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Marco A. Janssen
Arizona State University, USA

Nicholas Hohman
Center for the Study of Institutional Diversity, Arizona State University, Tempe, AZ 85287-2402, USA

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Addressing Global Sustainability Challenges from the Bottom Up: The Role of Information Feedback

Marco A. Janssen[a], Nicholas Hohman[b]

[a]Center for the Study of Institutional Diversity, Arizona State University, Tempe, AZ 85287-2402, USA;
[b]Center for the Study of Institutional Diversity, Arizona State University, Tempe, AZ 85287-2402, USA;

Corresponding author:
Marco A. Janssen
School of Human Evolution and Social Change
Center for the Study of Institutional Diversity
Arizona State University
PO Box 872402
Tempe, AZ 85287-2402, USA
Marco.Janssen@asu.edu

Abstract:
Global sustainable use of natural resources confronts our society as a collective action problem at an unprecedented scale. Past research has provided insights into the attributes of local social-ecological systems that enable effective self-governance. In this note we discuss possible mechanisms to scale up those community level insights to a larger scale. We do this by combining insights from social-psychology on the role of information feedback with the increasing availability of information technology. By making use of tailored social feedback to individuals in social networks we may be able to scale up the strengths of self-governance at the community level to address global sustainability challenges from the bottom up.

Keywords:
Collective Action, Information, Feedback, Social Influence, Social Networks

Addressing global sustainability challenges from the bottom up: The role of information feedback*

Nicholas Hohman and Marco A. Janssen†
Center for the Study of Institutional Diversity
Arizona State University

Introduction

Our global society faces unprecedented challenges if we are to achieve a sustainable future. The scale of human impacts on the environment may lead to abrupt global environmental changes (Rockström et al., 2009). For example, climate change has been a topic of international policy negotiations since the early 1990s. At that time scientific studies showed that an immediate stabilization and future reduction of the global greenhouse gas emissions was needed to avoid an average temperature increase of 2 degrees Celsius (Hammitt et al., 1992). Despite various global treaties, the global emissions of fossil fuel–related CO_2 have increased more than 45 percent‡. Carbon tax policies have been found to be difficult to get approved and implemented (Rabe and Borick, 2012).

Addressing global scale problems from the top-down has not been effective. However, decades of research have shown that collective action problems can be solved at the community level (Ostrom, 1990). Addressing a global scale problem like climate change requires actions at different levels of scales, including bottom-up initiatives, in a polycentric system (Ostrom, 2010). In this note we emphasize the opportunities in bottom-up processes, but recognize that initiatives at all scales are needed to address global scale problems.

The study of self-governance of the commons has mainly focused on small-scale communities (Ostrom, 1990). Studies in small-scale communities and in controlled experiments (Poteete et al. 2010) show that the strength of groups in overcoming collective action problems lie in whether or not participants can communicate, have input in the creation of the rules and if institutional arrangements are monitored and enforced. In small-scale communities, participants have relatively low costs in deriving information to determine the trustworthiness of others. This is not the case at a larger scale.

Despite the strengths of communities, the low hanging fruit of addressing large-scale problems are unaddressed at that level. For example, research shows that national carbon emissions could be reduced by more than 7 percent without new regulations, technology or infrastructure if people took advantage of existing opportunities, such as carpooling, driving behavior, insulation, turning off standby appliances, improving tire pressure, this can already make a big difference (Dietz et al. 2009).

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† Corresponding author: Marco.Janssen@asu.edu

‡ 1990, 21.6 Trillion Metric Tons CO_2 and 2009 31.8 Trillion Metric Ton CO_2 according to official statistics (www.eia.gov)

If there is such low hanging fruit, then why don't individuals make use of them? To understand this we have to look into the factors that influence individual decision making. A focus on individuals and providing factual information alone is often not effective (e.g., McKenzie-Mohr, 2000). Besides factual information, we have to pay attention to the individual motivations and the social influence on behavior (Olli et al., 2001; Heiskanen et al., 2010). From this perspective, the problem of scaling up insights from small-scale experiments depends on our ability to provide the necessary information including the factual consequences and social context of individual behavior.

In this note an attempt is made to blend insights from collective action research and psychological research on behavioral changes, especially the role of information feedback in behavioral change. We expect that the use of social media technology as a way to provide targeted feedback may facilitate such a scaling up.

Collective action and the Commons

Hardin (1968) concluded that overuse of common resources was inevitable since users would never self-organize. Creating private property rights or regulation by an external authority was proposed as the only possible interventions to avoid overharvesting of the commons.

Ostrom (1990) performed a meta-analysis of case studies on natural resource management. Many communities are able to self-govern their common resources without interventions. Ostrom found that a number of characteristics of institutional arrangements are common in successful cases, such as clearly defined boundary rules, conflict resolution mechanisms, monitoring, graduated sanctioning and the ability of users to participate in collective decision making.

The accumulation of studies using various methods to study collective action and the commons led Poteete et al. (2010) to present a framework of collective action and the commons where individuals have imperfect knowledge, learn and adopt norms, and are influenced by micro-situational and broader contextual variables. Especially important is the notion of other-regarding preferences and conditional cooperation. The majority of participants in controlled experiments are classified as conditional cooperators (Fischbacher et al., 2001). They will cooperate in collective action situations if they expect others will do so too. Smaller fractions of the participant population are identified as egoists or unconditional cooperators. In heterogeneous groups conditional cooperators will reduce their level of contributions to the public good if they see that there are others who do not invest the same level as they do.

The observation that most participants are conditional cooperators explains why communication is so important. Communication enables participants to signal their intensions and trustworthiness. Not only do participants cooperate if they expect that others will, they also value and receive emotional benefits if others receive good earnings too and that the earnings are fairly distributed among the participants.

The work of Ostrom focuses on small communities. There is a convincing amount of evidence that small communities are able to overcome the tragedy of the commons in the right context. They have the ability to develop and maintain trust relationships and monitor the behavior of the population. Larger groups will make it more difficult to evaluate the trustworthiness of all other participants and make it easier to free ride on

actions of others. The information that one can derive regarding the reputation of others can have an important influence on decision making.

Experimental research shows that more detailed information about the decisions of other increases cooperation (Chaudhuri and Paichayontvijit, 2006; de Oleveira et al., 2009). When participants can chose partners based on the decisions they've made in previous rounds, we see higher levels of cooperation (Page et al. 2005; Croson et al., 2006). Sorting of participants can increase homogeneity of the behavioral types in groups. Conditional cooperators will remain to cooperate and the level of cooperation will increase in the population as a whole.

The bottom line is that information about the other participants affects the ability to estimate the distribution of types of other within the group. More information typically increases the level of cooperation.

New information technologies reduce the costs of communication with a larger number of people who are not necessarily physically co-located. What will be the implications for collective action situations? Since there has been a limited focus on the potential impacts of information technology on the governance of shared resources, we will explore different areas of research to identify such potential impacts. New technologies can deliver accurate information on the consequences of decisions made by all participants. Cheap communication tools may also lead to an information overload. These different possible effects may lead conditional cooperators to make different decisions in order to contribute to the public good.

Personal feedback

Feedback occurs when we provide information about someone or some group's performance so that they may understand the effect of their actions and adjust them to some desired level (Kluger and DeNisi, 1996), such as by displaying current energy use to users. Some general lessons on effectiveness of feedback are known. First, feedback must be specific. Early studies that examined home energy-use often achieved no significant results and provided only aggregate energy use data (Seligman and Darley, 1977; Hutton et al., 1986). McCalley and Midden (2002) suggest that these early failures were the result, among other things, of not examining a specific task and providing participants too little data "of precisely how much energy is being used for various purposes" (p. 590). Grønhøj and Thøgersen (2010) provided electricity consumption feedback "broken down according to end-uses" to families and found significant reductions in energy use.

Second, feedback needs to be provided continuously (McCalley and Midden, 2002). McClelland and Cook (1979) and Van Houwelingen and Van Raaij (1989) found that when feedback is provided at various frequencies the greatest reductions of electricity occur at the most rapid feedback frequencies.

Third, feedback is more effective if goals are set. Locke and Latham (2002) define two types of goals, do-your-best and specific goals. Do-your-best type goals yield lesser performances because they have no external referent. Explicit, specific, and relatively difficult goals, lead to the most effort. Therefore a goal like "I will reduce my energy use by 20%" will yield better results than "I will use less energy."

Goals can be chosen for the user or by the user. Setting your own goals seems to be most effective (McCalley and Midden, 2002), but more socially oriented people may

respond better to assigned goals (Wright and Kacmar, 1994; Kluger and Denisi, 1996). If goals are set they can be shared publicly or kept private. Research shows conflicting findings of the positive effect of public sharing of goals (Hollenbeck et al., 1989) or keeping goals private (Gollwitzer et al., 2009).

Social Feedback

To improve the effect of feedback, inclusion on information on the actions of others is important. One can signal social norms from the community. Such comparative feedback provides individual performance relative to the performance of others (Schultz et al. 2007; Abrahamse et al., 2005).

Croson and Shang (2008) study donations to charity and use social information about the level of donations of others and self in the past. Those who donated above average in the past reduced their contributions, while those below the average increased their contributions. The net effect was a decrease of donations due to providing social information. A similar finding was found by providing social feedback on energy bills in a study in households in California (Schulz et al., 2007). However, when those who used less energy than average also got a smiley face - ☺ - those households stayed at a low energy use level. Those who used more than average got the icon ☹ alongside the factual information, and this led to a faster decline in energy use. The lesson from these studies is that even small details in how social feedback is provided matters.

The feedback system from Schultz et al. (2007) has since been implemented by OPOWER, a customer engagement platform for the utility industry. OPOWER works with utility companies to send customers information on how they are doing compared to the neighbors. Allcott (2011) performed an analysis of about 600,000 households, half of which derived the targeted feedback on their energy bills. The energy savings of about 2% is modest but statistically significant.

In providing social information it is important to provide information on others who are comparable, such student peers (Perkins, 2002) other hotel guests (Goldstein et al., 2008) neighbors (Gerber et al., 1990) and Facebook friends (Bond et al., 2012). In comparing, people prefer to compare to aspirational peers, a slightly upward comparison. This can lead to higher levels of motivation (Sun and Vassileva, 2006).

In order to avoid experimental interventions having only a temporary effect, it will be important to build social networks to reinforce the new habits (Staats et al., 2004). This reinforces the findings on the abilities of communities to solve collective action problems (Ostrom, 1990). A supportive social environment promotes sustainable change (De Young, 1996; Geller, 2002). The community can relate to physical communities (Hopper and Nielsen, 1991), or friends and kin (Weenig and Midden, 1991). The increasing connectivity in social networks makes it possible to create virtual communities, such as the Stepgreen website where users can self-report activities that lead to sustainable behavior and share carbon footprints via Facebook and Twitter (Mankoff et al., 2009).

Discussion

One of the challenges in solving large-scale collective action problems is that policies designed for this level do not relate to individual motivation and knowledge. Ostrom (2010) argues that a polycentric approach is needed for climate change policy where

activities that contribute to emissions reductions can be stimulated by incentives at the local level fitting local motivations such as improved health by cycling to work and smog reduction. The importance of Ostrom's argument is to fit the challenge to the motivations of the individual.

In a world where people are increasingly connected by ties in social network sites instead of spatial proximity and kinship, and where activities are increasingly monitored in real-time and spatially located, there might be opportunities to aim global change policies to individual motivations and social contexts.

The development of technology that allows for rapid delivery of information makes it possible to derive real-time accurate feedback on the consequences of our decisions and the decisions of others. Examples include smart energy meters (e.g. Mattern et al., 2010), smart water meters (Hauber-Davidson and Idris, 2006), tracking locations (e.g., Froehlich et al., 2009), and remote sensing of heat loss (e.g. Hay et al. 2011).

Increasingly people participate in various online social networks, which make it possible to share and compare information, and connect people with similar interests. This provides opportunities to scale up the strengths of self-governance as is observed in communities. Various web-based and mobile app-based projects have been initiated related to carbon footprints (stepgreen[§]), energy use (OPOWER[**], tendril energize[††], energywiz[‡‡], peoplepower[§§]), transport (ubigreen[***]), competitive sustainability challenges (ecochallenge[†††]), and water use (999 bottles[‡‡‡]). Except for OPOWER (Allcott, 2011), no systematic analysis of the effectiveness of these recent technologies has been made. Research needs to be done to investigate how these applications are adopted, used and lead to a behavioral change. Some basic questions we can ask are: What kind of information feedback is most effective? How do we measure the resulting behavioral change and the effect of that behavior change?

We are aware of various challenges with the use of social media technology. Although individuals share a lot of their private activities with the public through social media networks, the idea of tracking behaviors of individuals might be a frightening infringement on privacy. Probably the most challenging aspect would be to stimulate the use of the new technologies. Do we need a gamefication of technologies to keep people involved (McGonigal, 2011)? Some interesting examples exist, for example the car insurance company Progressive[§§§] allows customers to join a voluntary program where a device is installed in your car to track your driving style. One can save a significant amount on their car insurance with proper driving style.

We started our note with the observation that international negotiations on climate change led to ambitious treaties, but lacked a significant impact on the trends of emissions. Yet, there are opportunities emerging due to low-cost monitoring devices that

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[§] http://www.stepgreen.org/ accessed August 22, 2012
[**] http://opower.com/ accessed August 22, 2012
[††] http://www.tendrilinc.com/ accessed August 22, 2012
[‡‡] http://www.urbaninformatics.net/projects/energy/ accessed August 22, 2012
[§§] http://www.peoplepowerco.com/ accessed August 22, 2012
[***] http://dub.washington.edu/projects/ubigreen accessed August 22, 2012
[†††] http://eco-challenge.eu/en/ accessed August 22, 2012
[‡‡‡] http://999bottles.com/ accessed August 22, 2012
[§§§] http://www.progressive.com/auto/snapshot.aspx accessed August 22, 2012

provide personalized feedback to others. Various initiatives are underway, especially related to energy use, to implement such tools in practice. Those applications are promising and need to be studied in detail to enhance our understanding of how to scale up the power of self-governance to address global change challenges.

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