
'Nano Should Not Turn Out Like...': The Alerting Role of Analogies in Public Engagement with Nanotechnology

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Abstract

With the appearance of nanotechnology, the governance of emerging technologies has entered an 'age of public engagement' in many Western democratic states. Today, lay citizens are increasingly invited into dialogue fora to deliberate about the future of nanotechnology and other new technologies. Drawing analogies to known and familiar phenomena, especially to former technologies, plays a central role in such settings. This contribution traces how participants in a public engagement setting in Austria use analogies to alert or warn how nanotechnology should not turn out in this national context. With such 'alerting analogies', citizens put ethical and political demands on political and other actors that are seen to be re-sponsible for preventing undesirable futures. The analysis shows that analogy-based scenarios are employed as a cautioning counter-force to the politically dominant master narrative of techno-scientific progress in public engagement settings.

Introduction

In 2013, the Austrian Council for Research and Technology Development started a participatory initiative called 'Österreich 2050' that invited the Austrian public to fill out a questionnaire on a website¹ on the disruptive potential and probability of certain events (e.g. a break-up of the European Union) until the year 2050. This initiative represents a good example for the recent trend of foresight and anticipation in the (participatory) governance of science and technology, particularly regarding emerging technologies such as nanotechnology.² An emphasis on imagining sociotechnical futures, however, can bear the danger of losing sight of how the future is constructed out of the past to foster present goals. Even proponents of anticipatory governance have admitted that in 'following the future-oriented discourse of [nanoscale science and engineering], for ex-

ample, there is a risk of avoiding or downplaying the present by centering debate in the future' (Barben et al. 2008, 993).

To counteract this tendency it is necessary to examine the ways in which actors attempt to shape present action by co-constructing the past, and using these constructions to create and legitimate specific futures. A central lesson from the sociology of expectations literature is that visions of the future are inextricably interwoven with present interests on how the future should unfold, be it to mobilize towards a specific future becoming reality, or preventing others from materializing (Borup et al. 2006; Brown 2005; Brown & Michael 2003; Brown, Rappert & Webster 2000). Since prospection and retrospection are entangled imaginative movements, we need to investigate how the past and hindsight are used to influence and justify present activities and foresight.

One way in which this entanglement expresses itself is by means of analogy; that is, by highlighting or creating similarities between two phenomena, of which one is usually better known than the other. In the context of nanotechnology governance, EU policy-makers have for instance extensively drawn parallels with the debate about genetically modified organisms (GMOs) from early stages onward, thereby framing the GMO controversy as a political failure that presents a learning opportunity for the governance of nanotechnology (Einsiedel & Goldenberg 2004; Grove-White et al. 2004; Macnaghten 2008). The GMO-nano analogy constituted 'a warning, a cautionary tale of how not to allay public concern' (Kearnes, Macnaghten & Wilsdon 2006, 15).

Against this background, policy-driven upstream public engagement initiatives on nanotechnology co-emerged with political investments in this new field in Europe, the U.S., and other countries. Public engagement initiatives typically bring lay people together in discussion groups, sometimes with scientists, to deliberate on ethical, legal, and social implications, as well as on the potential safety, health, and environmental risks of nanotechnology (Bowman & Hodge 2007; Delgado, Kjølberg & Wickson 2011). These engagement initiatives can be interpreted as political technologies that were deployed to prevent a similar public controversy like with GMO. The GMO-nano analogy thus fulfilled an important performative function in generating specific policy actions.

But as previous studies on such engagement initiatives have indicated (Burri 2009; Davies 2011; Horlick-Jones, Linell et al. 2001; Marková et al. 2007; Michael & Brown 2004; Walls & Kitzinger 2007; Wibeck, Abrandt Dahlgren & Öberg 2007), participants in engagement initiatives likewise use analogies—especially with former risky technologies. In my previous research (Schwarz 2014), I set out to explore the role of analogies—their function and effects—in public engagement settings, or more specifically how Austrian lay citizens talked about nanotechnology in discussion groups. In this paper I trace how participants used analogies to voice how nanotechnology should not turn out in the future. In a first step, I introduce the empirical material as well as the methods used for gathering and analyzing data. Then I present a detailed discourse analysis of several excerpts from a transcript of one discussion group (for details concerning the system of transcription see the appendix). This contribution finishes with a concluding discussion on the alerting or warning role of the analogies used by participants.

Material and method

The material I use for analysis stems from four 4-hour discussion groups on nanotechnology, with six different lay citizens participating in each group. These moderated discussion groups were carried out in Vienna from 2009–2010 as part of the research project 'Making Futures Present: On the Co-Production of Nano and Society in the Austrian Context'.³ The aim of conducting these groups was to better understand the processes of articulating, forming, and negotiating opinions and arguments in public engagement settings. Each group focused on a specific nanotechnological application field, thereby covering the areas of medicine, food, information and communication technologies (ICTs), and consumer products including energy applications. For this contribution I draw on material from the group that discussed nanomedical applications.

To stimulate debate among the participants about a largely unfamiliar topic such as nanotechnology, we developed a card methodology called IMAGINE, inspired by the deliberative tool PlayDecide.⁴ IMAGINE is

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characterized by a choreography of four stages, each with one particular type of card (story, application, issue, or future). The cards were compiled from material generated by previous research (media, literature, documents, websites, stakeholder interviews), and depicted current positions, issues, debates, and expectations with a specific focus on the Austrian context. The cards were thus created from existing and mostly widely available resources, so that in principle participants could have encountered their content before. At every stage, participants are supposed to look through one of their four stacks of cards individually and choose the most relevant cards. This selection phase is followed by a longer discussion phase in each of the four stages. (For more on the design and appropriation of IMAGINE see Felt et al. 2014.)

The transcripts of the IMAGINE discussion groups were approached with a discourse analytic method that allows one to trace how analogies are co- and de-constructed in longer dialogic sequences by various speakers. The analysis was applied to longer sequences of analogical discourse (Filliettaz, de Saint-Georges & Duc 2010), which denotes any discourse that shares a mode of comparing/contrasting, thus encompassing (dis-)analogies, metaphors, similes, metonymies, and idioms/proverbs.

Demanding political action

In this section, we explore several excerpts that demonstrate how participants use analogies and metaphors to imagine rather dystopian scenarios, and demand from politicians to prevent these scenarios from materializing in the future. The first excerpt begins after David, a male participant in his late-twenties, explained why he chose story card 4.⁵ The text on the story card represented a statement of a politician and read:

Time is short. While on the EU level and in other EU countries the chances and risks of nanotechnology are discussed intensively, Austria is still lagging behind. Continuously, new products containing nanoparticles enter the market. We know far too little about the possible risks and effects of these particles, because risk research cannot keep up with market development. That's why transparency and clear state regulations are necessary. Only if that is the case, we can trust the

positive applications of this technology. Companies will then be willing to research and invest in the area of nanotechnology responsibly.

After David demanded that politics should 'build a regulatory framework' for nanotechnology, Franz, a 50-year-old business economist, started to elaborate on the issue of regulation, as the following excerpt shows.

Excerpt 1

Franz: Yes, I think that politics shouldn't from the outset somehow take sides with one side because it's a topic for the future and they always somehow jump on everything that lets them be associated with an agent of the future. I at first (clears his throat) understood this point about the regulatory framework also a bit differently. If I compare this with stem cell research and the like, where it has always been said that the absence of a legal framework would restrain Austria or-it's not just Austria, also other countries complained about that, compared to other countries. And I think that we will see the same issue here, if something isn't allowed or is viewed more critically or will be pushed stronger, it'll be moved somewhere else. (...) And when people get that glint in their eye, then they will lie like a trooper. (Med, 191-203)

In this excerpt, Franz uses the metaphor of 'taking sides' to highlight that he wished for politicians to stay neutral in debates about new technologies, despite their attributed tendency to adopt promising issues. The metaphor 'jumping on' is reminiscent of the idiom 'jumping on the bandwagon', which alludes to opportunistic attempts of trying to benefit from an already successful or promising development. Franz thus urges political actors to resist the impulse to participate in the hype of nanotechnology merely to present themselves as forward-looking.

Then, Franz explains that the issue of state regulation mentioned on the story card re-minded him of the debate about the regulation of stem cell research. By reproducing specific arguments, he highlights that certain actors demanded regulation to not fall behind other nation states, thereby invoking a discourse of national competitiveness to mobilize for investment. Franz anticipates and simultaneously warns by means of analogy that if nanotechnology were not regulated in Austria, such research might be relocated

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into other countries like it was the case with stem cell research. Finally, Franz predicts that the lure of new technologies will affect the trustworthiness of actors promoting these technologies. The ‘glint in their eyes’ metaphor refers to an excitement aroused by anticipating something—presumably profits—in the future, and this excitement is suggested to cause untruthfulness (‘lie like a trooper’). The final part of his utterance thus works as a warning to the public and its representatives in the discussion group that the techno-promissory talk of certain actors should not be trusted.

A little later, Bruno, a 65-year-old pensioner and former teacher, delivers a long unin-terrupted statement that is built on several analogies. For analytical purposes, I split this long statement into two parts.

Excerpt 2

Bruno 1: What comes to my mind now, a parallel example from recent history. It’s not so long ago, when the term globalization was (.) born, let’s put it like that, bor-, well, it entered mainstream society. Many have said, what’s that? Globalization? And is this now bad for us Austrians? Do we gain anything from it? What harm could it do? What good could it do? And in the meantime, the economic situation has overtaken us, the situation that developed concerning the banks. And suddenly they’re saying, was it globalization? Is globalization to blame that it came to this? Now, to me the big question is not the question of blame but how the fellow citizen sees it. You connect the term globalization with something negative that happened in the meantime.

2: And something like that would then also be the issue for me with nano. It could be that if this general framework doesn’t exist (...) of course, of course, once again the new technologies, right? We pay for it. (...) And the risks, I’m thinking about vaccination for instance, where people are becoming more and more critical, when risks cannot really be identified. And it will be the same here. For all these new terms that spill into society, the question is, ah, ‘Why aren’t we told the whole truth?’ And this seems to be the case with nanotechnology. Now it’s still insider knowledge, I would have said, isn’t it? I don’t know if it’s true, but (laughs) the term is rather dark, I think so at least. (Med, 223-242)

Right at the beginning, Bruno prepares his audience for an analogy to come and then narrates how he perceived the introduction of the term ‘globa-

lization' into Austrian society, during which he gives voice to concerns about national well-being, as did Franz before. Bruno suggests that the public might have come to blame globalization for the financial crisis due to chronological coincidences. In doing so, he presents himself as a detached analyst of his 'fellow citizens'.

In the second part, Bruno establishes an analogy between his narrative about globalization/the financial crisis and nanotechnology, which allows him to construct an undesirable future scenario in which the public could blame 'new technologies again.' By presenting the assigning of blame as a recurring pattern and by performing the anticipated public outrage, Bruno further strengthens this future scenario. The scenario is imagined to come about in the absence of a 'general framework', which alludes to state regulation. Bruno thus echoes Franz's attempt to make plausible the emergence of negative consequences brought about by a lack of political action and legal regulation.

Next, Bruno draws an analogy with public reactions towards vaccination, which renders nanotechnology and vaccination both as cases for which risks cannot be estimated. The analogy alerts policy makers to avoid similar public skepticism with nano by establishing public trust. Bruno's call for information is underpinned with the argument that citizens do not yet possess the necessary knowledge about nanotechnology ('insider knowledge' and 'dark').

While Bruno constructs a scenario in which the public should be educated, Christa, a 50-year-old woman working in the pharmaceutical industry, reacts critically to Bruno's account and shows herself more interested in stirring public opposition by reference to story card 5. This story card presented the view of an 'Action group against nano':

At first glance, nanomedicine appears to belong to the unproblematic nano applications, because nanomedical products are at present the only sufficiently tested nanoproducts. However, it is problematic that nanomedicine is built upon the ideology of the technical solution of all problems. Social and political structures that make people sick are blinded out. Nanotechnological developments aim to realize the total surveillance of humans. If nanoparticles cross the blood-brain barrier, we worry that completely new psychotropic drugs will flood the market.

Excerpt 3

Christa: This is why I right away took the 'action group against nano' card (laughs). Because I always like being against something (laughs) even before I know what it's about so this is, this is, late-68-thing probably, the gene in me. Well, I just always think it's really great, when something that is supported by industry and politicians gets a counter draw, to keep the balance in society, right? And that appealed to me most. Because the thing will start running on its own anyway, because there's so much money behind it, and a lot of recognition, and prestige, and I don't know, divinity, if you want. And then, to me, those who don't get blinded and who illuminate the other side are really important. That's why I chose this card.

(... ...)

2 Franz: Yes. Well, the term that I found the most tangible in all of the cards was this term 'ideology of the technical solution to all problems'. Here I said, I can relate to that, this is something that I've thought about from time to time. And in the next sentence, 'social and political structures that make people sick are suppressed'. This is, I think, yes, a second aspect, this blinding out at the beginning and then waking up too late. (Med, 250-260)

At the beginning, Christa constructs herself as someone with a rebellious identity originating from growing up in the late 1960s. By comparing her critical stance to a gene, she highlights the formative and permanent power of her specific generational experience. She then stresses the importance of a 'counter draw' coming from people who resist the lure of promising innovations and try to put the spotlight on neglected aspects of these innovations. Here she uses two metaphors stemming from the image domain of light/seeing: one suggesting that too much light ('light' as a metaphor for the promises of new technologies) prevents certain actors from seeing properly, whereas 'illuminating' stresses the additional activity needed to make visible aspects that would otherwise stay hidden.

Franz later declared to have selected the same card because of several of its phrases. As he points out, the light/seeing metaphor was already introduced by story card 5 and was taken up as a metaphorical resource by Franz and Christa. Franz connects it also with a metaphor of timing (see story card 4), when he states that the blinding out (negligence) comes

first, followed by waking up (realizing) 'too late.' The underlying theme that reappears here is that seeing/knowing has to happen in time.

Taken together, Franz's and Christa's metaphors create an undesirable scenario. First, the absorption of too much light (getting blinded) symbolically stands for the promises of nanotechnology that are expected to bedazzle politicians. This is connected with disregarding ('blinding out') certain issues or risks, which does not represent the ideal balanced approach. And finally, the sudden delayed realization comes at a point in time where damage has already been done. The employed metaphors thus assist in co-constructing a future-oriented narrative that—similarly to the use of analogies—serves as a warning to policy-makers to also recognize the critical voices raising these issues.

Nano should not turn out like Zwentendorf

Later David elaborates on the issue of societal balance by reminding the group of the debate about nuclear power that took place a few decades ago.

Excerpt 4

- 1 David: May I return to this question, we're talking about balance in society. Going back, I wasn't there in the sixties, topic nuclear politics, nuclear power plants, the new solution to all problems of mankind and all the rest of it. Let's look at the situation today. We have no clue where to put these fuel rods (...) What about the balance in society, I'm asking: where is it? Nuclear power plants are everywhere, [they are standing right in the middle of society.]
- 2 Christa: [But in Austria there are none, thank God! Which is of no help.]
- 3 David: One is there, but it's not running.
- 4 Christa: Yes, that one isn't running, right.
- 5 David: The main thing is that a lot of money- a lot of money has been spent [Christa: Yes] But that's the question, I'm asking myself, where is the balance?
- 6 Christa: It's not in balance anyway.
- 7 David: It's extremely unbalanced. [It does not even exist.] (Med, 293-320)

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David recalls the public debate about nuclear power, which he presents as characterized by huge promises that have not been fulfilled but instead led to unresolved problems. He talks about a society that transgresses national borders, considering that Austria is among the few countries in Europe without nuclear power plants. Christa (2) is glad that there are no operating nuclear power plants in Austria, but she also admits that this makes no difference in terms of risks.

In their next turns, David and Christa clarify their facts by collectively remembering that there exists one nuclear power plant on Austrian soil in Zwentendorf. It was built in the 1970s, yet never put into operation because of protests and a referendum (Felt 2015). David, then, sarcastically notes that building the nuclear power plant was a waste of money, with which Christa agrees, and he uses this as a case in point to rephrase his rhetorical question concerning societal balance. In turns 6 and 7, David and Christa consolidate the diagnosis that society is 'out of balance,' accentuated also by the metaphor 'overweight.' After a brief interlude, Bruno leads the debate back to the issue of nuclear power, which generates yet another rather controversial debate, as the next excerpt shows. It starts out with Bruno mentioning that economic actors will try to persuade politicians to invest in new technologies to not stay behind neighboring countries.

Excerpt 5

- 1 Bruno: Well, but then of course comes industry, like he says [David: Right, then comes], and says: wait a minute, if we don't do this in Austria, then the Germans or the Swiss will do it.
- 2 Christa: Yeah yeah.
- 3 Bruno: Or I don't know: let's be faster, let's do something (laughs) it's our chance.
- 4 Christa: But-
- 5 David: Do we have to jump off the cliff just because everyone's jumping?
- 6 Bruno: Well, yes, yes (.)
- 7 David: The Austrian solution is anyway typically Zwentendorf, now there's a nuclear power plant there, but not in operation.

(collective laughter)

8 Christa: I like that.

9 David: I like that too. But it would have been better, if it wasn't standing there.

10 Bruno: (laughs)

11 Christa: Yes, in this case they were stopped too late (laughs)

12 David: At least we did get the turn. (Med, 380-405)

According to Bruno, the business sector will put pressure on politicians by mobilizing arguments of national competitiveness and timing. Christa (2, 4) reacts with skepticism and David (5) assists her in mobilizing a well-known idiom that works as a counterargument against entering into a competition between nation states. The idiom points out that doing what the majority is doing can be fatally wrong (in a literal sense: dying when jumping from great heights), and legitimates Austria's maverick role in refusing promising yet risky technological innovations such as nuclear power. It allows interpreting the mode of doing it differently as prudent foresight.

The idiom has rhetorical power because Bruno only validates it and then pauses for a moment (6). This gives David the chance to elaborate, and he again draws on Zwentendorf to account for the ambiguous history of Austria's nuclear power politics. Zwentendorf, David concedes, illustrates that Austria cannot present itself as having exceptional foresight from the start because a nuclear power plant was built in the first place, although it was later abandoned after a referendum. The fact that Zwentendorf is called the 'typical Austrian solution' suggests that the Austrian way of handling new technologies is characterized by first trying to be part of a new development, but then backing down. Christa and David confirm that although they criticize the governance process, they are at least satisfied with the outcome: the collective rejection of nuclear power (8-9).

In the last two turns the public is invoked as having stopped politicians ('them'), and pulled the nation's energy politics into a more desirable direction—even if this turnaround should have taken place earlier, before having built the nuclear power plant. Thus, the issue of right

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timing reappears—here referring to the point in time when the public should intervene or be involved in the decision-making over new technologies. In short, the lesson is that nanotechnology should not turn out like Zwentendorf in terms of timing and governance process.

Concluding discussion

In the following, I will summarize and reflect on the alerting role of analogies that was carved out in the above analysis. In the first empirical section, we saw how participants constructed undesirable futures for nanotechnology that certain actors, in particular politicians, should prevent either by regulation or communication. These futures were based on and corroborated with analogies to previous regulatory and governance approaches ranging from stem cell research to the financial crisis, in order to highlight what should be done differently with nanotechnology. The same communicative intention was observable in the second empirical part that focused on collectively remembering Zwentendorf, Austria's never-operated nuclear power plant. This debate revealed that in hindsight public opposition or involvement in decision-making over new technologies should have started before investments are made.

Moreover, the analysis elucidates that metaphors from the image domains of balance, light/seeing, and timing were taken up and expanded from the cards or raised by participants themselves. These metaphors were used to refer to the alluring promises of new technologies, neglected aspects, and the right timing of actions. They also fitted together in a coherent alerting scenario that was constructed to sensitize actors in the field of nanotechnology governance.

Analogical evidence and metaphorical language thus play an integral part in participants' attempts to construct plausible future scenarios, which are designed to alert and activate specific (non-present) actors to prevent these undesired futures from materializing. Participants' alerting discourse here tries to fulfill a wider communicative function. The addressees range from other citizens ('Take action!'), to industry ('Act responsibly!'), or policy-makers ('Hear us!', 'Regulate nano!'). Lay citizens use alerting

analogies and scenarios to make their voices heard and demand, for instance, for policy-makers to learn lessons from past governance processes of emerging technologies. Alerting analogies rest on the shared belief that events and mistakes can repeat themselves under similar conditions, and that scientists, policy-makers, and citizens have not yet learned from the past.

Alerting analogies put ethical and political demands on actors that are considered to be responsible for preventing undesired futures. In parallel to the high hopes set in science and technology as ultimate problem solvers, alerting analogies work as a counter-force that warns 'against risks or hazards that might accompany innovation if it is pushed too hard or too fast' (Jasanoff and Kim 2009, 123). In this light, alerting analogies not only highlight neglected social, ethical, and political aspects, but likewise point towards the limits of scientific knowledge and the progress narrative; citizens use them to make their voices heard. In this sense, they can be understood as democratic means used to gain ground in the governance of emerging technosciences. Hence, if we take into account how participants in public engagement settings talk, we gain valuable insights on how to make socio-culturally robust technoscientific policies, and regulate nanotechnologies in agreement with the general public that is well aware of what has gone wrong in past debates.

But in order to make sense of citizens' communicative intentions, we have to closely consider the context in which utterances occur, and not ask for imaginations in context-free standardized surveys, like was done for the 'Österreich 2050' initiative. Future visions, as well as the analogies on which they are based, gain their performative meaning only in their contexts of use, because we all predict futures and draw analogies with past cases for certain purposes. Surveys with standardized questions simply are not able to capture for what specific purposes certain futures and analogies are mobilized.

Appendix: System of transcription

- [] Square brackets mark the start and end of overlapping speech
- (.) A micropause below one second
- (1) Pause in speech, in seconds

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hyph- A hyphen after or part of a word indicates a cutoff or an abrupt stop

. Indicates falling pitch or intonation

? Indicates rising pitch or intonation

(laughs) Annotation of non-verbal activity

(...) A few words omitted

(... ..) A few lines or turns omitted

Notes

- 1 <http://www.oesterreich2050.at/> (last accessed 15 August 2014)
- 2 The definition of nanoscience and nanotechnology (henceforth just nanotechnology or nano) is highly contested. From a technical standpoint, nanotechnology can be understood as the study, manipulation, and construction of elements of 1 to 100 nanometers—a scale on which many materials change their properties.
- 3 This FWF (Austrian Science Fund) sponsored basic research project was conducted at the Department of Science and Technology Studies at the University of Vienna. The project, as well as my collaboration, lasted for four years. My project collaborators were Ulrike Felt (principal investigator), Simone Schumann and Michael Strassnig. Many thanks for their inspiring input.
- 4 For more on this deliberative method see <http://www.playdecide.eu/> (accessed last 30 July 2014).
- 5 Research participants have been given pseudonyms.

References

- Barben, Daniel, Erik Fisher, Cynthia Selin, and David H. Guston (2008), 'Anticipatory governance of nanotechnology: foresight, engagement, and integration', in Edward J. Hackett, Olga Amsterdamska, Michael Lynch and Judy Wajcman (Eds.), *The Hand-book of Science and Technology Studies*, Cambridge: MIT Press, 979–1000.
- Borup, Mads, Nik Brown, Kornelia Konrad, and Harro van Lente (2006), 'The sociology of expectations in science and technology', *Technology Analysis & Strategic Management* 18 (3/4): 285–98.
- Bowman, Diana M., and Graeme A. Hodge (2007), 'Nanotechnology and public interest dialogue: some international observations', *Bulletin of Science, Technology & Society* 27 (2): 118–32.

- Brown, Nik (2005), 'Shifting tenses: reconnecting regimes of truth and hope', *Configurations* 13 (3): 331–55.
- Brown, Nik, and Mike Michael (2003), 'A sociology of expectations: retrospecting prospects and prospecting retrospects', *Technology Analysis & Strategic Management* 15 (1): 3–18.
- Brown, Nik, Brian Rappert, and Andrew Webster (Eds.) (2000), *Contested Futures. A Sociology of Prospective Techno-Science*, Aldershot: Ashgate.
- Burri, Regula V. (2009), 'Coping with uncertainty: assessing nanotechnologies in a citizen panel in Switzerland', *Public Understanding of Science* 18 (5): 498–511.
- Davies, Sarah R. (2011), 'How we talk when we talk about nano: the future in laypeople's talk', *Futures* 43 (3): 317–26.
- Delgado, Ana, Kamilla Lein Kjølborg, and Fern Wickson (2011), 'Public engagement coming of age: from theory to practice in STS encounters with nanotechnology', *Public Understanding of Science* 20 (6): 826–45.
- Einsiedel, Edna F., and Linda Goldenberg (2004), 'Dwarfing the social? Nanotechnology lessons from the biotechnology front', *Bulletin of Science, Technology & Society* 24 (1): 28–33.
- Felt, Ulrike (2015), 'Keeping technologies out: sociotechnical imaginaries and the formation of Austrian technopolitical identity', in Sheila Jasanoff and Sang-Hyung Kim (Eds.), *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power*, Chicago: Chicago University Press, 103–125.
- Felt, Ulrike, Simone Schumann, Claudia G. Schwarz, and Michael Strassnig (2014), 'Technology of imagination: a card-based public engagement method for debating emerging technologies', *Qualitative Research* 14 (2): 233–51.
- Filliettaz, Laurent, Ingrid de Saint-Georges, and Barbara Duc (2010), 'Skiing, cheese fondue and Swiss watches: analogical discourse in vocational training interactions', *Vocations and Learning* 3 (2): 117–40.
- Grove-White, Robin, Matthew Kearnes, Paul Miller, Phil Macnaghten, James Wilsdon and Brian Wynne (2004), *Bio-to-Nano? Learning the Lessons, Interrogating the Comparison*, Lancaster: Institute for Environment, Philosophy and Public Policy.
- Horlick-Jones, Tom, John Walls, and Jenny Kitzinger (2007), 'Bricolage in action: learning about, making sense of, and discussing issues about genetically modified crops and food', *Health, Risk & Society* 9 (1): 83–103.
- Jasanoff, Sheila, and Sang-Hyung Kim (2009), 'Containing the atom: sociotechnical imaginaries and nuclear power in the United States and South Korea', *Minerva* 47: 119–46.

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- Kearnes, Matthew, Phil Macnaghten, and James Wilsdon (2006), *Governing at the Nano-scale: People, Policies and Emerging Technologies*, London: Demos.
- Linell, Per, Victoria Wibeck, Viveka Adelswärd, and Ann-Sofie Bakshi (2001), 'Arguing in conversation as a case of distributed cognition: discussing biotechnology in focus groups', In Enikő T. Németh (Ed.), *Cognition in Language Use. Selected Papers from the 7th International Pragmatics Conference*, Antwerp: International Pragmatics Association, 243–55.
- Macnaghten, Philip (2008), 'From bio to nano: learning the lessons, interrogating the comparisons', in Kenneth David and Paul B. Thompson (Eds.), *What Can Nanotechnology Learn from Biotechnology?*, Burlington: Academic Press, 107–23.
- Marková, Ivana, Per Linell, Michèle Grossen, and Anne Orvig Salazar (2007), *Dialogue in Focus Groups. Exploring Socially Shared Knowledge*, London & Oakville: Equinox.
- Michael, Mike, and Nik Brown (2004), 'The meat of the matter: grasping and judging xenotransplantation', *Public Understanding of Science* 13 (4): 379–97.
- Schwarz, Claudia G. (2014), *Nano Is Like... The Role of Analogies in Public Engagement with Nanotechnology in Austria*, Dissertation at the University of Vienna, Department of Science and Technology Studies.
- Wibeck, Victoria, Madeleine Abrandt Dahlgren, and Gunilla Öberg (2007), 'Learning in focus groups: an analytic dimension for enhancing focus group research', *Qualitative Research* 7 (2): 249–67.