Key research questions for REINFORCE’s citizen engagement strategy: Bibliographic Research

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We performed a desktop bibliographic research on previous research regarding motivations and engagement of users in Zooniverse projects. The key points have been summarized below. One needs to take into account that the results below refer to users who have participated in at least one Zooniverse project and thus might not fully apply to newcomers in Zooniverse.

Research Question 1:
What motivates citizens overall in an online citizen science project in Zooniverse ?

**Input from Bibliography**
The following categorization helps us identify motivations relevant to the Physics projects that REINFORCE will create. In Zooniverse, a large fraction of classifications are provided by a relatively small number of volunteers across projects. Examining gender differences revealed a clear male bias amongst astronomy projects.

Motivations related to one’s self and to their relationship with the project.

* **Contribution to original scientific research**
* **Discovery, Novelty and competition**: Being the first to see a particular data set or make a serendipitous discovery.
* **Content**: Users may be motivated by the content. E.g Galaxy Zoo🡪 Astronomy, Higgs, Supernovae etc.
* **Learning:** Opportunity to learn more about science in a hands-on way
* **Self-Gratification:** pleasant sensations such as satisfaction derived from doing a good job.
* **Teaching:** Motivation of teachers specifically to use such projects for teaching.
* **Greater Involvement in the project:** Instead of feeling like a small cog in a broader research machine, democratic engagement could give users a stake in the completion of the project. Random access to images from a database is not the same as being handed elements of democratic control or even having users voices heard in the scientific process.
* **Self-efficacy:** The belief that citizens can successfully complete a given action. Classification anxiety is a negative variant of self-efficacy. Citizens want to know if their answers are correct and what a mistake of theirs will cost to the project.
* **Feedback:** on the overall contributions is made available to contributors.

Motivations for relationships with others.

* **Social status:** social associations and status perception by others (extrinsic), or internal satisfaction from one’s social relations (intrinsic).
* **Community:** Being part of a community. According to their levels of engagement, different things might motivate users: reputation mechanisms to recognize and reward high quality contribution, well presented content, status within community, visibility, praise, distinguished role. Not so strong especially in cutting edge science projects.
* **Altruism:** Helping scientists.
* **Having fun:** Doing the activity as a hobby

**Comments/Suggestions:**

- Different types of projects appeal to user samples with different motivation distributions. These distributions may shift over time. Also, different classes of users have different motivation distributions. The motivations presented here derive mostly from users who already use Zooniverse and may be biased towards higher science capital, as there seems to be a correlation between survey replies and user science capital. Motivations of other users such as visually impaired people, students, elderly people, have not been particularly addressed especially in projects like the ones proposed by REINFORCE.

- It seems that contributing to science is the most prominent motivation in REINFORCE style projects and comes mainly from high science capital users.

- We need to identify the primary motivations for people who may join our projects and differentiate between user types: vs age, science capital, maybe gender, experience with Zooniverse, visual impairments. To be identified via the online survey and visionary workshops based on the bibliographical input.

- We need to **recruit** users with messages appealing to said motivations.

- Motivation should be monitored regularly. We need to regularly fill a “motivation histogram” per project and see how it changes vs time. We need to take into account our sample distribution over time as well to normalize our histogram. This will be important in order to monitor the time evolution of our interventions. Perhaps with pop-up messages which ask quick simple questions.

- Our approach should address all kinds of motivations. Potential ways to do that could be:

*Table 1*

|  |  |  |
| --- | --- | --- |
| **Motivation** | **Project launch** | **Project duration** |
| **Contribution to original scientific research** | Highlight the importance of citizens’ involvement in a welcome message.Highlight the science case and the ongoing research of demonstrator in a welcome message/short video. Make the experience as authentic as possible for citizens.If demonstrator uses data being taken at the moment make sure to highlight it.If demonstrator searches for effects in data that have not been analysed yet by a scientific team, make sure to highlight it.Initiate relevant discussion in “talk” | Issue a status update in form of newsletter to inform users of overall progress of the project.Identify success stories of citizens and potential impacts (if any) of their work : e.g: “a user found the X kind of glitch which helped us identify the Y effect etc.” |
| **Discovery, Novelty and competition** | Highlight the novel character of the project in the landing page.Highlight that this is an open field for discovery.Initiate relevant discussion in “talk” | Release data in batches so that users may anticipate them.Infuse data with “golden events” (real or simulated) to motivate them to classify even mundane images.Issue classification challenges with new datasets. |
| **Content** | Motivation for content depends on users’ interest in said subject. Language used should be simple to address a broad range of users, but not oversimplified to estrange most dedicated users. Interdisciplinarity and impact to society should be highlighted on par with science case in the landing page. One could choose messages to be shared with users for users with different profiles : “eg. Student, teacher, citizen or so”Initiate relevant discussion in “talk” | One could pop up messages referring to scientific highlights, technological innovations, historical trivia, impact on society, or other (for example a message every 30 classifications). One could increase complexity of content with increasing nr of classifications. |
| **Learning** | Add initial educational resources (pdf, ppt, video, micro-mooc, links) to accompany project but not necessary to implement it.Design a teaching strategy.Initiate relevant discussion in “talk” for questions and answers. | “Reveal” more educational resources as time goes by.Add short self-assessment quizzes.  |
| **Self-Gratification** |  | Pre-arrange supportive messages for each user after passing a successful threshold of classifications. Recognise citizen’s individual accomplishments in newsletter. (e.g congratulations on the user XX for completing YY classifications, or congratulations to all for reaching our first 1000 classifications etc)Offer badges or other incentives.  |
| **Teaching** | Offer educational scenarios on how to use the proposed demonstrators in the classroom. | Pilot some activities in the classroom.Organise some competitions for students.Οrganise teacher training and citizen training workshops. |
| **Greater involvement in the project** | Organize visionary workshops to identify citizen needs and priorities.Be ready to adapt our projects to citizen needs.Initiate relevant discussion in “talk” | Organise regular webinars (e.g stream via youtube) to present project progress to citizens.Organize regular practice reflection workshops in the framework of WP8 with different groups of citizens.Maybe create a SLACK channel per demonstrator. |
| **Self-efficacy** | Add a ‘skip’ button as an option in each classification. Users might come back later to that. Decide if we want to reveal to citizens the majority logic of Zooniverse projects in order to relieve classification anxiety. | Offer an intercom option in order for citizens to be able to ask questions about problems they face at the moment. If it is too expensive, just add a “facing problems?” button and elaborate further. |
| **Feedback** | Make it clear where and how citizens will receive feedback in the landing page of each demonstrator. | Offer personalized help. E.g via an intercom, or via SLACK channel.Make sure that a scientist from each demonstrator team will be available to answer questions of citizens with high response rate. |
| **Social Status/Community** | Offer citizens opportunity to engage with leading scientists.Promise to offer some sort of token after XXX nr of classifications (e.g a certificate )Establish citizen recognition mechanisms both online and in situ. | Engage leading scientists to send messages to citizens in a regular fashion.Organise events where citizens can participate actively and high profile citizens will be there (community appreciation events, WP8)offer token after XXX classifications or after completion of other challenge.Apply citizen recognition mechanisms (e.g offer further roles in community according to user engagement).Empower citizens to organize their own events. |
| **Altruism** | Appeal to citizens’ affective domain. | Recognize citizens’ contribution and highlight their help if/when it is important. |
| **Having fun** | Make content engaging, presentable, easy to use, perhaps add gamification figures. | Make sure that users keep their interest, learn new things, discover rare events etc. |

### Research Question 2:How can we sustain citizens’ motivation over time?

 **Input from Bibliography:**Motivations change with time, with project type and with user group. Furthermore, increased project participation has impact on users’ learning, and supports the creation of more tightly knit groups of citizens to perform dedicated tasks.

Important factors influencing citizens’ sustained participation in Zooniverse projects.

* **The Zooniverse platform**:
Most Zooniverse projects follow a typical power law curve of classifications per user and display a decay curve of overall classifications vs time. Zooniverse offers a specific project format, great infrastructure, know-how and a broad range of users. However, the inclusion of a citizen science project on a successful citizen science platform website such as the Zooniverse does not guarantee high levels of engagement alone.
* **Communicating with users**:
Sustainability of project engagement relies on projects maintaining continuous communications with their audience.
* **Learning throughout the participation process**:
Learning about scientific topics occurs and is correlated with further engagement in the project. Someone who wants to learn more about science, may watch the tutorials and then not proceed to classifications. Learning occurs even if the motivation to learn is low among participants and if projects were not designed with learning as a primary goal. Learning can be supported through interactions among volunteer and scientist participation in online discussion forums and other communication channels.
Recruited volunteers were more engaged than volunteers who were not recruited.

 **Citizens’ sense of making a difference and actually contributing in science:**In citizen science people want to feel that what they do is important and useful for scientists. They need to know the impact of their own work. To do that they need feedback and recognition. Citizens begin enthusiastically if they like the concept and so on, even if they may not understand why we do it. The same person though, said that she compared the images classified and volunteers participating of yesterday and today and found out that over ten thousand images have been classified since the day before. This makes her contributions seem pitifully tiny. She wants to do it, but thinks: “why bother?” “does her small contribution actually make a difference?”.

* **Strategy of releasing data to users:**Scarcity of data is associated with sustained volunteer engagement with a project.
 “…Supernova Hunters🡪 weekly peaks of activity. scheduled release of new data concurrent with sending newsletter to users & 🡪 highest level of classification inequality among volunteers with primary males >65yrs old”;
 “Volunteers anticipate the release of new project data and are therefore deeply engaged”;
 “.. Scarcity, competition and rapid processing is causing the volunteer community of the Supernova Hunters to be limited to a smaller group of highly dedicated individuals who are willing and able to return to the project upon data release.”
* **Regular interventions vs time:**
According to Rotman’s framework for motivation, motivations are not goal-oriented but change with time and whether or not motivations are recognized at particular trigger points.
* **Users’ length of engagement:**According to O’Brien’s framework it refers to trying to increase length of time of engagement before user disengages.
Length of engagement depends on users’ rhythm of life. Engagement might come in bursts or have seasonal variations. Proposed steps to keep them engaged:
* **Users’ depth of engagement**:
Users with different depth of engagement might require different engagement strategies in order to remain in the project.
From readers who lurk in the background to contributors who contribute in the community to collaborators who regularly contribute, to leaders who participate also in governance. **For readers**: We need **regular update to content**, **well organized interface** etc, universal support to support a diverse group of users.  **For contributors**: **Interface should make it easy to make small contributions** without high investment (e.g logging in) with the ability to easily transition to making much larger and more frequent contributions. Here, **reputation mechanisms become important** (badges??) to recognize and reward high quality contribution.

**For Collaborators: Interface that enables them to work together (SLAK channel??) .** Visible recognition or rewards for collaborators, voting etc. **Possibility to request assistance (intercom??).** They might be motivated by altruism and to build and maintain their status within community.

**For Leaders:** Might be motivated by being awarded higher visibility, praise or special functionality, or become even mentors etc.

* **Users’ Science Capital:**
Different engagement strategies depending on the users’ science capital:

High Science Capital users: somehow related to science and willing to contribute and engage further: Retired scientists, science teachers are some of them.
Low Science Capital Users: They may join a project **just for fun**. Motivated primarily by **enjoyment**. “The low barriers to entry meant that classifications could be done at short notice or even while doing other activities like watching television. ..There was little understanding of what the classifications would be used for, instead users enthusiastically discussed their enjoyment of seeing and collecting pictures of different animals..”

**Comments/Suggestions**

*Table 2 (Strong overlap with aspects of table 1)*

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| --- | --- |
| **Factors influencing users’ sustained participation in a Zooniverse project** | **Comments relevant to the design of REINFORCE** |
| The Zooniverse platform itself |  |
| Communicating with users | Already addressed in Table 1. Offer online communication means (“talk forum”, social media group, SLACK channel, intercom) as well as opportunities for face to face communication (webinars, workshops, events). |
| Learning | Add initial educational resources (pdf, ppt, video, micro-mooc, links) to accompany project but not necessary to implement it.Design a teaching strategy.Initiate relevant discussion in “talk” for questions and answers. |
| Citizens’ sense of making a difference and actually contributing in science | Classification anxiety main reason to abandon a project. It arises because of the tension between how the users think of science and how the Zooniverse projects make them experience it. We will need to maybe explain them how Zooniverse uses the majority logic. Maybe also add a skip button on classification choices to relieve classification anxiety.Personalized feedback users need to be sure of the quality of their work.Scientific outcomes should be publicized.Maybe publish a project digest regularly to display progress.Maybe organize some streaming events in youtube or complement them with live meetigns. Not spam though.Alerts when research papers are published and attributing key findings to an individual.Commited users can act as role models and mentors. We need them.Citizens may be intimidated by scientists. Communication needs to increase.Add feedback mechanisms (e.g an intercom?) and maybe a more live community option (e.g SLAK channel?). Feedback on individual work should be immediate, after 1 or several tasks and synchronized with individual’s participation patterns. Lack of feedback may lead to disengagement. |
| Strategy of releasing data to users | A project with a large, pre-existing data set could partition their subjects for gradual release, generating an artificial scarcity to encourage more frequent volunteer interaction. We could combine both high publicity to increase our overall reach and a supernova hunters-like format ( returning users due to periodic release of data) to achieve deeper engagement vs time. However we need to take into account that this pattern might induce higher competition which will result in creating a tight dedicated community to contribute, excluding individuals who are unable to offer a regular time commitment. We need to dampen the ill effects of data scarcity to increase inclusiveness, but maintain scarcity in order to keep the feeling of competition and real time contribution.People will be interested in finding “exotic events”:People in click only projects like to search for rare “gold” events to classify. Maybe we can infuse them in our database along with more boring images. |
| Regular interventions vs time | Maybe organize some “ Classification Sprints”: Short term challenges to classify, e.g 250 imagesMaybe correlate with marketing campaignCorrelate with participatory events |
| Users’ length of engagement | Make the platform “addictive” for example through the timing of classifications (they may come in quick succession).Make the interface very presentable with nice graphics and so on.Add reminders to participate without spamming. Tasks should be optimized to fit into busy schedules.Short atomized tasks, not much time, not much commitmentTake advantage of dead time (e.g in train) 🡪 **create mobile friendly projects**.Make it easy for citizens to return, while still feeling like valued participants. |
| Users’ depth of engagement | Tasks should be able to satisfy all levels of users. We could use a multilevel approach here: Identify different user profiles and organize different/targeted actions: “journeys” and adjust compexity of tasks accordingly. |
| Users’ science capital | Make sure that the language and content will apply to users of different science capital. |

**References**

1. H.Spiers et.al: “Everyone counts? Design considerations in online citizen science”, JCOM 18(01)(2019)A04
2. https://en.wikipedia.org/wiki/Universal\_usability
3. 3. Woodcock, J., Greenhill, A., Holmes, K., Graham, G., Cox, J., Oh, E. Y., and Masters, K. (2017) ‘Crowdsourcing Citizen Science: Exploring the Tensions Between Paid Professionals and Users’, Journal of Peer Production
4. 4.M.J.Raddick et.al: “Galaxy Zoo: Motivations of Citizen Scientists”
5. 5. V.Homsy: “Engagement in the Zooniverse” (MSc Thesis Project)
6. 6. A. Barr et.al: “ Citizen Scientist Community engagement with the HiggsHunters project at the Large Hadron Collider”.
7. 7.T.K. Lee et. al, Appealing to different motivations in a message to recruit citizen scientists: results of a field experiment
8. Trouille, L., Lintott, C. J., & Fortson, L. F. (2019). Citizen science frontiers: Efficiency, engagement, and serendipitous discovery with human-machine systems. Proceedings of the National Academy of Sciences of the United States of America, 116(6), 1902–1909.