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for Debating Emerging Technologies**

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Technology of imagination:

A card-based public engagement method for debating emerging technologies¹

Ulrike Felt, Simone Schumann, Claudia Schwarz, Michael Strassnig

This article introduces and reflects on a group discussion method for public engagement exercises and for qualitative research into citizens' practices of developing and negotiating positions on emerging technologies. The method consists of card sets and a specific choreography in order to facilitate the development of citizens' imaginations on nanotechnology and society in the Austrian context. Drawing on concepts from Science and Technology Studies, we discuss the method's design as well as how citizens in four discussion groups appropriate the setting. The cards' materiality, their content and the discussion choreography allow participants to move between individual and collective positioning work, to creatively engage with the elements available and imagine how an emerging technology – in our case nanotechnology – could develop in future. For the analyst it allows reconstructing participants' ordering, assessment and projection practices. The paper concludes with reflections on the potential and limits of the method and how it could be employed as a tool for qualitative research more broadly.

A: "I was surprised that so many people can discuss a little-known topic with such endurance ..."

B: "... [that's because] we had good cards"

Workshop participants

1. Introduction

Over the past years, we have witnessed an ever louder call for public engagement at earlier moments (i.e. upstream) in technoscientific innovation processes (Wilsdon and Willis, 2004), when public attitudes are thought to be less

¹ The method presented in this paper was developed as part of the larger project "Making Futures Present. On the Co-Production of Nano and Society in the Austrian Context", funded by the Austrian Science Fund (FWF) project number P20819.

(See <http://sciencestudies.univie.ac.at/en/research/making-futures-present-nano-and-society/>).

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We would like to thank the participants of the IMAGINE workshops for their time and for sharing their ideas with us as well as the students in one of our seminars which did give us the opportunity to test the method. Furthermore, this paper benefited from generous feedback at a number of conferences and in particular from the critical reading of earlier versions by Bernadette Bensaude-Vincent and Gernot Rieder. Finally, we would like to thank two anonymous reviewers for their helpful comments, as well as Elizabeth Rosenbaum for her support with final language issues.

entrenched and technological trajectories as well as societal choices still open for debate. Consequently, a broad variety of engagement methods has been developed and tested. In these, selected citizens – sometimes together with scientists – deliberate on the potentials inherent in emerging technosciences and on their future ethical, legal and social implications. Yet the practical realisations of a seemingly consensual commitment to tighten the relationship between technoscience and society have proven problematic (e.g. Irwin, 2006).

Nanoscience and -technology (hereinafter nano) is among recently emerging technoscientific fields, which have triggered several upstream public engagement activities (Bowman and Hodge, 2007; Delgado et al., 2011) and simultaneously shown the challenges of such efforts: (1) While nano has become a buzzword in the policy arena and partly in public debates, it does not refer to a clearly defined object or field. As a so-called enabling technology, it crosses a broad range of disciplines and different areas of technological development such as food, new materials, or medicine. (2) Nano is a perfect case for illustrating the Collingridge dilemma (1980), which describes the difficulty of finding the ‘right moment’ for intervention. Once a ready-made technology arrives in society, impacts are easier to predict but modifications are hard as considerable investments have already been made. During early innovation phases, when sociotechnical trajectories are still more open, knowledge of potential consequences remains rather scarce. Therefore, upstream engagement demands feats of far-reaching anticipation and the ability to cope with many uncertainties from its participants. Nano adds further complexity: it is both upstream and downstream in its innovation process, since nano-products are at once on the market but also a “future technology” in many domains. (3) In many countries, nano is not an issue for the wider public, but is discussed among technopolitical elites in terms of risk governance (health, environmental). Following Marres’ (2005) assumption of “no issue, no politics, no public”, public engagement initiatives are thus confronted with citizens who cannot easily draw on publicly available vocabularies, positions and framings. Hence, interactional engagement situations become the place where people develop their positions (see Billig, 1996; Davies, 2011). (4) Nano is a technology that is closely entangled with sociotechnical promises and expectations of economic growth (Felt, 2010). To better cope with the uncertainty of futures, scenarios have been developed to inform both policy and public debate (Bennett, 2008; Rip and te Kulve, 2008; Tü rk et al., 2005). Yet using scenario methods comes with the “risk of avoiding or downplaying the present by centring debate in the future” (Barben et al., 2007: 993) and prematurely narrowing people’s imagination of possible future developments. (5) Finally, social sciences have been actively involved in building the nano-field from very early on, covering a vast spectrum of methods from straight forward information activities to multidisciplinary projects seeking to take seriously the cultural narratives citizens develop when addressing emerging technologies (e.g. Macnaghten and Davies, 2010).

These observations triggered our interest in developing a novel methodological approach for addressing emerging technosciences such as nano, emphasising the following aspects: It should allow citizen engagement in the context of a largely missing public debate without departing from predesigned scenarios. Further, the method should enable qualitative research on the processes through which people engage with complex new issues. A better understanding of such processes can

provide an essential reflexive input for research and policy-making regarding how citizens form opinions on emerging technologies.

Thus, the aim of our methodological approach was to create a space in which participants are encouraged to develop and negotiate individual and collective *imaginations* about nano. Imaginations are outcomes of imagination, which we understand as the ability and practice to relate and associate what is perceived as possible with what is seen as “given” or “real”. We conceptualize imagination as both individual and collective; as a genuinely social activity that cannot be reduced to mental images or confined to the “non-rational”; it is not exclusively directed towards the future (prospective) but also towards the past (retrospective).

We are aware that methods are always normative, performative, and participate in producing the kind of reality they claim to simply observe (Law, 2004). Drawing on Akrich’s (1992) approach from technology studies, we perceive the method we developed as a *technology of imagination*. Akrich points to the fact that any design – and thus ours too – contains a script defining “a framework of action together with the actors and the space in which they are supposed to act” (Akrich, 1992: 208). The script hence pre-scribes certain roles to participants and defines how they should adequately make use of the method. But Akrich also makes us aware that users might have different visions of a technology, attempting to redefine or reject the script. The attention of our analysis is thus directed to the active role of the users. Consequently, this paper will not focus on outcomes generated by the method, but mainly on its design and practical use. Accordingly, we reflect how we imagined and developed both the method and its script, and in a second step, how participants actually dealt with it – their “de-description” of the technology, to use Akrich’s term. Following this logic, the paper starts by discussing the development of our technology of imagination, which we named IMAGINE, and the choices made in this process, thereby making the script visible. After that, we analyse how participants made use of or described the method. In conclusion, we reflect on the potential and limits of the proposed engagement method for emerging technologies and how it could be employed as a tool for qualitative research more broadly.

2. Creating IMAGINE

Based on the considerations outlined above, the method should meet the following conditions:

(1) In absence of a wider public debate, it should offer participants a broad repertoire of resources to stimulate discussion without closing down or narrowing issues from the outset.

(2) Debate on the multifaceted moral and political economies of nano (Macnaghten et al. 2005) should be enabled by presenting the positions of different institutional or individual actors involved in shaping nanotechnology R&D in Austria.

(3) The discussion ought not be framed by experts of nanoscience or policy, i.e. neither external experts should be invited nor should we present ourselves as such.

(4) (Expert) knowledge or detailed information on nano should not be required for citizens to participate in the debate.

(5) The offered resources and the setting's format should accord all participants a voice, independent of their background or experience.

(6) The choreography of the discussion ought to allow for balancing between individual and collective positioning.

(7) An extensive debate should be triggered without being too demanding in terms of time commitment, concentration and capacity to engage.

(8) Participants should not be required to reach consensus, as this could lead to a premature reduction of the scope of opinions (Horst and Irwin, 2010).

To take these conditions into account, we opted for a card-based method, a choice guided by the assumption that the invited citizens might not have concrete ideas concerning nano and that therefore, some input would help to trigger debate. Consequently, we produced different sets of cards as support material and devised a particular choreography of how and when to use them.

Cards have frequently been employed as stimuli for debate and as research tools in qualitative research and public engagement on technoscientific issues. In the context of participatory methods, a card game called PlayDecide² has been developed to structure debate and ultimately decide on a common policy position. Although we adopted the idea of providing distinct sets of cards, some aspects of the PlayDecide script seemed problematic against the background of recent public engagement debates. For instance, starting with "info cards" and an information phase decoupled from a discussion phase, suggests that citizens have to be informed first to be able to build and discuss their positions. We refrained from presenting "facts about nano", which would tacitly imply a hierarchy of scientific knowledge and logic dominating over other kinds of knowledge (e.g. personal experiences) and their respective rationales of interpreting and ordering the world (Wynne, 1992, 1995). Additionally, we abandoned the idea of a "shared group response" at the end of discussion, because this would have forced consensus.

In qualitative research, particularly in interviews and focus groups, cards have been utilized to stimulate talk about sensitive issues (Sutton, 2011; Chang et al., 2005) and as part of "focusing" or "ranking exercises" to analyse people's ways of ordering and classification (Bloor et al., 2001; Kitzinger, 1994). Concept boards are a similar way of providing resources in group discussions, as they usually present different visual and textual elements, for instance, media articles, illustrations, objects, interview sequences, scientific facts or policy statements (see use of concept boards in DEEPEN project³). But card methods, and in particular the one presented here, show an important distinction to concept boards: each participant can materially rearrange the cards and thus appropriate the resource, whereas representations on concept boards are fixed and pre-arranged. Furthermore, using a card game-like setting allows

² PlayDecide is based on the Democs cards, a card-based public engagement tool (see <http://www.playdecide.eu>, URL last consulted 03 July 2011).

³ <http://www.geography.dur.ac.uk/projects/deepen/Outputs/tabid/1994/Default.aspx>, URL last consulted 18 January 2012.

participants to use their embodied skills from playing games, which include bodily performances, know-how (of rules) and interpretations (e.g. of the other players behaviour). We expect this familiarity with card games to facilitate participation in a card-based discussion. What is specific about our approach is that the choice of cards is kept at the level of the individual, each participant getting his/her own board and set of cards.

IMAGINE consists of four successive stages (each roughly the same length) and their respective sets of cards, these being story, application, issue and future cards. This choreography is supposed to encourage participants to focus on specific aspects and change their perspective when they enter new stages. The cards aim to capture the breadth of the available positions and issues and are meant to be handled by the discussants as an open resource box, allowing flexibility while providing some structure. They consist of textual elements, with the exception of the application cards which also include pictorial elements. These texts are rewritten content from publicly available resources (media reports, policy documents, PlayDecide and local websites), but also include material from qualitative interviews we had conducted with Austrian stakeholders (scientists, NGO representatives and policy makers).⁴

In total, we organized four IMAGINE discussion workshops with Austrian citizens in November 2009 and January 2010.⁵ Each of the four workshops focused on a different field of nanotechnological application – medicine, food, ICTs/surveillance, and consumer products – for which the cards were adapted. We settled on these application areas, assuming them to be linked to diverse pre-existing, often culturally entrenched sociotechnical frames, thus impinging differently on how nano is perceived and negotiated. Every workshop involved six participants, was facilitated by a moderator, and lasted four hours. Based upon prior experiences (e.g. Felt et al., 2008; Felt et al., 2009) with shorter settings (e.g. focus groups) and with formats lasting for entire days and longer, a timeframe of four hours was chosen because this length was expected to guarantee both citizens' availability and sufficient length of debate.

In the following we describe the setting's choreography: After a short welcome by the moderator, each IMAGINE workshop started with the screening of a video-clip⁶ sketching the topic and the multi-layeredness of the issue. This was meant to avoid an introduction to nano by the moderator, hereby circumventing the danger of slipping into an expert role. The screening also allowed the participants to duly 'arrive at the table', where everyone was equipped with a board and four piles of cards (flipside up) next to it. Each of the following *four stages*, which generally lasted around 40-45 minutes, started by inviting the participants to take their time going through the cards in the respective stack, choosing a defined number of cards and putting them on the space reserved for this stage on their board (see Figure 1). The participants were invited to apply their own selection rationale. Once the cards had been selected,

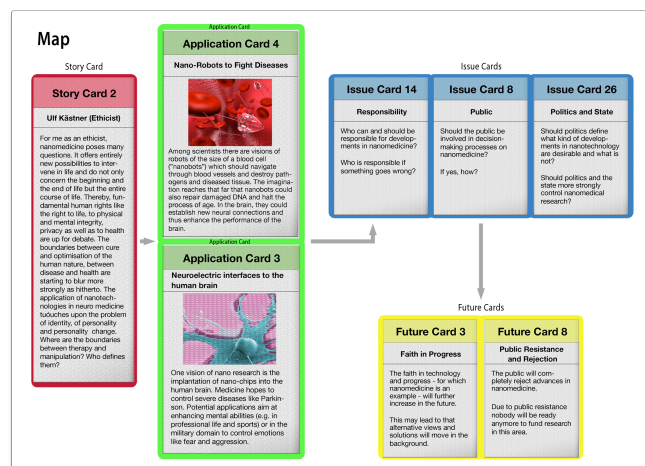
⁴ For the specific content and form of the cards, please go to the website <http://sciencestudies.univie.ac.at/en/research/making-futures-present-nano-and-society/resource-page-imagine/> (note: the cards are written in German).

⁵ A trial of the cards and procedure was carried out before with a group of students.

⁶ The seven-minute video presented definitions and examples of nano, its historical development, an overview of scientific disciplines involved in nanoresearch, some applications and products currently available and Austrian policy makers' expectations from investments in nano. The video ends asking how nano might concern "us as citizens", leading over to the discussion.

participants were asked to explain their choices. The moderator was only to intervene if the discussion did not start independently, to ensure that group members had equal chances to explain their choices, or to inquire for further elaboration of arguments. During and after presenting their individual choices, the discussion moved into a more open and interactive phase.

Figure 1: Schematic representation of board with cards



In the first stage, the participants were asked to read the first stack of cards (6-7), the so-called story cards, and to choose one card. The story cards capture positions of heterogeneous actors, based on condensed and slightly reformulated statements. We assumed that approaching the issue via personal stories facilitates participation best. Actors represented on the cards are diverse: researchers, physicians, ethicists, policy makers, industry and NGO representatives, science communicators and citizens writing letters to the editor.

Once the discussion seemed saturated, participants were invited to change perspective and pick up the application cards, which introduced much-discussed nano applications, ranging from products already available on the market over others currently under way to more visionary ones. Illustrated by an image, a short description depicted how scientists, media or industry presented the application. These cards included promises, possible benefits, but also potential problems and risks. The discussion thus moved from actor accounts (first stage) to application contexts (second stage), challenging participants to shift their frames of reflection. Participants were invited to select two cards out of six to seven options, giving them the chance to apply different choice rationales.

After the discussion of the application cards and a break, the participants were encouraged to choose three issue cards (out of 23-31) or write down their own issues on blank cards. The large number of cards represented the multi-facetedness of potential issues and the choice of three cards should allow to develop complex arguments. Issue cards pointed out ethical, environmental, health, economic, legal, political and social aspects of nano and thus explicitly situate emerging technosciences within a larger socio-political context. They carried a short heading

and text, usually phrased as question, thus leaving it to the participants to either formulate a response or scrutinize the question itself.

In the final stage, participants were invited to engage with expectations and promises concerning the mutual development of nanotechnology and society. This was meant to assemble and condense arguments about the future which had already been made in prior stages. In order to achieve this, the participants were asked to choose two future cards (out of 17-21) or to write their own. The cards comprised very short statements about future developments on different levels: Some addressed more or less concrete nano-visions – e.g. making society more efficient and safe, or losing control of technology – that circulated in specific societal arenas such as media, science policy, or science. Other cards extrapolated present issues into the future, for example by stating that existing societal imbalances could intensify. Additionally, future cards also raised the question of agency of different actors (e.g. citizens, policy makers or industry) in shaping these futures. We explicitly avoided presenting vigorous utopian and dystopian scenarios, leaving it to the participants to come up with such visions.

Several considerations guided this specific arrangement in four stages: Starting with the story cards was intended to embed nano first in a societal context involving heterogeneous interests, roles and actors, thereby introducing participants to different standpoints. To avoid framing the participants as consumers, we waited until the second stage before introducing applications as a discussion subject. While participants could gradually develop issues on their own in the first two stages, they could explore and supplement them more explicitly in the third stage. All this would then form the basis for a reflection on future developments in the last stage.

In summary the script of our engagement method looks as follows. Alternation between phases of selection and discussion over the course of each stage enables shifting from individual moments to more collective ones: reading and picking cards is supposed to be conducted individually, hereby facilitating introspection, while subsequent discussion requires a positioning towards the group and collective negotiation of these positions. Secondly, dealing with the cards individually can also be seen as an intermission from the more intense discussion phases. Reflection on earlier debate enables participants to reconsider their positions during the break, which is particularly important for those less experienced with discussion settings. These interruptions were also conceptualised as regeneration periods to keep up the momentum of discussion during the four-hour-debates. Thirdly, the cards were meant to embody functions of a moderator, giving participants maximum space, yet imposing some rules. This setting is deliberately reminiscent of card game situations where certain orders are at work and everyone has her/his turn to contribute. Fourth, experts such as scientists, politicians or NGOs are physically absent but present through the statements on the cards, especially on the story cards. This establishes a space in which participants might more openly express disagreement and challenge expert claims than in face-to-face encounters (Myers, 1998; Felt et al., 2009). Fifth, since sociocultural factors affect how people actually engage in interactive group settings (Farnsworth and Boon, 2010; Warr, 2005), we considered that some participants might be disadvantaged in discussion. Without succumbing to the illusion that the cards would put everybody on equal footing, we conceive them as material support for

participants who possess less rhetorical resources to formulate their opinions. So, the cards can be understood as an effort of balancing within heterogeneous groups. Finally, being confronted with the task to read and decide on cards in a limited timeframe generates a situation in which participants have to choose quite spontaneously and thus might apply more tacit than explicit selection criteria. Their ex-post explanations bear rich analytic potential in showing how they try to verbalize and rationalize their choices.

Before moving to the “de-description” part, we will briefly explain participant recruitment: Our *politics of invitation* was guided by the premise that decisions about who qualifies as a legitimate participant in social science research and in public engagement settings are always framed by implicit assumptions about the public and its representation in these settings (see e.g. Felt and Wynne, 2007; Felt and Fochler, 2010), for instance as individual informants in surveys or as representatives of a relevant social group in focus groups. We aimed to achieve a composition of “mini-publics” (Goodin and Dryzek, 2006) representing diverse positions and social backgrounds and not statistical representativeness. Putting this into practice, we sent flyers in bulk mail to households in selected Viennese districts and distributed them at science museums and science events. There were 51 respondents, out of which six participants were selected for each discussion group. We opted for heterogeneous mixed gender groups of diverse ages, educational and professional backgrounds, because differences between participants “allows one to observe not only how people theorize their own point of view but how they do so in relation to other perspectives and how they put their ideas ‘to work’” (Kitzinger, 1994: 113). Since we are interested in the processes of interaction, including both controversy and consensus, we did not exclude “engaged citizens” (e.g. members of activist groups or those with a strong opinion on the topic) from our setting (Irwin, 2006).

3. How the participants de-scribed IMAGINE

We will now explore participants’ practices of de-scribing IMAGINE, i.e., how they dealt with the cards, inhabited the setting, struggled with it or developed workarounds. Following a practice theoretical approach (Reckwitz, 2002) we conceptualize practices as “routinized ways in which bodies are moved, objects are handled, subjects are treated, things are described and the world is understood” (250). Subsequently, we are less interested in individual positions and their mere discursive expression than in how they are enacted in social practices. “As nexus of doings and sayings” (Schatzki, 1996: 89), practices are indispensably connected with a particular usage of things, such as the cards in our case. We start by analysing participants’ practices that were sparked by the materiality of the cards and then turn to how the content of the cards was used discursively to support, build and express positions.⁷

⁷ This empirical analysis is based on the transcribed audio recordings of the workshops and on participant observations during the workshops. All quotes from workshop participants are indicated by quotation marks.

3.1. Working with the materiality of the cards

For the following analysis it seems essential to underline our focus on both human and non-human actors (Law and Hassard, 1999), understanding the cards as performative non-human actors and vital semantic devices. Thus we pay close attention to the role of materiality, which often remains unreflected in social science analyses (Michael, 2004). We will therefore examine two main practices in which the cards' materiality has been pivotal: ordering and choosing as well as memorizing.

Ordering and choosing practices

Recurrent phases of card choice, in which the participants read cards and make choices, are central to IMAGINE's choreography. A main goal of analysing the material aspects of the practices related to the cards is to identify how the participants come to choose "their" cards and connect these with their verbal accounts. Consider, for instance, the following observation during one of the workshops:

Maria carefully examines each card and then puts it on one of the two piles she has created next to her board. Having finished a first round of card reading, she puts one of the piles aside and runs through the remaining one again, deeply concentrated. She hesitates and stops, puts one card aside and continues reading the others, stopping once more to put down a second card. She then tilts her head and places one card in the dedicated space on the board.

What is captured here is a specific way of card sorting. Maria's practise of creating piles tells us that deciding on one card was hard for her, in fact she seems forced to develop specific ordering practices to accomplish the pre-scribed goal of ending up with one card. We witnessed that in a first step, several participants had a similar approach to the cards as Maria: they immediately put aside some cards seemingly less relevant to them and then started a new round of sorting with the remaining cards. This took place without any verbal exchange between them; often, they did not even raise their eyes from the cards. Only a few shortly commented on the card content in this phase or bemoaned the limited number of cards they were supposed to choose. At the same time, every group included at least one person who resisted the pre-scribed 'rules'. This can be interpreted as a strategy to either conceal one's choice, refrain from making a choice, make use of resources from several cards, or simply to keep an overview. In order to make sense of these material practices, they have to be connected to the participants' overall verbal and non-verbal performance in the discussion phases. For example, one participant's refusal to put cards on the board fitted neatly with how he presented himself in the debate, namely as an expert who just came to the table to inform the others, showing little inclination to engage in mutual exchange. With this knowledge, we can interpret his material practice as supporting his position: By refusing to "play the game" by its rules, he distinguished himself from the prescribed role of a citizen in need of the cards' assistance to form an opinion. Therefore, observing the workshop participants' handling of the cards in the choice phases adds another layer to the interpretation.

In stages where several cards could be chosen, participants sometimes pondered over the order of and the relations between their selected cards by rearranging them several times on their boards. This material order was later

translated into a procedural order when they explained their choice to the others. For instance, one participant in the group on nano in consumer products explained the order of the three issue cards he chose as follows:

“Well, my cards are in the following order 10, 7 and 20. First ‘ethics’, because the technology should be examined properly and its consequences should be studied before it reaches the market. And the second point is ‘knowledge and having a say’. That’s, if I don’t know anything then it’s hard for me to assess it. And my third choice is ‘labelling’, because having a say is only possible if I’m aware that the technology is used in a product.”

The example here clearly shows that prescribing a choice of three cards invited the participants to put them into a specific order to construct a coherent narrative. Individual choices as described above were referred to when explaining card choice and also at moments in the discussion process, e.g. when a participant expressed support for another person’s choice by stressing that this card had also been ‘shortlisted’ but had not made it into the final choice. In so doing, the participants redistributed relevance among the cards and addressed the restricting script. At other times, participants distanced themselves quite explicitly from discarded cards as a way of sharpening their position.

When individual choices were explained to other participants, this also triggered the identification of shared choices of cards, transferring the debate from the individual to a more *collective level*. Cards that were mentioned several times gradually moved to the centre of talk, leaving those that were hardly ever chosen marginalised or undebated. However, this process does not necessarily point at a desire to reach a consensus, because even when people attributed relevance to the same card, their reasons for choosing it usually differed considerably. We also encountered exceptions where a single choice managed to become the centre of the debate, when several participants remembered that they too had found the respective card interesting in the individual selection phase.

A strength of the card method is that choosing from a given, limited and known set of options (i.e. selecting a defined number of cards) enables the analysts to observe and explicitly address *the non-chosen*, the present absences (Law, 2004). The moderator could bring those absences to the table and explore in situ why certain cards and themes were excluded. Our observations show that these mostly involved cards that were collectively judged as being of minor importance. In the group featuring nano in the food domain, for example, no participant opted for the application card depicting the possibility of using nanomaterials in food packaging. On inquiring why this was the case, the moderator learned that the card simply did not make the final selection - other cards were ranked higher. This, however, did not mean that nano in food packaging was automatically a non-issue or considered unproblematic for all participants, but had less priority compared to other aspects.

Memory practices

As public engagement with emerging technologies often demands from citizens that they manoeuvre a rather unfamiliar terrain full of new terminology, questions and ideas, the cards became crucial devices accompanying the participants’

journey. The possibility of putting chosen cards down on their boards enabled the participants to relate choices made in later stages to those made earlier. It allowed for reflection on shifts and changes and to work on the coherence of their positions. One participant, for example, stressed in a later phase of the discussion that for him, “now the debate is back to [his] first card”. He picked up the relevant card, showed it to the group, and continued elaborating the argument he had developed throughout the debate. With this practice, he materially reminded the other participants of his position, its coherence and robustness, using the card as a *memory device*.

The cards had additional functions in terms of memorizing such as following other people’s arguments by picking them up and reading them, or remembering their own readings. In particular, people less familiar with the topic and discussion group settings benefitted from having a set of arguments and vocabulary available literally at a glance. A detailed analysis shows that some participants relied heavily on this practise, as they either used the exact wording or rephrased the cards’ content, often followed by a short personal assessment. Hence, we argue that to a certain degree imbalances between the participants can be reduced to warrant easier participation. Finally, remembering which cards others had picked helped connecting specific cards with particular people at the table, thereby identifying potential affinities and discursive allies to build coalitions with. Thus, the cards became a device supporting group memory – on individual and collective levels – and allowed keeping track of the discussion.

3.2. Positioning practices

In the following, we analyse two central dimensions of participants’ (verbal) positioning practices with a special emphasis on the role of the cards and their content in these processes. We initially focus on the explanation and legitimization of individual card choices, then the cards’ functions in the more interactive negotiation of positions are addressed. Although the materiality of the cards remains central, our analytical focus shifts more towards discursive practices.

Arguing card choice

A detailed analysis of participants’ arguing their card choice shows that the reasons for picking cards were as multifaceted as their backgrounds: Some chose a card because it represented problematic aspects such as “the pretention of researchers, their paternalism”. Others argued in favour of more positive or promissory narratives such as “if food is enriched [through nano] ... and if it tastes neutral then I would find that not bad at all”. Some picked cards they “thought that definitely nobody else would pick” while others even chose those that were “not clear from the start”. Despite this variety two main rationales underlying participants’ choice of cards emerged, which were also linked to different practices of choice.

The first, performed by fewer participants, was about connecting nano-related issues with *pre-existing personal agendas*. Motives for choosing a card or highlighting specific parts of it were obviously connected to a more general, often quite normative argument they wanted to make. For instance, in the discussion on nano in the food domain, participants with a clear preference for organic food immediately identified

nanofood as incongruent with their nutritional approach. Over the course of the debate they only marginally opened up to other perspectives or arguments and retained their strong normative assumptions. They were remarkably quick to choose their cards and even expressed their rejection through emotional comments during the otherwise quiet selection phases.

The rationale we observed more often was typically performed by those who did not relate nano with a specific personal agenda, their dominant practice was to *balance different cards* on two levels: On an individual level, participants frequently tried to identify and select cards that presented both positive and negative aspects. This could indicate that they were either in the process of developing a position or deliberately leaving things open for the time being. Such tacit practices are said to reveal themselves best when their execution is impaired (Garfinkel, 1967), which was the case in stage one, where the participants were supposed to select just one card. As a way of coping, some 'rewrote' the script, choosing two cards or referring to a second one, when they explained their choice. On a collective level, some justified their choice in later stages as being influenced by a perceived need to balance the overall discussion, e.g. by including seemingly neglected issues.

This analysis elucidates that the ways in which participants explain and justify their particular card selection provides insights into the agendas they bring along as well as the processes of opinion formation during the debate. In both practices, participants strived for internal coherence of their choices, conceiving the different stages of the discussion process and the selected cards as interconnected entities. They conceptualised them as a "package" – as one participant explicitly called her choice of issue cards – and constructed causal connections or arranged them into a temporally ordered narrative.

Interactive positioning

As talk in group settings gets its richness from manifold interactive processes between speakers, it is central to ask what role the cards and the choreography of the setting played for negotiating choices and building positions. From our methodological standpoint, the cards have to be treated as relevant partners in interaction, as additional nodes in a conversational network of talk. The analysis elucidated two central aspects of this relationship: the mediating function of cards via their interpretative flexibility and their ability to impersonate human actors and their positions.

Actually, most participants handled the textual material on the cards as mutable entities, using textual elements (e.g. headings, phrases or words) as discursive building blocks and rearranging them in order to establish their position. Sometimes they changed the original meaning of the cards' content, thus playing with the *interpretative flexibility* of the text. This became particularly apparent, when people stated that they had selected the same card but had "understood it differently". A particular situation during the issue card stage in the workshop on nano and ICTs/surveillance demonstrates this point. Initially, most participants chose the issue card titled "ethics" which posed the question whether "ethics should have a bigger role in debates about nano". In the discussion, several meanings were attached to the word "ethics": Some participants referred to ethical behaviour of those responsible for

governing nano; others used it to argue for a moral authority that should confine technological development, which in turn triggered debate whether this was “anti-technology” or a legitimate way of performing moral guidance. Based on such observations, we argue that terms like ‘ethics’, which are robust yet malleable enough to be open for multiple interpretations, function as “boundary objects” (Star and Griesemer, 1989) in discourse, allowing diverse positions to be articulated and negotiated.

Further, the cards served as a kind of *proxy* through which positions and roles of societal actors and stakeholders could be indirectly challenged, as participants tended to avoid direct confrontation or conflict in order to create and maintain a socially agreeable and robust space. We experienced that some participants withdrew behind cards as a way of stepping ‘out of the line of fire’ when others challenged something they had said, e.g. one participant responded to a vehement objection by claiming that “the card said so”. Here, she insisted that she was not giving her own opinion but was just rephrasing the card’s content and, hence, cannot be held accountable for its message. This illustrates that the cards helped to bypass mutual critique and ‘tamed’ the debate in certain respects. Moreover, they facilitated different ways of challenging opinions as is illustrated by the following situation: One participant explained why he had chosen a card with a statement made by an industry expert. When he was narrating the expert’s claim that nano-particles in sunscreens could “probably” not permeate skin, he became upset and criticized the expert’s “arrogance” and “patronization of the public”. Other participants joined his critique and a shared position emerged among the group members. Thanks to the cards, expert positions were virtually present in the physical absence the expert, enabling participants to engage with expert opinions openly. In the Austrian context, where hierarchies between laypeople and experts are deeply culturally entrenched and members of the public rarely challenge experts in direct face-to-face encounters (Felt et al., 2009), our method thus created a space in which open criticism of expertise and experts became possible.

3.3. Projective and retrospective imagination

In this final section, we reflect more generally on how the central idea behind our *technology of imagination* worked out, which was to stimulate people’s capacity to imagine what the development of nanotechnology in specific areas of social life could mean for them as individuals and for the future of society as a whole.

As pointed out by a number of authors (e.g. Brown and Michael, 2003; Adams and Grove, 2007), past experiences and future expectations are deeply entangled with each other. In this regard, it is crucial to understand how participants connected retrospective and prospective imagination throughout the stages of the discussion process and how the change of perspective, as an important feature of the setting’s choreography, contributed to this process.

As stated before, the story cards in the first stage captured statements from contemporary actors, thus directing attention to the present. This, however, did not stop participants from connecting these narratives with what they already knew: we could observe participants’ efforts to relate them to their individual experiences as

well as to a collectively shared history in order to develop a position towards potential futures. One such historical event evoked by the story cards was the anti-nuclear protest movement in Austria during the 1970ies. Here in particular, its success in preventing the construction of nuclear power plants in Austria represented a shared experience that enabled participants to imagine a similar rejection of future technologies.

In the second stage, the application cards were intended to open up different temporal horizons by presenting existing as well as more speculative applications. During this phase we witnessed that more futuristic visions of nano applications were not taken up as an issue to be collectively discussed. This was especially the case in one workshop where, although four out of the six participants picked one particular application card, it was not taken up in the following debate. The card depicted a more speculative vision of a so-called nano louse, a tiny robot expected to autonomously repair the human body. Although fascinated, most participants were either reluctant or unable to imagine and discuss such applications unconnected with their everyday life experiences.

Subsequently, it was the aim of the issue cards stage to introduce both pre-existing issues and concerns of technoscientific developments in general as well as new aspects nano could raise. Here, the participants were particularly attracted to 'broader' ethical, social and legal issues such as distribution, discrimination, responsibility or product labelling, since these were seen as relevant for any technological innovation be it in the past, present or future. Therefore, discussing nano turned out to be a chance to reactivate debates about wider societal questions and the relationship of technology and society more generally. Yet at the same time, every new technology coins its specific issues, in the nano case these were particularly linked to invisibility and smallness, which were considered to be problematic in many respects (e.g. smallness as means to transgress body boundaries such as skin or nano 'creeping into' society unnoticed).

In the last stage, the process of imagining and expressing which futures might co-emerge with nano was put at the centre. Participants were explicitly encouraged to engage in projecting current socio-technical developments into the future and create their own scenarios. Although at the beginning some did not feel capable of deliberating about a novel and unfamiliar technoscientific field, over the course of the workshop, participants became quite comfortable with the topic, even daring to make projections into the future. This transformation process is not only evident in the astonishment they express about their capacities (see epigraph), but also showed itself in the diverse sophisticated narratives they constructed. In doing so, they demonstrated a kind of "adaptive expertise", which is oriented towards solving an unfamiliar problem "by creatively transferring and transforming elements of diagnoses, interpretations, and solutions across contexts" (Hackett and Rhoten, 2009).

4. Conclusions

The main goal of this paper was to present and reflect the design of the card-based engagement method IMAGINE, and to analyse how participants appropriated this *technology of imagination* through their discursive and material practices. We

offered insights into how users de-scribed the method's script and handled the materiality and content of the cards individually and collectively. This concluding section will reflect on the possibilities and limitations of IMAGINE as a way of creating a public engagement setting and as a qualitative research method.

Starting with the limitations and how to deal with them, we want to point out four aspects: (1) Using cards brings with it specific framings and vocabulary. As a consequence, social scientists working with this method need to carry out a fine-grained analysis of the field before writing the cards and have to carefully balance different views and positions on the cards. Yet at the same time, we should not believe that stimulus materials define the debate. In fact, the empirical analysis of our workshops shows that participants make use of the card content flexibly and appropriate it creatively for their own purposes. (2) Since the materiality of the cards turned out to be an important feature of the setting, we suggest complementing audio with video recording to better capture the non-verbal practices of handling the cards. (3) Although all participants had equal opportunities to explain their card choice in all four stages, it does not guarantee that everyone gets involved to the same extent. (4) As our four-hour discussion workshops represent a one-time engagement we can only speculate about the effects of the debate beyond this concrete setting. To counteract these last two shortcomings, we recommend carrying out follow-up interviews with selected participants as a means of reflecting the impact of such an engagement exercise as well as of investigating if and how positions are reconsidered. Our experience with such interviews elucidates that they also allow in depth exploration into those individual positions that remained marginal in discussion group settings. They therefore represent an ex-post strategy to bring back less visible positions into the analysis.

Regarding the method's potential, we would like to stress that in absence of a public debate on nano, IMAGINE allowed us to assemble dispersed elements of public discourses and visions. In general, participants worked actively and creatively with the elements we gave them. Analytically, addressing non-chosen cards allows to identify and inquire about less central issues. Such a research perspective can help us understand why certain issues are awarded attention in public debates, while others stay in the background or remain unaddressed. Additionally, IMAGINE enables analysts to focus on both individual and collective positions and processes, since its choreography balances moments of individuality and collectivity. The four stages and the ordering of their phases provided time for introspection and individual decision-making (card reading and choice phases), subjective positioning (explaining card choices) and collectively negotiating cards and positions in the interactive parts of the discussion phases.

In terms of public engagement, we argue that the presented *technology of imagination* actively contributes to supporting citizens' capacities to develop broader imaginations vis-à-vis the potential development of emerging technologies in a specific cultural context – thus rendering citizens a potential force in the governance of these technologies. This was clearest in the final stage, where the participants saw themselves not only as competent enough to build their own future scenarios but also played out their expertise by extrapolating certain developments, issues and problems into the future. Moreover, the physical absence of experts enabled them to focus more

on their own capacities, knowledges and experiences, while at the same time, the integration of expert voices in the cards allowed to critically deal with the positions of these societal actors or to use them creatively. In this respect, our outcomes tie into debates around *deliberative democracy* in the domain of S&T policy, whose advocates seek to expand public debate and decision making to a wider set of actors (e.g. Hagendijk and Irwin, 2006). Deliberative democracy approaches, however, have been criticized for their sometimes “naïve” assumptions on the openness of spaces of deliberation, especially for overlooking their rootedness in democratic cultures and local traditions. The proposed method could also serve as a tool to investigate precisely these tensions between the demands of deliberative democracy and cultural framings of citizens’ imagination. Such insights can, of course, represent the output of a social scientific analysis, yet in some instances our participants started to reflect on their own socio-cultural embeddedness and how this frames the imaginations of their own role in shaping current technopolitics.

This corresponds with our understanding of IMAGINE not being a ready-made tool that can be simply transferred from one national or cultural context to another. It has been designed in and for the Austrian context, which is characterized by a non-participatory technopolitical culture where public engagement hardly plays a role and open critical debate on technosciences is scarce (Felt et al., 2008). Yet even though IMAGINE is deeply entangled with its context, it is also an adaptive technology. It invites social scientists in their capacity as analysts, to prepare, structure and put at citizens’ disposal a scattered discourse on an issue. It demands reflecting on the choreography of participation and paying attention to the performative power of methods. Thus we want to encourage other qualitative researchers and creators of public engagement settings to adapt the method to their needs, cultures and specific topics. Although we developed IMAGINE for discussing an issue unfamiliar to the wider public, the method might equally have potential in debates about issues that are publicly polarized and/or characterized by a high degree of complexity, since the cards are intended to systematically present a range of existing stakes and the different stages encourage participants to take different perspectives into consideration. After all, we developed this *technology of imagination* to open up users’ field of vision and invite them to imagine potential sociotechnical worlds from different angles. Yet, users have it in their own hands how they utilize a technology – and these uses might often turn out to be quite unintended as the history of technology tells us.

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