Investigating the Impact of 'Emphasis Frames' and Social Loafing on Player Motivation and Performance in a Crowdsourcing Game

Geoff Kaufman
Carnegie Mellon University
Pittsburgh, PA, USA
gfk@cs.cmu.edu

Mary Flanagan and Sukdith Punjasthitkul
Dartmouth College
Hanover, NH USA
{mary.flanagan, sukdith.punjasthitkul}@dartmouth.edu

ABSTRACT
With an increasing reliance on crowdsourcing games as data-gathering tools, it is imperative to understand how to motivate and sustain high levels of voluntary contribution. To this end, the present work directly compared the impact of various "emphasis frames," highlighting distinct intrinsic motivational factors, used to describe an online game in which players provide descriptive metadata "tags" for digitized images. An initial study showed that, compared to frames emphasizing personal enjoyment or altruistic motivations, a frame emphasizing a "growing community of players" solicited significantly fewer contributions. A second study tested the hypothesis that this lower level of contribution resulted from *social loafing* (the tendency to exert less effort in collective tasks in which contributions are anonymous and pooled). Results revealed that, compared to a no-frame control condition, a frame emphasizing the *preponderance* of other players *reduced* contribution levels and game replay likelihood, whereas a frame emphasizing the *scarcity* of fellow players *increased* contribution and replay levels. Various strategies for counteracting social loafing in crowdsourcing contexts are discussed.

Author Keywords
Crowdsourcing games; motivation; engagement; social loafing; metadata; human computation

ACM Classification Keywords
H.5.3. Information interfaces and presentation (e.g., HCI): Miscellaneous; K.8.0. General: Games.

INTRODUCTION
In recent years, crowdsourcing approaches have been increasingly employed as a powerful research and data gathering tool in virtually every field [49], with mounting evidence demonstrating that masses of voluntary users can be efficiently and effectively mobilized via online platforms to generate vast amounts of new knowledge, particularly for domains or institutions in which investment in the same enterprise would not be considered feasible or cost-effective [28, 33, 41, 46]. Moreover, some of the most effective crowdsourcing projects, such as *Foldit* [20], *Citizen Sort* [32], and *Zooniverse* [2, 26], have reported great success with utilizing online games that target specific problems. Given their growing ubiquity in everyday life, digital games offer a logical, effective means to foster a widespread and sustained interest in crowdsourcing endeavors [1, 7, 29, 39].

One domain that has begun to recognize – and reap the benefits of – crowdsourcing (and crowdsourcing *games* in particular) for amassing new information is that of cultural heritage archiving and preservation. As cultural heritage institutions, such as libraries, archives, and museums, have seen the size of their digitized and born-digital media collections grow exponentially over the past two decades without adequate financial resources or staff to transcribe or "tag" (i.e., provide descriptive metadata) these collections, they have increasingly begun to rely on public participation to contribute to those collections [31]. For example, the New York Public Library's "What's on the Menu?" project invited users to assist in the transcription of historical restaurant menus [44], and the Library of Congress's Flickr pilot project enlisted the assistance of users to "tag" (i.e., to describe and categorize) hundreds of images from the library's extensive collection [38]. These projects, and others like them, including *Games with a Purpose* [23, 45, 46] and the National Library of Finland's *DigiTalkoot* media digitization project [5], have reported noteworthy levels of participation and engagement. To illustrate, Sen and colleagues [38] observed that "in 200 years of existence the Library of Congress has applied their expert-maintained taxonomy to 20 million books. In contrast, in just four years, Flickr users have applied their ad hoc tagging vocabulary to over 25 million photographs."

This growing utilization of crowdsourcing platforms is due in part to the increasing resource and budget constraints faced by cultural heritage institutions. Beyond these logistical and financial considerations, however, there is growing recognition of the value of citizen archivists' contributions for bridging the "semantic gap" between experts and laypersons. This is particularly true in the area of metadata crowdsourcing: the amassing of a user-provided "folksonomies" – the vocabularies naturally employed by users to tag the media items they encounter – promises to

CHI'16, May 07-12, 2016, San Jose, CA, USA
 ISBN 978-1-4503-3362-7/16/05…$15.00
DOI: http://dx.doi.org/10.1145/2858036.2858588

increase the accessibility and discoverability of digital media collections worldwide [12, 14, 27, 42, 43].

For crowdsourcing endeavors that rely on the recruitment and mobilization of a corps of motivated volunteers willing to devote their time and energy to contributing or sharing their knowledge, the core issue of user motivation is of paramount importance. To this end, recent work [3, 8, 11, 19, 24, 30] has begun to explore and catalog a host of *intrinsic motivational* factors that drive individuals to participate in voluntary crowdsourcing endeavors, including factors related to (1) personal fulfillment (e.g., fun and enjoyment, the opportunity to learn new knowledge or acquire new skills), (2) altruism (to give one's time to a cause simply in the interest of helping), and (3) social identity (e.g., the opportunity to affiliate oneself with a particular cause or to network with fellow contributors).

The increasing reliance on games as vehicles for crowdsourcing also rests significantly on the assumption that engaging game play itself satisfies a number of core intrinsic motivational needs and drives. Indeed, as noted by Ridge [34]:

"A well-designed crowdsourcing game can be more fun and more productive than other crowdsourcing interfaces. Not only does good game design entice more people to make their first contribution, but games are also designed to motivate on-going participation. Just as games have been called 'happiness engines', crowdsourcing games could be called 'participation engines.'"

In the same vein, examinations of game play motivations through the lens of self-determination theory have shown that enjoyment and engagement in games is predicted by how well play experiences satisfy individuals' basic needs for competence and autonomy [36]. Thus, games that provide players with opportunities to enhance or display their agency and effectance are more likely to promote immersion and higher rates of voluntary future play.

A new direction taken by recent empirical work in the domain of crowdsourcing motivations has begun to test the relative "pull" of various motivational factors and to identify the key contextual or psychological factors that encourage greater rates of participation and higher-quality contributions from users. A particularly promising approach that has emerged in this work is the direct comparison of various strategies for "framing" (i.e., describing or contextualizing) a crowdsourcing activity; for example, providing information about the meaning or significance of a task has been shown to increase the volume of contributions [47] and appealing to user' altruistic motivations enhanced the quality of their contributions [38]. The present research builds on this work by directly comparing the persuasive "pull" and impact of various "emphasis frames" (highlighting specific intrinsic motivational factors) used to describe a crowdsourcing game to potential players. Specifically, two randomized experimental studies tested the impact of several key motivation-related 'emphasis frames' on players of *Zen Tag*, a single-player, open-ended media tagging game [9, 10] that allows players to input descriptive metadata for image, audio, and film/video artifacts through gameplay (see Figure 1). This research aimed to provide a clearer understanding of how emphasizing particular participatory motivations might differentially impact player engagement and performance. The studies to be presented are the first to investigate motivational frames in the context of crowdsourcing *games* and take initial steps toward exploring whether and how highlighting intrinsic factors in addition to the promise of an engaging play opportunity affects player experience and behavior.

Figure 1. Sample game screen from *Zen Tag*.

STUDY 1

An initial, exploratory study compared the efficacy of three "emphasis frames" used to describe the game to potential players who encountered the game's introductory screen on university library computers. These frames emphasized distinct motivators identified by prior research (cited above) as among the most commonly cited by crowdsourcing participants: (1) *personal enjoyment* ("Have fun! Play an image-tagging game!"), (2) *altruism* ("Help the library! Play an image-tagging game!"), and (3) a*dherence to a perceived social norm of participation* ("Join a growing community! Play an image-tagging game!"). The study investigated the relative impact of these game descriptors on individuals' likelihood of play and, among voluntary players, the number of tags contributed during play. Thus, this study aimed to determine if, on average, any of these three basic intrinsic motivators would have more persuasive potential for engaging higher rates of participation and/or higher volumes of contributions.

Methods

Participants

One hundred forty-one visitors to the main library on the campus of a private college in New England participated in the study. For purposes of this study, the browser homepage of a randomly determined subset of public computer kiosks in the library was set to load one of the three emphasis-frame versions of the game (i.e., the personal enjoyment, altruism, and social norm frames) at random with each new launch. In

addition to the randomly assigned framing text, this launch screen provided an overview of game play (explaining that participants would play was a single-player online game that entailed providing short descriptions of media items for libraries and archives) and included a disclaimer to potential participants that the game was part of a research study on campus and that their participation was voluntary. The total number of participants who agreed to participate in each framing condition was used to assess the effect of each frame on overall motivation to play the game, and the number of tags input by participants was used to assess their motivation to contribute data through play.

Materials and Procedure

All participants who agreed to participate were presented with the free-form, single-player media tagging game Zen Tag, which is part of a free and open-source crowdsourcing project [9, 10]. The version of the game used in the study presented every participant with the same series of four images, drawn from the digitized collections of libraries, museums, and archives (see Figure 2). For each image, players were allowed to input as many single-word or short-phrase descriptions of the images' content as they wished. After tagging the four images, players were awarded points in accordance with the number of tags they submitted.

The game instructions directed players to type in single-word descriptions of the four images presented; however, participants were not given a set or minimum number of tags to enter (and, thus, were free to type in as many – or as few – tags as they wished). For each individual game session, all participant-provided tags – along with the specific version of the game that was played (i.e., the framing condition represented by that session) – were saved to a central game server to which only the researchers had access. At the end of the game, participants were taken to a debriefing screen explaining the purposes of the study and requesting that they do not share any information about the study with other library visitors. In addition, participants were asked not to refresh their browser to replay the game.

Results and Discussion

Following a six-week data collection period, analyses of the compiled game data revealed that while the total number of participants who chose to play the game did not significantly differ between the three frame conditions (Ns = 47, 32, and 42, respectively, in the personal enjoyment, altruism, and social norm frame conditions), the average number of tags entered by participants *did*. A one-way analysis of variance (ANOVA) revealed that, on average, players offered significantly *fewer* tags in the social norm frame condition ($M = 6.55$, $SD = 2.27$) than in the personal enjoyment frame condition ($M = 9.64$, $SD = 2.11$) and altruism frame conditions ($M = 9.98$, $SD = 2.41$), $F(2, 139) = 2.87$, $p < .05$ $d = .45$. Thus, while the three frames did not differ in their ability to attract players to participate in game play, emphasizing the participation of an increasing number of fellow players led to significantly *lower* individual levels of input from players.

This finding, at first blush, might be considered surprising given that decades of research in social psychology has shown that highlighting *descriptive norms* regarding the prevalence of particular behavior *increases* adherence to those norms [6, 37]. One explanation for this finding, based on prior work in social psychology, is that the presentation of the social norm regarding crowdsourcing participation may have triggered *social loafing*, the tendency to exert less effort when activities or work is pooled compared to when one is acting alone [18, 22]. Indeed, one key factor that distinguishes crowdsourcing endeavors from other types of collective activities is their typically anonymous, pooled nature. Moreover, because the social norm frame in this study may have led participants to assume that many other players may have already tagged the same images they were presented, participants might have been less inclined to exude effort due to the perception that their contributions may be redundant with those previously offered. As a result, players might have contributed less under the assumption that other participants have (or would) compensate for their lower level of contribution.

The results of Study 1 alone, however, do not provide definitive evidence for this hypothesis. Most importantly, the absence of a no-frame condition (which would provide a baseline for comparison) precludes concluding that the social norm frame necessarily *decreased* average contribution levels. For this reason, a second study was conducted to provide a more direct test of the predicted role of social loafing in decreasing crowdsourced contributions by comparing the effect of game frames intended either to *enhance* or *reduce* social loafing among player.

STUDY 2

To provide more conclusive evidence for the predicted impact of social loafing, Study 2 directly compared the social norm frame used in Study 1 with two new frames that combined the language of the original frame ("Join a growing community! Play an image-tagging game!") with a second sentence stating either (1) that many other players have tagged the same game images ("Be one among hundreds of players to tag this image!") or (2) that only a few other players have tagged the game images ("Be one of the few players among hundreds to tag this image!). Prior work has shown that language similar to that used in the former frame *increases* the likelihood of social loafing, whereas the language in the latter effectively decreases it [19]. In order to provide a baseline for comparison, a no-frame control condition ("Play an image-tagging game!") was added.

Methods

Participants

One hundred sixty-three visitors to the main library website at a large public university in the northeastern United States participated in the study. For purposes of this study, the

library homepage included a button inviting participants to take part in a "game research study." This button, which remained active for the four-week data collection period, was programmed to load one of the four emphasis-frame versions of the game (i.e., the original social norm frame, the social loafing reduction frame, the social loafing reduction frame, or the no-frame control condition) at random.

Materials and Procedure

As in Study 1, the framing language appeared on the introductory game screen, and the same four images used in Study 1 were implemented in the game in Study 2. As an additional indicator of player engagement and motivation, participants in this study were also given the option of replaying *Zen Tag* upon completion of the first game.

Results and Discussion

A one-way ANOVA revealed that compared to participants in the no-frame condition (N = 37, M = 10.17, SD = 2.80), participants in both the original social norm frame condition (N = 41, M = 8.31, SD = 2.51) and the social loafing amplification frame condition (N = 42, M = 7.44, SD = 2.89) offered significantly *fewer* tags through gameplay, whereas participants in the social loafing reduction frame condition offered significantly *more* (N = 43, M = 11.86, SD = 2.43), $F(3, 160) = 2.78$, $p < .04$, $d = .36$. In addition, a chi-square test revealed that a significantly higher proportion of participants in the social loafing reduction frame condition elected to replay the game, compared to participants in the other three frame conditions: specifically, whereas a slight majority (51%) of players in the former condition opted to replay the game, the overwhelming majority of players in all of the three other framing conditions opted to *decline* the opportunity to replay, $\chi^2(N = 163) = 11.3$, $p < .01$, $d = .42$. Furthermore, the pattern of results mirrored those reported for the number of tags, with lower proportions of participants in both the original frame condition (21%) and social loafing amplification condition (17%) opting to replay compared to the proportion in the no-frame control condition (33%).

GENERAL DISCUSSION

Taken together, the findings from both studies demonstrate the potentially powerful impact of emphasizing distinct motivational factors when presenting a game to players and, moreover, illustrate the potentially *detrimental* effects of highlighting descriptive norms for participation in crowdsourcing games. Specifically, highlighting a high volume of fellow contributors to a crowdsourcing endeavor can trigger social loafing, and its concomitant lower levels of effort, particularly in instances when user contributions may be redundant with those of other players. This presents a paradox for the design and deployment of effective crowdsourcing platforms for which redundancy is useful and necessary, as in the verification of prior players' input and the use of "majority rule" as a barometer for the accuracy or usefulness of user-contributed data [13, 21].

How, then, might this apparent "redundancy paradox" be solved? The present research suggests that one effective means of counteracting social loafing in crowdsourcing contexts is to reduce the perceived number of other participants (which itself may reduce the perceived level of potential redundancy of one's contributions). Another effective tactic supported by prior work is highlighting and reinforcing the value of users' unique perspectives for contributing valuable input [4, 14]. Indeed, the technique of reminding users of their uniqueness has been shown to increase levels of contributions to online communities [25]. In addition, the more important an individual finds a task or the more invested he/she is in the outcome of the activity, the more the individual is inclined to invest energy in collective or pooled endeavors, even in cases with a possible redundancy of contribution [4, 15, 17].

LIMITATIONS OF THE PRESENT RESEARCH

The findings must be interpreted with a certain level of caution due to several methodological shortcomings. First, though the implementation of the study in real-world settings and contexts (university library kiosks and websites) lends a high level of ecological validity to the research, this choice also resulted in a lack of control over the recruitment of participants and a lack of oversight over participants' behavior. Thus, for example, we are not able to rule out the possibility that some participants in both studies may have played the game multiple times (and thus be represented more than once in the study samples) or played the games in pairs or groups. Second, the differences in study locations (a small private university in Study 1 and a large public university in Study 2) and methods of recruitment (a web browser landing page in Study 1 and a web page "button" in Study 2) preclude a direct, unequivocal comparison between the results of the two studies. Thus, future work should aim to utilize both laboratory and field studies in multiple locations to test the generalizability of the reported results.

CONCLUSION

Though the present work aimed to enhance our understanding of the relative influence of key intrinsic motivational factors in crowdsourcing games, there remains a host of unanswered questions for future work to address. For example, given that different users might be influenced more by some motivational factors over others, is it possible to match player profiles or "types" to specifically tailored or framed game experiences to maximize motivation and long-term participation? Moreover, do games that satisfy key motivational factors such as competence, autonomy, and relatedness (as suggested by self-determination theory) invite high levels of contribution and engagement irrespective of the framing or highlighting of any additional motivational factors, such as the ones investigated in the present work? Addressing such questions will significantly shape the way that game-based crowdsourcing platforms are designed, deployed, and assessed – and vastly enhance their great potential for reaching and engaging a wide array of potential users.

REFERENCES

1. Janna Anderson and Lee Rainie. 2012. Millennials will benefit and suffer due to their hyperconnected lives. Pew Internet and American Life Project. Retrieved October 16, 2014 from http://www.pewinternet.org/Reports/2012/Hyperconnected-lives/Overview.aspx
2. Kirk D. Borne and Zooniverse Team. 2011. The Zooniverse: A framework for knowledge discovery from citizen science data. In *AGU Fall Meeting Abstracts*, 1: 650.
3. Daren C. Brabham. 2008. Moving the crowd at iStockphoto: The composition of the crowd and motivations for participation in a crowdsourcing application. *First Monday*, 13, 6. Available from http://www.uic.edu/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2159/1969
4. Mary A. Brickner, Stephen G. Harkins, and Thomas M. Ostrom. 1986. Effects of personal involvement: Thought-provoking implications for social loafing. *Journal of Personality and Social Psychology*, 51, 4: 763-769.
5. Otto Chrons and Sami Sundell. 2011. Digitalkoot: Making old archives accessible using crowdsourcing. In *HCOMP 2011: 3rd Human Computation Workshop*. Available from http://cdn.microtask.com/research/Digitalkoot-HCOMP2011- Chrons-Sundell.pdf
6. Robert B. Cialdini, Raymond R. Reno, and Carl A. Kallgren. 1990. A focus theory of normative conduct: recycling the concept of norms to reduce littering in public places. *Journal of Personality and Social Psychology*, 58, 6: 1015-1026.
7. Seth Cooper, Firas Khatib, Adrien Treuille, Janos Barbero, Jeehyung Lee, Michael Beenen, …, and Foldit Players. 2010. Predicting protein structures with a multiplayer online game. *Nature*, 466, 7307: 756-760.
8. Enrique Estellés-Arolas and Fernando González-Ladrón-de-Guevara. 2012. Towards an integrated crowdsourcing definition. *Journal of Information Science*, 38, 2: 189-200.
9. Mary Flanagan and Peter Carini. 2012. How games can help us access and understand archival images. *The American Archivist*, 75, 2: 514-537.
10. Mary Flanagan, Sukdith Punjasthitkul, Max Seidman, Geoff Kaufman, and Peter Carini. 2013 Citizen Archivists at Play: Game Design for Gathering Metadata for Cultural Heritage Institutions. In *Proceedings of DiGRA*. 2013. Available from http://www.digra.org/wp-content/uploads/digital-library/paper_418.compressed.pdf
11. David Geiger, Stefan Seedorf, Thimo Schulze, Robert Nickerson, and Martin Schader. 2011. Managing the Crowd: Towards a Taxonomy of Crowdsourcing Processes. In *Proceedings of the Seventeenth Americas Conference on Information Systems* (AMCIS '11), 1-11.
12. April Grey and Christine R. Hurko. 2012. So you think you're an expert: Keyword searching vs. controlled subject headings. *Codex: The Journal of the Louisiana Chapter of the* ACRL, 1, 4: 15-26.
13. Derek Hansen, Patrick Schone, Douglas Corey, Matthew Reid, and Jay Gehring. 2013. Quality control mechanisms for crowdsourcing: peer review, arbitration, and expertise at familysearch indexing. In *Proceedings of the 2013 Conference on Computer Supported Cooperative Work* (CSCW '13), 649-660. http://dx.doi.org/10.1145/2441776.2441848
14. Heather Hedden, 2008. How semantic tagging increases findability. *EContent,* 31, 8: 38-43.
15. Michael A. Hogg, Dominic Abrams, Sabine Otten, and Steve Hinkle. 2004. The social identity perspective intergroup relations, self-conception, and small groups. *Small Group Research*, 35, 3: 246-276.
16. Stephen G. Harkins and Richard E. Petty. 1982. Effects of task difficulty and task uniqueness on social loafing. *Journal of Personality and Social Psychology*, 43, 6: 1214-1229.
17. Steven J. Karau and Kipling D. Williams. 1993. Social loafing: A meta-analytic review and theoretical integration. *Journal of Personality and Social Psychology*, 65, 4: 681-706.
18. Steven J. Karau and Kipling D. Williams. 1997. The effects of group cohesiveness on social loafing and social compensation. *Group Dynamics: Theory, Research, and Practice*, 1, 2: 156-168.
19. Nicolas Kaufmann, Thimo Schulze, and Daniel Velt. 2011. More than fun and money. Worker motivation in crowdsourcing – A study on Mechanical Turk. In *Proceedings of the Seventeenth Americas Conference on Information Systems* (AMCIS '11), 1-11.
20. Firas Khatib, Seth Cooper, Michael D. Tyka, Kefan Xu, Ilya Makedon, Zoran Popović, David Baker, and Foldit Players. 2011. Algorithm discovery by protein folding game players. *Proceedings of the National Academy of Sciences*, *108*, 47: 18949-18953
21. Chinmay Kulkarni, Richard Socher, Michael S. Bernstein, and Scott R. Klemmer. 2014. Scaling short-answer grading by combining peer assessment with algorithmic scoring. In *Proceedings of the First ACM Conference on Learning @ Scale Conference* (L@S '14), 99-108. http://dx.doi.org/10.1145/2556325.2566238

22. Bibb Latane, Kipling Williams, and Stephen Harkins. 1979. Many hands make light the work: The causes and consequences of social loafing. *Journal of Personality and Social Psychology*, 37, 6: 822-832.
23. Edith Law and Luis von Ahn, 2011. Human computation. *Synthesis Lectures on Artificial Intelligence and Machine Learning*, 5, 3: 1-121.
24. Jan Marco Leimeister, Michael Huber, Ulrich Bretschneider, and Helmut Krcmar. 2009. Leveraging crowdsourcing: activation-supporting components for IT-based ideas competition. *Journal of Management Information Systems*, 26, 1: 197-224.
25. Kimberly Ling, Gerald Beenen, Pamela Ludford, Xioqing Wang, Klarissa Chang, Xin Li, ... and Robert Kraut. 2005. Using social psychology to motivate contributions to online communities. *Journal of Computer-Mediated Communication*, 10:4: 00-00.
26. Chris J. Lintott, Kevin Schawinski, Anze Slosar, Kate Land, Steven Bamford, Daniel Thomas, ... and Jan Vandenberg. 2008. Galaxy Zoo: Morphologies derived from visual inspection of galaxies from the Sloan Digital Sky Survey. *Monthly Notices of the Royal Astronomical Society*, 389, 3: 1179-1189.
27. Adam Mathes. 2004. Folksonomies-cooperative classification and communication through shared metadata. *Computer Mediated Communication* 47: 1-13.
28. Sam Mavandadi, Stoyan Dimitrov, Steve Feng, Frank Yu, Uzair Sikora, Oguzhan Yaglidere, …, and Aydogan Ozcan. 2012. Distributed medical image analysis and diagnosis through crowd-sourced games: A malaria case study. *PloS One*, 7, 5: e37245.
29. Casey Newton. 2012. Survey: iPhone, iPad ownership surging among teenagers. Retrieved October 15, 2014 from http://news.cnet.com/8301-13579_3-57529108-37/survey-iphone-ipad-ownership-surging-among-teenagers/
30. Oded Nov, Ofer Arazy, and David Anderson. 2011. Dusting for science: Motivation and participation of digital citizen science volunteers. In *Proceedings of the 2011 iConference* (iConference '11), 68-74. http://dx.doi.org/10.1145/1940761.1940771
31. Johan Oomen and Lora Aroyo. 2011. Crowdsourcing in the cultural heritage domain: opportunities and challenges. In *Proceedings of the 5th International Conference on Communities and Technologies* (C&T '11), 138-149. http://dx.doi.org/10.1145/2103354.2103373
32. Nathan R. Prestopnik and Kevin Crowston. 2012. Citizen science system assemblages: Understanding the technologies that support crowdsourced science. In *Proceedings of the 2012 iConference* (iConference 2012), 168-176. http://dx.doi.org/10.1145/2132176.2132198
33. Yolanda Rankin, McKenzie McNeal, Marcus W. Shute, and Bruce Gooch. 2008. User centered game design: Evaluating massive multiplayer online role playing games for second language acquisition. In *Proceedings of the 2008 ACM SIGGRAPH Symposium on Video Games*, 43-49. http://dx.doi.org/10.1145/1401843.1401851
34. Mia Ridge. 2011. Museum crowdsourcing games: Improving collections through play. Retrieved October 15, 2014 from: http://www.miaridge.com/projects/Stockholm_museumcrowdsourcinggames_MiaRidge.pdf
35. Jack Rogstadius, Vassilis Kostakos, Aniket Kittur, Boris Smus, Jim Laredo, and Maja Vukovic. 2011. An assessment of intrinsic and extrinsic motivation on task quality in crowdsourcing markets. In *Proceedings of the 5th International AAAI Conference on Weblogs and Social Media*, 321-238.
36. Richard M. Ryan, C. Scott Rigby, and Andrew Przybylski. 2006. The motivational pull of video games: A self-determination theory approach. *Motivation and Emotion*, 30, 4: 344-360.
37. P. Wesley Schultz, Jessica M. Nolan, Robert B. Cialdini, Noah Goldstein, and Vladas Griskevicius. 2007. The constructive, destructive, and reconstructive power of social norms. *Psychological Science*, 18, 5: 429-434.
38. Shilad Sen, F. Maxwell Harper, Adam LaPitz, and John Riedl. 2007. The quest for quality tags. In *Proceedings of the 2007 International ACM Conference on Supporting Group Work* (GROUP '07), 361-370. http://dx.doi.org/10.1145/1316624.1316678
39. Kurt Squire and Seann Dikkers. 2012. Amplifications of learning use of mobile media devices among youth. *Convergence: The International Journal of Research into New Media Technologies*, 18, 4: 445-464.
40. Steven J. J. Tedjamulia, Douglas L. Dean, David R. Olsen, and Conan C. Albrecht. 2005. Motivating content contributions to online communities: Toward a more comprehensive theory. In *Proceedings of the 38th Annual Hawaii International Conference on System Sciences* (HICSS'05), 193b. http://dx.doi.org/10.1109/HICSS.2005.444
41. Steven L. Thorne, Rebecca W. Black, and Julie M. Sykes. 2009. Second language use, socialization, and learning in Internet interest communities and online gaming. *The Modern Language Journal*, 93, s1: 802-821.

42. Jennifer Trant. 2006a. Exploring the potential for social tagging and folksonomy in art museums: Proof of concept. *New Review of Hypermedia and Multimedia*, 12, 1: 83-105.
43. Jennifer Trant. 2006b. Social classification and folksonomy in art museums: Early data from the Steve. Museum tagger prototype. *Advances in Classification Research Online*, 17, 1: 1-30.
44. Ben Vershbow. 2011. Bringing in the crowd: Effects, affects and a few (minor) defects. Paper presented at Make It Work: Improvisations on the Stewardship of Digital Information, Conference of the National Digital Stewardship Alliance.
45. Luis von Ahn and Laura Dabbish. 2004. Labeling images with a computer game. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '04), 319-326. http://dx.doi.org/10.1145/985692.985733
46. Luis von Ahn, Mihir Kedia, and Manuel Blum. 2006. Verbosity: A game for collecting common-sense facts. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '06), 75-78. http://dx.doi.org/10.1145/1124772.1124784
47. Andrea Wiggins and Kevin Crowston. 2011. From conservation to crowdsourcing: A typology of citizen science. In *Proceedings of the 44th Annual Hawaii International Conference on Systems Sciences*, 1-10.
48. Lixiu Yu, Paul André, Aniket Kittur, and Robert Kraut. 2014. A comparison of social, learning, and financial strategies on crowd engagement and output quality. In *Proceedings of the 17th ACM Conference on Computer Supported Cooperative Work & Social Computing*, 967-978. http://dx.doi.org/10.1145/2531602.2531729
49. Man-Ching Yuen, Irwin King, and Kwong-Sak Leung. 2011. A survey of crowdsourcing systems. In *Proceedings of the 3rd IEEE International Conference on Social Computing*, 766-773. http://dx.doi.org/10.1109/PASSAT/SocialCom.2011.203