

Running Head: Learning from deliberation on social values

Social learning as a link between the individual and the collective: Evaluating deliberation on social values

Max Eriksson¹
Carena J. van Riper¹⁺
Ben Leitschuh¹
Amanda Bentley Brymer²
Andrea Rawluk³
Christopher M. Raymond^{4, 5, 6}
Jasper O. Kenter⁷

¹Department of Natural Resources and Environmental Sciences, University of Illinois

² Environmental Science Program, University of Idaho

³University of Melbourne

⁴Helsinki Institute of Sustainability Science, University of Helsinki, Finland

⁵Ecosystems and Environment Research Program, Faculty of Biological and Environmental Sciences, University of Helsinki

⁶Department of Environmental and Resource Economics, Faculty of Agriculture and Forestry, University of Helsinki

⁷Department of Environment and Geography, University of York, United Kingdom

⁺Corresponding author

Department of Natural Resources and Environmental Sciences

University of Illinois at Urbana-Champaign

1102 S. Goodwin Ave.

Urbana, IL, U.S.A., 61801

Email: cvanripe@illinois.edu

Phone: 217-244-9317

Published in *Sustainability Science*.

Eriksson, M., van Riper, C.J., Leitschuh, B., Bentley-Brymer, A., Rawluk, A., Raymond, C., & Kenter, J. (2019). Social learning as a link between the individual and the collective: Evaluating deliberation on social values. *Sustainability Science*, 14(5), 1323-1332.

Abstract

The role of social learning in deliberative processes is an emerging area of research in sustainability science. Functioning as a link between the individual and the collective, social learning has been envisioned as a process that can empower and give voice to a diverse set of stakeholder viewpoints, contribute to more adaptive and resilient management decisions and foster broader societal transformations. However, despite its widespread use in the context of participatory management of natural resources, the empirical properties of social learning remain understudied. This paper evaluates the role of social interaction and social capital to achieve transformative learning in discussions about social values. We employ a longitudinal design involving three consecutive surveys of 25 participants of an expert workshop focused on social values, as well as approximately 12 hours of transcribed audio and video recordings of participant interactions. Our mixed methods approach demonstrates the potential of using changes in social networks and definitions of social values that emerge from qualitative coding as indicators of social learning. We find that individuals with a weaker conceptual understanding of social values are more likely to change their definitions of the concept after deliberation. Though slight, these changes display a shift towards definitions more firmly held by other group members.

Introduction

Over the past two decades, scholarship on transdisciplinary, community-based involvement in management decisions has burgeoned in co-management and knowledge co-production literatures (Armitage et al., 2011; Cundill & Rodela, 2012; Kates et al., 2001; Medema et al., 2016; Reyers et al., 2015). More inclusive management practices and governance systems are perceived as having a normative value, as they empower marginalized stakeholder groups and facilitate direct citizen participation in public processes (Culwick et al., 2019; Kenter et al., 2016; Liu et al., 2007; Ostrom, 1990, 2009). Increased public participation and inclusive deliberation confer a wide range of benefits, such as the ability to find novel solutions to recurring problems, the improved ability to turn scientific information into actionable knowledge relevant for policy action, increased legitimacy for institutions involved in resource management, and building a mutual understanding and ownership of results among participants (Baber & Bartlett, 2005; Cash et al., 2003; Culwick et al., 2019; Frantzeskaki & Kabisch, 2016; Lundmark et al., 2014). These societal trends are supported by a growing body of research in natural resource management and sustainability sciences that has called for clearer and more coherent understandings of the processes and outcomes of social learning (Muro & Jeffrey, 2008; Reed et al., 2010; Rodela, 2011; Wal et al., 2014).

A breadth of definitions and approaches have been applied to analyze the role of social learning in deliberative processes. The common core of many definitions is that individuals learn through engagement with others, which is situated in a wider social setting (Reed et al., 2010). However, this conceptualization of social learning does not capture the full complexity of influences that ultimately guide human behavior (Merriam & Caffarella, 1998). Some researchers have emphasized the potential of social learning as a tool to achieve collective-level

social change (Pascual et al., 2017; Rist et al., 2007; Steyaert & Jiggins, 2007; Webler et al., 1995). A debate on whether social learning should be understood as a process or an outcome is also prominent in the sustainability science literature (Collins & Ison, 2009), and there are related discussions on whether social learning is a linear process on the individual level (Umemoto & Suryanata, 2006), or if it is more accurately described as a collective-level emergent phenomenon resulting from the sum of all individual interactions (Daniell et al., 2010) or a multi-level process (Diduck et al., 2019).

While varied conceptualizations, characterizing features, levels of analysis, and operational measures of social learning exist across individual-, network-, and systems-centric research perspectives (Rodela, 2011), few researchers have operationalized social learning nor addressed what counts as proof of learning (Rodela, 2013). Recently, Bentley Brymer et al. (2018) synthesized dimensions and variables of social learning commonly found in the literature and developed a framework to analyze social learning at an individual level. Previous research in psychology that suggests verbal inquiry between conversational agents creates opportunities for learning (Graesser et al., 1993, 2014). As a corollary, Bentley Brymer et al. (2018) established a promising framework for better understanding and empirically investigating how learning occurred through deliberation among individuals. These authors also acknowledged that changes in understanding also occur through social interactions and become situated within wider communities of practice (Reed et al., 2010).

Social learning is a cornerstone of deliberative democracy given that individual and collective-level learning is conducive to the development and implementation of policies that reflect an inclusive set of stakeholder viewpoints (Folke et al., 2005; Goodin, 2017; Pahl-Wostl et al., 2007; Kenter et al. 2016a, 2016b). Deliberation facilitates a discovery of shared values and

the development of new values that emerge from in-depth exchanges (Schulser et al., 2003; Reich, 1985; van Riper et al., 2018), as well as communication within a social setting that results from relational understandings of an environment (Chan et al., 2018; Gould et al., 2019; McCrum et al., 2019). Despite previous efforts to clarify the mechanisms through which social learning occurs (e.g., Schusler et al, 2003; Van der Wal et al., 2014; Vinke-de Kruijf, & Pahl-Wostl, 2016), the processes within deliberative contexts that move people from seeing oneself as an isolated individual to seeing oneself as part of a collective are still unknown (Cundill & Rodela, 2012). Social capital theory (see Putnam, 2000; Bourdieu, 1986) has also been identified as important to the process and outcomes of social learning (Cundill & Rodela, 2012; Muro & Jeffrey, 2008). Social capital theory's focus on trust within groups, reciprocity, social interaction, group norms, and interconnectedness can bring clarity to the role of social learning in relation to the individual and her social context. Scholars within sustainability science have therefore underscored the importance of increased engagement in decision-making and transformative change attributable to the process and outcomes of deliberation (Goodin & Niemeyer, 2003; Pellizzoni, 2001; Rodela, 2013; Kenter et al. 2016a, 2016b).

In combination, the literatures related to social learning, social values and social capital are likely to advance conceptualization of the mechanisms behind social learning, as well as bring other useful insights to adaptive and co-adaptive management literatures (Armitage et al., 2011; Berkes, 2009; Dietz et al., 2003; Hahn et al., 2008). Social network theory is a common thread in these literatures; it shows potential to clarify the relationship among individuals and between individuals and a social context. Previous scholarship has theorized that social learning contributes to the creation and maintenance of stakeholder networks (Rodela, 2011; Steyaert & Jiggins, 2007) and that most new knowledge is created among loosely connected members

(Fischer et al., 2014; Granovetter, 1973; Levin & Cross, 2004; Prell et al., 2009). In particular, individuals with weak ties to other people facilitate social learning and these ties therefore bridge clusters of people within networks (Granovetter, 1973). Networks comprised of well-connected individuals (i.e., networks with a large proportion of strong ties) provide a foundation for building social capital given that they foster trust and social norms, and contribute to the spread of social values. Therefore, learning is most likely to occur in networks that strike a balance between weak and strong ties (Burt, 2004; McPherson & Smith-Lovin, 1987).

Another area of inquiry that carries potential to advance knowledge of social learning is the social values literature (Chan et al., 2012; Dietsch et al., 2016; Kenter et al., 2019; Raymond et al., 2014; van Riper & Kyle, 2014), including core principles that guide behavior (Rokeach, 1973; Schwartz, 1994; van Riper et al., 2019), economic and non-economic landscape preferences (Brown, 1984; Brown & Kyttä, 2014), felt and relational values (Schroeder, 2013; Chan et al., 2016), and indicators of shared, social values (Kenter et al., 2015; Rawluk et al., 2019). The social values and social learning lines of research are complementary, because values are integral to deliberative processes (Dietz, 2013), and deliberative processes have been identified as drivers of value change (Raymond & Kenter, 2016). Recent empirical research on non-market, deliberative valuation highlights that deliberation can lead to a statistically significant convergence in preferences, in that social learning can shape individual viewpoints to align with the views of a collective (Grainger & Stoeckl, 2019). Although group deliberation and social learning may affect the rate of change among value concepts (Kendal & Raymond, 2019; Manfredo et al., 2017; van Riper et al., 2018), the long-term effects of deliberation on social values remain largely unclear (Goodin & Niemeyer, 2003; Kenter et al., 2016b; Pellizzoni, 2001).

In this study, we investigate social learning that occurred among individuals and across an international group of experts before, during and after their deliberation on the concept of social values. We advance the social values literature by demonstrating how social learning can lead to more a nuanced understanding of social values for sustainability, improved interconnections among scholars and knowledge of different disciplinary positions on values theory. The following objectives guided our research design: 1) Document variation and change in definitions of social values among workshop participants; 2) Quantify and classify participants' social interactions about social values; and 3) Determine how interconnectedness, similarities in academic background, definitions of social values, and social interaction relate to social learning. In the following section, we describe our data collection process and methods, including a detailed presentation of an analytical framework based on academic background, definitions of social values and social interaction. Finally, we discuss how variation in individual traits affect social learning at the individual and group levels.

Methodology

Study area and design

This paper showcased a mixed methods approach for measuring social learning by drawing on survey data and qualitatively coded transcripts from an academic workshop focused on social values and environmental sustainability named “Theoretical Traditions in Social Values for Sustainability” held at the University of York, UK, 26-27th June 2018 (Raymond et al., 2018). This workshop included authors of the papers in this Special Feature (Kenter et al., 2019) and was funded by the United Kingdom Valuing Nature Programme. All attendees were asked to participate in three online surveys that measured background information, potential changes in social learning and definitions of social values as a result of workshop participation.

The surveys were distributed one week prior to the workshop (Survey 1), two weeks after the workshop (Survey 2), and three months after the workshop (Survey 3). We also employed social network analysis to study how instances of social learning, defined as a process of individual learning that happens in a social context (Bandura, 1977, 2018), could be identified as the product of social interaction and capital. This information was then used as the basis for a social network analysis (Scott, 1988), in which each individual respondent was treated as a node, with edges signifying cases where two respondents both indicated that another person was a previous acquaintance in Survey 1, or noted the other person was a collaborator in either Survey 2 or Survey 3. Variables related to academic background were considered to be evidence of social capital, while changes in the definitions of social values and social interactions during the workshop were used as evidence of social learning.

Measurements

The first of three surveys administered contained two open-ended questions designed to measure respondent backgrounds: “What is your primary academic discipline?” and “How many years have you been working on research questions related to social values for sustainability?” The academic fields of participants were categorized into larger thematic groups, and the question about previous research experience was recoded into 5 bins: >1, 1-3, 4-6, 7-9, and 10 years. Two items were used to assess respondents’ definitions of social values, including “How do you define the concept of social values?” and “Under what circumstances would social values change?” A review of existing literature on social learning and typological analysis was used to identify the most salient variations in respondents’ viewpoints relating to social values, with particular attention on the level of operation(s), mechanisms, and outcomes of different kinds of

social learning. Also, the question “Of the workshop participants, with whom have you previously collaborated” was used to measure interconnectedness.

In the second and third surveys, to measure social interaction, the following questions were added to the survey: “Did you make any new acquaintances that are likely to lead to new research collaborations during this workshop? If so, which new acquaintances, and what new collaborations could emerge from them?” and “Are you planning to initiate any new research collaborations as a result of the workshop, if so with which participants?” Survey items related to collaboration were coded to signify whether respondents reported previous collaborative experiences with other workshop participants before the meeting or had formed any new collaborations after the in-person meeting.

To complement the longitudinal survey data collected from workshop participants, all group conversations in formal settings during the workshop were video and audio recorded. All recordings were transcribed verbatim to understand interactions among the workshop participants (Guest et al., 2012), and the transcripts were then coded using open and axial coding (Marshall & Rossman, 2006). Specifically, question-answer exchanges among participants were identified and treated as proxies for social interaction. Each question and answer exchange was then classified as either “cognitive” (i.e., reflecting knowledge of facts and values; identification of factors contributing to a problem), “relational” (i.e., reflecting perceptions of others; expressions of trust; identification of opportunities for collaboration), or “epistemic” (i.e., challenging ways of knowing; questioning claims of validity; justification for knowledge), following Bentley Brymer et al. (2018) (see Table 1).

Table 1. Definitions of social learning dimensions drawn from Bentley Brymer et al. (2018)

Dimension of social learning	Operationalization
Cognitive	Knowledge of facts and values; identification of factors contributing to a problem
Relational	Perceptions of others; expressions of trust; identification of opportunities for collaboration
Epistemic	Challenging ways of knowing; questioning claims of validity; justification for knowledge

Results

A total of 25 individuals attended the Valuing Nature Programme workshop. Out of these, 21 completed Survey 1, seven completed Survey 2, and ten completed Survey 3. The total length of the workshop recordings was approximately 12 hours, which amounted to 320 pages of text that was transcribed verbatim and thematically analyzed. A majority of the 19 participants that answered the question about academic field were academics with interdisciplinary backgrounds related to conservation. Based on their answers, we categorized respondents into four groups: 1) Economics (n = 6); 2) Environmental Science (n = 5); 3) Psychology and Health (n = 3); and 4) Other Social Sciences (n = 5) (see Appendix 1).

Twenty respondents provided their definitions of social values in response to the question, “How do you define the concept of social values?” in the first survey. The majority of definitions emphasized that social values arise from processes occurring at the group (n = 12) or societal levels (n=10). For example, participants defined social values as “values that are beyond individual values and preferences,” and “values shared with others and society in general.” Out of the 20 definitions reported, the primary mechanism to catalyze the spread of social values was social context, relational interactions and mutual experience developed and expressed through relationships. Definitions also emphasized the importance of coexistence, as illustrated by one participant who defined social values as “values held by both individuals and collectives and

play some role in living harmoniously with others.” Changes in thoughts and practice, providing benefits for others and meeting popular needs were also cited as outcomes of deliberative processes surrounding social values.

In Survey 2, three respondents stated that they had changed their definition of social values as a result of the workshop. One person indicated that the workshop “clarified how other people use the term,” while another asserted that they had “developed a more pluralist or holistic definition of social values following the workshop.” Another participant stated, “it enhanced my depth of understanding - seeing different ways of understanding social values as lenses by which we look at common issues.” In Survey 3, the question “How do you define the concept of social values?” was repeated, but the differences in definitions compared to Survey 1 were slight. An overview of variation across definitions is presented in Table 2 and full definitions and codes are available in Appendix 1, Table 2.

Table 2. Definitions of social values among workshop participants

Aspect of social values	Focus of definition provided	N
Level of operation(s)	Individual level	5
	Group level	15
	Societal level	2
Mechanism	Relational	4
	Similar experiences	1
	Social context	5
Outcome	Coexistence	2
	Changes in thoughts and practice	2
	Meeting needs	2
Changes of definitions	Benefiting others	1
	Between Survey 1 and Survey 2	3
	Between Survey 2 and Survey 3	0

We observed 95 question-answer exchanges throughout the workshop dialogue. Cognitive question-answer exchanges ($n = 63$) were most common, including requests to clarify established concepts and their definitions. A total of 19 relational question-answer exchanges were observed at the workshop. Epistemic question-answer exchanges ($n = 13$) occurred when concepts were the subject of interdisciplinary synthesis and growth and were thus unclear and/or contested. In these cases, questions were framed as requests for evidence in support of knowledge claims. All exchanges that were observed, varied in length and complexity with longer discussions often involving individuals that presented the results of a discussion group or led a session.

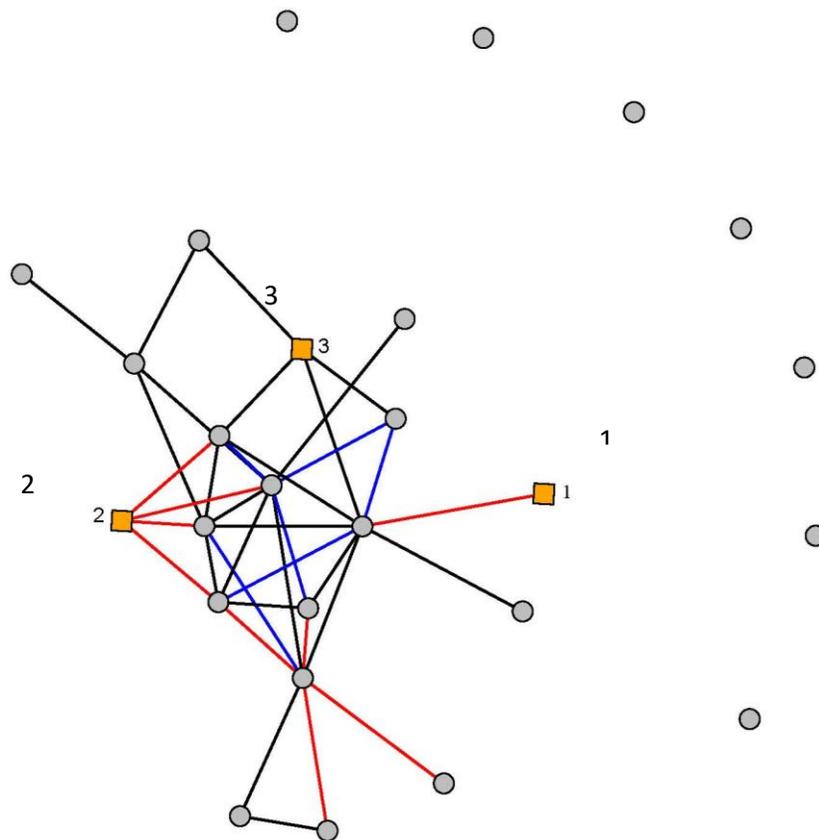


Figure 1. Collaborations among the 28 participants in the Valuing Nature Programme workshop

A total of 18 individuals had collaborated with another participant before the workshop (see Table 3). Survey 2 indicated that there were five new potential collaborations immediately after the workshop, and in Survey 3, six more collaborative opportunities were noted. Eight participants did not report any collaborations with other participants throughout the three surveys. In Figure 1, workshop participants were illustrated as nodes in a network and collaborations between participants as connection between these nodes. The workshop participants were represented by gray circles, while the three participants that changed their definitions of social values between Survey 1 and Survey 2 were shown as orange squares. Collaborations reported in Survey 1 were represented by black lines, red lines signified connections reported in Survey 2 and blue lines indicated connections reported in Survey 3.

Table 3. Overview of participants (i.e., “nodes”) that changed definitions of social values, including their background, definition of social values and social interactions measured by question-answer exchanges (QAEs)

	Background		Definition of social values			Social interaction			
	Discipline	Years in field	Level of operation(s)	Mechanism	Outcome	Cognitive QAEs	Relational QAEs	Epistemic QAEs	Change
Node 1	Psychology and health	<1	Group	Similar experience	Changed thought and practice	0	0	2	Clarified term(s)
Node 2	Economics	10+	Group	Social context	Not applicable	3	0	0	Increased pluralism
Node 3	Environmental science	1-3	Individual	Social context	Changed thought and practice	8	0	2	Deepened understanding
Mode (other nodes)	Economics, Other Social Sciences	10+ (M=5.3)	Group	Social context	Changed thought and practice, coexistence, meeting needs	52	13	15	Not applicable

On average, each workshop participant was involved in 2.5 collaborations during the time period studied. When excluding isolated nodes, the average node degree increased to 3.5, and the remaining non-isolated nodes had a clustering coefficient of 0.37. Overall, the network showed a situation in which new individuals were added to the network directly after the workshop (i.e., red lines), while most of the changes that took place after three months (i.e., blue lines) resulted in new connections between individuals that already had strong ties to the network. The three individuals that changed their definitions of social values occupied different positions in the network. One individual (Node 1), formed a single new connection to the network, another (Node 2) did not have any ongoing collaborations before the workshop but connected to multiple other people, and the third (Node 3) did not form any new connections. The “Other Social Sciences” categorization of participants’ disciplines was the only grouping that was not represented among the three individuals that changed their definition of social values. Two of the individuals that changed their definition had worked with issues of sustainability less than three years, while those who did not change their definitions had worked with issues of sustainability more than 10 years on average. The original definitions of social values among the three nodes varied, but the observed changes led to an increased correspondence with the most commonly held definitions within the network as a whole. In each of the three cases, the changes in definitions involved clarification or broadening of an existing concept, rather than a complete shift of conceptualization.

1 **Discussion**

2 This article advanced an ongoing dialogue in the sustainability science literature focused
3 on how social learning can be conceptualized and measured (Fischer et al., 2014; Reed et al.,
4 2010). Drawing on mixed methods including a longitudinal survey, deliberative workshop and
5 social network analysis, we examined the interconnectedness of individuals in relation to their
6 social interactions within an academic workshop focused on deliberation around social values
7 and sustainability (Raymond et al., 2018). Through this form of methodological triangulation, we
8 explored how social learning acted as a bridge between the individual and a collective in the
9 context of deliberation, while also contributing new knowledge from a social network analysis.

10 We investigated the role of social capital and social learning in achieving a common
11 definition for the concept of social values among individuals and across a research network. By
12 examining how social capital developed over time and analyzing the stages at which connections
13 were made (i.e., before, immediately after, and long after the workshop), we provided insight on
14 the role of strong ties in social learning outcomes (Burt, 2004; McPherson & Smith-Lovin,
15 1987). In other words, we examined the connectedness of individuals in relation to their social
16 interactions during deliberation to better understand the role of social capital and social learning
17 for transformative change. Our results demonstrated how social learning promoted through an
18 academic exchange could lead to a more nuanced understanding of social values and improved
19 interconnectivity among people (Bentley Brymer et al., 2018). Our research underlines the
20 importance of pre-existing connections within a group and variation in knowledge among group
21 members as factors that shape learning processes and outcomes. However, it is important to note
22 that our work is based on a small sample size, which presents challenges for disentangling our

23 multiple explanatory variables (i.e., discipline, experience, network centrality) and drawing
24 generalizable conclusions without further study.

25

26 *Definitions of social values*

27 Our first objective was to document variation and change in definitions of social values
28 among experts before, during and after their participation in a deliberative workshop. The
29 majority of workshop participants described social values as a concept that operated at a
30 collective level and worked through mechanisms of either social relationships or social context.
31 The outcomes of such mechanisms through which social values formed or evolved were
32 described as “changes in thoughts and practice,” “the creation of a common understanding,” and
33 “meeting societal needs.” However, while some participants developed a more nuanced
34 understanding of social values over the course of the workshop, collectively there was no general
35 agreement among participants on how to define or operationalize social values.

36 Our results showed some evidence of clustering of social value definitions across
37 academic fields. The Economics and Environmental Science subgroups were more likely to
38 focus on benefits and outcomes from deliberation, while Other Social Scientists placed greater
39 weight on process. This pattern echoes findings in extant literature suggesting that both social
40 values and social learning are contingent on social context and relationships (Diduck et al., 2019;
41 Rodela, 2011, 2013; van Riper et al., 2018; Wegner, 1999). We also found a divide in the views
42 on what outcomes were necessary for something to be regarded a social value between
43 academic disciplines focused on individuals (e.g., psychology, economics) and groups (e.g.,
44 sociology, anthropology). Participants from fields focused on group or societal dynamics had a
45 greater tendency to make normative claims in the outcomes of social values research (also see

46 Kenter et al., 2019), often equating social values with pro-social activity, and adding a
47 requirement of societal improvement (McCrum et al., 2009), or the development of a mutual
48 understanding of concepts (Kulundu, 2012; Armitage et al., 2008). This finding bolsters a trend
49 which is particularly pronounced in literature on applied discursive democracy (Dryzek, 1990),
50 including stakeholder involvement and adaptive management (Plieninger et al., 2013; van Riper
51 et al., 2012) where group processes are devised as a means to achieve increased ecological
52 sustainability (Cundhill & Rodela, 2012; Muro & Jeffrey, 2008; Reed, 2010). These perspectives
53 highlight the importance of deliberative social learning as a transformative process to bridge the
54 gap between self-regarding individual values and shared social values that seek to address
55 longer-term societal sustainability concerns (Kenter, 2016; Irvine et al., 2016; Ravenscroft,
56 2019)

57

58 *Question-answer exchanges as social interactions among workshop participants*

59 Examining the social interactions of respondents during the workshop, we found that
60 cognitive question-answer exchanges were the most common (63), followed by epistemic (19)
61 and relational learning (13). The prevalence of cognitive question-answer exchanges may have
62 been related to the nature of the workshop, given that it was centered on technical definitions of
63 social values. For the three participants who reported a change to their definition of social values,
64 cognitive changes in understanding were most common. Interestingly, none of these three
65 participants engaged in relational question-answer exchanges, meaning their experience of the
66 deliberative workshop did not include changes in relational understanding. Yet, two of the three
67 participants had no connections to the group prior to the workshop and reported new connections
68 with at least one other workshop participant in Survey 2. In other words, some participants

69 identified opportunities to collaborate after the conclusion of the deliberative workshop. This
70 finding underscores the importance of longitudinal research and social network analysis to more
71 effectively capture new or strengthened ties within a network given the implications for
72 understanding social learning and relational values.

73

74 *Social learning, definitions of social values, and social interactions*

75 Participants that had previous collaborations with others were, in general, part of more
76 question-answer exchanges than less well-connected participants. This pattern could be the result
77 of more well-connected individuals having more information to share with the group. However,
78 it could also be resulting from more well-connected individuals having higher trust in the group,
79 and therefore feeling freer to express themselves as suggested by Pretty and Ward (2001) and
80 Granovetter (1973).

81 In relation to the third study objective, we found evidence of three instances of learning
82 related to the reported definitions of social values. The three individuals that changed their
83 definitions all had some connections to the network after the final survey. The growth in the
84 number of collaborations between nodes that already had collaborations between Survey 2 and
85 Survey 3 indicated that these strong ties contributed to within group trust building, while the lack
86 of change in definitions also indicated these individuals were less likely to be exposed to new
87 ideas (Prell et al., 2009). Conversely, weak ties indicated a propensity to be more open to
88 changes in definitions (Fischer et al., 2014), possibly due to a combination of receiving new
89 information and alignment of existing definitions with group-level norms. Thus, our results lend
90 some support to literature that engages social capital theory and social network analysis that

91 suggests group interactions and similarities of definitions of social values contribute to social
92 learning (Burt, 2004; McPherson & Smith-Lovin, 1987).

93 Workshop participants that were engaged in a deliberative exchange about social values
94 for sustainability experienced different levels of learning. A majority of participants showed
95 indications of incremental improvement in their knowledge that did not involve questioning the
96 underlying assumptions of an idea (i.e., single-loop learning (Reed et al., 2010)), while not
97 challenging the assumptions behind what we learn (i.e., double loop learning), or questioning the
98 notion of what it means to learn (i.e., triple loop learning) (Argyris & Schön, 1978; Pahl-Wostl et
99 al., 2008). Most often, surface-level signs of change in social learning conformed towards
100 knowledge that was strongly held by other similar members of the group, possibly indicating an
101 existence of a homophily effect (McPherson, & Smith-Lovin, 1987). The weak ties that
102 connected participants in a loosely connected network were important for learning (Levin &
103 Cross, 2004), as were the strong ties that facilitated trust and more transformative learning from
104 self-reflection (Bentley Brymer et al., 2018). We also observed that changes in definitions were
105 reported by individuals who had been working with issues of social values in sustainability a
106 comparably short amount of time. This may explain why the Other Social Science subgroup was
107 less likely to change their definitions of social values given the potential for more experience
108 working with conceptual frameworks than participants working in the natural sciences.

109

110 **Conclusion**

111 This article showcases a mixed methods research approach to measure social learning
112 through social network analysis, qualitative analysis of deliberation and a longitudinal survey
113 design. In addition to demonstrating the potential of social network analysis as a tool to

114 understand social learning in the context of social values for sustainability, our empirical results
115 also offer a number of interesting contributions to the literature. We indicate, not unintuitively,
116 that social learning occurs where individuals holding a less well developed understanding of a
117 concept engage with more elaborate knowledge that is accepted by other individuals within a
118 social context. More generally, our results highlight the plurality of multiple understandings of
119 social values that exist within the sustainability sciences (also see Kenter et al., 2019) and
120 suggest that epistemic and conceptual plurality do not necessarily prevent social learning from
121 taking place. Building on this work, future research within sustainability science should continue
122 to strive towards a more refined understanding of individual and group level dynamics involved
123 in social learning, as well as better understand the role, potential and limitations of social
124 learning in deliberative decision-making for environmental management and policy making.

125

126

127 **References**

- 128 Argyris, C., & Schön, D.A. (1978). *Organizational learning: A theory of action perspective*.
 129 Reading, MA: Addison-Wesley Pub. Co.
- 130 Armitage, D., Berkes, F., Dale, A., Kocho-Schellenberg, E., & Patton, E. (2011). Co-
 131 management and the co-production of knowledge: Learning to adapt in Canada's Arctic.
 132 *Global Environmental Change*, 21(3), 995-1004.
- 133 Armitage, D., Marschke, M., & Plummer, R. (2008). Adaptive co-management and the paradox
 134 of learning. *Global Environmental Change*, 18(1), 86-98.
- 135 Bandura, A. (1977). *Social learning theory*. Englewood Cliffs, NJ: Prentice Hall.
- 136 Bandura, A. (2018). Toward a psychology of human agency: Pathways and reflections.
 137 *Perspectives on Psychological Science*, 13(2), 130-136.
- 138 Barber, W.F., & Bartlett, R.V. (2005). *Deliberative environmental politics: Democracy and*
 139 *ecological rationality*. MIT Press, Cambridge, MA.
- 140 Bentley Brymer, A.L., Wulfhorst, J.D., & Brunson, M.W. (2018). Analyzing stakeholders'
 141 workshop dialogue for evidence of social learning. *Ecology and Society*, 23(1), 42.
- 142 Berkes, F. (2009). Evolution of co-management: Role of knowledge generation, bridging
 143 organizations and social learning. *Journal of environmental management*, 90(5), 1692-
 144 1702.
- 145 Bourdieu, P. (1986). The forms of capital. In: *Handbook of theory and research for the sociology*
 146 *of education*, J. G. Richardson, Ed. (pp. 241-58). New York: Greenwood Press.
- 147 Brown, T.C. (1984). The concept of value in resource allocation. *Land economics*, 60(3), 231-
 148 246.
- 149 Brown, G., & Kytä, M. (2014). Key issues and research priorities for public participation GIS
 150 (PPGIS): A synthesis based on empirical research. *Applied geography*, 46, 122-136
- 151 Burt, R.S. (2004). Structural holes and good ideas. *American Journal of Sociology*, 110(2), 349-
 152 399.
- 153 Cash, D.W., Clark, W.C., Alcock, F., Dickson, N.M., Eckley, N., Guston, D.H., ... & Mitchell,
 154 R.B. (2003). Knowledge systems for sustainable development. *Proceedings of the*
 155 *national academy of sciences*, 100(14), 8086-8091.
- 156 Chan, K.M., Gould, R. K., & Pascual, U. (2018). Editorial overview: Relational values: what are
 157 they, and what's the fuss about?.
- 158 Chan, K.M., Guerry, A.D., Balvanera, P., Klain, S., Satterfield, T., Basurto, X., ... & Hannahs, N.
 159 (2012). Where are cultural and social in ecosystem services? A framework for
 160 constructive engagement. *BioScience*, 62(8), 744-756.
- 161 Chan, K. M., Balvanera, P., Benessaiah, K., Chapman, M., Díaz, S., Gómez-Baggethun, E., ... &
 162 Luck, G. W. (2016). Opinion: Why protect nature? Rethinking values and the
 163 environment. *Proceedings of the National Academy of Sciences*, 113(6), 1462-1465.
- 164 Collins, K., & Ison, R. (2009). Jumping off Arnstein's ladder: social learning as a new policy
 165 paradigm for climate change adaptation. *Environmental Policy and Governance*, 19(6),
 166 358-373.
- 167 Culwick, C., Washbourne, C L., Anderson, P.M., Cartwright, A., Patel, Z., & Smit, W. (2019).
 168 CityLab reflections and evolutions: Nurturing knowledge and learning for urban
 169 sustainability through co-production experimentation. *Current Opinion in Environmental*
 170 *Sustainability*, 39, 9-16.

- 171 Cundill, G., & Rodela, R. (2012). A review of assertions about the processes and outcomes of
 172 social learning in natural resource management. *Journal of Environmental Management*,
 173 *113*, 7-14.
- 174 Daniell, K.A., White, I., Ferrand, N., Ribarova, I. S., Coad, P., Rougier, J.E., ... & Perez, P.
 175 (2010). Co-engineering participatory water management processes: Theory and insights
 176 from Australian and Bulgarian interventions. *Ecology and Society*, *15*(4), 11.
- 177 Diduck, A. P., Raymond, C.M., Rodela, R., Moquin, R., & Boerchers, M. (2019). Pathways of
 178 learning about biodiversity and sustainability in private urban gardens. *Journal of*
 179 *Environmental Planning and Management*, 1-21.
- 180 Dietz, T. (2013). Bringing values and deliberation to science communication. Proceedings of the
 181 National Academy of Sciences, *110*(Supplement 3), 14081-14087.
- 182 Dietz, T., Ostrom, E., & Stern, P. C. (2003). The struggle to govern the commons. *Science*,
 183 *302*(5652), 1907.
- 184 Dietsch, A.M., Teel, T.L., & Manfredo, M.J. (2016). Social values and biodiversity conservation
 185 in a dynamic world. *Conservation Biology*, *30*(6), 1212-1221.
- 186 Dryzek, J.S. (1990). *Discursive democracy: Politics, policy, and political science*. New York:
 187 Cambridge University Press.
- 188 Fischer, A. P., Vance-Borland, K., Burnett, K. M., Hummel, S., Creighton, J. H., Johnson, S. L.,
 189 & Jasny, L. (2014). Does the social capital in networks of “fish and fire” scientists and
 190 managers suggest learning? *Society & Natural Resources*, *27*(7).
- 191 Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2005). Adaptive governance of social-ecological
 192 systems. *Annu. Rev. Environ. Resour.*, *30*(1), 441–73
- 193 Frantzeskaki, N., & Kabisch, N. (2016). Designing a knowledge co-production operating space
 194 for urban environmental governance—Lessons from Rotterdam, Netherlands and Berlin,
 195 Germany. *Environmental Science & Policy*, *62*, 90-98.
- 196 Goodin, R.E. (2017). The epistemic benefits of deliberative democracy. *Policy Sciences*, 351-
 197 366.
- 198 Goodin, R.E., & Niemeyer, S.J. (2003). When does deliberation begin? Internal reflection versus
 199 public discussion in deliberative democracy. *Political Studies* *51*, 627-649.
- 200 Gould, R., Pai, M., Chan, K., & Muraca, B. (2019). How one indigenous worldview informs
 201 relational values and social values. *Sustainability Science*.
- 202 Grainger, D., & Stoeckl, N. (2019). The importance of social learning for non-market valuation.
 203 *Ecological Economics*, *164*, 106339.
- 204 Granovetter, M.S. (1973). The strength of weak ties. *American Journal of Sociology*, *78*(6),
 205 1360-1380.
- 206 Graesser, A.C., Langston, M.C., & Baggett, W.B. (1993). Exploring information about concepts
 207 by asking questions. *Psychology of Learning and Motivation*, *29*, 411-436.
- 208 Graesser, A.C., Li, H., & Forsyth, C. (2014). Learning by communicating in natural language
 209 with conversational agents. *Current Directions in Psychological Science*, *23*, 374-380.
- 210 Guest, G., Namey, E.E., & Mitchell, M.L. (2012). *Collecting qualitative data: A field manual for*
 211 *applied research*. Sage.
- 212 Hahn, T., Schultz, C., Folke, C., & Olsson, P. (2008). Social networks as sources of resilience in
 213 social-ecological systems. In J. Norberg & G. Cumming (Eds.), *Complexity theory for a*
 214 *Sustainable Future*. Columbia University Press.

- 215 Irvine, K.N., O'Brien, L., Ravenscroft, N., Cooper, N., Everard, M., Fazey, I., ... & Kenter, J.O.
 216 (2016). Ecosystem services and the idea of shared values. *Ecosystem Services*, 21, 184-
 217 193.
- 218 Kates, R.W., Clark, W.C., Corell, R., Hall, J.M., Jaeger, C.C., Lowe, I., ... & Faucheux, S.
 219 (2001). Sustainability science. *Science*, 292(5517), 641-642.
- 220 Kendal, D., & Raymond, C. (2019). Understanding pathways to shifting values over time in the
 221 context of social-ecological systems. *Sustainability Science*.
- 222 Kenter, J.O. (2016). Shared, plural and cultural values. *Ecosyst. Serv*, 21, 175-183.
- 223 Kenter, J.O., O'Brien, L., Hockley, N., Ravenscroft, N., Fazey, I., Irvine, K.N., ... & Church, A.
 224 (2015). What are shared and social values of ecosystems?. *Ecological Economics*, 111,
 225 86-99.
- 226 Kenter, J.O., Reed, M.S., & Fazey, I. (2016a). The deliberative value formation
 227 model. *Ecosystem Services*, 21, 194-207.
- 228 Kenter, J.O., Bryce, R., Christie, M., Cooper, N., Hockley, N., Irvine, K.N., ... & Raymond, C.
 229 M. (2016). Shared values and deliberative valuation: Future directions. *Ecosystem*
 230 *services*, 21, 358-371.
- 231 Kenter, J.O., Raymond, C., van Riper, C.J., Azzopardi, E., Brear, M.R., Calcagni, F., Christie, I.,
 232 Chrisite, M., Gould, R.K., Ives, C.D., Hejnowicz, A.P., Gunton, R., Horcea-Milcu, A.,
 233 Kendal, D., Kronenberg, J., Massenberg, J.R., O'Connor, S., Ravenscroft, N., Raymond,
 234 I.J., Rawluk, A., & Rodríguez-Morales, J. (2019). Loving the mess: Navigating diversity
 235 and conflict in social values for sustainability. *Sustainability Science*.
- 236 Kulundu, I. (2012). In pursuit of participation: tracking the influence of local action for
 237 sustainable development. *Lotz-Sisitka, HB (ed.)*. Views on Social Learning Literature: A
 238 monograph for social learning researchers in natural resources management and
 239 environmental education, Environmental Learning Research Centre, Rhodes
 240 University/EEASA/SADC REEP, Grahamstown.
- 241 Levin, D. Z., & Cross, R. (2004). The strength of weak ties you can trust: The mediating role of
 242 trust in effective knowledge transfer. *Management Science*, 50(11), 1477-1490.
- 243 Liu, J., Dietz, T., Carpenter, S. R., Alberti, M., Folke, C., Moran, E., ... & Ostrom, E. (2007).
 244 Complexity of coupled human and natural systems. *science*, 317(5844), 1513-1516.
- 245 Lundmark, C., Matti, S., & Sandström, A. (2014). Adaptive co-management: How social
 246 networks, deliberation and learning affect legitimacy in carnivore
 247 management. *European journal of wildlife research*, 60(4), 637-644.
- 248 Manfredo, M.J., Bruskotter, J.T., Teel, T.L., Fulton, D., Schwartz, S.H., Arlinghaus, R., ... &
 249 Sullivan, L. (2017). Why social values cannot be changed for the sake of
 250 conservation. *Conservation Biology*, 31(4), 772-780.
- 251 Marshall, C., & Rossman, G.B. (2006). *Designing qualitative research*. Sage Publications,
 252 Inc., Thousand Oaks, CA.
- 253 McCrum, G., Blackstock, K., Matthews, K., Rivington, M., Miller, D., & Buchan, K. (2009).
 254 Adapting to climate change in land management: The role of deliberative workshops in
 255 enhancing social learning. *Environmental Policy & Governance*, 19(6), 413-426.
- 256 McPherson, J. M., & Smith-Lovin, L. (1987). Homophily in voluntary organizations: Status
 257 distance and the composition of face-to-face groups. *American Sociological Review*,
 258 52(3), 370-379.

- 259 Medema, W., Furber, A., Adamowski, J., Zhou, Q., & Mayer, I. (2016). Exploring the potential
260 impact of serious games on social learning and stakeholder collaborations for
261 transboundary watershed management of the St. Lawrence River Basin. *Water*, 8(5), 175.
- 262 Merriam, B.S., & Caffarella, S.R. (1998). *Learning in adulthood*. A comprehensive guide, 2nd
263 ed. Jossey-Bass Publishers, San Francisco.
- 264 Muro, M., & Jeffrey, P. (2008). A critical review of the theory and application of social learning
265 in participatory natural resource management processes. *Journal of Environmental*
266 *Planning and Management*, 51(3), 325-344.
- 267 Ostrom, E. (1990). *Governing the commons: The evolution of institutions for collective action*.
268 New York: Cambridge University Press.
- 269 Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological
270 systems. *Science*, 325(5939), 419-422.
- 271 Pahl-Wostl, C., Craps, M., Dewulf, A., Mostert, E., Tabara, D., & Taillieu, T. (2007). Social
272 learning and water resources management. *Ecology and society*, 12(2).
- 273 Pahl-Wostl, C., Tabara, D., Bouwen, R., Craps, M., Dewulf, A., Mostert, E., . . . Taillieu, T.
274 (2008). The importance of social learning and culture for sustainable water management.
275 *Ecological Economics*, 64(3), 484-495.
- 276 Pascual, U., Balvanera, P., Díaz, S., Pataki, G., Roth, E., Stenseke, M., ... & Maris, V. (2017).
277 Valuing nature's contributions to people: the IPBES approach. *Current Opinion in*
278 *Environmental Sustainability*, 26, 7-16.
- 279 Pellizzoni, L. (2001). The myth of the best argument: Power, deliberation and reason. *British*
280 *Journal of Sociology* 52, 59-86
- 281 Plieninger, T., Dijks, S., Oteros-Rozas, E., & Bieling, C. (2013). Assessing, mapping, and
282 quantifying cultural ecosystem services at community level. *Land use policy*, 33, 118-
283 129.
- 284 Prell, C., Hubacek, K., & Reed, M. (2009). Stakeholder analysis and social network analysis in
285 natural resource management. *Society & Natural Resources*, 22(6), 501-518.
- 286 Pretty, J., & Ward, H. (2001). Social capital and the environment. *World Development*, 29(2),
287 209-227.
- 288 Putnam, R.D. (2000). Bowling alone: America's declining social capital. In *Culture and*
289 *politics* (pp. 223-234). Palgrave Macmillan, New York.
- 290 Rawluk, A., Ford, R., Anderson, N., & Williams, K. (2019). Exploring multiple dimensions of
291 values and valuing: A conceptual framework for mapping and translating values for
292 social-ecological research and practice. *Sustainability Science*.
- 293 Reed, M. S., Evely, A. C., Cundill, G., Fazey, I., Glass, J., Laing, A., . . . Stringer, L. C. (2010).
294 What is social learning? *Ecology and Society*, 15(4).
- 295 Raymond, C. M., Kenter, J. O., Plieninger, T., Turner, N. J., & Alexander, K. A. (2014).
296 Comparing instrumental and deliberative paradigms underpinning the assessment of
297 social values for cultural ecosystem services. *Ecological Economics*, 107, 145-156.
- 298 Raymond, C. M., & Kenter, J. O. (2016). Transcendental values and the valuation and
299 management of ecosystem services. *Ecosystem Services*, 21, 241-257.
- 300 Raymond, C.M., Kenter, J.O., Kendal, D., van Riper C.J., & Rawluk, A. (2018). Call for papers
301 for "Theoretical traditions in social values for sustainability." *Sustainability*
302 *Science*, 13(2), 269-271.
- 303 Ravenscroft, N. (2019). A new normative economics for the formation of shared social
304 values. *Sustainability Science*, 1-11.

- 305 Reich, R.B. (1985). Public administration and public deliberation: An interpretive essay. *Yale*
 306 *Law J.* 94(7), 1617–1641.
- 307 Reyers, B., Nel, J.L., O’Farrell, P.J., Sitas, N., & Nel, D.C. (2015). Navigating complexity
 308 through knowledge coproduction: Mainstreaming ecosystem services into disaster risk
 309 reduction. *Proceedings of the National Academy of Sciences*, 112(24), 7362-7368.
- 310 Rist, S., Chidambaranathan, M., Escobar, C., Wiesmann, U., & Zimmermann, A. (2007).
 311 Moving from sustainable management to sustainable governance of natural resources:
 312 The role of social learning processes in rural India, Bolivia and Mali. *Journal of rural*
 313 *studies*, 23(1), 23-37.
- 314 Rodela, R. (2011). Social learning and natural resource management: The emergence of three
 315 research perspectives. *Ecology and Society*, 16(4).
- 316 Rodela, R. (2013). The social learning discourse: Trends, themes and interdisciplinary influences
 317 in current research. *Environmental Science & Policy*, 25, 157-166.
- 318 Rokeach, M. (1973). *The nature of human values*. Free Press, New York
- 319 Schwartz, S.H. (1994). Are there universal aspects in the structure and contents of human
 320 values?. *Journal of social issues*, 50(4), 19-45.
- 321 Schroeder, H. (2013). Sensing value in place. In: W. Stewart, D. Williams, & L. Kruger (Eds.),
 322 *Place-based conservation: Perspectives from the social sciences* (pp. 131-155).
 323 Dordrecht, The Netherlands: Springer.
- 324 Schusler, T. M., Decker, D. J., & Pfeffer, M. J. (2003). Social learning for collaborative natural
 325 resource management. *Society & natural resources*, 16(4), 309-326.
- 326 Scott, J. Social network analysis. *Sociology* 22.1 (1988): 109-127.
- 327 Steyaert, P., & Jiggins, J. (2007). Governance of complex environmental situations through
 328 social learning: a synthesis of SLIM's lessons for research, policy and practice.
 329 *Environmental Science & Policy*, 10(6), 575-586.
- 330 Umemoto, K., & Suryanata, K. (2006). Technology, culture, and environmental uncertainty:
 331 Considering social contracts in adaptive management. *Journal of Planning Education*
 332 *and Research*, 25(3), 264-274.
- 333 van Riper C.J., & Kyle, G.T. (2014). Capturing multiple values of ecosystem services shaped by
 334 environmental worldview: A spatial analysis. *Journal of Environmental Management*,
 335 145, 374-384.
- 336 van Riper, C.J., Thiel, A., Penker, M., Braitto, M., Landon, A.C., Thomsen, J., & Tucker, C.M.
 337 (2018). Incorporating multi-level values into the social-ecological systems
 338 framework. *Ecology and Society*, 23(3), 25.
- 339 van Riper, C.J., Kyle, G.T., Sutton, S.G., Barnes, M., & Sherrouse, B.C. (2012). Mapping
 340 outdoor recreationists' perceived social values for ecosystem services at Hinchinbrook
 341 Island National Park, Australia. *Applied Geography*, 35(1-2), 164-173.
- 342 van Riper, C.J., Winkler-Schor, S., Stamberger, L., Keller, R., Braitto, M., Raymond, C.,
 343 Eriksson, M., Golebie, E., & Johnson, D. (2019). Integrating multi-level values and pro-
 344 environmental behavior in a protected area. *Sustainability Science*.
- 345 Vinke-de Kruijf, J., & Pahl-Wostl, C. (2016). A multi-level perspective on learning about
 346 climate change adaptation through international cooperation. *Environmental Science &*
 347 *Policy*, 66, 242-249.
- 348 Wal, M., De Kraker, J., Offermans, A., Kroeze, C., Kirschner, P. A., & Ittersum, M. (2014).
 349 Measuring social learning in participatory approaches to natural resource management.
 350 *Environmental Policy and Governance*, 24(1), 1-15.

- 351 Webler, T., Kastenholz, H. & Renn, O. (1995). Public participation in impact assessment: A
352 social learning perspective. *Environmental Impact Assessment Review* 15:443-463.
353 Wenger, E. (1999). *Communities of practice: learning, meaning, and identity*. Cambridge
354 University Press, Cambridge, UK.