Modelling Commons-based Peer Production: The 'Commoners Framework'

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1 Introduction

This extended abstract introduces a novel conceptual framework - the 'Commoners Framework' - to be used when conceptualising and modelling the behaviour of commons-based peer production (CBPP) communities. The framework is currently being finalised, implemented in NetLogo, and tested on a case study; this process will be completed by the time of SSC2017. The current version of the NetLogo model, still in development, can be accessed at https://github.com/P2Pvalue/CommonersFramework.

The Commoners Framework can be used to represent the behaviour and operation of a wide-range of CBPP communities, and similar organisations (such as those that make use of volunteers). It represents the processes behind individuals' decisions to contribute to, enter or exit, or make 'friends' in, communities. Through this representation of individuals' behaviour, the framework aims to account for patterns of behaviour observed at the community level. For example, the distribution of participation rates among individuals, which often follows a power law distribution, also known as the '1-9-90 rule' (Crowston et al 2006; Howison et al 2006; Arazy et al 2015); where 1% of the community – the core members – perform most of the work, 9% of the community – the contributors – occasionally contribute and 90% of the community – the users or consumers - use the commons without directly contributing to produce it. The framework was developed based on recent empirical findings (Morell et al 2016; Arvidsson et al 2016) on behaviour in a wide variety of communities and was refined using the structural rigour imposed when building an agent-based model (ABM).

At SSC2017 we intend to present (i) the framework, (ii) its implementation in NetLogo, and (iii) its use, exemplified using a case study from the EU FP7 P2PValue project. P2PValue developed 'TEEM', a software platform designed to support collaborative working and the operation and development of CBPP communities. We are building an ABM utilising the framework to simulate the potential effects of TEEM on CBPP communities. We believe this use of a conceptual framework in an ABM, to explore the potential effects of a software tool such as TEEM, fits well with the theme of 'Social Simulation for a Digital Society' at SSC2017. Finally, other potential uses of the framework will be discussed, such as in other simulation and modelling efforts, in participatory and qualitative research, and in quantitative social research.

2 Commons-based peer production

This form of productive organisation was orginally identified in the 1980s by Powell (1987). Since named 'Commons-based peer production' (CBPP) (Benkler 2002; 2006), it differs from traditional forms and structures of production, such as firms and markets. Instead, individuals collaborate in a relatively non-hierarchical manner, and contribute their time and energy for free, to produce goods and services that they do not charge for (i.e, commons resources). Often cited examples include Wikipedia, and Free/Libre and Open Source Software (FLOSS) projects such as GNU/Linux or Modzilla Firefox.

CBPP, typically reliant on the internet to aid coordination of efforts, is expanding from its initial popularity in FLOSS communities, to be used in areas such as citizen science, product design and open data (Salcedo et al 2014). Maker spaces such as Fab Lab London (fablabs.io/fablablondon), and WeMake (wemake.cc/), and farming groups such as Rural Hub (ruralhub.it/en/) are all examples of CBPP and exemplify the breadth of domains, and types, of communities.

Previous research has focussed on three elements of CBPP (or FLOSS, and specifically Wikipedia, as these have dominated the field) (Salcedo et al 2014): motivation for contributions (i.e. the individual), governance (i.e. the group), and competitive dynamics (i.e. relation to external groups such as firms) (von

Krogh and von Hippel 2006; Rozas and Gilbert 2015). Within these streams attention has been on describing in detail individual cases of CBPP, or comparisons of similar communities (Salcedo et al 2014); for example, Wikipedia (e.g. Kittur et al 2007; O'Neil 2009; Reagle 2010; Viégas et al 2007). The literature has tended to be based on ethnographic and qualitative accounts of CBPP, giving a deep understanding of how communities govern themselves, and why people are motivated to contribute to them (e.g., Kelty 2008; Coleman 2012). Recent efforts have been made (e.g. Salcedo et al 2014) to broaden understanding, and map out the wider 'universe' of CBPP. Examples of non-qualitative approaches being used, include traditional social science statistics (Schweik and English 2013) and network analysis (Huang et al 2011; Howison et al 2006).

There is value in building generalisable understandings and theoretical frameworks of CBPP and similar communities. These understandings will help community organisers and policy makers better support communities, structure and design their operation, and improve their sustainability. The formalisation of the knowledge produced by qualitative social research using formal models enables its application to different communities, studying their characteristics and behaviour in an experimental and comparative manner. Examples of models developed in this area include: explorations of what makes communities successful (Radtke et al 2009); attempts to reproduce observed patterns in communities (Wagstrom et al 2005; Gao et al 2005), and; participation and conflict in communities – specifically Wikipedia 'type' communities (Ciampaglia 2011; Iniquez et al 2014). None of these studies provide a holistic framework for understanding participation (i.e. contributions, exit and entry, and making 'friends') in a wide range of communities. They either focus on a specific type of community, on competition between communities, or on one narrow aspect of participation. The Commoners Framework aims to fill this gap in the literature.

3 The Commoners Framework

The framework is currently being finalised and implemented in NetLogo, however, Figure 1 outlines the overall logic of the framework. When finished, the framework will be presented using diagrams like this, alongside text descriptions, and tables connecting activities (e.g. making friends) with factors.

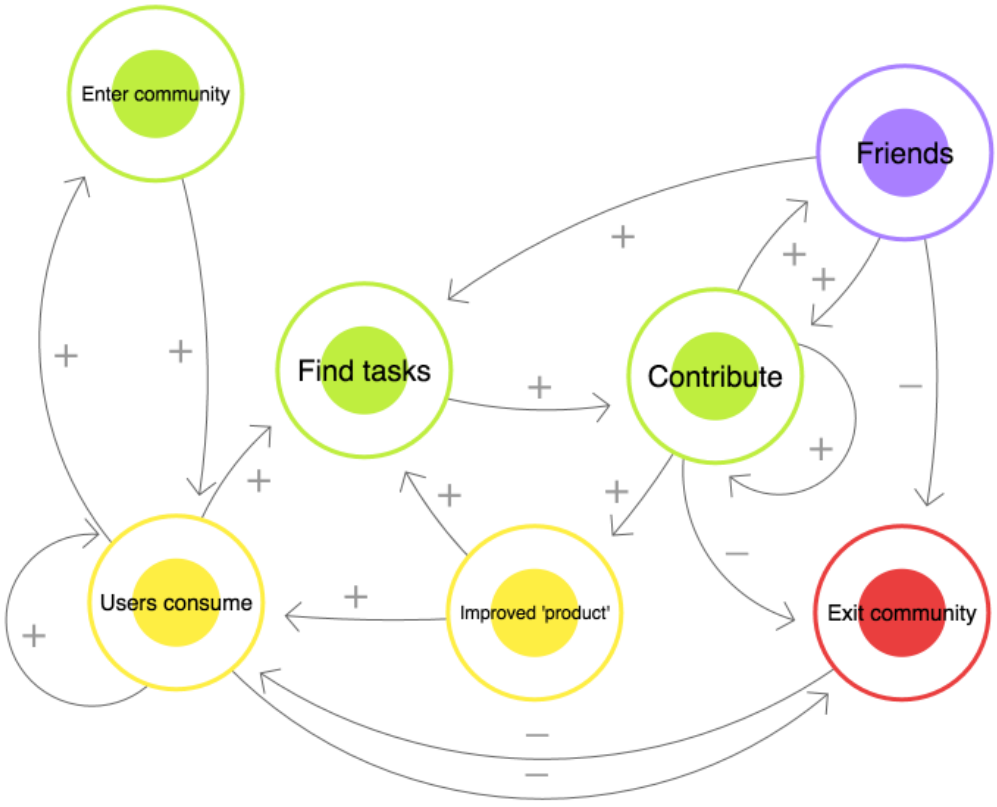

Figure 1: Commoners Framework Logic (Drawn in Loopy - ncase.me/loopy/)

The focus of the framework are Commoners. Commoners is the name given to individuals in a community – both those that contribute, and those that consume the product(s) of a community. The core productive activity of any Commoner is to find tasks in the community, and contribute to them. Their ability to, and likelihood of, contributing will depend on their interests (a Commoner and task parameter), skill types (a

Commoner and task parameter), and past activity. Commoners may stay in a community, only consuming but not contributing, if no tasks meet their interest or skills. Commoners may make 'friends' with others contributing to the same tasks. Having friends increases the chance of finding tasks and contributing. Friends may be lost over time with a certain probability. Commoners' probability of leaving a community decreases as they make more contributions and have more friends. Contributions improve the quality, or number, of products in the community. More consumption of products increases the probability of existing consumers of these products continuing to consume them, and new Commoners entering the community.

The implementation of the framework in NetLogo, including the *.nlogo* file, and a description of the model can be found at https://github.com/P2Pvalue/CommonersFramework. This will be updated as development continues, but readers can find the current version using the history function in Github.

4 Using the Framework

The example we will present at SSC2017 of using the framework will be on simulating the use of TEEM in CBPP communities. However, we will also present next steps, guidelines, and resources for researchers thinking of using the framework in other contexts – something we wish to encourage. We envisage these uses may include: (i) modelling other CBPP communities, and other communities where voluntary contributions are important; (ii) participatory and qualitative research, where the framework can be used to inform the development of topic guides and analytical approaches; and finally, (iii) quantitative social research, where the framework can be used to identify topics and formats for survey questions.

5 Next steps

Over the next five and half months, the framework's implementation in NetLogo will be finalised and then tested against real world data on a selection of different communities. Longitudinal data on the number of contributions, peoples' entry and exit, and social networks in communities has already been collected on a range of online communities from Github. Data is also being collected for other types of communities, notably data from collaboration tools such as Trello used by offline communities (i.e. those that meet and work together in person, rather than online only). Data may also be collected from Wikidata.org. These different datasets will be used to paramterise and validate the framework as implemented in an ABM. Once the framework has successfully reproduced a range of communities' past histories, the ABM will then be run for each community with the TEEM platform being introduced during the communities' history. This introduction of the platform will be operationalised via the adjustment of some of the rules and parameters of the framework's implementation in NetLogo, changing how Commoners interact with one another and make contributions. The resulting changes in communities' histories (measured by outputs such as number of contributions, entry and exit, and social networks) will be used to make tentative suggestions about the impact the platform may have on communities.

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