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Values and argumentation in collaborative design

We present analyses of interactions produced in meetings concerned with design of artefacts, where core values (i.e., fundamental beliefs of a person or a group) are at stake, focussing on the processes by which debates evolve and are (possibly) resolved during face-to-face elaboration of design solutions. Four groups of four participants were studied during their collaborative design of sustainable neighbourhood projects. We show that in this case, value conflicts are not genuinely resolved, in that participants do not concede with respect to their values within the duration of the meetings. Value conflicts involve renegotiating meanings of design proposals in order to examine their (in)compatibilities, and to determine possible compromises. Participants either try to ‘dissolve’ value conflicts by transforming them into conflicts on a factual plane, or else they abandon the discussion, maintaining adversarial positions, changing the topic of discussion, without reaching agreement. The study also highlights the importance of participants who spontaneously adopt moderator roles, supporting meaning-making on the plane of values or else shift the debate towards practical considerations. We discuss implications for both collaborative design and participatory design, considering the roles that values play in these processes.

Keywords: collaboration, design, value conflicts, argumentation, interaction analysis, interactive roles

1. Introduction

The question of designing and implementing technologies in moral or ethical ways has become a key issue for both design research and practice (Friedman and Hendry 2019). Value Sensitive Design, or VSD, is an approach that accounts for human values in the design of artefacts (Friedman and Hendry 2019; Friedman et al. 2013). VSD recognises that design processes involve a complex interplay between practical considerations (e.g. feasibility, cost and utility) and values. Existing studies describe how to deal with competing values throughout the design process, as well as how values and the design process co-evolve. In effect, the design process deals with tensions between values through the construction of stories and scenarios of use (Lloyd and Oak 2018). In order

to further explore the articulation of values in design, this paper focuses on how values underly argumentative processes in collaborative design.

The concept of ‘values’ is very important in the field of argumentation studies. Here, values are situated in the distinction between two types of referents of argumentation (Golder and Coirier 1996; Schwarz and Baker 2017; Plantin 2018): 1) factual, when it is possible for one party to convince the other by means of logical argument (e.g. calculation, evidence-based reasoning); and 2) axiological (‘axia’ *value* – ‘logos’ *discourse*), when argumentation is based on ethical judgements. Debates on factual contents (knowledge) differ from debates on values. When it is possible to prove by demonstration, argumentation leads to elimination of proposals that have commonly accepted counter-arguments. When discussion involves values, participants usually retain their initial opinions and even elaborate and reinforce them, in response to critique (Baker 2009a). In fact, collective problem-solving often involves both types of content (knowledge and values), depending on the subject matter. Furthermore, studies of students’ debates on socio-scientific issues involving value systems – such as genetically-modified organisms, human cloning, etc. – are concordant in showing that opinions (almost) never change radically, i.e. from ‘for’ to ‘against’, or the converse (e.g. Simonneaux 2001; Baker 2009b; Noroozi, McAlister, and Mulder 2016). More subtle changes have been observed, however, such as participants becoming less certain, more concessive or more open to consideration of counter-arguments.

In this paper, we analyse argumentative interactions in design meetings with respect to artefacts which involve values of Sustainable Development, such as freedom, solidarity and respect for nature (Robert, Parris, and Leiserowitz 2005). We show how the focus of the discussion evolves in the interplay between practical knowledge and values. We draw on the pragma-dialectical theory of argumentation (van Eemeren and

Grootendorst 2004) to investigate verbal conflicts on values in dialogue. Our findings highlight that value conflicts cannot really be genuinely resolved in the sense of mutual acceptance of refutation or successful defense of conflicting proposals. Rather, conflicts are ‘dissolved’ when participants renegotiate the meanings of values in order to examine their (in)compatibilities and to evaluate whether compromise is possible. Debates on values therefore usually end in a cooperative way, in the case where participants shift the focus of debate towards practical considerations. Otherwise, participants maintain adversarial positions, which then hinder the co-elaboration of design solutions. In the following sections we first describe the theoretical approach that we elaborated for characterising values in design, and argumentation in design. We then describe the design workshop we constructed and studied, explaining how our data was analysed, then present our results. We finally discuss the contribution of our research considering the role that values play in both collaborative design and participatory design processes.

2. State of the art

2.1. Values in design

For twenty years at least, the roles of human values in design have become a major focus of research (Friedman and Hendry 2019; Détienne, Baker, and Le Bail 2019). Values are commonly defined as ‘the principles or standards of a person or society, the personal or societal judgement of what is valuable and important in life’ (Oxford English Dictionary), or as ‘the beliefs that people have about what is right, wrong, and most important in life, business, etc. which control their behaviour’ (Cambridge English Dictionary). Various properties and roles of values in design have been distinguished (for an overview see Boztepe, 2007; Friedman and Kahn 2007). For example, values are

the symbolic or moral meanings that people attribute to a designed object. This concerns the distinction between objectivity and subjectivity, and between rationality and judgement. Value is also related to how artefacts provide desirable experiences for people. Values depend substantively on the interests and desires of human beings. In this study, we consider values as criteria, based on morality, beliefs and experiences, that influence the ways people evaluate and select design solutions, given that people may decide what is a good or bad solution based on their values (Friedman and Kahn 2007; Schwartz 2012). Values enter awareness when the solutions to be approved collectively provoke conflict of values between people.

Value Sensitive Design or VSD (Friedman and Kahn 2007; Friedman et al. 2013) is an approach which concerns specifically how values are included in the design process. This method investigates what values are involved, how people apprehend values in the context of use, and how technological properties support or hinder human values. VSD has been applied to projects that deal with sustainability issues. The study of Mok and Hyysalo (2018) concerned the installation of solar panels on a historical building. These authors showed how VSD helped designers to prioritize and manage values of different interest groups (e.g. values such as preservation, modernization and aesthetics). The study of Borning et al. (2005) described a project (a large simulation for predicting urban development) that involved numerous stakeholders and their divergent values (e.g. privacy vs. well-being in public spaces, sustainable development vs. economic development). VSD helped to take into account values such as fairness and democracy. The simulation does not discriminate between groups of stakeholders, but rather supports the democratic process in the context of land use, transportation, and environmental planning. Other studies highlight how VSD supports design processes embedded in societal tensions (e.g. post-conflict context in Rwanda) over a long period

of time (Friedman et al. 2010; Friedman, Nathan, and Yoo 2016). These studies showed that both design process and design principles (values) evolved in response to the shifting socio-political climate. As an example, the development of a commenting system in Information and Documentation Centres in Rwanda, to provide people the opportunity for sharing their own reflections, supported the value of freedom of expression.

VSD concerns how diverse values are articulated throughout the development of the artefact, as well as how the values and the artefact co-evolve over a long time period (i.e., several weeks, months). Stakeholders are considered separately, using several methods (e.g. surveys, focus group, field observations, interviews) to ‘collect’ the values that are important for them. As a result, new design solutions are imagined, developed and tested to integrate competing values. This paper explores how conflicting values are articulated in face to face social interactions during team meetings, using a framework of argumentation analysis in collaborative design.

2.2. Argumentation in design

In design, argumentation is a means for evaluating design problems and design constraints collaboratively, confronting viewpoints and elaborating common solutions (Trousse and Christiaans 1996; Stumpf and McDonnell 2002; Détienne, Baker, and Burkhardt 2012). The pragma-dialectical theory of argumentation (van Eemeren and Grootendorst 2004) is relevant to the analysis of argumentation in collaborative design situations (Baker et al. 2009). Pragma-dialectics views argumentation as a discursive activity that has communicative goals such as clarifying, refuting and negotiating the meaning of proposals, with respect to an issue or question. A proposal is a speech act such as statement or standpoint. People enter into an argumentative discussion once a

proposition has been expressed by one participant and then rejected (not accepted or called into doubt) by another one. This constitutes a ‘verbal conflict’ in dialectical terms, i.e. an exchange of (counter-)arguments or a debate (Walton 1989). According to pragma-dialectics, participants adopt specific dialectical roles (proponent, opponent or neutral) towards the initial proposition. These roles reflect their attitudes in the discussion (i.e. using arguments to defend or attack the proposition, explaining, conceding or searching for the best alternative in a cooperative way). Argumentative discussions may be more or less conflictual exchanges of arguments, involving processes of negotiation of meaning and reconceptualization, relating to knowledge co-elaboration. Argumentation may also involve systems of values underpinning overall viewpoints (Schwarz and Baker 2017).

In collaborative design situations, the pragma-dialectical theory helps to understand why a solution is accepted, transformed or rejected as a function of the moves made and the outcome of an argumentation dialogue. Previous studies (e.g., Barcellini, Prost, and Cerf, 2015; Détienne et al. 2016) have characterized argumentative interactions in design through the distinction between argumentative and epistemic dimensions. The argumentative dimension concerns the types of argument mobilised to debate design solutions (e.g. arguments in favour of solutions or against solutions, argument to clarify solutions). The epistemic dimension concerns the types of knowledge or values brought into the discussion (Baker et al. 2009; Détienne et al. 2016). Roles of participants along each dimension (What knowledge or values they evoke? In what way?) can be combined to give a summary of their ‘interactive profiles’. Interactive profiles reflect the positions of people towards design solutions (proponent, defender, opponent of the solution, neutral) and reasons (based on knowledge or values) that support such positions.

Thus, the research questions that we address here are: How are verbal conflicts on values managed by participants? Are conflicts resolved in a cooperative way or do participants maintain conflicting (adversarial) positions? To what extent is the outcome of the conflicts related to the incompatibility of values between participants? To what extent do value-conflicts intervene in design processes and knowledge building? In the next section, we present our research methodology.

3. Methodology

3.1. Experimental study: a one-day design workshop

We designed and implemented a one-day design workshop on the concept of a smart and sustainable neighbourhood. The workshop was designed on the basis of a previously carried out field study (Le Bail, Détienne, and Baker 2016; Le Bail 2018) on cohousing projects that were in the process of being created. We presented sustainable neighbourhoods to the participants as systems that encourage citizens to develop ecological and shared uses of goods, services and spaces (e.g., energy, transports) with the help of Information and Communication Technologies (Höjer and Wangel 2015). Such systems are intrinsically related to the values of Sustainable Development (Robert, Parris, and Leiserowitz 2005): social values (equality, solidarity), ecological values (respect for nature) and economic values (shared responsibility). The workshop was implemented with four teams of four students from different academic backgrounds. Participants were recruited on a voluntary basis. We sought participants with different visions about the concept of smart and sustainable neighbourhood. For each team, we recruited one engineering student, one student in economics, one student in design and one student in ecology and biodiversity. Our conjecture was that such a multidisciplinary constitution of groups would favour a broad and rich debate. 14

participants came on the day of the workshop (average age = 23; min = 20; max = 26, nine men and five women, at least one woman in each team). Two teams were composed of three participants and without the designer student.

3.2. Data collection

Before constructing collaborative design groups, we asked to each individual participant to complete a questionnaire comprising the following questions: How good do you find the concept of smart city? How good do you find the concept of cohousing? How good do you find the concept of collaborative consumption? The three concepts were defined in the questionnaire and we asked to each participant to explain why he/she found the concept good or not. The objective of this was to identify participants' initial positions with respect to the concept of the cohousing project to be designed, in order to better contextualize the interaction analysis.

Secondly, we asked each participant to generate a maximum of solutions concerning the following ten themes, with the general instruction: 'you have to imagine a new concept of neighbourhood in which you would be ready to live': 1) objectives of the neighbourhood; 2) means of production and distribution of water and electricity; 3) shareable resources (natural, material and immaterial); 4) non-shareable resources; 5) collaborative spaces; 6) type and shape of houses; 7) monetary or exchange systems; 8) collective decision-making process between inhabitants; 9) digital tools that could help collaboration and resource sharing, and how they could help; and 10) a set of events (political, climatic, economic) that could occur, towards which the cohousing design would need to respond.

We then built the teams randomly, whilst nevertheless respecting the rule of having one student from each of the different types of academic background (business,

art, engineering, ecology) in each team. We asked each of team to produce a collective sheet containing their common solutions for the ten themes (Figure 1). Within teams, participants had to confront their individual solutions (the ones they had imagined alone) to achieve a common concept. Data analysis concerns both the video recordings and the solution sheets (see Figure 1) of each team.

INSERT FIGURE 1 HERE

3.3. Data analysis

Exchanges between participants of each team were fully transcribed. We removed parts that did not relate to discussion on the design problem. For each team, the content of the retained discussion was divided into sequences according to the ten themes addressed by participants. We then coded each speech turn, using a coding scheme inspired from Baker et al. (2009), which aims at identifying, for each speech turn, two dimensions: 1) an argumentative dimension, which accounts for the debate between the participants; 2) an epistemic dimension, which accounts for the types of content (knowledge or values) mobilised to argue.

The coding and the data analysis were both collaborative (the three authors of this paper). This is a process in which there are face-to-face exchanges between two or more researchers, regarding a body of data, to produce an agreed coding. This differs from analyses where researchers code separately the same body of data and then measure a degree of agreement among them (e.g. Cohen's kappa coefficient). Collaborative analysis is suited to dialogical analysis. The combination of multiple viewpoints brings a diversity of perspectives to the analysis, embodied in researchers with different preoccupations and opinions (Cornish, Gillespie, and Zittoun 2013). The

three researchers who are familiar with interaction analysis met regularly to watch the videos, read the transcripts, discuss the coding and compare similarities and differences in interpretation.

3.3.1. Identifying the argumentative dimension

Argumentation dialogue can be seen not only as an exchange of arguments to persuade, but also as a process working on the plane of meanings, conceptual notions and their interactive redefinitions (Schwarz and Baker 2017). We therefore analyse both the expression of (counter-)arguments in dialogue, with respect to proposed solutions, and processes of sense-making with respect to proposals or their underlying concepts and values.

Furthermore, argumentation may be more or less conflictual, and this is made visible through the way of how people interact with each other. In conflictual argumentation, participants adopt opposed roles (proponent, opponent) with respect to proposals, each aiming to successfully defend their own views and to refute those of their opponents. In collaborative argumentation, participants openly explore arguments for and against proposals, with no fixed personal commitments, with the aim of reaching agreement on what should be accepted collectively, on the basis of the arguments evoked. This means participants find strategies in interaction to accommodate their divergent opinions about the object of design (McDonnell 2012).

Table 1 summarises the coding of the argumentative dimension, which distinguishes seven categories of dialogue moves. According to the theory, propositions of design solutions, approvals, disapprovals and interrogative moves are not argumentative. Both types of debate (conflictual and collaborative) imply

conceptualizing knowledge or values behind solutions. We identified an epistemic dimension for these categories.

INSERT TABLE 1 HERE

3.3.2. *Identifying the epistemic dimension*

For each argumentative turn, we identified the types of contents (the epistemic dimension) used. For example, an argumentative move such as ‘*this solution is too expensive*’ involves the notion of *cost*, evoked in order to reject the solution. Similarly, an argumentative move such as ‘*this solution is good for reducing waste*’ involves the notion of *ecology* in order to defend the solution. Epistemic categories were defined in an inductive manner, depending on the words used by the participants in their arguments (i.e. semantic analysis, meaning of the words, looking for synonyms). In total, we found 15 different epistemic categories used in argumentative interaction (Table 2). The distinction between knowledge and values was based on argumentation theory and the difference between factual and axiological argument. We consider knowledge in terms of contents related to arguments that depend on (putative) factual considerations, and values as contents related to argument reflecting judgement and ethics. Furthermore, values are identified here on the basis of the theory of basic human values (Schwartz 2012), even if the terms we used are not exactly those of the theory (e.g. ‘ecology’ in our study and ‘protecting the environment’ in Schwartz’s model). Table 2 gives examples of how contents used to argue were identified (underlined words are those which help to relate the argumentative move to knowledge or values).

INSERT TABLE 2 HERE

4. Results

4.1. A significant divergence on values within team 4

In total, the four teams proposed 336 design solutions. Among them, 40 involved arguments ‘against solutions’ (*contra*). This constitutes moments where the debate was conflictual, reflecting divergence of opinions between participants. For each team, Figure 2 shows the proportions of solutions concerned with conflictual argumentation. For all the four teams, most of the conflicting solutions involved values. Furthermore, team 4 was the team that debated the most solutions in a conflictual manner, these solutions being mostly debated with respect to values (associated with knowledge, or not).

INSERT FIGURE 2 HERE

In addition, according to the individual questionnaires, 15 participants found the concept of cohousing very good or quite good, whilst 1 participant stated that it was a very bad concept. This participant was the student in economics within team 4. He wrote in his questionnaire that ‘*cohousing leads to a loss of freedom and certain rights, such as choosing to like your neighbours or not or participating in shared tasks or not*’. Such a viewpoint strongly implies specific values (freedom, rights, participation) that are potentially in conflict with certain values of sustainable development (such as sharing resources).

For the two reasons stated above (the proportions of conflicting argumentation within teams and answers to individual questionnaires) we present the dynamics of

three argumentative phases within team 4, which reflect a divergence on values between the diverse participants.

4.2. Evolution of three verbal conflicts on values within team 4

In chronological order, the three phases of discussion in team 4 concerned the same verbal conflict on the values of sharing. We present the coded data (Tables 3a, 3b, 3c, 4a, 4b, 4c, 5a and 5b). The first column (T) is for speech turns (and subdivisions of turns if necessary). The second column (Pa) is for the participant speaking. P1 is the designer, P2 is the economist, P3 is the ecologist and P4 is the engineer. The third column is for dialogue. The fourth column is for the theme concerned. The fifth column is for the argumentative dimension. The column 'relation' makes the link between argumentative moves and the solution or speech turn concerned. The last column is for the epistemic dimension. In the three diagrams shown in Figures 3, 4 and 5, we retrace the dynamics of each conflict. The horizontal line represents the evolution of time, with moments of conflict according to the argumentative dimension. The argumentative dimension is illustrated through various symbols that are presented in the legend. We added the numbering of the dialogue turns. The vertical axis illustrates the move of the discussion between knowledge contents and values (epistemic dimension). Codes of epistemic categories are also presented in the legend.

4.2.1. First verbal conflict on the values of sharing

The first conflict on the values of sharing appeared within team 4 when participants started to discuss the second theme 'means of production and distribution of water and electricity' (Table 3a). P1 proposed a solution (S15, turn 203) and gave two arguments in favour of it (turn 205): one concerns how people consider the exploitation of natural resources (engagement), the other was practical (technical persuasion). Both P4 – who

approves the solution – and P1 discuss the meaning of personal engagement, supported by the concept of a shared well, ‘located in the centre of the neighbourhood’ (turn 206) and functioning by peer pressure (turn 207). P2 rejected the proposal to have a shared well because people would not be free to consume how much they wanted (turn 208). This disagreement was the starting point of the conflictual argumentation between P1 and P2.

INSERT TABLE 3A HERE

Pursuing his claims, P1 proposed a second solution (S16, turn 209a). Again, he gave arguments related to the notions of persuasion and engagement of people (turn 209b). For P1, the means of distribution of water and electricity must be designed to support decrease in consumption (a change from ‘classical’ practices to sustainable practices) as well as to change beliefs and values of people towards these practices (the ethical meaning behind ecological practices). P2 disagreed and rejected both S16 and the peer pressure it imposes (turn 210). As a result, P1 relaxed his idea of social pressure and argued that the main objective of his proposal was to raise awareness in people (turn 211).

INSERT TABLE 3B HERE

According to the direction taken by the debate, P3 opens up a new theme of discussion, on ‘how to engage people in better consumption practices’ (turn 212). At that moment, ethical questions clearly underlie the whole debate. The challenge is to find solutions that both encourage sustainable practices and respect people’s values.

Once again, P1 argues in favor of solutions such as S15 and S16 (turn 213), by mobilizing the relationship between persuasion (forcing people to better consume) and personal engagement (it changes the mentality of people). P2 answers P3 by elaborating a new solution (S17, turn 214). S17 means that each unit will have a water quota not be exceeded every month. Finally, P1 recognizes that the solution of P2 could correspond to his own point of view (turn 215) and P3 agrees (turn 216). S15, S16 and S17 were all written by P3 (transcriber of the team) on the collective sheet, but we do not know if P2 finally accepted S15 and S16.

INSERT TABLE 3C HERE

Figure 3 shows the dynamics of the verbal conflict. Argumentation is at first conflictual (presence of arguments against the proposed solutions), then becomes more collaborative (disappearance of counter-arguments), being supported by both knowledge and values. P1 and P2 have adversarial positions (proponent for P1 and opponent for P2, respectively) concerning solutions for collaborative consumption (S15 and S16). The divergence of opinion takes place in the epistemic ‘space’ of values. P2 disagree because of the social pressure that the two solutions claimed by P1 imply. But, P2 does not debate the value of engagement and technical persuasion, claimed by P1 as well. A compromise is found when the discussion moves to reflection on how to engage people. P2 proposes a solution (S17) that echoes the argumentation of P1 (engagement through persuasion) and eliminates the problem of ‘social pressure’ that does not please P2.

INSERT FIGURE 3 HERE

4.2.2. Second verbal conflict on the values of sharing

The second conflict, on the values of sharing, concerns the fifth theme ‘collaborative places in the neighbourhood’ (Table 4a). P3 proposes two connected solutions (turns 294a and 294b), one consisting of creating collaborative kitchens in the neighbourhood (S22), and one consisting of imposing a daily scheduling for use of equipment in the common kitchens (S23). P2 rejects S22 because of the reason of annoyance (turn 295a). This rejection opens the verbal conflict.

INSERT TABLE 4A HERE

The practical argument of annoyance then changes into a conceptual discussion initiated by P4 about what ‘being annoyed’ about sharing kitchens means for people (Table 4b). P4 and P2 agree with the idea that inhabitants should feel free to have individual kitchens in their private units, and thus to use common kitchens or not (turns 296 and 297). P1 rejects S23 because of the organisational reason that people have different practices concerning the hours when they would use equipment (turn 298).

INSERT TABLE 4B HERE

The conflicting argumentation ends (Table 4c) with P2, who proposes another solution, which is ‘sharing basic foods’ (S24, turn 299a). P2 argues with the notion of ‘utility’ (turn 299b). P1 accepts the solution, but not only for practical reasons. P1 thinks sharing foods is necessary to reduce the consumption of the neighbourhood (turn

300). P2 agrees with P1 (turn 301a) but continues practical thinking on how to organise the sharing of foods and why this would reduce costs (turns 301b and 304). P1 and P3 both approve the evolution of the initial solutions (turns 302 and 303) and ‘sharing foods’ was finally accepted and proposed on the sheet of the team.

INSERT TABLE 4C HERE

Figure 4 shows the dynamics of the verbal conflict. Again, conflicting argumentation becomes cooperative, and it is supported by both knowledge and values. In this sequence, P1 and P2 both agree with the rejection of collaborative kitchens (S22 and its corollary S23) and they both accept the solution of sharing foods (S24). P1 rejects the solution of sharing kitchens for practical reasons (organisation), whereas P2 rejects the same solution for ethical ones (the fact of imposing shared places on people). Then, P1 accepts the solution of sharing foods for ethical reasons (the benefit of sharing for society), whereas P2 defends the same solution for practical ones (sharing is useful). Alternatively, P1 and P2 do their meaning-making in two different epistemic ‘spaces’ (knowledge and values). The confrontation of these two types of contents does not create conflict between them. This is made possible because the practical knowledge evoked by P2 (utility, reducing cost) do not interfere with the values claimed by P1 (sharing is good for society).

INSERT FIGURE 4 HERE

4.2.3. Third verbal conflict on the values of sharing

The third conflict on the values of sharing concerns the seventh theme ‘monetary or

exchange systems' (Table 5a). P1 proposes a solution, which is 'a perishable local currency' (S41, turn 442) and argues that is favourable to the reduction of individualism (turn 444). P3 agrees and specifies the solution (turn 443). P2 disagrees because of values of freedom and economy (turn 445). This disagreement is the starting point for the conflict between P1 and P2.

INSERT TABLE 5A HERE

The conflicting argumentation clearly shows a divergence of opinion between P1 and P2, concerning the notion of sharing and the value of economy (Table 5b). For P1, saving money is not necessarily a good thing and if people value economy as less important, other forms of inheritance will appear (turns 446 and 449). For P2, this is not acceptable. P2 rejects the idea of seeing money as collective property with no value (turns 447 and 450). For P1, money as individual property restrains the development of collaborative functioning (turn 451). The debate closes there. S41 was finally written by P3 (who agrees with P1) on the collective sheet, without agreement of P2.

INSERT TABLE 5B HERE

Figure 5 shows the dynamics of the verbal conflict. Argumentation is only conflictual, and it is supported only by values. P1 and P2 have adversarial positions concerning the value of economy and the underlying concept of sharing money. They do not find a solution which satisfies both of them, and therefore they do not resolve the 'problem' of the 'monetary system of the neighbourhood'.

INSERT FIGURE 5 HERE

4.2.4. Management and outcome of the conflicts, interactive profiles

The evolution of the three conflicts on the values of sharing within team 4 indicates that negotiating with respect to controversial solutions results from compromises between what is ‘factually’ a ‘good’ solution and what is ‘acceptable’ for participants’ values.

The dynamics between conflicting argumentation and collaborative argumentation concerns the extent to which compromise is possible and the extent to which values are divergent between participants. Table 6 summarizes the interactive profiles of the participants for each verbal conflict. Profiles result from the combination of the dialectical role of the participants (proposer of the initial solution, proponent or opponent of the initial solution, proposer of the selected solution) and their epistemic roles (contents they mobilise, knowledge or values).

INSERT TABLE 6 HERE

First, it should be specified that we found sequences of discussion where there was no conflict between values (the loop a in Figure 6). Then, in the case of a minor conflict, participants found solutions that were less controversial, and which did not question values to a great extent (loop b on Figure 6). This was the case with the ‘sharing foods’ solution (conflict N°2). P1 and P2 were both against the solution of P3, for practical reasons (Table 6). The change of the initial solution (‘sharing kitchens’) eliminated the problem of ‘sharing too many things with other inhabitants’ (P2’s argument) and did not compromise ‘the benefit of sharing in the neighbourhood’ (P1’s argument). Debate was brought back to practical issues (anticipating food quantity)

through another solution proposed by P2 and that pleased P1. A major disagreement clearly reflects a conflict between individual aspirations (loop c on Figure 6). In the three moments of debate, P2 rejected collaborative solutions three times (first the common well, then common kitchens and then a perishable currency) and proposed solutions that preserved people from (problematic or not) social relationships. Thrice, P2 rejected the idea of sharing places and resources. Twice, he mentioned the desire to feel free to do what he wanted. During the first conflict ('common well') P1 and P2 opposed each other on the initial solution of P1 because of underlying values, but not because of practical argument (Table 6). This offered the opportunity for the participants to find a compromise (P2' selected solution). The debate ended with a new solution that was less controversial (loop c' on Figure 6). During the second (minor) conflict, for P1, the rejection of sharing kitchens was not a rejection of the notion of sharing itself. But, for P2, it was. The 'perishable currency' (conflict number 3) revived the debate concerning sharing values, which had not really been solved the first time around. This time, P1 and P2 opposed each other on the initial solution of P1 only because of values of economy that were totally divergent (Table 6). Because the problem to be solved (finding a 'monetary system') is, by its very nature, based on the values of economy, P1 and P2 did not find any alternatives to their adversarial argumentation. The third conflict had closed with no cooperation and with a partially accepted solution (loop c'' in Figure 6).

Finally, according to Table 6, we can see that P4 emerged as a type of moderator during the first two conflicts. Twice he engaged in sense-making on values. The first time, P4 helped P1 to clarify his 'common well' solution and the underlying value of engagement. The second time, P4 helped P2 to clarify what he meant by 'being annoyed by other people'. Then, P4 remained 'neutral' during the third conflict. In addition, P3

remained quite 'neutral' during the first two conflicts. The first time, P3 moved the discussion to ethical issues, but did not give any opinion. The second time, she did not defend her solutions. Then, P3 was on the side of P1 and was an opponent of P2 during the third conflict.

INSERT FIGURE 6 HERE

5. Concluding discussion

Considering that it is necessary to support the articulation of values in co-design (Friedman et al. 2013), our study aimed to understand the roles that values play in verbal conflicts and argumentative interaction, during collaborative design meetings. We implemented a design workshop with four teams of students each containing participants from different academic programs. Using the pragma-dialectical theory of argumentation (van Eemeren and Grootendorst 2004) we identified, in each team, design solutions that were the objects of verbal conflicts giving rise to argumentation. We focused on one team in which there were many conflicting argumentation sequences on the values of sharing, identifying the roles that participants played in the outcome of the conflicts (Baker et al. 2009). Within the scope of our limited study, our interaction analysis highlights three important points regarding the roles that values play in collaborative design processes.

Firstly, most verbal conflicts occur with respect to value systems (Baker 2009a; Schwarz and Baker 2017). This implies that a design meeting engaging people with divergent values relating to the artefact to be co-created will run higher risks of provoking conflicting debates on design solutions. Because value conflicts cannot

always be avoided, it would be advisable to help people to find a means of accommodation (McDonnell 2012).

Secondly, and following the first point, value conflicts cannot be genuinely resolved, in the sense of achieving sincere agreement on the choice of proposals to be accepted or rejected. In the long term values, of people and groups sometimes evolve and change, but not in the duration of a short meeting or even that of a design project lasting several weeks or months. In these cases, participants resort to transforming the meanings of value conflicts into conflicts bearing on practical considerations that can potentially be resolved. Otherwise, debates are abandoned, usually with topic shifts. Our conclusions regarding value conflicts are concordant with studies of students' debates on socio-scientific issues involving value systems (e.g. Simonneaux 2001; Baker 2009b; Noroozi, McAlister, and Mulder 2016), which show that, although no major changes occur (from "for" to "against", or the converse) it is nevertheless possible that participants become more open to consideration of counter-arguments and deepen their own understanding of the issues at stake. For that, participants must identify where the main sticking points are in the debate. Then, they can easier clarify what they think. Moderator strategies that we observed, such as scaffolding sense-making on values, or shifting the debate towards 'established facts' or 'evidence' (Baker, Détienne, and Barcellini 2017), may be considered for helping participants to understand what they agree or disagree on.

Thirdly, unresolved value conflicts impact the group level. Value systems influence the design of an artefact, as well as the construction, the cohesion and the functioning of the collective itself (Détienne, Baker, and Le Bail 2019). A recent field study, carried out on a cohousing project under construction, showed that many unresolved conflicts within the community led to the exclusion of members (Le Bail

2018). With the emergence of communities of citizens concerned by sustainability and other political issues, a big challenge is to develop methods and tools to support constructive debate on values in participatory design (e.g. moderators' training, visualisations that encourage the discussion of meaning of values).

Finally, our study is limited to a laboratory situation. Participants were students from diverse educational programs, but future research could extend this to teams in organizations with more diversity in age, status, and experience. Furthermore, participants did not have an immediate tangible stake in the outcome of the design (they would not be actually living in the cohousing project that they had designed). We suggest future research on value conflicts in the design of sociotechnical systems, involving field studies, longitudinal studies, the study of evolution of individual values throughout the design process, and the study of human strategies, tools and methods for conflict resolution.

To conclude, notwithstanding the limited data under study, this paper has highlighted the fact that value conflicts are not genuinely resolved within the duration of design meetings. Groups and participants therefore develop strategies (renegotiating meanings of solutions, meaning-making of values, determining possible compromises, shifting the debate towards practical considerations) to deal with that. The study has also emphasized the importance of moderators in supporting these strategies, more or less spontaneously.

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Table 1. Coding of the argumentative dimension.

Categories of speech	Coding	Example	Type of debate
1. Proposition of design solution	S _n (chronologically numbered from 1 to X)	<i>"I propose solar panels"</i>	No Argumentation
2. Approval of solutions without argument	[+]	<i>"Yes, ok"</i>	
3. Disapproval of solutions without argument	[-]	<i>"No, I don't want that"</i>	
4. Interrogative formulation such as asking to repeat or to explain something	?	<i>"Are you sure?"</i>	
5. Sense-Making: definition, clarification or illustration of a solution (generally follows interrogations)	SeM	<i>"It's like other non-nuclear sources of energy"</i>	Argumentation not Conflictual
6. Argument in favour of (pro) a solution (generally follows approvals)	Arg+	<i>"It works very well"</i>	
7. Argument against (contra) a solution (generally follows disapprovals)	Arg-	<i>"It's expensive because it takes a lot of rare minerals to build them"</i>	Conflicting Argumentation

Table 2. Coding of the epistemic dimension.

Epistemic contents (notions)	Coding	Example of argumentative speech	Knowledge or Value
1. Economy	ECON	<i>“<u>Saving money</u> is important it's <u>your children's legacy</u>”</i>	V
2. Social relationships	SOCR	<i>“It provokes <u>jealousy</u> and jealousy creates <u>conflicts</u>”</i>	V
3. Ecology	ECOL	<i>“This solution provokes <u>waste of resources</u>”</i>	V
4. Freedom (degree of)	FREE	<i>“Everyone should <u>be free</u> to use it or not”</i>	V
5. Engagement	ENGA	<i>“This requires <u>a personal commitment</u>”</i>	V
6. Equity	EQUI	<i>“All people are <u>treated as equal</u>”</i>	V
7. Hedonism	HEDO	<i>“We must consider <u>the beauty</u> of buildings”</i>	V
8. Cost	COST	<i>“With this solution, <u>we will pay less</u> heating”</i>	K
9. Utility	UTIL	<i>“Solar panels are <u>useless</u> if there is no sun”</i>	K
10. Organisation	ORGA	<i>“It's necessary <u>to manage</u> quantities”</i>	K
11. Technical Persuasion	PERS	<i>“<u>the more you reserve</u> for the car sharing service, <u>the more your priority to reserve</u> it in the future decreases”</i>	K
12. Annoyance	ANNO	<i>“Wind turbine no, it makes <u>too much noise</u>”</i>	K
13. Technical Feasibility	FEAS	<i>“Today, <u>it's easy to capture</u> it with sensors”</i>	K
14. Efficiency	EFFI	<i>“It <u>works very well</u>”</i>	K
15. Practical Usability	BILI	<i>“But old people <u>don't use</u> smartphones like young people”</i>	K

Table 3a. Opening of the first conflict.

T	Pa	Dialogue	Theme	Argum. dimension	Rel.	Epistem. dimension
203	P1	I think fetching water from the well is a good idea	(2) Production/ Distribution water and electricity	S15		
204	P4	Yes.		+	S15	
205	P1	It helps to change your relationship to the resource. You plan your consumption and you know exactly what you consume.		Arg+	S15	ENGA(V) PERS(K)
206	P4	Yes, a kind of public fountain located in the centre of the neighbourhood.		SeM	S15	ENGA(V)
207	P1	Yes, and people can name and shame those who take too much water.		SeM	S15	ENGA(V)
208	P2	No, I want to consume however much I want.		Arg-	S15	FREE(V)

Table 3b. Argumentation within the first conflict.

T	Pa	Dialogue	Theme	Argum. dimension	Rel.	Epistem. dimension
209a	P1	This is not the most important. Imagine you have common areas to recharge batteries and if you need electricity you must go in these places.	(2) Production/ Distribution water and electricity	S16		
209b	P1	This system requires you to reason. If you consume too much, you need to move your ass. It changes your relationship to the resource.		Arg+	S16	PERS(K) ENGA(V)
210	P2	No, this implies that you are judged by others!		Arg-	S16	SOCR(V)
211	P1	No, the main message is to make people aware of their consumption practices.		Arg+	S16	ENGA(V)

Table 3c. Conclusion of the first conflict.

T	Pa	Dialogue	Theme	Argum. dimension	Rel.	Epistem. dimension
212	P3	But it is possible? Will people really do that?	Engage people to reduce consumption	?		
213	P1	Yes, because they will have no choice. If they want to drink, or want energy, they will need to move their ass. And this will change how they do the thing.		Arg+	S15 S16	PERS(K) ENGA(V)
214	P2	Well, we can have a fixed package such as a monthly water package, something like that.		S17		
215	P1	Yes, my idea leads to your idea.		+	S17	
216	P3	Yes, I had the same idea		+	S17	

Table 4a. Opening of the second conflict.

T	Pa	Dialogue	Theme	Argum. dimension	Rel.	Epistem. dimension
294a	P3	We can have collaborative kitchens	(5) Collaborative places	S22		
294b	P3	and schedules, and you have the right to use equipment only at that time.		S23		
295	P2	No, I don't want someone messing up my kitchen.		Arg-	S22	ANNO(K)

Table 4b. Argumentation within the second conflict.

T	Pa	Dialogue	Theme	Argum. dimension	Rel.	Epistem. dimension
296	P4	But it depends on what being annoyed by others means for you. We can have individual and collective kitchens.	(5) Collaborative places	SeM	S22	SOCR(V)
297	P2	Yes, everyone should be free to use collaborative kitchens or not.		SeM	S22	FREE(V)
298	P1	I am an insomniac and I want to be able to cook at 4 am. If you impose me a schedule, I will not be happy.		Arg-	S23	ORGA(K)

Table 4c. Concluding of the second conflict.

T	Pa	Dialogue	Theme	Argum. dimension	Rel.	Epistem. dimension
299a	P2	Me, I had the idea of sharing basic foods such as milk, coffee and salt	(5) Collaborative places	S6		
299b	P2	Imagine you go home at 10 pm, you want coffee and don't have it. Now you know you can always find it.		Arg+	S24	UTIL(K)
300	P1	Yes, but it's more than rationing things, it's pooling things, sharing...		Arg+	S24	ECOL(V)
301a	P2	Yes! Yes!		+	300	
301b	P2	And you anticipate quantities in advance. You know exactly how many people drink milk, how many people drink coffee, and you have big containers for these people.		SeM	S24	ORGA(K)
302	P1	Ok.		+	301b	
303	P3	Yes.		+	301b	
304	P2	And this reduces costs.		Arg+	S24	COST(K)

Table 5a. Opening of the third conflict.

T	Pa	Dialogue	Theme	Argum. dimension	Rel.	Epistem. dimension
442	P1	For me it is necessary to have a perishable local currency.	(7) Monetary or exchange systems	S41		
443	P3	I agree. A kind of system with points to be exchanged before a certain date.		SeM	S41	BILI(K)
444	P1	Exactly. Not giving the opportunity to store money or something else is favourable to the reduction of individualism.		Arg+	S41	ENGA(V)
445	P2	But it restricts the opportunity to save money!		Arg-	S41	FREE(V) ECON(V)

Table 5b. Argumentation within the third conflict.

T	Pa	Speeches	Theme	Argum. dimension	Rel.	Epistem. dimension
446	P1	Saving money is shit!	(7) Monetary or exchange systems	Arg+	S41	ECON(V)
447	P2	Saving money is important it's your children's legacy.		Arg-	S41	ECON(V)
448	P3	But with this system precisely, people will be on the same level of equality.		Arg+	S41	EQUI(V)
449	P1	If you give people a cultural heritage, they don't need money.		Arg+	S41	ECON(V)
450	P2	No, I think It's always better to have more than less, whatever the type of money.		Arg-	S41	ECON(V)
451	P1	Yeah, but in a collaborative system, when you try to minimize the use of resources, money is not important		Arg+	S41	ECON(V)
452	P3	Yes.		+	451	

Table 6. Interactive profile of the participants for the three conflicts.

Verbal conflict	Initial solution	P1		P2		P3		P4		Selected solution
		K	V	K	V	K	V	K	V	
N°1	P1	Arg+	Arg+		Arg-				SeM	P2
N°2	P3	Arg-		Arg-	SeM				SeM	P2
N°3	P1		Arg+		Arg-	SeM	Arg+			

Figure 1. A part of the collective sheet of team 1.

Figure 2. Solutions concerned with conflicting argumentation, in each team.

Figure 3. Dynamics of the first conflict.

Figure 4. Dynamics of the second conflict.

Figure 5. Dynamics of the third conflict.

Figure 6. Evolutions of debate involving values within team 4.