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Decision Support

Structured dialogical design as a problem structuring method illustrated in a *Re*-invent democracy project

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ABSTRACT

This article proposes the importance of admitting into the repertoire of Problem Structuring Methods for (Community) Operational Research, the methodology called Structured Dialogical Design (SDD). Problem Structuring Methods are described in the literature as facilitating transparent and participative ways of formulating and systemically modelling problems with a view to participants' co-defining alternative futures. We reflect upon the contribution of SDD as lying in its appreciation of "third phase science" and discuss links to other deliberative processes. We indicate why SDD can be classed as "problem structuring" despite the near absence of publicisation in the Operational Research (OR) literature to date. We discuss distinct contributions that the SDD offers to the OR world and indicate how it strengthens and extends Community OR, contributes to Critical Systems Thinking in OR, and offers new mathematical approaches that the Community OR practitioners may wish to consider using. By way of illustration, we showcase the "European Initiative" as an aspect of a large-scale project across five geographical regions funded by the United Nations Democracy Fund, in conjunction with the Future Worlds centre (2016–2018). It engaged as stakeholders five cohorts of youth pioneers concerned with formulating options for Re-inventing democracy in the digital age.

1. Introduction

The objective of this article is to elucidate why the methodology of Structured Dialogical Design (SDD) (e.g., Christakis & Bausch, 2006) should be considered as a Problem Structuring Method (PSM). It adds a specific contribution to the Operational Research (OR) Community, including when facilitating Community Operational Research (COR). Midgley, Johnson, and Chichirau remark that a "critical attitude" on the part of OR practitioners is "commonly found in Community OR theory, methodology and practice" (2018, p. 772). However, they note that this cannot be considered the *defining feature* of COR, which is defined by the meaningfulness of the community engagement as COR practitioners/facilitators attend to participants' concerns. Midgley et al. further comment that in COR, the "clients" need not be "obvious" community organisations such as grass-roots community groups or voluntary associations (2018, p. 772). Applications of COR can stretch beyond this – to include, for example, a "section of the population" that has a high stake in the issues (pp. 772–773). The case discussed in this article can be considered as COR using the above definition.

Midgley et al.'s point, that COR practitioners typically adopt some form of critical attitude in their implicitly or explicitly invoked theory(ies), is important for this article – because SDD arguably falls under the ambit of Critical Systems Thinking (CST), as we argue below (Flood & Romm, 1996; Flood & Jackson, 1991; Jackson, 1991, 2019, 2000; Midgley, 1996, 2000; Midgley & Rajagopalan, 2021; Midgley et al., 2013; Ulrich, 1983). For this reason, we regard it as advisable to include it as part of the repertoire of approaches that can be drawn upon by practitioners using PSMs. If we do so, the interpretive tradition sometimes associated with PSMs (as in "soft OR") can become appropriately coupled with a "critical" edge, which includes an empowering remit, especially for those marginalised in the social fabric (Jackson, 2006).

To organise our proposal to consider SDD a vital addition to PSMs, we structure our discussion around the framework Smith and Shaw (2019) used to identify methods (actually methodologies[1]) that can be deemed PSMs. By way of an extensive litera-

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[1] As Greene indicates, what affords a *methodology* its character is its ability to grapple with questions such as "whose interests are served by the inquiry and what

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0377-2217/

ture review, Smith and Shaw set out to locate characteristics that PSMs can be considered as having in common (2019, p. 404). They use the four pillars of paradigms as identified by Guba and Lincoln (1994, 2003), namely: *ontology* (the presumed nature of reality); *epistemology* (the relationship between "knower" and "known"); *axiology* (how the enquiry process itself might encapsulate values); and *methodology* (how the knower can proceed to engage with "what can be known"). As we indicate in footnote 1, the term *methodology* itself is not reducible to the use of particular methods (processes of enquiry).

As part of their advocacy of a constructivist approach, Lincoln and Guba vouch for a "hermeneutic/dialectical methodology", which involves facilitating the establishment of "hermeneutic circles" (circles of participants) within which "various constructions can be juxtaposed and examined in an encounter format" (Lincoln and Guba, 2013, p. 66). They indicate that, ultimately, "constructivist and qualitative researchers choose to confront the ethical demands of a recaptured, reconceptualised and recommitted form of research", which breaks with the demands of the "culture of science and scientism" (where science is posed as seeking to harness "objective" knowledge). Smith and Shaw refer to this characteristic of the "OR quantitative paradigm" as "scientisation and depoliticisation" (Smith and Shaw, 2019, p. 404). From Lincoln and Guba's perspective, in renouncing this vision of science, enquiry processes are used instead to "extend democratic and participatory ends" (Lincoln and Guba, 2013, p. 79). As far as stakeholders are concerned, Lincoln and Guba recommend that constructivist inquirers take a posture of "activism with respect to all stakeholder groups with which they interact, particularly those that are in some way disempowered" (Lincoln and Guba, 2013, p. 78).

It can be said that Lincoln and Guba's position on renouncing a scientistic claim to "objectivity" and instead seeking to facilitate a democratic and participatory process of knowledge co-creation, echoes a similar appeal made by Churchman in his book *Challenge to Reason* – sections of which he indicates he "presented to the joint Canadian Operational Research Society and The Institute of Management Sciences meetings in Toronto, May 1962″ (Churchman, 1968, p. vi). He states his view of the notion of objectivity as follows:

One of the most absurd myths of the social sciences is the "objectivity" that is alleged to occur in the relation between the scientist-as-observer and the people he [sic] observes. … Instead of the … empty claim that an observation is objective if it resides in the brain of an unbiased observer, one should rather say that an observation is objective if it is the creation of many inquirers with many different points of view. (Churchman, 1968, p. 86)

In terms of his (re)definition of "objectivity" as residing in *intersubjectively-created observations and understandings*, Churchman insists that lay people in society need to be involved in "inquiring about those things that are of concern to them" (Churchman, 1968, p. 87) to develop actionable insights to the "serious problems of our society" (p. 87). In line with these sentiments, Brans and Gallo point out that, based on Churchman's arguments presented in various OR forums, "ethics, although not always under this name, has surfaced many times in the OR/MS literature" (Brans and Gallo, 2007, p. 166). Mingers and Rosenhead refer in this regard to the role of PSMs to enable key stakeholders to develop enriched understandings of the nature of the perceived "problem situation" and possible ways of addressing it (Mingers and Rosenhead, 2004, pp. 532–533). Rosenhead indicates that potential applications of PSMs in "significant areas" for the future include: "development planning" methods; "Community OR"; "large group interventions"; and the "design of information systems" (Rosenhead, 2006, p. 764). The SDD methodology, as discussed in this article, is indeed fruitfully applicable to all of these areas identified by Rosenhead (which need not be considered as mutually exclusive). We recommend that it be taken seriously by (C)OR practitioners and theorists on these grounds.

At this point, it is worth mentioning that although this methodology has not been widely publicised in the OR literature – with an exception being Laouris and Michaelides (2018)-it has had a more prominent presence in various systems journals (e.g., Laouris, 2012; Laouris & Christakis, 2007; Laouris et al., 2009a; 2009b; Laouris, Laouri & Christakis, 2008; Bausch & Flanagan, 2013; Christakis, 1973, 2004; Christakis & Harris, 2004; Christakis, Dye & Shearer, 1999). Various edited books dealing with contemporary systems thinking (e.g., books edited by McIntyre-Mills, Romm, & Corcoran-Nantes, 2019; McIntyre-Mills & Corcoran-Nantes, 2021; Metcalf, Kijima & Deguchi, 2021) also include contributions by SDD proponents. As will be seen below, one of the characteristics of PSMs identified by Smith and Shaw is that PSMs "see problems as systems in which elements are connected by interrelationships", where the aim is to "build shared understanding" of such interrelationships (2019, p. 405). The need for a high-quality systemic problem definition has been emphasised by authors transcending "disciplinary" boundaries in systems thinking mode (e.g., Cardenas, Janes & Otalora, 1999; Cisneros & Hisijara, 2013; Corredor, 2020; De Quincey, 2005; De Zeeuw, 1996; Flood, 2010; Gergen, 2015; Kakoulaki & Christakis, 2018; McIntyre-Mills, 2008; McIntyre-Mills & Binchai, 2014; Midgley, 2000, Midgley, 2008; Pickering, 1995, 2013; Romm, 2002, 2018, 2020).[2]

The article is structured as follows. In Section 2, we outline a conception of three phases of science as put forward by various authors who propound the idea that "observation" is inextricably tied to intervention, whether this is consciously acknowledged or not. We spell out how "third phase science" works with the recognition that observation is performative (that is, action-imbued). We situate SDD in terms of its commitment to this understanding of science.

In Section 3, we describe the SDD methodology briefly and explain how it was used in the particular case of the *Re*-invent Democracy project implemented by the Future Worlds centre (FWC). We outline the staged processes for facilitating participants' dialogical modelling. We indicate how the stages of the SDD process panned out, leading to what are called "Influence MAPS". We discuss how these maps – expressing interrelationships between ideas as formulated – were a product of processes of participant learning, wherein people's initial preferences/views became altered as they participated in the deliberations.

In Section 4, we conduct a critical evaluation of the SDD under the prism of PSMs, drawing attention to its ontological, epistemological, axiological, and enquiry process underpinnings – as per Smith and Shaw's (Smith & Shaw, 2019) framework – while at the same time offering some extension of the framework.

In Section 5, we refer briefly (with reference to the application of SDD) to the four areas located by Rosenhead (2006, p. 764) for the actual and potential use of PSMs: namely, development planning; Community OR; large-group interventions; and the design of

political stances and value commitments are advanced" (Greene, 2008, p. 19). In the systems literature, Checkland (2000) speaks of soft systems *methodology* (admitting that it contains a philosophical position on what the purpose is of SSM in terms of accommodating alternative perspectives on interpreted "reality"); and Jackson (1993) refers to the system of systems *methodologies* as offering a guide to inquirers.

[2] In considering whether OR (or Community OR) should be treated as a separable "discipline", Churchman pleads that in naming OR practices (and theorising around these), we should nevertheless recognize the deficiencies of organising ourselves along the lines of "the same kind of disciplinary structure that the physicists created", where borders between disciplines are seen as impermeable (Churchman, 1968, p. 85).

information systems. In Section 6, we draw and discuss our conclusions.

2. Three phases of science: SDD's commitment to third-phase science

De Zeeuw (1996) locates theories of science (used more or less consciously by those practising "science") as falling into three phases. He pinpoints the first phase, which he sees as associated with the natural sciences developed in 15th and 16th century Western Europe, as embodying the view that the "observational devices" employed by scientists enable the observation of realities existing "out there". This view of science is based on a self-understanding that what is being observed exists "in reality", as opposed to being a function of the instruments and mindsets of the observers. (De Zeeuw refers in this regard to the Cartesian notion of objects "out there" – De Zeeuw, 1996, p. 2.) This, De Zeeuw notes, is what is traditionally called "science" (De Zeeuw 1996, p. 4). However, in keeping with the arguments popularised in Kuhn's book, *The Structure of Scientific Revolutions* (Kuhn, 1962), many scientists began to appreciate that "science is not an a-historic process" operating independently of its social context (De Zeeuw, 1996, p. 1). Furthermore, there was a growing recognition that observations depend on the particular frames scientists use to pose questions about posited "realities" (whether natural or social). These frames could and did differ between observers. Thus, in second-phase science, observations are (broadly) recognised as being "observer-dependant", that is, value-laden, "action and context-dependant, and … human-laden" (De Zeeuw, 1996, p. 4). De Zeeuw notes that to account for the human-ladenness of observation, scientists in various fields of study developed strategies to define criteria for "good" observations. For example, observations could be judged as 'better than others' insofar as they seemed to mitigate against unintended effects in the realm of their application (1996, p. 18). However, they are still judged for their quality by professional researchers rather than by the "general public of users" (as also noted by Flood, 1995, as cited by De Zeeuw, 1996). Even within the scientific community, there appeared to be no method for resolving contention between scientists, given that frames of reference for "observing" could be regarded as incommensurable (as in Kuhn's 1962 account). Meanwhile, efforts were often made to reduce the "observer-dependant" character of the constructed objects (1996, p. 20).

With the advent of what De Zeeuw calls "third phase science", objects are defined as being "high quality" insofar as they become constructed to enable new activities on the part of (public) users (p. 20) and insofar as they invite the participation of users. De Zeeuw considers that the advantage of third phase science is that it "leaves the construction of objects to those who need them" (De Zeeuw, 1996, p. 21). He concedes that people might wonder whether "third phase" science still is "science". He points out that the prime characteristic/advantage of such a science is that it does not aim to reduce differences between how people see things, but rather to increase differences in the collective in which people construct their exchanges … [the intention is that people will] use their exchanges to … improve on collective learning. (De Zeeuw, 1996, p. 21)

De Zeeuw's considerations regarding third phase science as involving the participation of citizens and providing the space for collective learning in the public sphere is based on his account of the different ways in which "observations" can be treated by would-be scientists. According to Christakis and Bausch's interpretation of De Zeeuw, third phase science is characterised by an insistence that "the subjects of a social system design must also be the designers of the system, because only then will that design be based upon needed high quality observer dependant data" (Christakis & Bausch, 2006, p. 179). From the point of view of this article, observations in third phase science are linked to some purpose(s), and in this sense, constitute an intervention in the arena of action. Midgley draws out the implications of acknowledging this when he notes that, as soon as we postulate links between the "observer and observed [we] bring into question the possibility of observation free of intervention" (Midgley, 2000, p. 42; Midgley, 2008, p. 56). As far as OR practice is concerned, it means that specific forms of "intervention" are already implied by any OR modelling (whether quantitatively- or qualitatively-based) – and these have to be accounted for (Midgley, 2008, p. 57).[3] In addition, Midgley emphasised in his various writings that not all (groups of) people can be involved in discussing all issues. Hence, stakeholders of concern still have to be defined when setting up an enquiry process. Gregory, Atkins, Midgley and Hodgson (2020, p. 322) propose that we can determine stakeholders using the question (one amongst a set of related questions), "who are the stakeholders of this [identified] issue?" In the illustrative case elucidated in Section 3 of this article, we indicate that, in deliberating about our future, the youth have a prime stake in the issue of democracy – but they are often sidelined/marginalised in discussions around its meaning. In the *Re*-invent Democracy project as a whole, cohorts of youth from five geographical regions were involved, respectively, in week-long face-to-face dialogues from each region, namely, Africa, the Middle East and North Africa (MENA), Latin America, Europe, and Australasia. This article concentrates on the European Initiative.

3. The SDD methodology explained using the case of the European Initiative of the *Re*-invent democracy project

3.1. Framing the problem and selection of participants

SDD processes are always structured around Triggering Questions (TQs), which serve to frame the discussions and help define the stakeholders of the issues under consideration. The FWC team formulated two TQs and applied for funding from the UN Democracy Fund to implement the enquiry:

TQ1 What are the shortcomings of our current systems of governance that could be improved through technology; and
TQ2 What concrete action, project, or product would you propose to solve a particular shortcoming of current systems of governance?

The idea behind SDD (as in Gregory, Atkins, Midgley and Hodgson, 2020 stakeholder theory) is that those people who are (mostly) concerned with and/or affected by the issues under consideration should become the primary participants. In the case of deliberating about our future, the youth are clearly prime contenders for participation. Hence the Re-invent democracy project focused on "youth" involvement. The youth was not regarded as a "homogeneous group": aside from their age categorisation (18–30 years of age), the FWC team realised that there would, of course, be differences "within" the group – both in terms of social categories and in terms of differing viewpoints that different participants might bring to bear. When we say that "the youth" as a "community" (in a stretched conception of community, as defined by Midgley, Johnson & Chichirau, 2018, pp. 772–773) was invited, we mean that in some way, they were regarded as a collective distinguishable from other collectives in terms of their capacity for

[3] In quantum physics, the influence of the "knower" on the supposed "object of knowledge", called the Heisenberg effect, has been well documented. See also Bausch and Flanagan (2013), Bausch (2016), Barad (2003), and Midgley (1992, 2001), for further accounts. In the social realm, Lincoln and Guba call this the "social Heisenberg effect" (Lincoln and Guba, 2013, p. 65).

collective deliberation around these issues. This is also in keeping with Konsti-Laakso and Rantala's (2018) definition of a "community" as a collective. One can also argue that in inviting them as a collective to participate in collective deliberation, a *stronger community* could (and did) become formed through this very process. In terms of the epistemology of third phase science, it is recognised that inquiries from the outset already intervene (make a difference to) the social "realities"/systems being "inquired into". It is also worth noting that although in each region about 20 *core* participants were chosen to participate, each participant also selected "shadow participants" with whom they would be virtually involved during the project – thus spreading the impact of the project.

The youth who became core participants in the project were chosen on the basis of a number of criteria that the FWC team applied in assessing the submissions submitted to the FWC, following the project being advertised in various forums (using FWC networks and various social media). What was firstly important was that indeed provision needed to be made for a variety of viewpoints/knowledge-bases. Hence years of relevant experience and prior relevant activities became criteria of selection. Youth were also selected on the basis of their being potentially influential as young leaders and as belonging to associations with wide networks. The commitment to the project (as sensed by the team by perusing the applications with the attendant videos) was further taken into account. Their country of origin was also considered when choosing the cohort to participate in each geographical region to include participants from a range of countries. Additionally, the FWC team ensured a balanced gender distribution of participants and tried to ensure a balanced socio-economic status as well. Other criteria that were applied were their communication skills and that they had uninterrupted access to social networking.

3.2. Week-long process for all five regions

Week-long sessions (co-laboratories) held with all five groups of participants were structured as follows: Two days were spent on TQ1 (namely, a critical systemic examination of shortcomings, to consider the potential for improving democracy in the digital age). Then two days were spent on TQ2, namely, the development of their collective understanding of the "drivers for change", which could serve as an inspiration for significant action to be pursued by the participants or by others inspired by the maps, which were later made accessible on the internet via the project's website (reinventdemocracy.info). On the final day, participants engaged in empowering activities, including panel discussions with presentations, and organising self-created groups to make action plans that they (with others) could pursue, springing from the collective work in locating leverage points for significant types of action while working on the second TQ. The FWC team selected projects to be given a small grant to implement their actions following an application process.

3.3. The stages of the SDD process and supporting software

The following diagram (Fig. 1) illustrates the stages of the process, which is implemented twice as documented in 3.4.1 and 3.4.2. It is characterised by a strict sequence: Following the framing of the problem and of the TQ, the participants go through the stages of generating and clarifying responses, clustering all ideas, choosing the five ideas they considered the most important (from the whole pool), and finally conducting Interpretive Structural modelling (ISM) on those ideas that received 2 or more votes. They conclude with interpreting their results and planning actions. These stages are exemplified in the following sections, and discussed in Question 12.

The SDD process is supported by specialised software. The algorithm for the exploration of influence relations between ideas implementing ISM was initially based on an algorithm developed by Warfield to support Interactive Management (Warfield, 1976; Warfield & Cárdenas, 1994; Warfield & Cardenas, 1994), and later was refined into the Cogniscope and upgraded to Cogniscope v.2 (Magliocca & Christakis, 2001). Ekkotek developed the current Cogniscope v.3[4] based on requirements collected from theoreticians and practitioners from across the world, using the SDD approach. Next-generation SDD software (i.e., Cogniscope v.3, Concertina,[5] and Logosofia[6]) also records timestamps when participants make a contribution or respond with a 'Yes' or 'No' to posed questions, calculates indices that reflect on spreadthink, complexity, and quality of the implementation, allows voting via mobile devices, and, in some, supports clarifications to be recorded and uploaded to the cloud in real-time (i.e., IdeaPrism[7]). IdeaPrism also supports scaling up (i.e., engaging hundreds of participants) of the SDD process by permitting asynchronous structured interactions between participants and the construction of temporally and/ or spatially distributed Clustering and/or Influence Maps.

3.4. The European Initiative process and results

In the European cohort of youth, countries represented were: Albania, Croatia, Czech Republic, Cyprus, Estonia, France, Greece, Latvia, Poland, Romania, Serbia, Slovakia, and Ukraine (with 20 core participants in total). The dialogues of this cohort were held in Cyprus (8–12 February 2016) at a resort village in the Troodos mountains (Platres) where participants had no access to any other activities. Hereunder we offer some detail from the European region.[8]

3.4.1. Answering the first TQ (first two days)

In the idea-generation stage of the process of answering the first TQ, each participant was asked by the facilitator to state three relevant ideas. These were recorded using IdeaPrism (which also "matches" the different ideas to their corresponding authors). The participants were then invited to "pitch" their ideas for 1–2 minutes and respond to clarification questions asked by the audience. Their pitches were recorded and uploaded to the cloud in real-time. The participants produced 57 Ideas (i.e., shortcomings/challenges of democracy in the digital age). IdeaPrism also supports the automated production of what the authors call "IdeaWalls". The IdeaWall from these contributions can be found online (http://platres.reinventdemocracy.info). The subsequent stages were implemented using Cogniscope v.3.

The next stage involved clustering the ideas. To accelerate the process of clustering during this co-laboratory, and to allow for more interaction and discussion, the participants were divided into three groups to create the clusters. For this process, participants were asked to respond to the question:

Does Idea X have significant common attributes with Idea Y
(to justify putting them into the same cluster)?

The participants discussed the ideas in the light of this question and when/if at least two thirds agreed, then the ideas were placed in a cluster (which was later given a name). The group's clustering

[4] https://www.ekkotek.com/index.php/products/wisdom-tools/cogniscope3
[5] http://concertina.live
[6] http://logosofia.decisionpoint.design
[7] https://www.ideaprism.net.
[8] If readers wish, they can examine the cross-regional comparisons as set out in the *Manifesto* compiled by the FWC team, who applied a range of quantitative and qualitative methods in undertaking their analysis/synthesis, aiming to distil key points (Laouris et al., 2017). All the reports can be found at: https://www.futureworlds.eu/wiki/Reinventing_Democracy_in_the_Digital_Era_(UNDEF)#Final_Reports

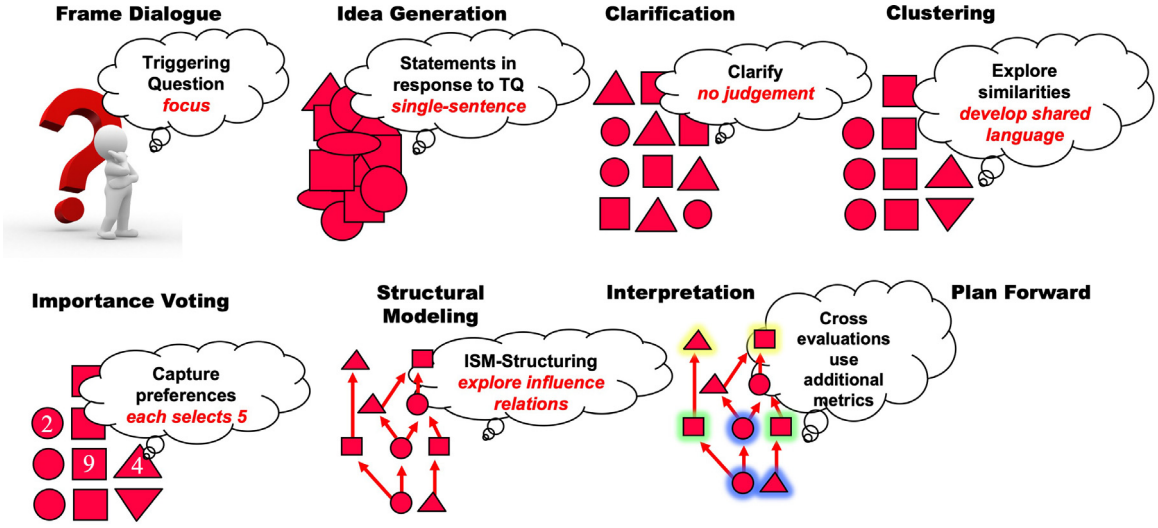

Fig. 1. The Stages of the SDD process.

of the 57 Ideas can be retrieved from either the project's website or the relevant report.[9]

In the light of the clustering, which helped participants to consider what could be regarded as distinct aspects of the design challenge, all the participants were now asked from the whole pool of ideas to choose the five ideas that they considered the most important. Ideas that received at least two votes from the participants were selected for the next stage. The ideas that received votes (and the numbers of votes):

From Table 1 it can be seen that 38 ideas out of the 57 received one or more votes. This indicates (see Section 4.4. below, question 13) a high degree of initial divergence in this cohort of youth as to what should be regarded as important/significant aspects of the problem under consideration. This could mean that the subject under discussion was indeed complex and required dialogue to unravel its complexity with a view to considering ways of addressing the challenges as observed/understood. The extent that individuals in a group do not agree on what are the most important sub-issues, and in general not have a majority view on the merits of any of the many sub-issues is a quantifiable psychosocial phenomenon called Spreadthink (Warfield, 1995), and in the case of our project it is equal to 63%.

The following stage of the SDD process is where participants are asked to explore "influence relations", which ultimately will result in an "influence map", stating root challenges which should be given priority. The participants first structured challenges which received four or more votes (aided by the Cogniscope), which resulted in a first round of mapping. In a second round of mapping, where additional factors were introduced, the map was enriched, as shown in Fig. 2.

Statement number 24 (at the bottom of the tree at Level 4) indicates that the participants felt that "the public does not understand what is the decision-making process in government", was a critical problem, making other problems worse. This tallies with Lincoln and Guba's (2003, p. 262) suggestion that, insofar as participants "do not understand political systems", more training/education can be advocated for. Number 5 refers to the problem of government propaganda, which obfuscates issues (indicating the normative requirement for governments to subject ideas to the test of scrutiny, which is currently lacking). Numbers 50, 26 and 27 refer to the problem that politicians chosen to represent people are not representing them, that only one party is governing (instead of there being genuine multi-party discussion and decision-making), and that politics seems to be the preserve of politicians (all of these pointing to the erosion of the public sphere). Number 6 refers to the lack of good judgement/mindfulness in the making of (political) decisions; and number 1 refers to the problem of lack of possibility to vote via online elections. With this diagnostic influence tree having been developed, the participants were now in good stead to move towards focusing on proposals for action by answering the second TQ.

3.4.2. Answering the second TQ (second two days)

Over the next two days, the participants discussed actions through which the shortcomings of our current systems of governance, as they had defined them before, could be resolved (for a Re-invented future). Employing the same process as used to answer TQ1, the participants came up with 71 proposals. As in the TQ1 sessions, the participants started off by clustering the ideas in small groups; however, time did not allow for this process to be completed. They were therefore asked to choose their top ideas from the wall of 71 ideas without a complete clustering. The voting panned out as represented in Table 2.

At first the participants structured (via pair-wise comparison with the help of the Cogniscope) ideas that had received more than three votes; subsequently, participants were asked to select some of the ideas that had received two votes so that these could also be mapped. They chose numbers 10, 36, 39 and 46. Note that Idea 39 had received initially only two votes (Table 2). Still, it was identified as a "deep driver" at the bottom of the eventual influence tree (on Level 4) – that is, as highly influential in impacting on other ideas (see Fig. 3). This indicates that the group intelligence as a whole, considering the influence directions between ideas, *placed this as a priority action* during the mapping process. Number 39 was the idea to create an online consultation portal so the public could comment on proposals for changing the laws regarding ways of voting. This then patterned into a higher level on the tree, where number 10 (which again initially had received only two votes when people voted individually on the importance of ideas) was seen as being significantly impacted upon by number 39. Number 39 was also seen as impacting significantly on numbers 20 and 48 (making provision for online voting in elections and for "liquid democracy"). Note that the lack of online voting had been regarded as a highly significant challenge when answer-

[9] European Report: www.futureworlds.eu/wiki/Reinventing_Democracy_in_the_Digital_Era_(UNDEF)#Final_Reports

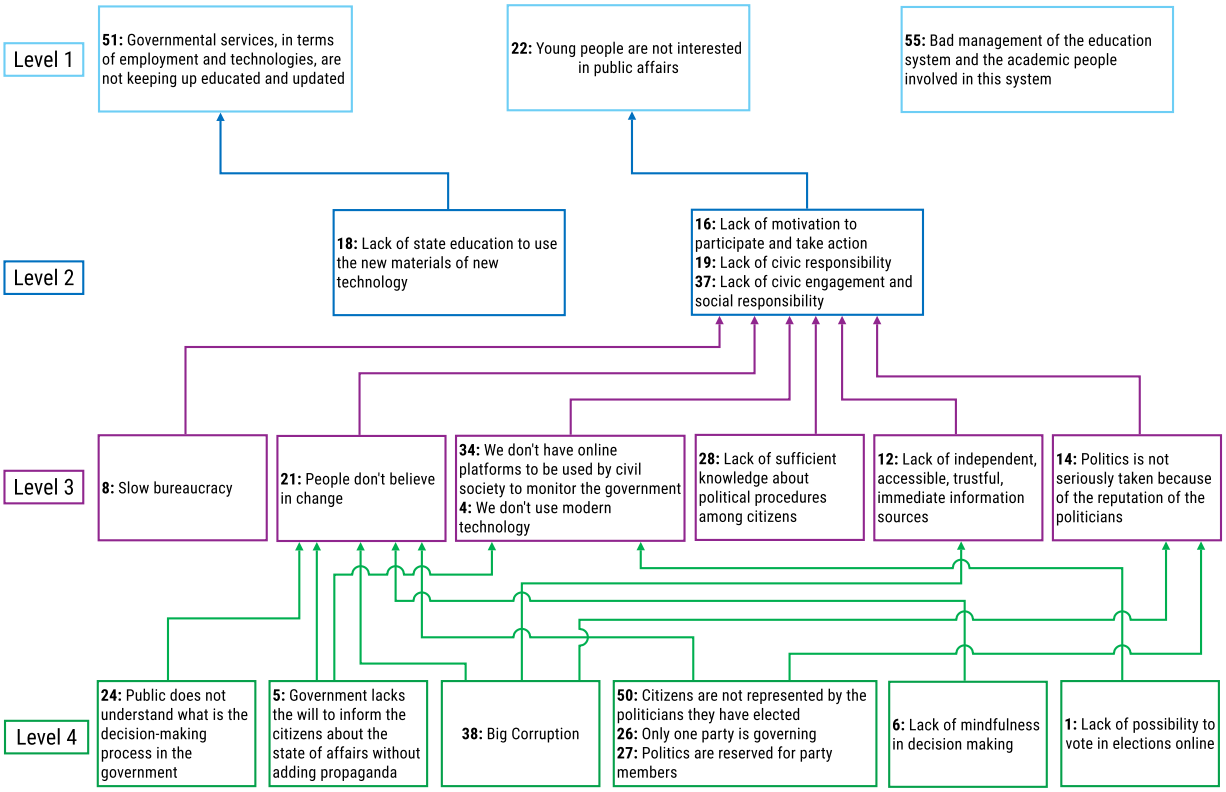

Fig. 2. Final Mapping of Challenges (Future Worlds Center, 2017, *Re*-Inventing Democracy in the Digital Era: European Initiative, p. 36).

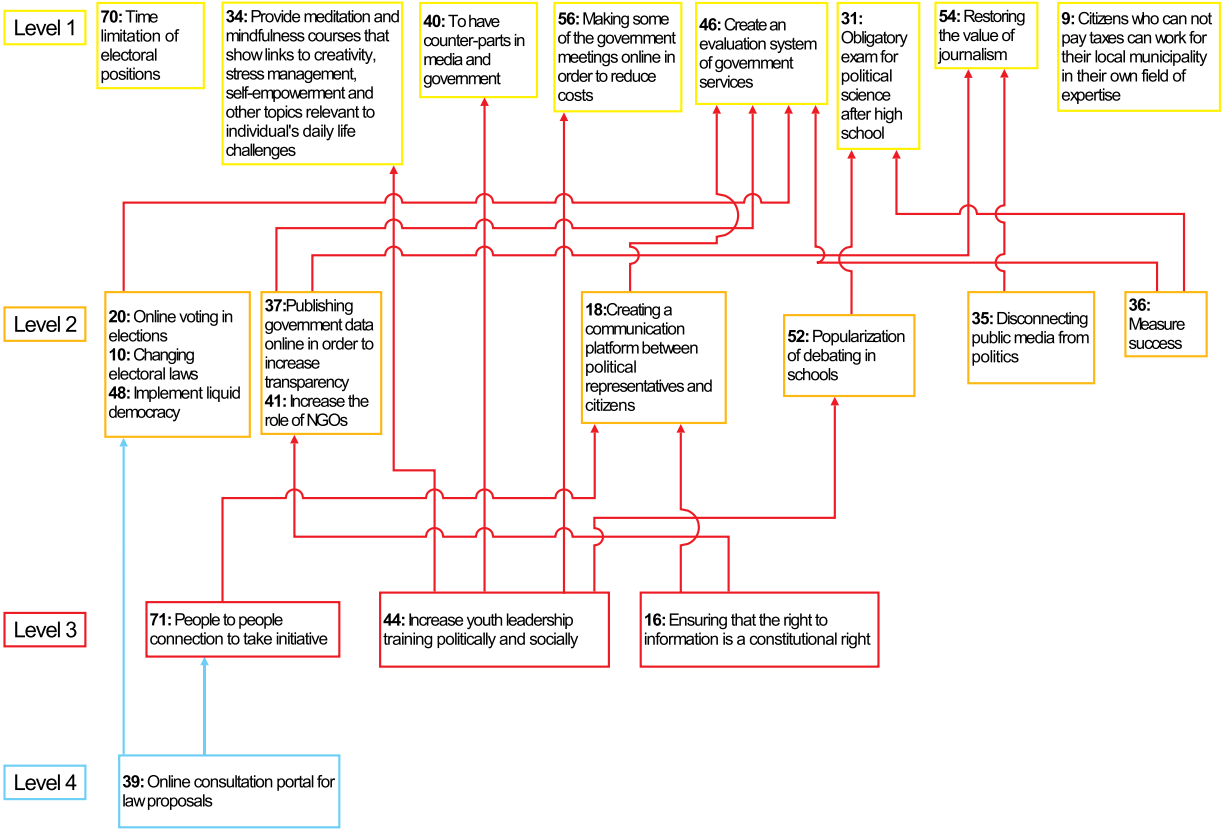

Fig. 3. Final Mapping of Actions (Future Worlds Center, 2017, *Re*-Inventing Democracy in the Digital Era: European Initiative, p. 44).

Table 1
Results of voting for the top five challenges. Note that the statements are authentic, i.e., presented as they were formulated by their authors; reference to the full clarification and/or video is required in order to interpret the intended meaning.

Idea	Votes	Challenge
38	8	Big corruption
16	6	Lack of motivation to participate and take action
19	6	Lack of civic responsibility
28	6	Lack of sufficient knowledge about political procedures amongst citizens
37	5	Lack of civic engagement and social responsibility
18	4	Lack of state education to use the new materials of new technology
21	4	People don't believe in change
55	4	Bad management of the education system and the academic people involved in this system
5	3	Government lacks the will to inform the citizens about the state of affairs without adding propaganda
8	3	Slow bureaucracy
12	3	Lack of independent, accessible, trustful, immediate information sources
14	3	Politics is not seriously taken because of the reputation of the politicians
50	3	Citizens are not represented at all by the politicians they have elected
1	2	Lack of possibility to vote in elections online
4	2	We don't use modern technology
6	2	Lack of mindfulness in decision making
22	2	Young people are not interested in public affairs
23	2	Apathy of citizens
24	2	Public does not understand what is the decision-making process in the government
26	2	Only one party is governing
27	2	Politics are reserved for party members
34	2	We don't have online platforms to be used by civil society to monitor the government
47	2	Citizens are not aware of their civic duties
51	2	Governmental services, in terms of employment and technologies, are not keeping up educated and updated
7	1	Less educated people's votes are equal to more educated people's vote
10	1	Lack of specific information and political education
11	1	Lack of legitimacy of political decisions
13	1	Non-efficient decision-making in terms of equality and results
17	1	Lack of control and information to people about food products entering the state and those produced in the state
30	1	Bureaucracy governing instead of politicians
32	1	Non-scientific approach on governmental processes
35	1	Not enough relevant information is being provided
36	1	Not transparent and open diplomatic relationships and matters between politicians from different countries
41	1	Low elections turnout
42	1	Fixed mindset of many people
45	1	Close personal relationships on top political positions
52	1	Politics is problem of politicians
53	1	Bad tax collection system

ing TQ1 and had reached the bottom of that tree of influence – see the placement of Idea 1 in Fig. 2. The fact that initially unpopular ideas can become pivotal by virtue of their position in the logic of the map is an important feature of SDD. It was first observed by Dye (Dye & Conaway, 1999), who coined the term "erroneous priorities" to highlight the fact that interventions are often ineffective because they are based on peoples' perceived priorities without exploring influence relationships between them, which helps them to get to the root causes of systemic problems; the SDD changes people's priorities and stimulates learning.

At this stage, also placed on the level above the bottom of the TQ2 tree at Level 3 (Fig. 3), were three ideas. The first number 71, namely "people to people connection to take initiative", which also had received only two votes in the initial selection of ideas to be included in the mapping, was now placed at Level 3 in the Proposal for Actions tree (TQ2). Idea number 44 (to increase youth leadership training politically and socially), which too had received only two initial votes in the selection of ideas to be included in the mapping for TQ2, likewise reached Level 3. Again, this shows that the group intelligence resulted from *people's deliberation upon* the *influence relationships and defining areas for priority actions accordingly.* And Idea number 16, which had not received many initial votes (only three) and had to do with "ensuring that the right to information is a constitutional right", also reached Level 3. It is interesting to note here that Idea 16 in TQ2 tallies with what was taken to be a highly significant challenge when answering TQ1, as it has to do with the problem of government "lacking the will to inform the citizens about the state of affairs without adding propaganda" – Idea number 5 in TQ1.)

3.4.3. The last (fifth) day: some activities to enhance the impact

The final day of the week-long sessions was designed to strengthen the project's potential impact in various ways. This was done firstly by giving the youth some "practice" in the hands-on use of multiple media to develop their capacities for civic participation (Laouris et al., 2017, p. 46.) To this end, the team held a "simulated press conference" where small groups of youth presented ideas regarding the transformation of democracy. Further to this, participants were interviewed, again preparing them for "public speaking". The participants were also offered the opportunity to share their experiences of the Re-invent democracy project with local and European stakeholders concerned with governance issues at local authority level. In this way they could (re-)iterate what they had learned, and they could share their learning with these stakeholders, thus potentially already making some impact.

Another critical part of the final day was giving participants the chance to liaise with certain others in the group (whom they could choose to work with) to prepare a Regional Action Group grant proposal. They were asked to propose actions that promote good governance and social and political development, in line with their newly acquired understandings as advanced over the previous four days (to be eligible, an action group needed to include at least three members of the core participants). Three action group proposals were submitted. Two of these were approved by the FWC for funding, using the money provided by the UN Democracy Fund contract. The two were:

1. "Democracy is a challenge, debate it"; and
2. "Where are the immigrants"?

Table 2
Results of voting for the top five actions. Note that the statements are authentic, i.e., presented as they were formulated by their authors; reference to the full clarification and/or video is required in order to interpret the intended meaning.

Idea	Votes	Action Plan
20	8	Online voting in elections
37	7	Publishing government data online in order to increase transparency
41	7	Increase the role of NGOs
54	6	Restoring the value of journalism
18	5	Creating a communication platform between political representatives and citizens
52	5	Popularization of debating in schools
35	4	Disconnecting public media from politics
48	4	Implement liquid democracy
16	3	Ensuring that the right to information is a constitutional right
40	3	To have counter-parts in media and government
70	3	Time limitation of electoral positions
2	2	Civic assessment
4	2	Online platform for food products and not only, exiting or entering in our country, with specific sensors to detect composition and other data
9	2	Citizens who cannot pay taxes can work for their local municipality in their own field of expertise
10	2	Changing electoral laws
13	2	Introduction of blind voting
31	2	Obligatory exam for political science after high school
34	2	Provide meditation and mindfulness courses that show links to creativity, stress management, self-empowerment and other topics relevant to individual's daily life challenges
36	2	Measure success
39	2	Online consultation portal for law proposals
44	2	Increase youth leadership training politically and socially
46	2	Create an evaluation system of government services
56	2	Making some of the government meetings online in order to reduce costs
71	2	People to people connection to take initiative
1	1	Establish an organization and organize people
6	1	Extensive use of governmental digital services creating one-stop services
8	1	Make dynamic action plans for government and decision making
14	1	Creating the dialogue for experts to solve the problem of equal votes
15	1	Creating meditation rooms/ spaces in government buildings and public institutions

The concept for the first action group was based on "concretising" Actions 71 and 44 – Ideas on Level 3 of the TQ2 influence tree (Fig. 3). The intention was to "train" students to understand democracy through a discussion format, where historical, political and social aspects of democracy could be discussed. It was planned to support participants to learn how to listen to others and to see the interconnections of different arguments. Key trainings occurred via democracy lectures (e.g., examining political culture), debate lectures (e.g., how to take opposing views into account) and self-awareness lectures (focused on systems thinking, including SDD and games to stimulate decision making and action taking).

The second action group topic was related to Challenge 12, identified as significant for TQ1 (lack of independent, accessible, trustful, immediate information sources), and also clearly linked to Idea 16 on Level 3 of the TQ2 influence tree (ensuring the right to information, in this case, information regarding the issue of immigration). This project was led by a journalist (from Poland). The group detected that, while the issue of immigration has proven to be of crucial importance in elections (especially in Poland and the UK, but also in France and Germany), the general populace has their awareness of this issue influenced "by big media when some crisis happens" (Laouris et al., 2017, p. 53). The idea of this group was to source additional information (e.g., from UNHCR and FOIA) and publish this with a modern layout on an interactive website. The idea was also that data could regularly be added to the platform via web scrapers as a way of using modern media relevant to the digital age.

In October/November 2019, that is three and a half years after the event, Romm held Skype interviews, assisted by Jordan Kent from FWC, with some of the youth involved in the *Re*-invent Democracy project. The aim was to obtain feedback, now that some years had passed, on how they remembered the SDD process; what they felt they had learned as a result of their participation; whether they had (re-)read the final report from their region that was available on the FWC website, and/or the synthesis comparing all the regions, taking the form of a *Manifesto* (as prepared by the FWC team in 2017); and what follow up actions they had initiated (individually or in groups). Five interviews were held with participants from the EU cohort. One of these participants had (coincidentally) been involved in both the funded action group projects, and she offered some indication of what they have achieved. She stated that her leadership of the action group providing learning opportunities for youth in the region had helped her and others to "understand more about democracy and political decisions". She explained how the SDD process, during the weeklong session in Cyprus, was helpful because it encouraged the participants to become more "open-minded" in listening to others, and she pointed out that the "things that were discussed would not usually be discussed" when the functioning of democracy was being considered in more usual fora. In the course of the interview, she mentioned that with regard to immigration issues, "a journalist from Poland had already been conducting research on refugees", and "in Cyprus, he went to visit refugee camps". She stated that through her participation in the action group project led by this journalist, she had "learned a lot about the problem [of immigration, especially how it was formulated by big media] and about the status quo". She explained that, as part of this "smaller project", she would "get in contact with him on social networks and would check out what is going on", and that the network was used to "talk about immigration issues and democracy".

Space restrictions mean we cannot share the full feedback received from these participants and the other interviewees. Suffice it to say that all of them stated that the work they were doing in various capacities (e.g., for a small "social enterprise"; for a non-profit educational organisation; for an NGO concerned with social innovation; for a local government; and for an international peace organisation) had been informed by and strengthened through their involvement in the *Re*-invent Democracy project. All

of them also offered very enthusiastic statements regarding the SDD process and how, in the end, "final ideas and classifications were shaped" (as one participant expressed it).

4. Argument for categorising SDD under the prism of PSMs

In this section, following Smith and Shaw's rubric, we spell out the characteristics of SDD methodology – where methodology is seen as wider than "methods and includes a view of science that inquirers might use to self-label their own orientation and/or that others can use to label it, by rendering more explicit what are seen to be the underlying assumptions of the approach adopted (see also Romm, 1998, p. 79, Romm, 2018, p. 30). Smith and Shaw (2019, p. 404) propose the use of the four paradigmatic pillars offered by Lincoln and Guba (1994, 2003). They firstly look at certain characteristics associated with PMS identified as such in the literature, and then in terms of the four-pillar framework, they ask 13 questions, the answers to which they suggest help us to decide whether various candidate methodologies fulfil the criteria to be classed as a PSM. Using their four-pillar framework, they note that, at the end of their analysis, "only the three established PSMs answered 'yes' to all the questions and therefore, according to the framework, can be classified as a PSM" (p. 413). The three were: Soft Systems Methodology (SSM: e.g., Checkland, 2000); Strategic Choice Approach (SCA: e.g., Friend & Hickling, 2012); and Strategic Options Development and Analysis (SODA: e.g., Eden & Ackerman, 2001).

Smith and Shaw suggest that to be called a PSM, the candidate should answer "yes" to all of the questions posed. According to them, the four-pillar framework helps to keep alive "debate concerning the philosophical, theoretical and methodological characteristics of PSMs" (Smith and Shaw, 2019, p. 403). We regard the framework as helpful in its purpose of fostering continued discussion around the classification of PSMs, and we suggest that SDD offers a specific way of answering "yes" to all of the questions. Smith and Shaw state that, given the challenge of considering "what constitutes a PSM and the *acceptance of new PSMs*" (Smith and Shaw, 2019, p. 403, our italics), their paper offers a fruitful contribution. We propose that using their framework shows that SDD can constitute a new PSM (for OR) to be welcomed by the OR practitioners. We proceed by showing how, relative to the descriptions that Smith and Shaw provide of the (other) PSMs, to which we briefly refer, SDD has unique contributions.

4.1. Systems characteristics (Ontological questions)

The ontological questions posed in terms of Smith and Shaw's first "pillar" relate to what they call "systems characteristics" (Smith and Shaw, 2019, p. 410). Below, we show how the three PSMs, which they ultimately defined as such, answer the ontological questions in terms of a focus on how "the system" which is "observed" is *observer (and intersubjective observer) dependant.* In each case, we identify how SDD answers the questions in a specific way

Question 1: Does the approach identify a system to model?

In answer this question, Smith and Shaw note that it is clear that SSM models the *human activity system*, rather than propounding to model some externally existing "system". SODA builds cognitive maps that are designed to "represent the way in which a person [and groups of people] define[s] an issue". And SCA builds models that represent "the interconnectedness of [people's] decisions with an aim to reduce uncertainty" (Smith & Shaw, 2019, p. 410). In the SDD philosophical stance, notably, there is no attempt to posit a distinction between "observations" and "ideas". Observations/ideas are elicited from and clarified by participants in response to a Triggering Question, designed to kindle the generation of specific descriptors or characteristics of the system as conceived. The group proceeds to arrange them into affinity clusters as a collective discovery of categories; and connections are then sought between possible decisions by considering the influence of an idea (if implemented) on another idea (called pair-wise comparisons as explained in Section 3.4). The consequent modelling of influence relationships is an expression of people's deliberating together around these comparisons. *The model that arises reflects their deliberations* (cf. Bausch & Flanagan, 2013; Cisneros & Hisijara, 2013; Kakoulaki & Christakis, 2018). No judgement is made on any posited connection between those deliberations and an external world of complex problems and potential actions to be taken. Like all other PSMs, SDD leaves that judgement to the participants to handle and is only concerned with the deliberations themselves. Nonetheless, the process creates momentum towards implementing the resulting action map (see Question 7).

Question 2: Does the approach model participants' subjective interpretations of the world? Smith and Shaw note that SSM "builds models of the human activity system, in which a purposeful system is modelled in the systems world from multiple perspectives, so subjectivity is a key feature". SODA builds models from "different subjective views of the situation"; and the SCA models too "represent subjective information" (Smith and Shaw, 2019, p. 411). What is unique about SDD is how models are built: the participants' subjective observations undergo pair-wise comparisons (aided by Cogniscope, whose logic is outlined in Footnote 11) to determine whether one exerts an influence on the other. In addition to preserving the authentic subjective interpretations, the SDD models their interrelations rendering it particularly effective in interconnecting different points of view and positionalities. The purpose is to harness people's collective wisdom via deliberative reasoning, as per the normative ideal of deliberative democracy, as propounded in Habermas's *Theory of Communicative Action*, (1984a/b), and also in others' accounts of deliberative speech acts – e.g., Corredor, 2020).

Question 3: Does the approach seek to build a holistic understanding of the system? According to Smith and Shaw, SSM, SODA, SCA "all prioritise the study of whole entities before the study of parts". This "allows decision-makers to consider systemic properties" (Smith and Shaw, 2019, p. 411). Here the word "systemic" refers not to a system "out there" but to how different decisions which could be made might impact one another (Smith and Shaw, 2019, p. 411). Smith and Shaw note that, for Churchman, every formulation of a problem/challenge is a statement of a solution; and …every problem is a symptom of another problem" (Smith and Shaw, 2019, p. 404). SDD is in line with this vision of holism, which appreciates that "problems" or challenges as identified need to be looked at holistically. In SDD, the participants reason together about the influence of an idea on another (through pair-wise comparisons). This process reduces their potential cognitive overload when trying to appreciate the complexity of influence factors and their patterns of influence. The outcome is a collectively generated influence map, which encompasses a holistic understanding of the system graphically.[10]

[10] The software implements the Interpretive Structural Modelling algorithm developed by Warfield (1976; 1994), adapted by Christakis (1996), and further expanded by Laouris and Christakis (2007). What is important about this algorithm is that, as Flanagan (2020) summarizes, it "relies on a transitive logic". Flanagan explains that "a relationship such as 'influence' is transitive. If idea 1 influences idea 2, and if idea 2 influences idea 3, then idea 1 has a *transitive influence on idea 3, and designers need not be asked to explore that relationship.* When the tracking software keeps track of transitively inferred relationships, designers are spared about 70% of the work that is involved in mapping influence relationship across large sets of comparisons. The software dutifully captures and stores all of the group's strong in-

4.2. Knowledge and involvement of stakeholders (Epistemological questions)

The epistemological questions posed in terms of Shaw and Smith's second "pillar" relate to what they call "knowledge and involvement of stakeholders" (Smith and Shaw, 2019, p. 410). In their discussion of the involvement of stakeholders, they note that PSMs recognise that participation in the co-production of knowledge "goes beyond merely consulting stakeholders, and envelops stakeholders into the model building process" (Smith and Shaw, 2019, p. 208). This is done in order to "create models reflecting solutions [that] are jointly developed". Furthermore, by involving stakeholders in the creation of solutions, their buy-in to feasible outcomes" is increased (2019, p. 2008). Smith and Shaw pose four epistemological questions, which follow on from their three ontological questions in their numbering as follows.

Question 4: Does the approach build a qualitative model? Smith and Shaw point out that SSM, SODA, and SCA all build qualitative models. They do not elaborate on this, other than by noting that some other candidate PSMs likewise "qualitatively map feedback loops between different elements of a system" (Smith and Shaw, 2019, p. 411). Flanagan explains the status of the qualitative models built in SDD as follows: "The structure represents a meaningful understanding in the sense that it carries *meanings linked to specific influence relationship assessments* into a coherent, overall understanding reflective of the wisdom of the group" (Corredor, 2020, p. 17, our italics). According to Christakis (personal communication), these influence maps are ephemeral abstractions in the sense that if the same participants repeat the process, their deliberations and resulting maps will not be identical (just like the Heraclitus's river metaphor), but they would be qualitatively coherent.

Question 5: Does the model building involve the facilitation of participants? Smith and Shaw remark that some of the "moments" in SSM, SODA and SCA do involve facilitation, such that the models can be regarded as "built using facilitation" (Smith and Shaw, 2019, p. 411). SDD likewise is a facilitated process. The stages of the SDD process, as outlined in Section 3.3, require that the group is directed/guided by SDD prompts. However, in the case of SDD, there is a strict separation between process and content. The facilitator is not permitted to engage in any way in the content of the dialogue. While the current model of SDD requires synchronous face-to-face interactions, the authors have been experimenting with various scaling-up models (Laouris & Christakis, 2007), briefly described in Section 5.3. In these new models, the "machine" assumes the facilitator's role.

Question 6: *Does the model building enhance participants' learning about the situation?* Smith and Shaw (2019, p. 408) state that in PSMs, "stakeholder learning is critical" – this must therefore be regarded as a defining feature of a PSM. They further point out that "learning arises from participants sharing knowledge, allowing them to acquire and create knowledge by synthesising views" (Smith and Shaw, 2019, p. 411). They explain how SSM does this by "encouraging participants to discuss different worldviews during group modelling, and encourages learning about the system" (Smith and Shaw, 2019, p. 412). SODA "enables participants to share knowledge through the building of composite or group causal maps". And in SCA, groups can "adopt open technology so that many can share ideas, allowing participation to be interactive and learning to be enhanced" (Smith and Shaw, 2019, p. 412). In SDD, co-learning is also central. Each participant may contribute three to four ideas/observations in the idea generation stage, but collectively they generate 50–100. Their learning is not only enhanced (a 10–20-fold increase), but more importantly, they recognise and appreciate that others may have different understanding, priorities or perspectives. This is the point of trying to improve people's competence in practising Critical Systems Thinking – as proposed by, for instance, Ulrich (1996, 2001), and as expressed in various renditions of "citizen science" (Gregory & Atkins, 2018). What is also crucial, following Lincoln and Guba (2013, p. 78) and Midgley et al. (2018, p. 773), is that the "hermeneutic circles" (where constructions become developed and sophisticated) include as participants those who could all-too-easily be marginalised in society, so they are *empowered to participate in meaningful ways*. SDD-inspired model building is transformative in intent, intended to potentially lead to the restructuring of society in ways that deflect/redirect what Habermas (1984a,b) calls the steering functions of "money and power", which are strategically directed in terms of self-interest rather than communicative action for the public good (see also Bausch, 2008). In short, SDD provides a way for participants to become involved in critical-systemic thinking for socially transformative ends as part of their learning/deliberating together.

Question 7: Does the approach aim to develop buy-in to politically feasible outcomes? Smith and Shaw indicate that in order to "enhance political feasibility", PSM approaches "increase participation through enveloping stakeholders in the process and addressing issues of power within the problem situation" (Smith and Shaw, 2019, p. 412): "SSM envelops stakeholders by building different models with them during the intervention" (4019, p. 412); SODA, for its part, "establishes a joint understanding of a problem through building shared group maps" (p. 412); and "SCA builds shared models to increase understanding of a situation" (Smith and Shaw, 2019, p. 412). They add that "SCA integrates a policy stream that involves managing the conflicting positions of those involved to develop a commitment to the results" (Smith and Shaw, 2019, p. 412). However, what Smith and Shaw do not attend to when elucidating these PSMs' ways of obtaining "buy-in" to generate "politically feasible outcomes" is the *stakeholder theory* that is invoked in these PSMs. Gregory et al.'s (2020, p. 322) advice on choosing stakeholders in terms of issues of concern (and not only of concern in a defined "problem situation" as identified in a particular organisational context) offers a novel, more critical-systemic view of "political feasibility". Such feasibility is also seen as tied to the involvement of citizens as *citizens* (and not necessarily as stakeholders of some organisation). Hence, the "problem situation" where SDD shows its strength is in exploring the feasibility of developing collective buy-in to *redirect our responses to the kinds of problems* which Rajagopalan calls "our current growing welter of large crises" (Rajagopalan, 2020, p. 6). SDD practitioners insist that when the process complies with all laws of structured dialogic design, the stakeholders transcend into the action phase (see Law of Requisite Action in Laouris et al. (2008)). They claim the "magical transition" from the cognitive part (which is to understand the problem and to envision its solution) to the action part happens almost automatically. Participants are just about always willing to assume some kind of responsibility and engage in action.

4.3. Values of model building (Axiological questions)

Bearing in mind the purpose of SDD, to promote deliberative democratic processes, we now proceed to answer the four questions posed by Smith and Shaw under their "pillar 3″ – which they name "values of model building", starting with question 8 (Smith and Shaw, 2019, p. 412).

Question 8: *Is credibility established in models by preserving multiple participant contributions?* Smith and Shaw identify that, "during SSM multiple perspectives are accommodated, preserving multiple contributions"; "SODA preserves multiple views in cognitive maps stitching together participant models to form a new model

fluence assessments and applies transitive logic to speed the group through a complete consideration of influences among ideas" (Flanagan, 2020, p. 17).

that encompasses multiple views"; and "SCA builds group models via participants writing out their individual ideas so that competing contributions can be compared, merged or preserved" (Smith and Shaw, 2019, p. 412). In these various ways, the PSMs are able to "represent different social realities" in a synthesised model (p. 412). Smith and Shaw draw on Guba and Lincoln's terminology of credibility (or believability) to suggest that credibility of results is enhanced because the models are able to incorporate, while synthesising, the different starting perspectives. This means that participants, as well as wider audiences who are party to seeing the models as generated, are likely to have confidence in them (Lincoln & Guba, 2013, p. 104).

In SDD, the credibility of the synthesised interpretations is a function of participants and audiences being able to appreciate that the resultant maps arise from people *using deliberative reasoning to decide on the significance of specific ideas in terms of their influence on other ideas*. The process almost always concludes with an Awe effect; all feeling astonished that their path was full of disagreements, yet the resulting influence map is recognised by all as their own! The credibility of an SDD outcome is also established when a different group of stakeholders immersed in a similar situation and using the same TQ arrive at very similar conclusions. This strengthens the premise that SDD harnesses the collective wisdom of its participants (for a striking example, refer to Laouris & Michaelides, 2018). Finally, the fact that "outsiders" (e.g., policymakers), who receive the results and the recommendations of an SDD, perceive them as making sense is an additional factor in favour of its credibility.

Question 9: *Is the model building process suitably generic so it can be transferred to multiple problem contexts?* Smith and Shaw note that all eight of the candidate OR approaches discussed in their article had the quality of being "successfully deployed in multiple and varied problem situations" (Smith and Shaw, 2019, p. 412). For them, transferability of a PSM approach means that it can be employed in "varied problem situations". In addition, Lincoln and Guba propose that transferability refers to whether the results of the enquiry (that is, the results of the discussion process as synthesised), resonate with audiences who believe that these results (insights regarding "the situation") can be applied, with some adaptation as necessary, in the contexts with which they are familiar. As Lincoln and Guba note, "the applicability of the … interpretations is to be determined by those who want to apply them" (Lincoln and Guba, 2013, p. 104). The initial inquirers must provide enough description of the context so that readers can judge whether they can make use (in other contexts) of the insights developed. Ultimately, "it is up to readers to transfer this understanding to other contexts and assess the similarity" (Costantino, 2008, p. 118).

We argue that SDD fulfils both of these ways of considering transferability. Firstly, SDD can and has been applied across a range of "problem situations" (as noted in our Introduction and further discussed in Section 5). Secondly, the "observations/ideas/maps" developed within any set of SDD sessions (as applied to issues deemed as being of concern) are sufficiently "rich" that readers can consider how relevant the collectively-created insights are to situations with which they are familiar. Notably, the SDD is also a self-documenting methodology. Every contribution is recorded authentically and in real time. Readers can decide if the collectively-generated insights as reported upon, help them as individual and collective agents to act "better" in their own arenas of influence.

Question 10: Does the model building process aim to create confidence in the outcome through procedural rationality? Smith and Shaw state that "PSMs have to demonstrate they are procedurally just without having hard data to prove economically that the outcome is rational; therefore, there is transparency in the model building process and involvement by participants" (p. 412). They argue that for SSM, SODA and SCA this is indeed "explicitly the case". In SDD. the outcome is a result of people applying *communicative rationality* to: i) clarify all of their initial observations as presented (and participants can ask questions for clarity); ii) cluster different observations into categories (by deciding together on affinities), and iii) deliberate upon the influence of ideas on other ideas, and in this process *review their significance* by using relational logic (also called abductive logic[11]) to locate leverage points for significant (influential) action. This is through the pair-wise comparisons, where participants are asked to give reasons for believing that if idea X is implemented, this will significantly impact on idea Y – and the deliberation continues until there is a 75% majority believing or not that X significantly impacts on Y. Thus, the model is built by the participants following a transparent step-wise approach in which every contribution is authentically recorded. Therefore, the participants and wider audiences with whom the results are shared can be assured that a procedural logic has been followed *towards the development of a collective intelligence (in the form of the resultant maps).*

Question 11: Does the model act as an audit trail of the decision-making process validated through collaborative enquiry? Smith and Shaw note (using Lincoln and Guba's terminology of the "audit trail") that such a trail provides a detailed indication of the collaborative process used to generate the results (Smith & Shaw, 2019, p. 412). Smith and Shaw state that this is provided for in SSM, SODA and SCA, because "participants build models and the audit trail so will have seen it develop throughout the process". They note that the audit trail can also be recorded – either through software such as Decision Explorer (SODA) and STRAD (SCA), or by photographing models drawn on paper (e.g., in SSM). Markedly, SDD not only uses a variety of ways to recording the audit trail (using suitable software: see Section 3.3), but more importantly, decisions taken in every single step of the process are validated through collaborative enquiry before being recorded.

4.4. Research methodology (Structured analysis)

In their final pillar, Smith and Shaw ask two questions:

Question 12: Does the approach structure knowledge through different stages of analyses? Smith and Shaw concluded that nearly all candidate PSMs met this criterion. Notably, in SDD, the stages cannot be switched as there is a *specific way of building up people's collective deliberations* towards creating influence maps. Before we continue, we need to re-iterate (see Section 3.1) that in SDD, the participants/designers will be focused on answering two types of (content) questions, both of which are called Triggering Questions (TQs). The first type of TQ – which forms the basis of the first SDD co-laboratory – is concerned with identifying obstacles/barriers that are deemed as challenges to generating some hoped-for future. Having participated in this SDD co-laboratory, participants are then regarded as equipped, bearing in mind the influence map developed, to proceed to answer the second type of TQ, related to designing options for meaningful action. In answering both types of questions, five stages are followed (refer to Fig. 1):

1. *Observation making*. This is where all participants are required in a round-robin fashion to offer observations/ideas as a contribution to answering the question at hand (the TQ).
2. *Clarifying observations/ideas*. In this stage of the SDD process, the participants are encouraged to ask others to clarify their various observations/ideas. In the process of offering such clarification, the people who originally put forward the observation/idea already learn more about their own ideas by considering them in light of the questions asked. And, of course,

[11] For a detailed discussion of abductive logic see Romm (2018, pp. 335-338).

they learn about others' ideas as they have to listen carefully to them with a view to asking clarifying questions.
3. *Clustering*. This is where participants decide together, in engagement with one another's considerations, how to cluster the various observations which seem to have affinity with each other. This process has the function of drawing distinction and further clarifying the views of participants on the meaning of the ideas, so that when they can draw distinctions and develop "shared language".
4. *Voting*. Each participants chooses a number of ideas (typically 5) from the whole pool of ideas, which they deem most significant. Ideas which have received a selected number of votes (with the number being defined by the group in the light of time constraints) then enter the process of "pair-wise comparison".
5. *Pair-wise comparison*. Here the facilitator asks people to consider whether, if idea X is addressed, it is more likely to address idea Y. Influence relations between two Statements at a time are sought, using a question in the format, "If we make progress in addressing Challenge (or Action) X [a Statement/Idea] will this help us SIGNIFICANTLY to address Challenge (or Action) Y [another Statement/Idea]". Flanagan aptly summarises how this is a form of interpretive structural modelling (ISM): Through the pair-wise comparisons, "long chains of influence extending across other observations – from the root of the [influence] tree extending upward" – are located with the help of the Cogniscope algorithm of the (see Section 3.3). Laouris and Michaelides make the point that, although this is a mathematical technique to support modelling, it is used to support *facilitated dialogue* (2018, p. 930, our italics). Hence, we can state that the "scientistic" assumptions of first phase or even of second phase science (insofar as the latter tries to minimise observer dependence) are not the epistemological underpinning for this approach. The underpinning is third phase science, which encourages and facilitates observer *interdependence* with people to work together towards developing their collective intelligence, as discussed in Section 2.

With regard to Stage 5 of the SDD process, Flanagan (2020, p. 14) draws our attention to Dye's observation (Dye & Conaway, 1999) that in the SDD process as a whole, "when preliminary votes are collected to name observations which a group thinks are central for understanding a complex problem, the most important ones as identified by participants rarely include the deep drivers" (which emerge as such in the final development of the influence tree). This means that "erroneous priorities" (to use SDD terminology) are prevented. (See Section 3.4.2). It is for this reason that, in SDD, the stages leading to structural analysis have to be followed and cannot be "switched".

Question 13: *Does the approach have distinct phases for divergent and convergent thinking?* Smith and Shaw indicate that "SSM, SODA and SCA all have examples of structuring both types of thinking" (Smith and Shaw, 2019, p. 413). In their initial presentation of observations/ideas, SDD participants contribute to the discussion arena with divergence of thinking. While the idea generation stage produces up to say 120 ideas, the subsequent clustering stage groups them into typically less than a dozen, thus achieving a 10-fold convergence. Fig. 4 illustrates successive phases of divergent and convergent thinking. In the next (i.e., Voting) stage, the participants are confronted with a new challenge: to choose only 5 ideas out of the total. Typically, only half of the ideas receive votes, with half of them receiving probably just one or two. Thus, this new convergence, based on individual preferences, reduces the number of ideas which will enter the influence-mapping stage to about one fourth of the total.

During the pair-wise exploration for possible influences, a new type of convergent thinking starts to take place, as the participants are asked to offer reasons for why they intend to vote "yes" or "no" to the question as to whether tackling Idea X will significantly impact on the prospect of tacking Idea Y. Naturally, there are different opinions, but also reasonings regarding the presence or absence of an influence relation. The facilitator encourages people to continue to offer their justifications until the group settles. A "yes" (for a pair-wise comparison) is registered only when the supermajority votes (typically 66% or even 75%) for it. A distinct characteristic of this stage of the SDD is that we often observe people changing their position (from "yes" to "no" or vice versa) on the basis of listening to others' reasoning. The structuring stage gradually produces a directed graph, in which ideas that end up at the lowest level are the ones with the greatest influence. Thus, supported by the interpretive structural modelling algorithm, the group thinking convergences to a very small number of ideas (see examples in Figs. 2, 3) that should be considered in deciding their next steps.

The convergence in SDD is based on the (normative) principle of *deliberative* democracy (cf. Dryzek, 1999, 2006; Floriani, 2013; Habermas, 1989, 1996; Harvey, 2017; Midgley & Ochoa-Arias, 1999; Ulrich, 1996, 2001). Flanagan points out that the SDD process is democratic in the sense that "observations which are nominated for inclusion in the model include input from all co-designers" (Flanagan, 2020, p. 14). What is imperative is that the development of the supermajority takes place as the co-designers learn from one another in the process of having to reconsider their own and others' reasoning regarding the likely consequences on Idea Y of implementing Idea X. Flanagan makes the additional point that even when convergence is achieved in this way, "the process of adding new ideas is never fully sealed; nor is the pattern of influence in a map cast in stone" (Flanagan, 2020, p. 15). He remarks that "reflection on a collective mental model can, and arguably should, stimulate new ideas for inclusion in that model" (Flanagan, 2020, p. 15). This is similar to Smith and Shaw's point, citing Churchman, that problems (as observed) can never be "exhaustively formulated" and that "there is no stopping rule" (Smith and Shaw, 2019, p. 404). We might suggest that not only participants but also wider audiences can continue to engage with (and deliberate with others around) the models as created. This is the point we also mentioned in answering Question 9 of Smith and Shaw's framework. OR practitioners can decide whether they consider that SDD is an effective/helpful way to proceed to set up modelling processes in various contexts. In case practitioners would like to proceed along these lines, IdeaPrism is a free App available in both the Apple and the Google App stores, while Cogniscope, together with its manual, is available from Ekkotek (see Footnote 5).

5. Domains of application of SDD

Before we close our discussion, we consider briefly the application of SDD to the four areas located by Rosenhead (2006, p. 764) for the actual and potential use of PSMs (namely, development planning; COR; large-group interventions; and the design of information systems). We consider Rosenhead because he is one of the few OR theorists who calls for PSMs to be more critically inclined. In his work with Mingers, and also in his own work, he tries to move PSMs in a more critical direction. He did not want PSMs just to be used in large-scale organisations – but he wanted it to be used to help "ordinary citizens in society." That is why he identified these specific extra four areas. Mingers and Rosenhead (2004, pp. 532–533) suggest that one of the ways in which OR can assist people (and not only those managing large, hierarchically structured organisations), is by offering support in the process by which carefully chosen key participants come to an en-

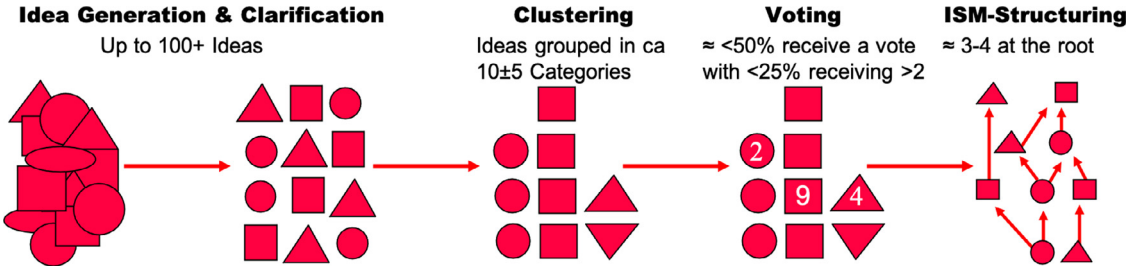

Fig. 4. Divergent and convergence phases of the SDD process.

riched understanding of the nature of the "problem situation" and of possible ways of addressing.

We point to some implications of these applications for what has been termed "citizen science" (e.g., Irwin, 1995; Stilgoe, 2009). Space in this article does not permit a full discussion of citizen science, but Gregory and Atkins (2018) explore links between COR and such a science, noting that the defining feature of citizen science is that it involves citizens in researching issues of concern. We suggest that the use of SDD in the areas discussed in Sections 5.1-5.4 below can help to set up momentum for re-structuring the institutions of our societies to cater for citizens' understanding of what Rajagopalan (2020, p. 6) calls "the growing welter of crises", as currently experienced. We outline our position on this in Section 5.5.

5.1. Development planning methods

A good recent example of using SDD in development planning with local authorities is provided by Laouris and Michaelides (2018). In their article, they report upon the use of SDD with the Local Government Authorities of the Republic Cyprus, with a view to facilitating development planning with the involvement of citizens. In their discussion of SDD as a PSM, they point out that "it uses natural language constructs to support stakeholders to explore similarity and influence relations between their distinct observations", with matrix operations that take place through the Cogniscope mapping process "making it possible for people from all walks of life to deal with complex societal problems without needing to master systems science" (p. 918). While pointing to the advantages of the SDD process for aiding the local authorities' involvement of citizens in development planning in this case, they indicate that they regard this as an instance of Community OR, as well as development planning. They indicate that, in the context of Cyprus, this SDD initiative with local authorities was intended to cater for local people who "wanted more rights and powers [in the political arena] but they were aware that they did not have the know-how, the capacity, the democratic culture or the necessary infrastructure to implement reforms that entailed taking on increased responsibilities" (p. 922). The SDD team's task was to "provide a democratic vehicle … to channel the desire for change and produce results that would be widely acceptable to different stakeholders" (Laouris & Michaelides, 2018, p. 922). In their recounting of the project, which was implemented over a period of six years starting in 2009, Laouris and Michaelides offer what Smith and Shaw (2019) might call a credible account of the effectiveness of SDD in fulfilling this aim. Their description of the project, with details of the specific *results* and *use of the methodology* to support citizen involvement, can function as a resource for others who might be concerned with strengthening local government as a way of restructuring our political systems.

5.2. Community or (COR)

We have indicated above that involvement of citizens via public deliberation in development planning can be considered a form of COR. This is especially so if we use Midgley et al.'s (2018) stretched conception of community, which is consistent with our remarks that "communities" can be *made* as people *work together as a collective through applying the SDD process*. The SDD process of encouraging "collective consciousness", and what can be called a "community spirit" of deliberating together around public concerns, became manifest in the expressions of the participants in the *Re*-invent Democracy project (as outlined in Section 3) when we asked them during the follow up interviews about their experiences of the SDD process. Note that our conceptualisation of the Re-invent democracy project as an example of COR was explained in the introduction.

5.3. Large group interventions

In his seminal paper "Past, present and future of Problem Structuring Methods," Rosenhead (2006) identifies large group interventions as a possible area of expansion/application for PSMs. The aim of a large-scale process is of course to support a community of stakeholders to develop a common understanding of their problematic situation, converge to a clear shared vision, and ultimately to generate collaborative action towards a desired future. In principle, one could achieve this goal through the application of the same PSM repetitively, but every time engaging a different subgroup from the larger community concerned with a particular challenge. To this end, the SDD process has been applied in forms that combine hybrid face-to-face with virtual modes of communication, but also in forms which are totally virtual, i.e., combining synchronous and asynchronous sessions. By shortening the time and effort investment for every process, a 10–100-fold number of participants can be engaged as in the case of the *Re*-inventing democracy example reported here. Analogous applications have been reported in diverse domains, including conflict resolution (Laouris & Christakis, 2017), accessibility and emerging technologies (Laouris et al., 2010, 2017), reforming local authorities (Laouris & Michaelides, 2018), promoting gender equality in research and innovation,[12] sustainable development of coastal cities,[13] etc. If, however, a large-scale intervention is expected to accelerate the process and achieve positive social change at a fraction of time, then, what is required is more than virtual-hybrid applications of existing solutions. We would first need new theoretical grounding that enables massive collaboration. Challenges of scalability and applications that made the participation of hundreds of participants in a single intervention possible, are discussed only scarcely (e.g., Rosenhead (2006 p. 6; Laouris, Dye, Michaelides, & Christakis, 2014, p. 179) in the literature. For a more recent example of a large-scale project using SDD, readers can refer to McIntyre-Mills and Christakis (2021), which combined SDD with an interactive software called "Pathways to Wellbeing", where

[12] All Mutual Learning Workshops conducted using SDD: http://ripeers.eu

[13] One example: https://www.marinaproject.eu/index.php/event/what-responsible-research-and-innovation-actions-are-needed-for-sustainable-maritime-rtdi-by-2030-cyprus-11-april/

the latter was aimed at facilitating citizen involvement in thinking together about choices being made, with a view to moving towards an inclusive wellbeing (for humans and the planet as a whole).

As mentioned in Section 3.4.1, the participants in the *Re*-invent Democracy project used a free App called IdeaPrism to self-record and publish their motivations to participate, and during the process, to "pitch" (and record) their contributions in front of their colleagues. Each of the nearly 100 core participants (about 20 in each region) had 10 shadow participants also involved in the project, who were also allowed to use IdeaPrism. This resulted in structured and authentic engagement of almost 1000. This contributed to rendering realisable, digitally-assisted group interventions in support of large-scale public deliberation around what Churchman (1968, p. 87) calls "issues of concern". With the exception of few good additional examples by White (2002) and Burns (2018), who explain how to work with larger groups, or discuss the scaling-up of PSMs, this level of participation is exceptional compared with most face-to-face PSM applications. As Rosenhead notes "large group methods employ elaborate procedures to enable face- to-face conversations in smaller groups to be integrated into larger processes of consensus formation. However, they do not have the benefit of the interactive and transparent modelling to support decision that is PSMs distinguishing characteristic."

5.4. The design of information systems

The initiative led by Harvey and colleagues (Harvey, 2017), called the Applied Community Informatics Lab (ACIL), draws on third phase science and citizen science (including SDD-type processes) to reconsider how information systems are designed. Currently based in Canada, but with international partners (including from Europe), Harvey indicates the relevance of this Lab as supporting transdisciplinary researchers worldwide in seeking information systems that support citizens' involvement in "[natural] science, digital arts, complexity and social sciences" (Harvey, 2017, p. ix). He considers that the "imagination paradigm" invoked by the ACIL provides a paradigmatic shift, which transports us towards an age where "creativity, imagination and collaborative design take over the economic and cultural scene" (Harvey, 2017, p. ix) – thus being socially transformative. This is indeed crucial for the operation of democracy in the digital age. As seen from Figs. 2 and 3 above, the European youth cohort in the *Re*-invent Democracy project proposed (as did other youth cohorts) that we need information systems designed for transparency with the participation of lay people in their construction, to avert the obfuscation of "information" used strategically by powerful forces with the intent to be misleading (as in propaganda). SDD can arguably come into its own in facilitating the re-design of information systems, as implied by Harvey (2017, p. xiv), citing Bausch and Flanagan (2013) in this regard. Here, we are pointing briefly to how SDD offers a specific critical lens for Re-inventing democracy and that SSM normally works in specific organisational contexts and as we said earlier, we are about democracy for citizens and not for an organisation. We made this clearer earlier when we spoke about stakeholders. While it is not within our scope to discuss how SSM contributes to IS, the interested reader should check relevant literature (e.g., Checkland & Winter, 2006; Checkland Holwell, 2007; Córdoba & Midgley, 2008; Lewis, 2012; Mirijamdotter & Bergvall-Kåreborn, 2006). Even SODA has also been used in this area, and to some extent (even though not claimed as a PSM by Smith and Shaw) VSM was fundamental to the hugely ambitious but ultimately failed Cybersyn project with Stafford Beer and the Chilean government (Espejo, 2014).

5.5. Citizen science

The SDD may be specifically equipped to organise the alignment between COR and Citizen Science called for by Gregory and Atkins (2018). In answering Questions 12 and 13 above, we have indicated how SDD, in Gregory and Atkins's (2018, p. 1121) terms, offers access to a "practical tool for orienting social problems and overcoming common biases [which we call erroneous priorities] in perceiving social reality". Gregory and Atkins (2018, p. 1121) refer to the "cognitive limitations common to all humans", and they point to how such limitations might "undermine our collective actions" (in striving for a better society). The stages of the SDD process are designed to address such limitations.

Ulrich (1996) calls for citizen involvement in re-thinking our ways of addressing issues of concern, referring to the "need to prepare citizens for critical participation in matters of public concern" (p. 174) by developing their competency to participate in Critical Systems Thinking (CST). He considers that in this context it is important to "pragmatise" CST for citizens, as they are unlikely to wish to spend time "familiarising themselves with complicated frameworks", such as CST as an "abstract idea" (Ulrich, 1996, p. 170). But they are "smart": that is, they will accept CST if it seems to have "practical significance" (Ulrich, 1996, p. 170). SDD revitalises the public sphere, precisely by enabling citizens (groups concerned with issues to be discussed) to build up frameworks which express social complexity without becoming overly "complicated" (mystifying), aided by the software used to support this process in non-mystifying manner.[14]

SDD can be regarded as an intervention approach for developing a citizen science so as to contribute to social transformation, broadly conceived, which draws in turn on Habermas's (1984b, 1989) analysis of the structural transformation of the public sphere. Citizen science is, however, a complex construct and discussion of this deserves more profound and in-depth consideration, which is beyond the scope of this article.

6. Concluding remarks

It is unfortunate that although SDD was developed alongside the other first-generation approaches, it was not included in the two main books (Rosenhead, 1989; Rosenhead and Mingers, 2001) that are standard reference points for defining the first generation of PSMs. In this article, we have demonstrated, by using Smith and Shaw's (2019) four-pillared framework and their 13 questions, that SDD meets all criteria and can therefore be classified as a PSM. Admitting SDD into the inventory of PSMs also contributes towards methodological pluralism (cf. Midgley, 1996). We, therefore, propose that SDD should henceforth be seen as part of the repertoire of PSM approaches.

Some particular strengths of the SDD offer significant contributions to OR and Community OR. For example, a distinct characteristic of the mapping stage of SDD is that we often observe people changing their position (from "yes" to "no" or vice versa) based on listening to others' reasoning. The process creates the conditions for people to learn and change their priorities elegantly and efficiently. They "use their exchanges to … improve on collective learning" (De Zeeuw, 1996, p. 21). The Awe effect, which is typically observed when the participants confront for the first time the complete influence map, is another unique characteristic. Their appreciation that this map resulted from their deliberative reason-

[14] Mingers and Rosenhead (2004, p. 531) note that "in several cases PSMs employ software to support the process of choice". In the case of SDD, the original software to support "choices" (decisions/reasoning around whether a particular observation/idea has a significant influence on another one) was called the Cogniscope (see also Footnote 11).

ing as to whether one of their ideas influences another contributes strongly towards the emergence of a clear collective action plan. They are motivated to assume responsibility and take initiatives to materialise this action plan.

Furthermore, the SDD: (i) Equips (C)OR practitioners with its mathematical approach to facilitated formal modelling, which combines robustness with efficiency in the use of group time. (ii) Strengthens Community OR by formalising and scientifically grounding the requirement that the needs and interests of underrepresented populations be accounted for (Johnson, 2011; Johnson & Smilowitz, 2007; Johnson et al., 2016), and that marginalisation is addressed (Boyd et al., 2004; Midgley, 2000). Its ethics of design principles (Laouris et al., 2008) formally require that those whose lives will be affected are invited to participate and contribute. The authentic participation of especially marginalised groups is imposed by Ozbekhan's Engagement Axiom (Predicament of Mankind proposal to the Club of Rome: Ozbekhan, 1970), which states that "Disregarding the participation of all stakeholders is unethical." The SDD adds scientific grounding for these ethical but also pragmatic dimensions of OR. Including stakeholders that represent a rich spectrum of positions and points of view is essential if the consensus to be generated is widespread. Moreover, SDD's Law of requisite action states, "the capacity of a community of stakeholders to implement a plan of action effectively depends strongly on the true engagement of the stakeholders in designing it. Disregarding the participation of the stakeholders, the plans are bound to fail" (Laouris et al., 2008, p. 341). (iii) Makes a specific contribution to participative models and methods for integrating different stakeholders' perspectives while offering new ways for dealing with power relations within the group discussion and in the larger society. (iv) Offers a method of real-time self-documentation, removing the extraneous cognitive load from the participants while increasing transparency and credibility.

The SDD methodology has applications in many domains, including development planning methods, designing of information systems, and citizen science. However, probably its most substantial contribution lies in its potential for scaling up deliberations (Laouris & Michaelides, 2018, p. 930). We lack any governance structure capable of adequately representing today's world's diversity. SDD might provide models for new dynamic forms of governance, which cater for forums for structuring of deliberations around opinion/meaning in our world. In this venture, we must also find ways to include the voices of those that have no voice, such as plants, animals and the ecosystem as a whole. Doing so is a principal ethical obligation we humans have towards nature.

All in all, there are exciting and novel aspects of SDD that PSM practitioners should know about, even if they are only going to continue in their stream of practice. We have detailed how SDD invites citizens to participate in a deliberative modelling process to locate leverage points for effective and ethical future-directed action.

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