COOPERATING ON NATURAL RESOURCE COMMUNITIES: HOW INFORMATION INFRASTRUCTURES INFLUENCE BELIEFS FORMATION

Alexandra Valencia Zapata[1], Erik Reimer Larsen[1], Dorthe Døjbak Håkonsson[1], Kyosuke Tanaka[1]

[1]Department of Management, Fuglesangs Allé 4,DK-8210 Aarhus V, Denmark

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1 INTRODUCTION

Building upon prior research [1], we know that cooperation [2], or shared values, may be insufficient for fostering collaboration around natural resource commons; actors also need information that enables them to coordinate their actions. Specifically, when actors are provided with an infrastructure that enables shared situational awareness (specifically pertaining to the state of the commons, as well as others' likely future actions), they are generally better able to organize consumption in a sustainable fashion.

What remains unclear is how, at the individual level, actors experiencing suppressed demand for a common good, such as electricity in an off-grid renewable energy system in a remote area, adjust their beliefs (i.e. knowledge, values, and expectations [3,4]) about cooperation in response to specific types of information.

2 MATERIAL AND METHODS

To examine the effect of information infrastructures on the evolution of beliefs, we conducted two studies in Colombia, including a total of 416 participants: (1) a laboratory experiment with university undergraduates and (2) a lab-in-the-field experiment with residents of a geographically isolated island community. Both studies used an electricity resource commons game, where a four-person community group shared the electricity during the night and independently decided how much electricity to request for their household, without any communication, based on their electricity needs and the total electricity available to all members. If everyone acted cautiously, the electricity would suffice for all essential functions. However, over-consumption by one or more members resulted in shortages.

The game lasted 17 rounds (nights). At the end of each round, participants received feedback through one of two experimental conditions to which they were randomly assigned: one providing aggregated information about others' decisions (i.e, total requested electricity), while the other offering disaggregated information (i.e., detailed information about the others individual request for electricity). These two feedback conditions enabled us to compare, using panel regression models, how different information infrastructures shape beliefs about others' behavior and, in turn, one's cooperative behavior over time.

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3 RESULTS

In both the laboratory and lab-in-the-field experiments, participants who received disaggregated feedback were more strongly influenced by their prior beliefs about others' consumption than those who received aggregated feedback. However, disaggregated feedback led to less cooperative belief updating. Given equivalent prior beliefs, participants in the disaggregated condition consistently held higher current beliefs about others' electricity consumption than those in the aggregated condition. This suggests that access to detailed individual-level information may have increased perception of overconsumption by others, potentially justifying over-requesting electricity themselves.

4 CONCLUSIONS

This study demonstrates that the effectiveness of information infrastructures in fostering cooperation depends on their specific design, particularly the level of detail provided about others' decisions. Across two different contexts, we found consistent patterns. Both feedback information infrastructures conditions prompted belief updating, as they provided information about the system's state by revealing the outcomes of one's own and others' actions, which in turn shaped participants' beliefs [5].

Disaggregated feedback information led to shifts in beliefs in a less cooperative direction. In particular, disaggregated information may increase participants' attention to discrepancies between their own beliefs and those of others, weakening their belief that cooperation (i.e., requesting a fair share) can adequately satisfy their own consumption needs. In contrast, aggregated information may reduce these differences and instead foster belief updating that promotes more cooperative decisions.

These findings highlight underlying cognitive differences in how individuals attend to, process, and represent information about future alternatives, differences that align with early insights from the Carnegie School tradition [6].

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Contact information
Corresponding author's e-mail: alexandra.vz@mgmt.au.dk