and working status on the effective of RFM. Findings from such studies may eventual yield computational algorithms to help the crowdsourcing platform and requesters to form productive teams of participants automatically.

RFM could impact the technological foundation of crowd- sourcing platforms as well. In the future, artificial agents could be infused into a crowdsourcing platform to take up the role as the coworkers around the isolate workers to fulfill their role requirements. The agent can be either anthropomorphous or just an intelligent messaging system. We will study the effectiveness of these types of artificial intelligent agents in fulfilling the absent roles in mundane crowdsourcing tasks.

The role fulfilling system may also affect the long term relationship between the participants and the crowdsourcing platform. To understand this aspect, we plan to conduct long term observation experiments in the future.

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References

[1] D. C. Brabham, "Crowdsourcing as a model for problem solving: An introduction and cases," The International Journal of Research into New Media Technologies, vol. 14, no. 1, pp. 75–90, 2008.

[2] H. Yu, Z. Shen, C. Miao and B. An, "Challenges and opportunities for trust management in crowdsourcing," in Proceedings of the IEEE/WIC/ACM International Conference on Intelligent Agent Technology (IAT'12), 2012, pp. 486–493.

[3] R. Silberzahn and E. L. Uhlmann, "Crowdsourced research: Many hands make tight work," Nature, vol. 526, pp. 189–191, 2015.

[4] P. Michelucci and J. L. Dickinson, "The power of crowds," Science, vol.351, no. 6268, pp. 32–33, 2016.

[5] J. Surowiecki, The Wisdom of Crowds. Anchor,2005.

[6] H. Jenkins, Convergence Culture: Where Old and New Media Collide. NYU Press, 2006.

[7] T. Terranova, Network Culture: Politics for the Information Age. Pluto Press, 2004.

[8] H. Yu, C. Miao, B. An, C. Leung, and V. R. Lesser, "A reputation management model for resource constrained trustee agents," in Proceedings of the 23rd International Joint Conference on Artificial Intelligence (IJCAI'13), 2013, pp. 418–424.

[9] H. Yu, C. Miao, B. An, Z. Shen, and C. Leung, "Reputation-aware task allocation for human trustees," in Proceedings of the 13th Inter- national Conference on Autonomous Agents and Multi-Agent Systems (AAMAS'14), 2014, pp. 357–364.

[10] L. Tran-Thanh, T. D. Huynh, A. Rosenfeld, S. D. Ramchurn, and N. R.Jennings, "Budgetfix: Budget limited crowdsourcing for interdependent task allocation with quality guarantees," in Proceedings of the 13th International Conference on Autonomous Agents and Multi-agent Systems (AAMAS'14), 2014, pp. 477–484.

[11] H. Yu, C. Miao, Z. Shen, C. Leung, Y. Chen, and Q. Yang, “Efficient task sub-delegation for crowdsourcing,” in Proceedings of the 29th AAAI Conference on Artificial Intelligence (AAAI-15), 2015, pp. 1305–1311.

[12] H. Yu, C. Miao, Z. Shen, and C. Leung, “Quality and budget aware task allocation for spatial crowdsourcing,” in Proceedings of the 14th Inter- national Conference on Autonomous Agents and Multi-Agent Systems (AAMAS’15), 2015, pp. 1689–1690.

[13] S. Liu, C. Miao, Y. Liu, H. Yu, J. Zhang, and C. Leung, “An incentive mechanism to elicit truthful opinions for crowdsourced multiple choice consensus tasks,” in Proceedings of the 2015 IEEE/WIC/ACM Interna- tional Conference on Web Intelligence and Intelligent Agent Technology (WI-IAT’15), 2015, pp. 96–103.

[14] H. Yu, C. Miao, Z. Shen, J. Lin, C. Leung, and Q. Yang, “Infusing human factors into algorithmic crowdsourcing,” in Proceedings of the 28th Conference on Innovative Applications of Artificial Intelligence (IAAI-16), 2016, pp. 4062–4063.

[15] Z. Pan, H. Yu, C. Miao, and C. Leung, “Efficient collaborative crowd- sourcing,” in Proceedings of the 30th AAAI Conference on Artificial Intelligence (AAAI-16), 2016, pp. 4248–4249.

[16] E. L. Deci and R. M. Ryan, Intrinsic Motivation and Self-Determination in Human Behavior. Springer US, 1985.

[17] N. Kaufmann, T. Schulze, and D. Veit, “More than fun and money. worker motivation in crowdsourcing - a study on mechanical turk,” in Proceedings of the 17th Americas Conference on Information Systems (AMCIS’11), 2011.

[18] D. C. Brabham, “Moving the crowd at threadless: Motivations for participation in a crowdsourcing application,” Information, Communication & Society, vol. 13, no. 8, pp. 1122–1145, 2010.

[19] J. M. Leimeister, M. Huber, U. Bretschneider, and H. Krcmar, "Leveraging crowdsourcing: Activation-supporting components for IT- based ideas competition," Journal of Management Information Systems, vol. 26, no. 1, pp. 197–224, 2009.

[20] B. J. Biddle, "Recent developments in role theory," Annual Review of Sociology, vol. 12, pp. 67–92, 1986.

[21] J. Heiss, "Social roles," in Social Psychology: Sociological Perspectives, M. Rosenberg and R. H. Turner, Eds. Transaction Publishers, 1981, pp. 95–129.

[22] S. Stryker and A. Statham, "Symbolic interaction and role theory," in Handbook of Social Psychology, C. Linzey and E. Aronson, Eds. Transaction Publishers, 1985, ch. 1, pp. 311–378.

[23] C. Gordon and P. Gordon, "Changing roles, goals, and self-conceptions: Process and results in a program for women's employment," in Person- ality, Roles, and Social Behavior, W. Ickes and E. S. Knowles, Eds. Springer New York, 1982, pp. 243–283.

[24] J. Piaget, The Language and Thought of the Child. Psychology Press,1959.

[25] D. C. McClelland, The Achieving Society. Princeton NJ, 1961.

[26] D. C. McClelland, "Business drive and national achievement," Journal of Management Information Systems, vol. 40, pp. 99–112, 1962.

[27] J. B. Miner, Role Motivation Theories. Routledge, 2008.

[28] A. Erez and T. A. Judge, "Relationship of core self-evaluations to goal setting, motivation, and performance," Journal of Applied Psychology, vol. 86, no. 6, pp. 1270–1279, 2001.

[29] P. H. Blaney and R. J. Ganellen, "Hardiness and social support," in Social support: An interactional view, B. R. Sarason, I. G. Sarason, and G. R. Pierce, Eds. Wiley New York, 1990, pp. 297–318.

[30] T. N. Bauer, E. W. Morrison, and R. R. Callister, "Organizational socialization: A review and directions for future research," in Research in Personnel and Human Resource

Management, G. R. Ferris and K. M. Rowland, Eds. JAI Press Inc., 1998, ch. 16, pp. 149–214.

[31] T. Judge, C. Thoreson, J. Bono, and G. Patton, "The job satisfaction– job performance relationship: A qualitative and quantitative review," Psychological Bulletin, vol. 127, pp. 376–407, 2001.

[32] H. Yu, Z. Shen, and B. An, "An adaptive witness selection method for reputation-based trust models," in Proceedings of the 15th International Conference on Principles and Practice of Multi-Agent Systems (PRI- MA'12), 2012, pp. 184–198.

[33] J.-P. Mei, H. Yu, Y. Liu, Z. Shen, and C. Miao, "A social trust model considering trustees' influence," in Proceedings of the 17th International Conference on Principles and Practice of Multi-Agent Systems (PRIMA'14), 2014, pp. 357–364.

[34] Y. Liu, S. Liu, H. Fang, J. Zhang, H. Yu, and C. Miao, "RepRev: Mitigating the negative effects of misreported ratings," in Proceedings of the 28th AAAI Conference on Artificial Intelligence (AAAI-14), 2014, pp. 3124–3125.

[35] A. C. Crouter, "Participative work as an influence on human development," Journal of Applied Developmental Psychology, vol. 5, pp. 71–90, 1984.

[36] P. Ekman, "Basic emotions," in Handbook of Cognition and Emotion, T. Dalgleish and M. Power, Eds. Sussex, UK: John Wiley & Sons,1999, ch. 3, pp. 45–60.

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