9. THE CONTRIBUTION OF PLAYFULNESS IN ACHIEVING REFLECTION ON EMERGING TECHNOLOGIES AMONG CITIZENS:

Evaluating a theatrical debate on synthetic biology

Abstract

As research and innovation (R&I) in emerging fields are expected to alter our lives substantially, inclusive and deliberative reflection is needed to integrate societal needs and concerns in R&I. Arts-based and playful formats may help citizens to engage in such reflection, yet investigation into such formats in relation to reflection seems largely absent. Therefore, this study evaluates a Theatrical Debate (TD) on synthetic biology (SB). Explicitly built upon playfulness design principles, improvisation actors play futures with SB, followed by an interactive debate and replay. We organized three TD events in the Netherlands in order to investigate how the playful design contributed to the reflection among the citizens that participated. To gather data, participants filled-out Learner Reports at the end of the events, and after-event interviews were conducted with a selection of the participants. Transcript analysis showed that playfulness process conditions (‘focus’, ‘experimentation space’, ‘stimulating guidance’) supported by playfulness activity principles (‘narration’, ‘imagination’, ‘action-reflection’) enhanced first, second and third order reflection. The strong synergies found between the design elements, in combination with the format’s potential to trigger reflection in numerous ways, call for larger scale, systematic experimentation with theatre-based reflection in RRI context, e.g., for participatory foresight.

9.1 Introduction

Research and innovation (R&I) in emerging fields like nanotechnology, information technology, and synthetic biology are expected to alter our lives in substantial ways. With respect to such fields, social actors produce different legitimate perspectives on the possibilities and dilemmas that emerge (see Wynne, 2001). Societal discussions including a variety of actors and viewpoints, mobilize actors to make sense of new developments, provide a public space for inquiry and deliberation, and increase reflexive awareness.

Since the 1990s, technology assessment (TA) practices gradually shifted from expert assessment to participatory-deliberative approaches (Joss, 2002). Around the same time, Public Participation (PP) for the governance of R&I, and Public Engagement (PE) for the broader societal dialogue surrounding the introduction of
R&I in society, started to supplement the traditional focus on one-way informative science communication (Irwin, 2001; Wilsdon et al., 2004). More recently, the policy framework of Responsible Research and Innovation (RRI) emerged, promoting the integration of societal reflection in the governance of R&I (Stilgoe, et al., 2013). These approaches all signify a shift towards the idea that society-inclusive deliberation is needed to integrate societal needs and concerns in R&I processes. At the same time, PE efforts enable people who are not working in R&I to develop scientific citizenship skills, implying the discovery of own opinions and preferences in relation to R&I (Elam & Bertilsson, 2003), on the basis of which one can make life decisions related to R&I.

When R&I are emerging and applications do not exist yet, conversing about the future is complicated as feasibilities and impacts of R&I are hard to imagine (Felt et al., 2014). Although the boundary conditions of PE events are well known now (e.g., Davies et al., 2009; Rowe & Frewer, 2000; 2005), many reflection processes are word-oriented. Such formats may ensure the exchange of arguments, but may overlook value-based deliberation (cf. Dietz, 2013) or out-of-the-box thinking. To overcome that, arts-based and playful approaches could be an interesting direction. For example, films about potential R&I applications and their societal implications are an accessible way to enable imagination about the future and thereby discussion about the broad diversity of perspectives that various actors hold (Schmidt et al., 2015). Also, exhibitions about emerging R&I make people reflect on unconventional applications and their implications (Kerbe & Schmidt, 2015), which could trigger thinking outside of the box.

Little is known about how the process architecture of arts-based playful PE can relate to the specific learning and reflection that it triggers among participants. Therefore, we developed and tested a format for technology reflection that integrates the benefits of word-oriented and arts-inspired PE. Baptized as the Theatrical Debate (hereafter TD), the format comprised a 2-hour event with several semi-improvised theatre sketches about the future; each being discussed and replayed based on the discussion, under guidance of a moderator.

The emerging technology of focus in the TD was synthetic biology (SB). SB comprises the purposeful selection and creation of living organisms by means of genetic technology (Schmidt et al., 2009). So far, there are few tangible SB applications (Engelhard, 2010), but the field gives rise to potential ethical conflicts. According to some societal actors, SB raises issues regarding possible effects on health and environment, the divide between rich and poor, and more fundamental, the principles of life (Engelhard, 2010; Ancilioti et al., 2016). Other actors merely see the potential benefits of SB (ibid). Such fundamental differences may hamper an open and respectful exchange of ideas. For these reasons, SB serves as an appropriate field for designing and evaluating a new PE format.

In order to contribute to the arsenal of formats for arts-based and playful reflection on R&I, this study aimed to understand the working mechanisms of the TD format in
Case study 5: Theatrical Debate

relation to the reflection facilitated among participants. Therefore, we developed the TD format with considerate attention to playfulness design principles (see section 9.2.2). We gathered data about the reflection that the format triggered by means of Learner Reports (cf. van Kesteren, 1993) and semi-structured interviews with participants of three TD events. Data analysis revealed the working mechanisms of the design principles in relation to the reflection that appeared to be facilitated. The central question to this study, therefore, was: How do playfulness design elements contribute to reflection in the TD format?

9.2 Background

This section first presents a conceptualization of reflection and thereafter a framework for identifying the contribution of playfulness design elements to reflection.

9.2.1 Reflection

We derive our conceptualization of technology reflection in an RRI context from van de Poel & Zwart (2009), who combine two learning and reflection frameworks to define reflective learning. They use Grin and van der Graaf (1996) concerning reflection in the context of policy-making, and Schot and Rip (1997) with respect to learning in a TA context. They observe a comparable dichotomy in both frameworks. Namely, Grin and van der Graaf (1996) distinguish between first and second order reflection. First order reflection is an iterative process where problem definitions and evaluations of solutions are considered.

Second order reflection refers to reflection “upon the background theories and appreciative systems that she brings to bear upon the situation” (ibid, p. 299). In other words, second order reflection makes a person consider assumptions and values that are used to construct problem definitions and solution weightings. Similarly, Schot and Rip argue (1997): “In first-order learning, one improves one’s working towards given goals, while second-order learning requires clarifying values and ways of relating values to each other” (p. 257).

By combining these frameworks, van de Poel and Zwart (2009) conceptualize ‘first-order reflective learning’ as a process that “takes place within the boundaries of a value system and background theories”, and ‘second-order reflective learning’, which “requires a person to reflect on his or her background theories and value system” (van de Poel & Zwart, 2009, p. 7). Since such learning between R&I practitioners is crucial to eventually make R&I practices responsive to societal perspectives (Schuurbiers, 2011), we argue that first and second order reflective learning are essential in technology reflection among societal actors as well.

To help PE organizers in tackling the challenge of achieving long-term, continuous reflection (Felt, 2014), we argue that PE events should evoke certain self-awareness about learning too. In this light, single- and double-loop learning, originally
introduced by Argyris and Schön (1974), are interesting concepts to consider. Whilst they show similarities with first and second order reflective learning as conceptualized above, Argyris and Schön (1978) supplemented the concepts with triple-loop learning. Triple-loop learning has also been referred to as deuto-learning (Tosey et al., 2012), which Yuthas et al. (2004) defined as “continual reflection on the learning process, the contexts within which learning occurs, and the assumptions and values motivating the learning and influencing its outcomes” (p. 239). We follow this definition and argue that deuto-learning, in addition to first and second order reflective learning, can make people’s reflection on R&I continue beyond organized RRI-related reflection events and processes.

In this study, we complement first and second order reflective learning (Van de Poel & Zwart, 2009) with deuto-learning (Argyris & Schön, 1978). For the context of citizen reflection on emerging technologies, we use the term first order reflection to describe a process of assessing and judging reality, without considering personal beliefs in that process. That is, opinions are expressed as though they were facts. We use the term second order reflection to indicate notions of awareness and reflection on the learner’s values and assumptions that underlie first order reflections. We use the term third order reflection to indicate notions of awareness about the reflection itself.

9.2.2 Playfulness

To identify how playfulness design elements supported reflection during the TD, we adopted the framework of van der Meij et al. (2017a; see Chapter 4) about playfulness design principles for the designing of RRI-reflection (2017). The authors argued that applying playful tools, exercises and formats in an RRI context can trigger ‘playfulness’ in participants’ minds, which is “an intellectually curious, alert, flexible, inventive and prejudice-free attitude in (1) the analysis of new complex information or issues, as well as in (2) the synthesis of new creative ideas or solutions” (see Page 39). The playfulness attitude can support people in the complex reflection on emerging and potentially controversial R&I fields. According to the framework (see Table 4.2), ‘narration’, ‘imagination’, ‘action-reflection’ and ‘co-creation’ are playfulness activity principles, while playfulness process conditions ‘focus’, ‘experimentation space’ and ‘stimulating guidance’ make the activity principles functional (ibid). Several activity principles and all process conditions are ideally applied to make RRI-reflection playful. As Table 9.1 displays, each principle has its own characteristics and anticipated effects. Van der Meij et al. (2017a) noted that playful reflection formats are needed in which the design principles are consciously applied to prove their functionality in practice. Therefore, this study explicitly investigates playfulness design principles as applied in the TD format in relation to reflection.
9.3 Methodology

By investigating the contribution of the TD’s playfulness design principles to reflection, this study aimed to advance the theory on playfulness (cf. van der Meij et al., 2017a) in relation to reflection as well. To achieve this, we used a Design-Based Research approach (hereafter DBR; cf. Barab & Squire, 2004), in which practitioners engage in an iterative process of developing and applying learning formats in practice, advancing the theory that underlies their practice at the same time. Therefore we describe the TD prototype and design choices first. Following this, we describe the data gathering method.

9.3.1 The prototype

The TD format comprised:
- (10 min) An introductory speech by the moderator about the event and SB, to inform participants about SB in a brief and balanced manner (adopted from Betten et al., 2017).
- (10 min) An icebreaker exercise.
- (60-70 min) Four scenes, each showing a possible future with SB. Each scene comprised an introductory talk, a sketch by improvisation actors, a moderated debate among participants, a replay or continuation of the sketch building on debate-based suggestions, and an evaluative debate.

Each scene focused on a representative cross-section of SB application domains:
- Healthcare: Bacteriophages that detect and kill illnesses in the body (derived from Budynek et al., 2010).
- Sustainable development: Plastic-eating bacteria (cf. iGem; Yoshida et al., 2016).

A moderator tied the event together by giving the introductory talk about SB at the beginning, facilitating the debates, and wrapping-up the event.

In the design of the TD, six playfulness elements were incorporated: narration. The sketches comprised of narratives with various fictitious and at times comical protagonists to depict futures of SB from various perspectives. The chosen SB application domains were translated into the following semi-improvised sketches:
1. End of life: a dialogue between a daughter, a doctor and a mother who is not ‘allowed’ to die. Improved health care by ‘synthetic phage cocktails’ increased the general life expectancy. The mother promised various parties to live as long as possible, but actually longs for a ‘natural death’.
2. Plastic-eating cell: monologues of ‘normal people’ (e.g., a housewife) illustrating a society in which cells exist that eat plastic.
3. Algae: play between stakeholders (researcher, car company, etc.) that depicts a situation in which synthetic algae have taken over the world’s fuel production.
4. DIY biology: monologues of three ‘DIY synthetic biologists’, chosen by the participants, who synthesize food, medicines, toys, etc. in their garage.

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1. See: http://2012.igem.org/Team:UC_Davis/Project
In this TD context, ‘semi-improvised’ means that actors played non-scripted sketches on the basis of keywords that represented particular opportunities and dilemmas surrounding the four SB applications, and ideas of the participants during the debate in response to the initial play (Van de Poel, 2017). The keywords of the sketches were (1) self-determination, (2) the consequences of techno-fixes, (3) changes in social order, and (4) the ethics surrounding motives of DIY synthetic biologists. The sketches were roughly pre-played during three rehearsals, held throughout the month before the first TD event.

**Imagination.** The scenes were open-ended: the sketches allowed freedom of various interpretations to create space for alternatives perspectives and new ideas and the debates did not have to come to a (unifying) conclusion.

**Action-reflection.** Each sketch was followed by a plenary reflective debate about a moral dilemma as stated in the sketches. After certain elaboration, the moderator selected input of the participants for a sketch replay or continuation, as to show the ‘consequences’ of participants’ ideas.

**Experimentation space.** The number of participants was limited to 45 to maintain a personal and therefore relaxed atmosphere. The moderator was asked to make sure that a wide variety of viewpoints would be expressed during the debates. Furthermore, the improvisation actors and moderator responded to unforeseen circumstances in a flexible way, being role models of openness to free experimentation.

**Focus.** The event was designed to make participants go through reflection in a stepwise manner from introductory talk to final wrap-up. Each scene revolved around only one SB application, which again was introduced first, followed by sketches and debate in a stepwise manner.

**Stimulating guidance.** The moderator was asked to energetically and pro-actively ask participants to elicit their viewpoints and reward them for explicit contribution to the plenary reflection conversations (“thank you!”). The TD prototype employed all playfulness design principles except ‘co-creation’. Implementing ‘co-creation’ would have required participants to converge towards one end-result to build one possible future together. Following Felt et al.’s notion that consensus can threaten the elicitation of diverse viewpoints (2014), we opted to keep sketches and debates open-ended instead.

### 9.3.2 The prototype testing

**Data gathering**

To test the TD, we organized three TD events in the Netherlands:

- An art-science-citizen interface organization in Amsterdam.
- A creative community platform / theatre house in Utrecht.
- A citizen-dialogue house in Amsterdam.

Table 9.2 displays the participant composition of each event.
Table 9.2: participant composition of the TD events.

<table>
<thead>
<tr>
<th>Event</th>
<th>Total number of participants</th>
<th>Mean age (min - max)</th>
<th>Number* of men / women</th>
<th>Number of LRs (&amp; LR responses)</th>
<th>Number of interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td>TD 1</td>
<td>17</td>
<td>32 (24 - 64)</td>
<td>7 / 10</td>
<td>17</td>
<td>7</td>
</tr>
<tr>
<td>TD 2</td>
<td>19</td>
<td>48 (26 - 67)</td>
<td>8 / 11</td>
<td>19</td>
<td>4</td>
</tr>
<tr>
<td>TD 3</td>
<td>41</td>
<td>41 (19 - 70)</td>
<td>18 / 16</td>
<td>34</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>77</td>
<td>41 (19 - 70)</td>
<td>33 / 37</td>
<td>70 (185)</td>
<td>17</td>
</tr>
</tbody>
</table>

* In cases where known

At the end of each event, a ‘Learner Report’ (van Kesteren, 1993) was handed out to participants to capture their learning experiences. Learner Reports (hereafter LRs) are diaries in which learners are asked to complete predefined fill-out sentences (ibid). It serves as a tool to monitor the major insights of learners’ own viewpoints during or after their engagement in a learning environment. The LRs of the TD contained the following sentences:

- Concerning my own ways of thinking I discovered during this event that.....
- Concerning other people’s ways of thinking I discovered during this event that.....
- Concerning the future of SB I discovered that.....

At the end of the TD events (in particular when participants returned their finished LR to the researchers), the organizers recruited participants for qualitative follow-up evaluation interviews.

After the event, the recruited participants were contacted by e-mail with an invitation for the interview. All participants that had reported interest responded and were interviewed face-to-face within two weeks after their respective event. During the interviews, a modified version of the Critical Incident Technique (Butterfield et al., 2005; see also in Chapter 5) was applied. After introductory questions like “Who are you?” and “Why did you come to the event?” we asked for the interviewee’s expectations of the event, the overall experiences, the conceptualization of the goal of the event, the most important learning experiences in the light of this/these goal(s), the effects thereof, the after-event ‘effects’ they experienced, and suggestions for improvement in the format. During the interview, the interviewer maintained rapport by asking probing questions and active rephrasing of the interviewee’s answers.

The first author and the research assistant conducted the interviews, two of which they conducted together in order to align their procedure. After each interview, a member-check procedure was performed, whereby interviewees received a summary of their interview within two days after the interview. Interviewees were asked to check the summary and correct if necessary within two weeks. All interviews agreed that the summaries represented the interviewees well.
Chapter 9

Data analysis
Upon informed consent of participants, based on an explanation of our study purpose, the TD events and follow-up interviews were audio-recorded. These audio-recordings were transcribed verbatim for analysis. The LRs (185 responses from 70 participants) and transcripts of the semi-structured interviews (17) were imported to qualitative data analysis software MaxQDA for data analysis. Both the LRs and the interviews were used to analyze the reflection that the TD triggered among participants. The interviews were also used to analyze how the playfulness design elements contributed to this reflection.

We used first, second, and third order reflection conceptualizations (see background) to deductively code (Braun & Clarke, 2006) instances of reflection in the LRs and interviews. To explore how playfulness design elements contributed to reflection during the TD, we used conceptualizations of playfulness design elements (see Table 9.1) to code participants’ TD experiences, and the ways by which these linked to their reflection. When the interviewees presented conflicting accounts of the TD, the transcripts of the TD events were used to clarify and thereby provide deeper understanding of the interview data. The second author, who was in charge of the data analysis, labeled the participants’ reflections and the contribution of playfulness to these, and discussed the labeling with the first author on a daily basis in order to establish patterns. In this data analysis phase and during reporting, the other authors functioned as critical friends (Erwee & Conway, 2006); researchers who were not part of the core research team, but employed a co-author role by critically reflecting on the findings and reporting.

9.4 Findings

Our data showed that playfulness activity principles ‘narration’, ‘imagination’ and ‘action-reflection’ contributed to first, second, and third order reflection on SB directly, by allowing participants to identify with protagonists on stage, providing inspiration for envisioning alternative viewpoints and providing direct feedback on elicited ideas. Process conditions ‘experimentation space’, ‘focus’ and ‘stimulating guidance’ appeared to indirectly contribute to reflection, and so served as preconditions for the activity principles, by allowing participants to feel free and experiment, allowing participants to process and integrate ideas, and motivating participants to pay attention and contribute to the TD. We first proceed to describe the reflection that was triggered among participants of the TD in detail, and then present how each of the playfulness design elements supported this reflection.

9.4.1 Reflection

In the 185 LR responses, we identified first order (68), second order (12) and third order reflection (41). In the interviews, 44 excerpts (1 to 72 lines each, average 16 lines) demonstrated reflection in a combination of first, second and/or third order reflection.
In the numerous first order reflection excerpts, participants expressed their opinion with regard to SB. The LRs provided a clear overview of the wide range of opinions that participants expressed: participants stressed the importance of SB (9) or unimportance (2) of SB for their personal lives, and whether they considered SB to be promising (15) or dangerous (10). They also reflected on the complexity of SB (5), suggesting it was difficult to understand (3), multi-faceted (3), uncertain (7), and/or provoked ethical dilemmas (8). The remaining participants (6) displayed other insights. Most interviewees expressed a similar range of opinions.

In the excerpts of second order reflection, which occurred less frequently, participants explored the bases of their opinions. In the LRs, participants reflected on their values (11) or assumptions (2) with respect to SB. For example, one participant reported to have discovered that she valued the acceptance of how things are, because throughout the ‘End of life’ sketch (see description above) she kept thinking ‘be satisfied with the things you have!’ The interviewees expressed similar second order reflections. Interviewee #1, for example, discovered an assumption underlying many of her viewpoints: “I discovered that all decisions that I make are related to that; to my idea that I don’t have a free will.”

In the third order reflection excerpts, which occurred more frequently, participants reflected on their own learning process with regard to SB. In the LRs, participants reported self-awareness of being open to new ideas in general (6), reflections on how much they knew or had learned about SB (10) and what factors had or would have helped them to make sense of SB, regardless of whether they had missed it during the TD (4), had liked it during the TD (3) or neither (11).

In addition, participants made (third order) notes in the LRs on whether they had changed their mind during the TD (2), and whether they were generally able to make up their mind (5). These two patterns could be found in the interviews too. Interviewees reported that the TD had broadened their opinion (4) and had triggered their further deliberation (4). The following extract of interviewee #10 illustrates these processes respectively. First, she said she had broadened her opinion by opening up to possibilities of SB, without losing sight of her original viewpoint: “To have your DNA repaired… At first, I didn’t want to do that. And then halfway through, I changed my opinion. It might come in handy in some cases. (...) I want to live without medication for as long as possible, and therefore also without DNA repair (...) But you know, when you’re really in pain, or if you could add ten years to your life with a small treatment- Then I think I would.”

Then, she also found the TD triggered further deliberation until long after the debate: “These are things that you’re not finished thinking about, the advantages and disadvantages and the risks and the opportunities and the kind of future we’re headed for. It could be so different (...) and at the end I was like, I was sitting next to someone and we were talking about it, like ‘yes, and now what?’ I’m just not done with it. Yes, how do you decide upon a thing like this?”
Next to broadening of opinions or continued deliberation, some interviewees reported that the TD made their opinion clearer (5). For example, interviewee #8 felt she did not really change her perspective, but rather became aware of her pre-existing ideas:

“I think I thought this before. But it became clear to me because the other people seemed to think that SB can just fix everything. Thereby it made my opinion clear to me because I really thought like… This is not how it works.”

9.4.2 Playfulness

Narration

The interviews showed that ‘narration’ as it was applied in the TD, supported reflection by making participants mentally engaged in two ways: interviewees felt emotionally affected by the sketches (‘It touched me deeply’, ‘I empathize with that’) or they identified with certain protagonists staged (‘I recognize myself in him’, ‘that could happen to me too’). These ways of engagement could occur simultaneously and both incited critical reflection. Interviewee #10, for example, said:

“The format was the biggest eye-opener for me. That you experience things so emotionally, and come to think like, ‘what do I think?’ or ‘what is… what would I like to see in the future? (...) You get so emotionally involved by the play, by them [actors] playing out a sketch (...) a sketch that could happen in the future because of certain developments in SB. (...) I usually don’t do this as a journalist (...). Even though I wrote about SB before, including about its social implications, I’m not used to asking myself what I would do. I’m simply not used to doing that. And now I did.”

The emotionally engaging storyline made this interviewee re-engage with a topic she was familiar with professionally, helping her to discover her personal stance to it.

Identifying with protagonists could also incite critical reflection. Interviewee #4, for example, described how he first identified himself with a protagonist on stage that was critical of SB, but eventually started to dismiss this protagonist for his reserved stance, after which he opened up to a wider perspective on SB:

“I recognized myself in that, I have the same line of thought. (...) And then I thought, ‘well actually, it’s really stupid to think that way’ (...) It’s very conservative, totally not open to new developments or other perspectives. Actually, I don’t like it so much. (...) I noticed that at first I was hesitant, like ‘it [SB] is a bit scary, I don’t think it is necessary’. But eventually I thought, ‘well, yeah, why not?’.”

This second example shows that identification with the sketch or a protagonist could function as a mirror in which the participants literally saw their own perspective reflected, making them reconsider their initial viewpoint. Overall, the processes of positioning oneself amidst the protagonists or sketch on stage supported interviewees in wondering how they would approach the situation themselves and in critically reflecting on that.
**Factors influencing ‘narration’**

Two aspects of the TD seemed to either support or hamper participants identification with certain sketches or protagonists. First, interviewees were inclined to identify with the sketch if it represented their daily life. Interviewees said that they found it easier to position themselves in a home-like decor (e.g., a garden), with civilian protagonists and dilemmas. Interviewee #13, for example, observed with regard to the ‘end of life’ sketch:

“Yeah people identified themselves especially with the woman in the sketch (...) I saw it touched people emotionally, maybe very deeply. (...) I have a mother with dementia myself. (...) Everybody has or had parents, or grandparents.”

However, this interviewee also made it clear that a sketch could become ‘too relatable’, noting about another participant, who had become very emotionally engaged:

“The moderator really had to intervene in order to prevent it from becoming too personal.”

In other words, although situations from daily life helped participants to identify with protagonists and reflect on the matter at hand, extremely relatable sketches might have narrowed the discussion and thereby hamper reflection on diverse viewpoints.

Another aspect that could influence interviewees to mentally position themselves in sketches concerned the protagonists credibility. Interviewee #7, for example, said:

“I think you really let people reflect on themselves when they see a sketch where in one instance they think ‘I agree with the progressive guy’ and the next time they think ‘oh no! now I agree with the conservative guy’.”

Interviewee #5 added:

“When the actors are philosophers, then I’d also expect the language that comes along with that (...). Otherwise it is simply not credible”.

When protagonists were not credible, e.g., due to inconsistency in their acting, interviewee #5 and #7 both mentioned that this could demotivate them to participate in the debate or reflect on the issues at hand.

**Imagination**

Both the sketches and debates appeared to support participants’ ‘imagination’, by allowing them to envision new ideas or sides to the story and then reflect on those. Interviewee #2, for example, explained how the sketches triggered ‘imagination’:

“Because you talk about it for a while and then one actor brings in something and then the other actor brings in something else (...) they introduced other aspects than the ones that I’d consider. That made it, yeah, wider.”

The debates helped interviewees to envision new sides to the story, especially when surprising viewpoints were discussed. For example, interviewee #1 noticed that when other participants had a different opinion than her, she was triggered to rethink her own opinion, and ultimately reach a new insight:

“Seeing how other people look at it, you are forced to consult yourself: how about that? (...) I noticed that a lot of people thought it [SB] had to have a
utilitarian purpose and that there are several downsides, which cannot be overlooked. (...) I have been in the lab myself. I know how people do research. That everybody (...) is conscious of what they are doing. And why.”

Whether agreeing with surprising notions of other participants or not, the diverse and occasionally surprising other perspectives shared during debates in response to the sketches seemed to prolong the imagination as initially triggered by the sketches.

Factors influencing ‘imagination’
Several aspects of the TD particularly stimulated participants to imagine new ideas and sides to the stories. In general, it seemed important that the debates were open-ended, meaning that the TD presented no conclusions. Interviewee #17, for example, described his deliberation due to the open-endedness of the healthcare scene:

“It seemed we had two sides, because one said (...) ‘you have, at all times, self-determination’. After that, somebody else said ‘well, my mom (...) did not want to live anymore, while the kids thought that her condition was not life-threatening, not really, that it was more a psychological thing’. And then I thought, I have not decided yet. The only thing I thought is that people will never be obliged to extend you life. But on the other hand, if your health insurance punishes you for not extending your life, well in that case it [the self-determination] would disappear.”

Interviewee #17 added that he had continued to think about this issue after the event. In that sense, the open-endedness seemed to prolong the ‘imagination’ of viewpoints.

Open-ended sketches and debates could also hamper imagination. Several interviewees longed for more clarity and closure at the end of the event, in order to have a clearer direction for further thinking. In that, interviewees desired clarity about what part of the sketch was real and what not; especially since the debate had made them aware of the possible dangers of SB. Interviewee #2, for example, noted:

“Those actors, they come up with all sorts of stuff. Obviously, for improvisation you bring in everything. And then I thought ‘well they just made up these things, they are no experts’. So what is true and untrue?”

Furthermore, interviewees mentioned that the participant composition could influence their own imagination of different or more viewpoints. Interviewee #15, for example, emphasized the impact of the participant diversity on her reflection:

“I think it was so nice that things were said from many different angles. Let’s say, the scientific angle, but I also thought there was somebody with a legal background (...), with 80 year olds kind-of concerns too (...). I think that this [diversity] was the most valuable for me that night.”

Similarly it could be problematic when an interviewee felt a majority of the participants seemed single-minded about a certain topic, as interviewee #13 had experienced:
“I have to say, actually the uncontrollability remained under-addressed! (...) It sort of alienated me that the participants were rather positive, without addressing the pitfalls (...). It seemed little thoughtfulness was present among the participants on other approaches to the issue at stake.”

In that sense, diversity triggered ‘imagination’ and thereby respectful consideration of new viewpoints, whereas single-sidedness hampered it.

Action-reflection

‘Action-reflection’ as applied in the TD appeared to support reflection as it stimulated participants to perform various actions, on request or spontaneously, and consequently provided immediate feedback on these. The actions evoked among participants were (1) the physical demonstration of their opinion (e.g., by changing their posture, raising or clapping hands), or (2) the providing of verbal input for the debate or the replay of the sketches. In principle, participants could participate as co-actors on the stage, but this type of action occurred only during one sketch of the third TD event. Several interviewees noted that the actions made them re-evaluate consequences of own ideas, like interviewee #10 said:

“The play was sharp-witted. Some of the participants suggested a solution and the man [actor] immediately played that out. And then you could see, ‘oh no that is not gonna work’.”

In addition, interviewee #8 said:

“Because they [the actors] took the idea much further, it made you think about what consequences it would have to make a certain choice in the research field of SB.”

These two interviewees indicated that testing particular thinking and doing made participants discover consequences of their ideas.

Factors influencing ‘action-reflection’

Several interviewees volunteered certain hesitance to act and see consequences of their thoughts. Interviewee #3 described a possible source of this hesitance:

“Well, I noticed in myself that I am rather anxious to debate (...) to actually open my mouth. Because, well I saw some movies and read something about it [SB], but I also thought, who am I to say and know something about it? (...) During the last scene, I thought of grain-free bread, but I did not dare to put that up front, because I did not know whether it would be within the possibilities of SB; would that be an appropriate end-product? I didn’t know that (...). I think I missed something, namely a bit more settling time for the information that we received and what I really thought of it, in order to really get into the discussion mode.”

As can be seen from the excerpt, the debate may have developed too quickly for some participants to reflect on the content and to formulate a response, which made action and immediate reflection on thinking and action hard to realize for some.
In addition to not feeling safe or confident enough to publicly perform actions to see consequences of thinking and behaving, interviewee #9 reported the following: “I did not get the impression that I experienced the effect of the notions that I had shared. I had, maybe, one interaction with somebody else from the participants, but then the rest of the participants continued on (...) with something else completely.” Although this interviewee later on reasoned that his suggestion “apparently did not inspire them enough”, he reported that the lack of results from his previous suggestions held him back to act again.

However, if actions were taken as input to the play, interviewee #8 explained the effect as follows: “In the sketch about the manageability of life, the effects that were shown were the most interesting. I had given a lot of input for the actors, and I rather liked that they really showed what the world would then look like.” When participants had given input, their interest to see the consequences of that seemed to enlarge.

**Experimentation space**

In contrast to the activity principles mentioned above, the playfulness process conditions seemed to trigger reflection indirectly. The following three sections therefore describe the role that each process condition seemed to play in the TD. All but one interviewee experienced the TD as a really safe space. Interviewees described the TD atmosphere as inviting, unforced, light-hearted and comfortable, and reported to have experienced that everybody was equal and people did not judge one other. Various factors helped participants to relax and thereby experiment with ideas. An often-mentioned factor was the use of humor in the sketches. Interviewee #4 described this as follows: “I thought it was good that the sketches were rather extreme, because that makes you laugh a bit. A debate is usually rather scary, I think, so this breaks the ice.”

Furthermore, interviewee #15 emphasized that the non-technical approach to the topic of SB generally made him feel at ease: “I had the idea that everybody was equal (...). The topics were presented in a very approachable manner. (...) Although I am well educated, I don’t know a thing about this topic, making me a layperson. (...) I usually feel like a dummy due to the technical way things are presented. But this was the opposite.” Also the relatively small scale of the TD events (45 participants max.) helped participants to experience a free and safe space. For example, interviewee #8 noted the benefit of a small setting: “It was good that the group was small. It was also very pleasant that everyone could talk.” It seems that the small scale gave every participant a chance to contribute.

Lastly, interviewee #6 felt that the neutrality of the organizers contributed to his sense of freedom during the TD:
“They allowed everything to happen, without a dictum of ‘this is what you should know’, they really explored the participants’ thoughts. (...) I thought this was really good. It meant that I really started to think myself too.” Interviewee #7 said to experience a similar ‘neutrality’ of the organizers and added that this enabled a wide variety of ideas to be shared:

“That’s partially why the atmosphere was so relaxed, because there was no hidden agenda. (...) I think that the unforced atmosphere made people daring to express themselves (...) the woman who sat in front dared to remain unconvinced, whereas the man in the back also dared to share his stories.” For interviewee #7, in particular a comment from this ‘unconvinced lady’ made him refine his own viewpoint on a particular matter. Therefore it seems that the open TD atmosphere allowed a multitude of new and alternative ideas to be expressed, thereby allowing participants to broaden their perspective.

Focus
In general, it seemed that the TD did not apply enough ‘focus’ to support reflection well. For example, interviewee #5 felt like the topics were touched upon only ‘superficially’ rather than discussed intensively, which hampered his reflection:

“Since everything was so multifaceted, I am not sure whether it really ‘landed’.” He felt that the number of topics discussed in one evening was “on the edge” and argued that since the sketches triggered so many and rich responses, each of them could have been used for an event on their own.

Furthermore, interviewee #9 experienced a lack of coherence between scenes:

“Between the scenes there was little reflection. It was more like, the scene has ended and now we start with another scene.” Interviewee #5 described that a more coherent, in-depth discussion of one single topic would have made the experience more fulfilling for him personally:

“That one thing is central, and you can look at it from different sides and think about it. It would give slightly more satisfaction in the whole exercise of thinking.”

Overall it seems that a more focused TD, covering a reduced number of topics, would have been more fruitful for the reflection.

Stimulating guidance
Various interviewees described the TD as an interesting or exciting experience that stimulated both a general motivation within members of the participants to pay attention throughout the whole event and a specific motivation to contribute to the debate. Interviewee #6 for example, a man in his 70s, mentioned:

“From experience I know that I always fall asleep during lectures (...). That’s why I thought to myself, what an incredibly good evening, I was not even tired for one moment at all.”

A major attention grabber for the interviewees, were the sketches themselves, as interviewee #11 described:
“The provocative and playful sketches put people, let’s say, on the tip of their seat. It creates a sort of excitement and lifelines among the participants, to which people want to respond.”

Interviewee #17 explained how being able to identify with the situation on stage made the TD very exciting too:

“I was able to emphasize (...) Like, ‘OMG, how would that be?’ And yes, in that respect it was an adventure in which we participated.”

In any way it seems that contributing to the discussions and providing input to the sketches was a memorable event for all interviewees. Most interviewees could remember exactly what they had said or done during the TD, even though the interviews were held 1-2 weeks after the debate. It seems that although several interviewees mentioned to have felt some fear with regard to participation (see ‘action-reflection’), perhaps this same fear was a stimulating factor too, keeping participants awake.

Another stimulating and guiding aspect of the debate was the moderator. Interviewee #17 described the stimulating power of the moderator as follows:

“The man that presented the event and glued everything together, that was somebody who makes you automatically join the ride (...) his posture, his gestures, his alteration in tone of voice, his enthusiasm”.

More specifically, interviewee #4 attributed the stimulating power of the moderator to the way he rewarded contributions by asking further questions and personally addressing members of the participants:

“I had the feeling that the things that were shared were taken seriously and that something was done with it. For example, the presenter also asked follow-up questions or asked other participants ‘do you think the same?’.”

According to interviewee #6, the effect was that participants dared to share new perspectives:

“There were people in the room who said something entirely different from what had been said before. (...) And when that happened, the moderator, the chairman- he responded to that. He asked additional questions, so (...) that we came with something new. He activated that.”

9.5 Discussion

9.5.1 Strengths & limitations of methodology & findings

The identified reflection and contributions of playfulness design elements to reflection in the TD may have been influenced by several factors. The first issue relates to the composition of the three TD events. The TD events were diverse in terms of participants’ ages and gender, but as we used our own and the venues’ networks to invite people, the participants were likely to be people that are techno-interested and generally keen to visit dialogue houses for reflection on R&I.
In addition, each TD event had different group dynamics. All the TD events were relaxed, but the second and third event were slightly more energetic and engaged than the first. Also, the theatrical play was not always SB-specific during the first event because the actors were still unfamiliar with the field, while the later events were more SB-specific. Since our findings show that reflection could be hampered by a lack of ‘focus’ and participant diversity e.g., limiting ‘imagination’, TD test sessions on a larger scale would be necessary to reveal whether our findings hold.

Secondly, the LR respondents and interviewees volunteered a wide variety of notions on reflection and the contribution of playfulness to reflection. This suggests that they were a heterogeneous sample. However, this variety also hints that every participant may have learned something else from the TD. A realist evaluation approach (cf. Pawson & Tiley, 1997) could be useful to unravel the inter-dynamics between contextual and methodological factors, mechanisms and outcomes.

Thirdly, our choice for LRs and interviews may have impacted the degree to which reflection took place. Our data-collection was done on the basis of self-selection; our participants were willing to fill-out a LR and give an interview. As a result, it could be the case that they were more (willing to be) reflective by default. Furthermore, it seemed the interview itself acted as a trigger for our interviewees’ (after-event) reflection processes. For example, when interviewee #3 was asked when she had an ‘aha-moment’, she said:

“Actually, I have it right now (...) It was not so much during the sketch itself.”

Before the interview, this interviewee had not reflected on the event that much yet, and had merely experienced the TD as a nice evening out. In that sense, one could argue that follow-up interviews are crucial to encourage further reflection on R&I during and after PE events. In that light, it could be interesting to extend a theatrical debate with a short group interview or focus group discussion (e.g., as done in Wieringa et al., 2011).

9.5.2 Synergies and trade-offs between playfulness design elements

Our study showed that the hearing or seeing of new things, thoughts or situations evoked new thoughts in our participants’ minds, which we considered as ‘imagination’. This thinking of ‘new things’ was often a result of the theatrical play, ‘narration’, in combination with the degree to which other people (1) felt safe to share new thoughts, which is ‘experimentation space’, and (2) felt motivated to do this, which is ‘stimulating guidance’, and (3) actually did it in the end, which is ‘action-reflection’. An additional synergy could be observed between ‘action-reflection’ and ‘stimulating guidance’. Asking participants to actively act upon situations that happened during the TD event served as a motivation to pay attention throughout the event. Therefore, we argue that there is a strong interplay between the playfulness design elements. The moderator could certainly play a role in facilitating these dynamics, but more research should reveal how to optimize these synergies.
Furthermore, there seemed to be a trade-off between ‘focus’ and ‘simulating guidance’ during the TD. The variety of activities during the TD motivated participants to stay engaged throughout the whole event, and felt energized (‘stimulating guidance’), but this variety could also blur the issue focal to the debate (‘focus’). We hypothesize that the two design elements do not have to contradict one another, but how to make them synergetic requires further investigation by applying them in a TD or comparable reflection format.

9.5.3 Conclusion & implications for deliberative practice

Building upon our findings, we can conclude that the TD functions as a promising format to facilitate reflection on SB among a broad variety of citizens. Our general conclusion about why the playfulness elements especially contributed to this reflection is best summarized by interviewee #11’s general experience of the TD:

“It is more playful and yields more responses from certain gut feelings. I think that is a strong aspect (...), this is why typical academic debates are generally miserable (...).”

We argue that improvised theatrical sketches, followed by debate that informs further play, can enrich the usual rational approaches of non-playful debates with thinking, talking about and testing ideas beyond the usual lines of thinking.

This study re-emphasizes the importance of using playful tools to support reflection in RRI contexts. Not all citizens (or researchers) are word-oriented, and it can be hard to imagine what a new R&I field looks like, what its applications could be, and what the implications of these might be (Felt et al., 2014). Visually oriented tools for reflection can help more visual or spatial oriented people in reflecting on science and technology (Horst & Michael, 2011). A format like theatrical play, combined with verbal reflection in a plenary exchange between participants guided by a moderator, seems a good combination. We hypothesize that letting participants co-act with the actors on stage could be an interesting line of thinking for further theatre-based reflection formats in RRI contexts. Kinesthetic and visual formats like role-play are essential to trigger consequential thinking upon thoughts or actions e.g., concerning choices in relation to a technology development (van der Meij et al., 2017a). Moreover, Horst and Michael (2011) emphasize that unpredicted behaviors of people can trigger reflection among the makers of a tool as well. Following that line, we could say that co-acting behaviors may yield interesting, out-of-the-box insights for format development as well as for the anticipation of R&I futures. Nevertheless, if people have to converge their thoughts, it could be difficult to ensure that diverse viewpoints are being shared (Felt et al., 2014). Also, we noted that co-acting, which happened only once during our TD events, could divert the ‘focus’ at stake in the sketch and thereby influence the debate. Therefore, further investigation into semi-scripted theatrical play and debate that allows co-creation of participants could discover how to ensure diversity and focus. If such research is performed, we foresee that theatrical debates could be an interesting direction for participatory foresight (for example see Heidingsfelder et al, 2015).
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CHAPTER 10

Conclusion & discussion
10. CONCLUSION & DISCUSSION

To answer the main question on how playful tools and formats can contribute to RRI-reflection, this chapter discusses answers to the study questions first. After having answered the main question, we discuss strengths and limitations of this thesis, as well as implications for further research into and research and development into methods for reflection in RRI contexts.

10.1 Playfulness design elements

The first study question of this thesis, was:

1. What playfulness design elements for tools and formats could, according to state of the art literature, contribute to RRI-reflection?

The playfulness literature review (Chapter 4) yielded seven playfulness design principles for RRI-reflection methods. Four of these comprised playfulness activity principles: ‘narration’, ‘imagination’, ‘action-reflection’ and ‘co-creation’. Depending on the aim of the reflection in RRI context, one or a combination of these activity principles can be selected to construct playful reflection tools and formats. The further three principles concerned playfulness process conditions: ‘focus’, ‘experimentation space’ and ‘stimulating guidance’. Ideally, each of these is applied in an RRI-reflection format. Since the playfulness design principles rooted in literature on learning and reflection in general, the narrative review concluded that their practical contribution to reflection in RRI context would be material for further research.

10.2 Conclusions about the reflection methods

The five case studies of this thesis anticipated to the conclusion of the playfulness literature review. These case studies helped us to answer the second study question of this thesis:

2. How do various combinations of identified playfulness design elements lead to reflection in real-life RRI-reflection contexts?

We proceed to answer this question per case study below.

10.2.2 TransLearning

Case study 1, TransLearning (Chapter 5), was our primary investigation into the contribution of playfulness activity principle ‘narration’ to reflection, in the form of authentic video-narratives. Case study 1 showed that these narratives triggered
TransLearning workshop participants to engage in two major reflection processes, which we labeled as ‘inter-video comparison’ and ‘by-pass learning’. The former comprised a process by which the participants developed new stories by combining small elements of multiple video-narratives. The latter was a process by which the narratives triggered participants to think in completely new directions. Additionally, the personalities of storytellers or a ‘meta-insight’ gained from seeing all narratives together helped some participants in their idea-generation for improvement of their R&I practices. Figure 10.1 provides a visual summary of the identified reflection processes.

The ‘inter-video comparison’ seems especially interesting for RRI-reflection. Dewulf and Bouwen (2012) performed a study into favorable ways by which people react on each other’s viewpoints during conversational interactions. Amongst others, they identified ‘frame reconnection’ as an interaction strategy, which comprises the identification of links between different viewpoints on a level that exceeds the level at which the viewpoints themselves operate (Dewulf & Bouwen, 2012). It is especially valuable to achieve mutual understanding during conversations (ibid). Since ‘inter-video comparison’ shows similarities to this ‘frame reconnection’, authentic video-narratives seem to carry the potential to support people in creating deeper connections between various rationales and thereby achieving mutual understanding during conversations.
The ‘by-pass learning’ shows similarities to the working mechanism of playfulness activity principle ‘imagination’. This principle implies that people are provided with a multitude of ambiguous tools or objects to stimulate thinking of new directions (van der Meij et al., 2017a; see Chapter 4). The ‘by-pass learning’ pattern showed that providing (a database with numerous) authentic narratives could realize this too, which suggests a synergy between playfulness activity principles ‘narration’ and ‘imagination’. As workshop participants were allowed to browse through the narratives database freely, resembling process condition ‘experimentation space’ (ibid), ‘narration’ seems to enhance the realization of ‘imagination’ especially if ‘experimentation space’ is emphasized.

Nevertheless, the TransLearning workshop participants argued that the narratives could have stimulated reflection better when provided in smaller numbers and in a more structured way. The former aligns with the general notion that people can only deal with limited information at once (Mayer & Moreno, 2002). The latter hints to a lack of playfulness process condition ‘focus’ in the narratives. Furthermore, TransLearning workshop participants noted that some narrators were more inspiring and thereby were able to trigger more reflection. Altogether this increased our awareness that reflection methods should provide narratives that are told by interesting narrators, with a clear content focus, e.g., on one well-demarcated issue, and with a strong narrative structure, such as problem-struggle-solution (cf. McKee, 1997).

10.2.3 Video-Narrative Based Reflection

With TransLearning’s conclusions in mind, we limited the number of narratives in case study 2 and made them semi-scripted in order to ensure more narrative quality and structure (see Chapter 6). Case study 2 showed that these semi-scripted narratives evoked three reflection outcomes, (1) ‘minor modifications’ in initial viewpoints, (2) ‘analytical understanding’ for other viewpoints, and (3) ‘appreciation of the diversity’ in viewpoints; and three reflection processes, which we labeled as (1) ‘shopping’, (2) ‘demarcation’, and (3) the ‘discovery of fundamental differences’. The latter comprised second order reflection. Figure 10.2 schematically summarizes these findings. Although the narratives of case study 2 differed from the narratives of case study 1 in terms of topic (synthetic biology vs. sustainable development) and structure (semi-scripted vs. authentic), the way by which the narratives supported case study 2 participants in discovering ‘fundamental differences and similarities’ between viewpoints, shows similarities to the ‘inter-video comparison’ as identified in case study 1. Both comprised a process in which participants took tiny elements from different narratives to (re-)construct a viewpoint. The only variance is that the ‘discovery of fundamental differences’ concerned second order reflection. Since ‘inter-video comparison’ showed similarities with Dewulf and Bouwen’s favorable application of ‘frame reconnection’ (2012), semi-scripted narratives seem to carry the potential to deepen this strategy; this can have benefits to the realization of mutual understanding when people with fundamentally different viewpoints interact with one another.
The ‘appreciation of diversity’ and ‘analytical understanding’ reflection outcomes as identified in case study 2, seem an interesting addition to Dewulf and Bouwen’s ‘frame reconnection’. These outcomes trigger our idea that ‘inter-video comparison’ can yield both understanding and appreciation of the (existence of) diverse viewpoints surrounding potential impacts of R&I. In that sense, especially semi-scripted video-narratives carry the potential to prepare or support face-to-face dialogues in which it is desired that people with fundamentally different views grow respect for each other’s viewpoint.

The ‘shopping’ and ‘demarcation’ processes identified in case study 2 were new patterns compared to case study 1. The ‘demarcation’ could be explained by means of the favorable application of ‘frame disconnection’ of Dewulf and Bouwen (2012). This concerns the serious consideration of elements of another person’s view, without adopting them, but also without neglecting or masking them (Dewulf & Bouwen, 2012). The ‘shopping’ could be compared to the favorable application of Dewulf and Bouwen’s ‘frame incorporation’, in which aspects of another viewpoint are seriously considered and adopted, in addition to, so without complete disruption of, a person’s own initial view.

The ‘minor modification’ reflection outcome identified in case study 2, adds to this that favorable applications of ‘incorporation’ and ‘disconnection’ (logically)
lead to ‘minor modifications’ in people’s viewpoints. The favorable forms of ‘disconnection’ and ‘incorporation’ can be fruitful to evoke mutual understanding among conversation participants (Dewulf and Bouwen, 2012). The similarities between ‘shopping’, ‘demarcation’ and these interaction strategies in combination with the reflection outcomes identified in case study 2, opt that semi-scripted video-narratives have promising contributions for RRI-reflection especially in terms of enabling people to (re-)form their own viewpoint into a more inclusive version.

Since we applied different test set-ups in case study 2, a nuance should be made here to make these findings of use for further studies. We presented the narratives per narrator to one part of participants, and per subtopic to the other participants. The study findings showed that subtopic story sequences had better potential for deep reflection than narrator-based story sequences. Also, the narrator story sequences evoked more narrator-annoyance among participants, which could inhibit the degree to which the viewpoint of this ‘annoying narrator’ would be considered. These notions align with the case study 1 conclusion that narrative-based reflection is best facilitated if narratives are told by inspiring narrators, and focus on one topic, as this allows better ‘inter-video comparison’ and thinking of new directions. In other words, ‘narration’ in combination with a strong ‘focus’, trigger stronger ‘imagination’.

Nevertheless, case study 2 concluded that other playful activity principles in addition to narratives (e.g., ‘imagination’, ‘action-reflection’, ‘co-creation’, or a combination thereof) need to be applied especially if RRI-reflection aims for deeper reflection on values and assumptions.

10.2.4 Frame Reflection Lab

Based on the findings of case study 2, case study 3 focused on a reflection method that included more playfulness activity principles, the Frame Reflection Lab (FRL, see Chapter 7). In addition to video-narratives, the FRL added ‘imagination’ and ‘co-creation’, and more explicit ‘stimulating guidance’ in the form of workshop facilitation. Case study 3 showed that this combination of design elements evoked a larger degree of second order reflection in the following identified patterns:

• ‘Allocating values and assumptions’ to own and other people’s views of SB. Especially card-sorting and allocating exercises based on the ‘imagination’ principle triggered reflection on second order notions.
• ‘Re-adjusting own viewpoints’ (minorly), especially after these exercises.
• Developing a stance to the further directions for SB that is inclusive for various perspectives, in which individual variances in stances could co-exist. Especially the final ‘co-creation’ exercise of the FRL triggered this ‘inclusive convergence’.
• Developing ‘awareness about the own learning process’ regarding the development of an SB viewpoint as a result of the whole process.

Figure 10.3 schematically summarizes these findings.
In addition to the previous case studies, case study 3 showed that the added value of ‘imagination’, ‘co-creation’ and more explicitly applied playfulness process conditions could result in awareness about the own learning process, similar to deutero-learning (Yuthas et al., 2004; Tosey et al., 2012). This combination also resulted in a stronger interplay between ‘imagination’ and ‘narration’. The two design elements combined, could trigger the development of, and discussion on, many more perspectives (‘imagination’), eventually resulting in (1) certain viewpoint reconsideration and (2) the group-wise ‘inclusive convergence’ towards a stance regarding the governance of R&I.

In line with the effects of ‘co-creation’ as conceptualized in van der Meij et al. (2017a; see Chapter 4), this case study showed that ‘co-creation’ exercises could function as a mediator in the elicitation and respectful weighing of different viewpoints. In the last round of FRL workshops, after the allocation of values and assumptions to various SB viewpoints, we made participants co-create an ethical approach to the field. In that last process, we identified extensive reflection on the various viewpoints among participants, often including an exchange about value and assumptions underlying these viewpoints. This contrasts with a notion of Felt et al. (2014), who argued that asking participants to reach a consensus on a particular topic can be disruptive to the diversity of viewpoints shared.
However, the FRL study showed that ‘imagination’ could work as a hampering factor in the reflection process as well. We made participants reflect on viewpoints as represented in video-narratives by means of ‘value and assumption cards’, which contained keywords and suggestive visualizations. On the one hand, these cards were a major reason that second order reflection happened but on the other hand, participants could get confused, not knowing what to do, and get blocked in their reflection, unless asking for support from the FRL workshop facilitators.

We also found that a large part of second order reflection instances occurred when facilitators supported the table conversations. As a result, case study 3 suggested that especially for second order reflection, facilitation is needed to realize the full potential of ‘imagination’ and thereby stimulate the elicitation of, and negotiation on, different rationales. In other words, playfulness process condition ‘stimulating guidance’, e.g. in the form of providing rewards for people’s (daring) engagement, would need more emphasis in case reflection methods desire to evoke second order reflection with the help of ‘narration’ and ‘imagination’. To prevent heavy expenses, case study 3 suggested that facilitation could be delegated to participants themselves.

Last, the FRL participants occasionally got irritated by particular narrators, which could hamper the degree to which they took these narrators’ views seriously. Case study 1 and 2 showed influences of narrators to reflection as well. These influences are logically explained by the fact that a story-character is generally taken more seriously if viewers like and identify themselves with the character (Raney, 2004). Case study 3 added that especially the (apparent) knowingness of the narrators could play a crucial role in the development of such appreciation and identification. Therefore, case study 3 suggested that narrators of stories provided during reflection should ideally come across as equally knowledgeable.

10.2.5 Opinion Lab

With the lesson of case study 3 in mind, we developed and evaluated a format for reflection on synthetic biology among a younger group of citizens, the Opinion Lab (OL, see Chapter 8). The OL design was comparable to the FRL reflection method but differed from the first three case studies in its operationalization of playfulness process conditions ‘focus’, namely with the help of ‘imagination’: we made OL participants reflect on synthetic organisms in a research stage, and added slightly fictitious elements in the ways we introduced these organisms to the participants. Furthermore, the OL used audio-narratives instead of video-narratives, and made the child-participants ‘play a scientist’ themselves. Despite these differences with other case studies, the findings of case study 4 showed similarities with findings of the first three case studies (see Figure 10.4 for a visual summary). Firstly, the audio-narratives triggered what we labeled as ‘frame forming’ and ‘counter argument incorporation’ processes among case study participants, resembling the ‘shopping’ process of case study 2 (Chapter 6), as well as the ‘inter-video comparison’ identified in case study 1 (Chapter 5).
Secondly, the reflection in the OL that we labeled as ‘frame extrapolation’, the generation of totally new ideas concerning R&I, could be linked to the ‘by-pass learning’ that we identified in case study 1. The ‘deeper reflection’ that we identified, in which the narratives merely functioned as a way to identify with particular viewpoints or not, occasionally appeared to be the ‘base for convergence’ between viewpoints of parents and children. This could be linked to the ‘inclusive convergence’ as we identified in case study 3 (Chapter 7).

Thirdly, case study 4 explicitly showed, again, the importance of the narrators to RRI-reflection if ‘narration’ is applied, but with a slight variance as this reflection method was designed for young participants. Narrators with friendly voices and approachable vocabularies seemed to increase the likeliness that children considered their viewpoints in their reflections. Also, although the number of narratives was limited to four in case study 4, children frequently had memorization issues, which could influence their reflection. Therefore, the study suggested that youngsters might need only two narratives, representing opposing citizen viewpoints concerning R&I, with equally approachable vocabularies and friendly voices, to effectively stimulate perspective(s)-diverse reflection on R&I.
Earlier studies into perceptions of science among children, such as the Draw A Scientist Test (DAST), often conclude that children obtain stereotypical ideas about science from their school lessons and the media (Finson, 2002). Indeed, the young OL participants’ initial viewpoints showed similarities to a positivist thinking of science that has been persistently present in schools and society throughout the last decades (cf. Burbules & Linn, 1991). The viewpoints became more nuanced especially after discussing the second order question. In that sense, case study 4 showed that lessons could be learned from studies into the philosophy of science in classroom settings (e.g., Linn et al., 2016) or socio-scientific inquiry based learning (e.g., Levinson & Amos, 2017) to inspire RRI-reflection in science museums. Case study 4 re-emphasized that asking deeper questions, and providing children with alternative viewpoints representing also contemporary epistemological perspectives on science and knowledge, seem crucial to make youngsters discover different angles when considering the relationship between science, technology and society.

Case study 4 concluded that if reflection on R&I is to be facilitated in science museums among its young visitors, further research would be needed to unravel how one could replace the facilitator-based ‘stimulating guidance’ by other tools, e.g., in a stand-alone exhibition or environment. This aligns with the call of case study 3 for investigation into other forms of ‘stimulating guidance’.

10.2.6 Theatrical Debate

The last case study built on the findings of case studies 1-4 (Chapters 5-8). The major contrast with the other case studies was that the TD case applied all playfulness design principles except ‘co-creation’. This enabled us to also explicitly investigate the interconnectedness of playfulness design principles, in relation to reflection. Case study 5 showed that the TD method stimulated participants into reflection that we could label as first, second and third order reflection. Figure 10.5 summarizes these reflection findings.

While first order reflection concerned the visitors’ development of ideas on whether synthetic biology is complex, uncertain, important, and a positive or a negative development, second order reflection comprised the visitors’ discovery of values and assumptions that influenced their opinions or ideas; especially their own. Third order reflection referred to the visitors’ awareness of their opinion broadening or clarification, or their (continued) deliberation process in general (after the TD).

Case study 5 also showed that playfulness design principles ‘narration’, ‘imagination’ and ‘action-reflection’ contributed to the reflection directly, respectively by allowing visitors to identify with characters on stage, providing inspiration for envisioning alternative viewpoints, and by providing direct feedback on existing ideas.
‘Experimentation space’, ‘focus’ and ‘stimulating guidance’ contributed to reflection indirectly, serving as preconditions for the other design elements, by allowing visitors to feel free to experiment in sharing many different ideas, allowing actors and visitors to deepen, process and integrate ideas, and motivating visitors to pay attention. In addition to the importance of ‘stimulating guidance’ to trigger deeper and viewpoint inclusive reflection, as shown in case studies 3 and 4 (Chapters 7 and 8), the TD case study exposed that ‘experimentation space’ could also stimulate ‘imagination’ through ‘narration’, and thereby diversify and deepen the reflection. An absence of ‘focus’ appeared to block this effect.

Figure 10.5: schematic overview of the types of reflection that the TD evoked among participants. Legend: F stands for facilitator, LRs for learner reports, SB for synthetic biology.
10.3 New insights into the playfulness design elements

The last study questions of this thesis were:

3. **What new contributions and limitations of the literature-based playfulness design elements arise in real-life RRI-reflection contexts?**

4. **What synergies and trade-offs between literature-based playfulness design elements arise in real-life RRI-reflection contexts?**

In line with the design principles’ conceptualizations (cf. van der Meij et al., 2017a; see Chapter 4), especially case studies 3-5 (Chapters 7-9) showed that ideally all playfulness process conditions are applied at all times. However, the studies provided additional insights that in specific contexts, especially to realize second order reflection among participants, some of the playfulness process conditions need to be put in practice more extensively than in other situations. We start by discussing these, after which we describe newly gained insights into the value of each activity principle for reflection. Last, we discuss the identified trade-offs and synergies between them.

10.3.1 Focus

Whereas ‘focus’ appeared to be of importance to realize depth in reflection it was also contested the most by other design principles (or contextual circumstances such as group dynamics). Case studies 4 and 5 (Chapters 8 & 9) showed that the addressing of a few narrowly demarcated issues regarding R&I could help to deepen reflection. In other words, it seems better to cover only one issue with regard to one R&I application, in case of one-time RRI-reflection events. Such ‘focus’ would require many reflection events or long-term processes to realize RRI for the full spectrum of an R&I field. This aligns with Davies et al.’s (2012) notion that a kaleidoscope of events is needed to ensure that reflection on the whole spectrum of R&I is realized among diverse societal actors.

10.3.2 Experimentation space

Playfulness process condition ‘experimentation space’ adds to the more common public engagement criteria such as openness, fairness and equality (e.g., see in Rowe & Frewer, 2000; 2005; Davies, 2011), that it is important to stimulate participants’ flexibility and voluntariness in making mistakes, trying again, and possibly, changing one’s mind (van der Meij et al., 2017a). Case study 5 reemphasized (Chapter 9) that it comprises the creation of a relaxed ambiance, since people are often unfamiliar with the topic and to each other. Case study 3 (Chapter 7) showed that ‘experimentation space’ needs extra emphasis when participants are insecure, e.g. in case they are unfamiliar with the topic, the type of exercises, or with other participants. In that sense playful reflection distinguishes from conventional formats for its people focus as opposed to a mere process focus.
Case studies 3 and 5 (Chapters 7 & 9) showed that giving people (more) ‘thinking time’ and having a facilitator who consciously divides attention between participants and deals with unforeseen circumstances in a flexible way, supported people in daring to contribute. These findings suggest that RRI-reflection methods ideally take place in a ‘super-friendly’ environment. Since learning environments that are too free and too open to everything can distract learners as well (Pavlas et al. 2012), further research could point out how the above-mentioned factors and physical conditions such as particular colors, shapes, temperatures or sounds, could make process condition ‘experimentation space’ most contributory to reflection.

### 10.3.3 Stimulating guidance

Especially case studies 3-5 (Chapters 7-9) showed the importance of ‘stimulating guidance’. Participants were actively asked to contribute to the reflection and verbally rewarded once they did. As a result, many of them started to contribute more spontaneously, in the end. Facilitators that applied ‘stimulating guidance’ in our studies seemed to particularly ‘feed’ the reflection in case they had an energetic character, keeping the participants hooked. ‘Stimulating guidance’ in forms other than facilitators, are uncovered in this study. If RRI-reflection is to ‘go online’ or expand to settings where numerous participants are ‘available’ (museums, public spaces), the stimulating and guiding of the reflection would be equally important in such settings; participants still have to cope with uncertainties and unfamiliarities surrounding R&I and RRI-reflection. The findings of case study 3 (Chapter 7) suggest that unthreading a finish-able ‘co-creation’ task can already be very guiding and stimulating. Comparable suggestions can be found in museum studies (e.g., see Bradburne, 2000; Allen, 2004). Since reflective conversations could easily get unfocused and thereby loose ‘depth’, we foresee that in non-moderated methods it may remain difficult to realize especially second order reflection.

### 10.3.4 Narration

Case studies 1, 3-5 (Chapters 5, 7-9) showed that lived or potential (citizen) experiences in a narrative-format are simple and effective means to invoke reflection on R&I in the ‘now’, especially when the narratives represent various opposing viewpoints and are narrated by people with equally intelligible and attractive personalities. They stimulate inclusive reflection and thereby inclusive viewpoint (re-)forming among RRI-reflection participants. Chapter 9 suggested that narratives with more imaginative and futuristic aspects carry the potential to be used for participatory foresight as well (e.g., see in Heidingsfelder et al., 2015). If ‘narration’ of this format is complemented with ‘co-creation’, participants can test and shape (the rules for) a commonly desired future for R&I, linking to the anticipatory governance that is needed for RRI (Stilgoe et al., 2014).

Furthermore, the ways by which we applied ‘narration’ in our case studies proposed a new type of science narratives. We did not use science fiction (e.g., see Knippels et al., 2009) or artist impressions of the future (e.g., see Schmidt et al., 2015) or a
narrative in which a ‘visually attractive researcher’ (like a ‘Carl Sagan’ see Bucchi & Trench, 2008) excitingly explains the promises and risks of R&I. In contrast, we made various improvisation and authentic actors narrate monologues to represent lived experiences regarding R&I. These narrated monologues do not fit in the science narrative categorization of Avraamidou and Osborne (2009). Still, they triggered people to weigh different perspectives, identify links between different viewpoints on deeper levels, and occasionally reconfigure their own, initial view. These processes resemble interaction strategies that are fruitful for the growth of mutual understanding (cf. Dewulf & Bouwen, 2012). Therefore, we argue that our new narrative-format could especially be interesting to prepare participants for- or support them in heterogeneous RRI-reflection, in which they directly encounter other participants with, possibly, very different viewpoints.

10.3.5 Imagination

The ‘imagination’ that we applied in case studies 4 and 5 (Chapters 8 & 9) yielded insights into the challenges of providing imaginative scenarios, as well as on triggering thinking of multiple, new, alternative thoughts or viewpoints regarding R&I-related applications or ethical-moral considerations surrounding these. ‘Imagination’ means providing objects, situations or questions that are ambiguous (van der Meij et al., 2017a; see Chapter 4). Case study 5 explicitly showed that well-applied ‘imagination’ could incite an ‘imagination flywheel’. When actors played a sketch, people started thinking of new directions, and once these were shared in plenary discussions, (other) people in turn, started to think of even more directions. This abundance resulted in open-endedness, which could prolong the reflection.

Our ways of applying ‘imagination’ in the case studies were different from its conceptualization (cf. van der Meij et al., 2017a). We applied ‘imagination’ not necessarily as an activity principle in itself. Instead, we often included it within exercises that centered around other design principles, like in ‘co-creation’ exercises (case study 3), or in ‘narration’ or ‘focus’ on particular applications (case studies 4 and 5). Furthermore, we applied ‘imagination’ merely to trigger thinking about ‘what would that mean, right now, in this exercise?’ This form of ‘imagination’ appeared to be fruitful to reflection too. This suggests that ‘imagination’ can function well as a supportive element, applied indirectly through other design elements, to trigger reflection on contemporary, so not only futuristic (What if?)-, situations or cases.

10.3.6 Co-creation

Case study 3 (Chapter 7) yielded insights into ‘co-creation’. FRL workshop participants had to collaboratively agree on an ethical approach to SB. The convergence to one viewpoint can threaten the diversity of issues and perspectives being shared during reflection on R&I (Felt et al., 2014), but we saw the opposite: the ‘co-creation’ of an ethical approach to SB seemed particularly valuable to deepen the reflection. It evoked genuine negotiation about different viewpoints, without disrupting individual viewpoints. Maybe this was due to the fact that participants had dialogued about
viewpoints, values and assumptions already extensively before they did the ‘co-creation’ task. Nevertheless, I pose that the ‘co-creation’ of ‘intangible things’ might be a solution to the risk that ‘co-creation’ becomes too much a task in itself, which potentially forces people to agree with one another beyond their boundaries of acceptance (Pavlas et al. 2012). In other words, where playfulness activity principle ‘co-creation’ originally stood for the creation of objects or future scenarios, case study 3 adds that the ‘co-creation’ of a viewpoint can also have a value to inclusive reflection on R&I.

10.3.7 Action-reflection

Case study 5 (Chapter 9) was the study that yielded new insights into ‘action-reflection’. The playfulness review conceptualized ‘action-reflection’ as a process in which a learner performs particular actions to see the consequences of thinking and actions (van der Meij et al., 2017a; see Chapter 4). The TD method made participants define actions that had to be tested in a scenario concerning a particular SB application; however they actually delegated the ‘real action’ to the improvisation actors. As a result, the participants discovered consequences of thinking and acting indirectly. The case study showed that the contribution of this indirect ‘action-reflection’ contributed to reflection substantially (cf. van der Meij et al., 2017a). Staying closer to the original conceptualization of ‘action-reflection’ (cf. van der Meij et al., 2017a) would ask for a reflection method in which participants join the stage and co-play. As briefly mentioned earlier, this may be an interesting addition to anticipation exercises in RRI contexts, such as participatory foresight (e.g., see in Heidingsfelder et al., 2015). The results of case study 3 indicate that taking that direction would probably require additional guarding of the ‘focus’. Case study 5 showed that co-acting participants could divert the play in particular off-topic directions, by which, as a result, other participants could lose track. Also, since some participants felt shy to speak up during the event, the hesitance to join a stage is likely to be even be higher. Therefore, ‘stimulating guidance’ may need additional emphasis in such direct action settings too, e.g., by having improvisation actors take the lead to support the ‘novice’ players in joining the stage. Since such direct ‘action-reflection’ touches the ‘co-creation’ of particular ideas, visions or scenarios (cf. van der Meij et al., 2017a; see Chapter 4), it should be guarded that the action does not become too much of an autotelic activity (Pavlas et al., 2012), diverting the activity from the reflection on diverse viewpoints.

10.3.8 Synergies en trade-offs between design elements

The interplay between design elements was directly investigated in case study 5 (Chapter 9), and indirectly in the other case studies. Answers to the last study question concerning this interplay remain hypothetical, given the exploratory nature of the case studies in this respect. Case studies 1-4 (Chapters 5-8) particularly provided insights into the synergies and trade-offs between ‘narration’ and other playfulness design principles, whereas case study 5 (Chapter 9) showed more overarching synergies and trade-offs. Overlooking these, we can re-affirm that the
process conditions enhanced the contribution of activity principles to reflection, and thereby merely functioned as indirect contributors to reflection, especially to go beyond first order reflection. Therefore, the advice to always apply all process conditions in RRI-reflection methods, still holds, especially for the realization of second and third order reflection.

Furthermore, most case studies showed that ‘narration’ stimulated ‘imagination’. Case study 5 (Chapter 9) added a contribution of ‘action-reflection’ to ‘imagination’. Case study 4 (Chapter 8) applied ‘imagination’ slightly more independent from other design elements, nevertheless, the reflection that was evoked here showed similarities with studies in which ‘imagination’ was applied as activity ‘within’ other activity principles. In that sense, it seems that ‘imagination’ can be applied just as well ‘through’ other activity principles, if explicitly designed as such.

Overviewing the interplay between ‘narration’ and other elements, we should make one side-note. ‘Narration’ can also comprise that reflection process participants create narratives (e.g., by means of co-creation) (van der Meij et al., 2017a; see Chapter 4). We did not investigate this form of ‘narration’. Although this may inherently trigger ‘imagination’ too, we foresee that such ‘narration’ could result in a different interplay with the design elements. In most case studies, the preserving of ‘focus’ in the reflection was contested the most. In case studies 2-4 (Chapters 6-8), ‘narration’ seemed synergetic to ‘focus’. The narratives provided in the reflection formats, when covering just one sub-topic, sharpened the conversations and thereby deepened the reflection. However, case studies 1 and 5 (Chapters 5 & 9) showed that reflection methods with an emphasis on ‘experimentation space’ hampered the effect of ‘narration’ on the reflection ‘focus’. Providing participants with ample tools and opportunities to discover and test multiple lines of thinking and doing, could blur the ‘focus’ of reflection(s). The use of ‘imagination’ in case studies 3 and 5 (Chapters 7 & 9) could have a focus-disturbing effect as well. Ambiguity can confuse people. As a result, we argue that RRI-reflection formats in which ‘imagination’ and ‘experimentation space’ have a strong emphasis, e.g. in reflection that really has to go out-of-the-box, especially ‘stimulating guidance’ should be more directed to the safeguarding of ‘focus’.

10.4 The value of playfulness to RRI reflection

The study question answers enable us to answer this thesis’ main question:

How can playful tools and formats contribute to RRI-reflection?

To answer this question, I compare the insights gained from the case studies with the tentative playfulness definition of van der Meij et al. (2017a; see Chapter 4, p. 39). It conceptualized playfulness in the context of RRI-reflection as: “an intellectually curious, alert, flexible, inventive and prejudice-free attitude in (1) the analysis of new complex information or issues as well as in (2) the synthesis of new, creative
ideas or solutions”. Our reflection methods primarily evoked playfulness in the analysis of new and complex information or issues, and secondarily in the synthesis of new, creative, ideas or solutions. Superintending the reflections of our case study participants, as displayed in the conclusions, our reflection methods seemed to make people intellectually curious in a fluent and almost autotelic manner, keen to explore different viewpoints, and thereby test different ways of looking at R&I. They did not only consider first order arguments but also values and beliefs underlying these arguments, and in case of case studies 3 and 5 (Chapters 7 & 9) also became aware of own sense making processes. If encouraged enough, e.g. by applying the playfulness process conditions well, our case study participants also demonstrated alertness, flexibility and inventiveness during the reflection processes. They were generally highly engaged throughout the process, dedicated to tackle the quests that we gave them.

Although our tentative playfulness definition would suggest so, the attitudes of our participants were mostly not judgment-free. The ways by which they elicited their viewpoints while using the playful tools that we provided, especially narratives, made clear to us that people quickly developed judgments, hampering the respectful weighing of particular viewpoints. Nevertheless, these judgments, which seemed inherently connected to some tools (e.g., names, gender, age and the looks of narrators can easily trigger judgments), could be seen as useful for reflection too. If participant were stimulated to go beyond them, e.g. by means of the tasks by which they could analyze the viewpoint rationales, many participants became aware that multiple viewpoints could co-exist and be legitimate, in the end. In this sense, playful RRI-reflection methods do not have to strive towards the facilitation of an environment that is completely judgment-free, if it would even be possible. Instead, this thesis showed that playful reflection tools should challenge people to scrutinize judgments and, if they discover it is useful to change perspectives, make them daring to take another stance and then reflect on that again, and so on.

Our case studies also yielded several insights into the role of playful RRI-reflection methods for the synthesis of new, creative, ideas or solutions, which relate to the second part of van der Meij et al.’s playfulness definition (2017a; see Chapter 4). For instance, authentic video-narratives triggered thinking of new directions for sustainable development (Chapter 5). Also, the collaborative defining of an ethical approach to R&I (Chapter 7), made participants develop new, multi-viewpoint inclusive stances to this issue. Last, participants were also capable to invent new directions for testing ideas concerning societal futures of R&I (Chapter 9), which resulted in the performing of actions to reflect on and thereby further opinion forming on R&I. These preliminary insights hint to the idea that playfulness can also result in an intellectually curious, alert, flexible, inventive and judgment-free attitude during the synthesis tasks; yet the provisionality of these findings ask for further investigation into the synthesis-contributing power of playful tools and formats for RRI-reflection.
10.5 Validity

10.5.1 Internal validity

Since little research had been done into playful RRI-reflection methods, it was necessary to make our investigation exploratory. A case study methodology and a DBR approach are very suitable for such exploratory investigation (Eisenhardt, 1989; Barab & Squire, 2004; Wang & Hannafin, 2005). Inherently connected to such study set-ups is the absence of benchmark materials (Barab & Squire, 2004). To compensate this as much as possible, we extensively compared cross case and compared with other studies into reflection, with an eye for contextual differences. Still, the exact contribution of each distinct playfulness design element cannot be fully assured.

Another internal validity challenge of DBR is that the roles of designers, facilitators and researchers are heavily intertwined (Wang & Hannafin, 2005). We tried to tackle this by being reflexive, but foremost by triangulation. Our triangulation strategies concerned the conduct of multiple case studies in a cross section of RRI contexts, and the use of mixed methods in each case study (cf. Mertens, 2013). Within the latter, we often used techniques to gather experiences of participants themselves, in addition to our own (observational) analyses, e.g. member-checks. As these were unanimously returned with minor or no corrections, our own interpretations hardly juxtaposed experiences of participants.

Reflexivity was achieved by working in researcher teams with principal investigators and critical friends (cf. Erwee & Conway, 2006). The effect of this strategy can best be illustrated by several ‘unexpected findings’, which made us design consequent case studies in different ways than initially planned by the principal investigators.

We did not expect that case study 1 participants (Chapter 5) would compare videos in the ways they did, or that they could be inspired by the narrators in a way that incited the generating of new ideas. This made us more aware of storytelling structure, storyteller charisma and themed video-narratives in consequent case studies.

• In case study 2 (Chapter 6), we had hypothesized that the narrator set-up would deepen the reflection better than the subtopic (themed) set-up, since we thought that a focus on one narrator would trigger more respect for that particular viewpoint, while it appeared to be the other way around. It inspired us to design case study 3 with a subtopic setup.

• Data of case study 3 (Chapter 7) surprised us with the many instances of second order reflection. While facilitating the workshops, we ‘feared’ this would not be the case (enough).

Furthermore, our intense researcher involvement also made us experienced and thereby capable of understanding the data with attention for contextual differences and nuance (cf. Barab & Squire, 2004). This deep understanding especially enriched the cross-case comparison. Nevertheless, we should note that in DBR it remains
hard to fully escape from a researcher bias.

10.5.2 External validity

An issue of external validity is that our reflection methods were designed and tested in the Netherlands, with the exception of case study 3 (Chapter 7). The design and use of reflection methods for the triggering of playfulness may be different in other cultures. For example, in Asian cultures, ‘speaking up’ in public may need extra facilitation, compared to Western cultures (Lee & Lee, 2009). In different cultures, playfulness design elements may therefore need to be applied in different ways to achieve inclusive and deep RRI-reflection.

Second, our case studies focused on RRI-reflection surrounding synthetic biology, with the exception of case study 1, which focused on sustainable development. Although this diversity is marginal, potentially decreasing options for extrapolation of our recommendations for facilitating RRI-reflection on all R&I fields, the focus on these two fields align with the idea that especially volatile R&I require societal reflection (Sykes & Macnaghten, 2013). This increases the generalizability of findings at least for RRI-reflection on emerging, potentially controversial R&I.

Third, the selection of participants for our reflection method test sessions was based on convenience sampling (participation was based on voluntariness and coincidence). Although our participant composition showed a good spread in residency, gender and ages, most of our participants were more highly educated and R&Iinterested than the ‘average citizen’. Higher-educated citizens can have the most polarized opinions concerning R&I, yet they tend to be more engaged in R&I and more experienced with reflection on R&I (Nisbet & Markowitz, 2014). Our participant bias, therefore, could have resulted in a higher willingness to reflect on R&I among our case study participants and might have resulted in more second and third order reflection. This raises questions about whether our reflection methods would yield the same results with participants with lower levels of education and/or less interest in R&I. Our experience in other studies is that playful tools and formats can facilitate reflection on R&I among many different kinds of people (e.g., Betten et al., 2017; Lynch et al., 2016). However, in case our findings are used for the organization of playful RRI-reflection among ‘the general public in R&I’, further investigation into playful RRI-reflection methods with a larger diversity of participants would be necessary.

Fourth, in RRI contexts, reflection can be organized with or without a motivation to inform R&I policy (Stilgoe et al., 2014). This thesis only presents case studies into reflection methods free from R&I governance, merely focused on the facilitation of (inter-)personal RRI-learning outcomes (cf. Kupper et al., 2015). We merely engaged R&I and non-R&I actors separately from another, in one-time events. By doing this, we could focus on reflection processes (in relation to the reflection method design elements) as opposed to the generation of output for policy. Still, we argue that our findings could have implications for heterogeneous and/or policy-motivated
RRI-reflection. We consciously chose not to design our reflection methods from a ‘deficit thinking’ approach (e.g., as historically described in Bucchi, 2008), adhering to the idea that R&I and non-R&I actors have important contributions to make when it comes to reflecting on R&I. Also, the articles in which our design principles rooted took a constructivist stance to learning, for which we believe that our RRI-reflection methods inherently took this stance as well. It implies that we supported the generation of insights into the perceptions and beliefs of our participants in their language and understandings of the world. Such a constructivist approach is a promising way to include diverse actors and make them “elicit perceptions and values on which to build an assessment framework” on R&I (Ancillotti et al., 2016, p. 311). This, in combination with our observation that the reflection methods triggered respect for diversity, makes us believe that RRI-reflection designs similar to the ones in this thesis could be used in (heterogeneous) reflection in a R&I policy-context, and that the playfulness design principles could have comparable beneficial contributions to the reflection in cases.

Nevertheless, we acknowledge that some playfulness design elements may need extra consideration in R&I policy context. For example, we gave our participants a lot of time for ‘free exploration’, occasionally asked participants to reflect on slightly fictitious situations, and did not guard the feasibility of thoughts about R&I that our participants contributed during the sessions. In contrast, decision making on R&I is known to have contingent time frames (Dietz, 2013). Also, it would be needed to do a reality-check or a take-back of societal reflections concerning (futuristic) R&I applications and their potential implications, to translate them into input for R&I governance (e.g., see in Heidingsfelder et al., 2015). Therefore, especially playfulness design elements ‘experimentation space’ and ‘imagination’ may need to be considered differently in contexts of R&I governance.

10.6 Implications for future research & practice

The conclusions of this thesis regarding the contribution of playfulness for reflection on R&I trigger thinking of several directions for further research. Firstly, RRI is aimed at making R&I responsive to societal perspectives. This thesis showed that playful methods are a good way to incite RRI-reflection in a policy-free context. However, making R&I responsive requires the collecting of viewpoints and their translation into R&I governance (O’Doherty, 2013). As our playful reflection methods supported youngsters and people relatively unfamiliar with R&I to elicit (well-considered) R&I viewpoints, we could say that playful reflection methods carry the potential to support the (large-scale) collecting of societal viewpoints concerning R&I. Felt et al. (2014) argued that for such purposes, further research should be done into the pre-framing effect of the methods, e.g., the vocabulary used in the supportive tools, as this can threaten the authenticity of citizen viewpoints to be shared. Also, they stressed that playful tools do not guarantee equal opportunities to speak up for everybody (ibid). This thesis reaffirms that further research could focus on tackling these challenges, especially if playful methods would be used in R&I policy contexts.
Since we observed that playful tools and formats can support the respectful weighing of diverse arguments and the creation of new ideas or solutions, we argue that they carry the potential to aid the ‘translation step’ of RRI-reflection for R&I governance as well. Traditionally, it seems that R&I ‘experts’, STS-scholars or politicians are assigned with this role (e.g., see in O’Doherty, 2013; Zwart et al., 2014). As a result, the consideration of societal perspectives in R&I and its governance comes across as a ‘black box’, often resulting in frustrations among those who contributed; this process might benefit from becoming more transparent (see in Schuurbiers, 2011). Therefore, it could be especially interesting to develop playful reflection methods that enable the inclusion of various actors in the ‘translation step’ as well. We theorize that the inclusion of various actors throughout different aspects of R&I governance in a playful way, can eventually help to realize the co-responsibility that RRI aims for (Owen et al., 2012).

Secondly, further research into ‘stand-alone’ RRI-reflection tools and formats would be relevant. Various scholars consider informal places like science centers as forums for facilitating reflection on R&I (Bandelli & Konijn, 2015; Bandelli, et al., 2009; Delicado, 2009; Skydsgaard et al., 2016; Stocklmayer, 2005; Yaneva et al., 2009). Such places hold the potential to enlarge the inclusion of often-forgotten societal groups in RRI-reflection. Although a few pioneers have investigated this potential (e.g., Bell, 2008), playfulness seems unaddressed. This thesis showed that playful reflection methods can effectively support reflection on R&I, but need to put a strong emphasis on guidance to reach depth. Important in such guidance for the realization of mutual understanding seemed the rewarding of (1) sharing ‘wild’ perspectives to test ‘extreme’ ideas, (2) idea changing, and (3) discovery and revealing of values and assumptions, in order to make participants collaboratively scrutinize rationales in a respectful manner. In that sense, one could say that facilitators of playful RRI-reflection need to possess skills that exceed the skills of ‘regular’ group moderators (cf. Krueger & Casey, 2000). In addition to the asking of (deepening) probing questions (ibid), a facilitator needs to be skilled in the ad hoc conversion of thoughts into new actions in such a way that all participants stay hooked, so that implications of participants’ answers can be considered in multiple ways. Also, whereas ‘regular’ group moderators may need to be immune to ‘distractions’ (ibid), facilitators of playfulness in RRI-reflection need to be very agile, in order to convert unforeseen distractions that are inherently connected to a playful setting into meaningful assets for the conversation. However, it may not be possible to offer such guidance in a science gallery, center or museum (e.g., see Hawkins et al., 2014; Skydsgaard et al., 2016), in maker spaces (e.g., see Kera, 2014), or pop-up museums1, during a science festival (Schmidt et al., 2015), or performances in public spaces (e.g., see Horst & Michael, 2011). Further investigation into playful RRI-reflection methods for such informal settings need to unravel how (deep) reflection on R&I can be facilitated best.

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Thirdly, this thesis applied a DBR approach, which had an exploratory nature. As doing a valid and reliable cross-case comparison is accompanied with challenges when the case study conditions are highly variable, it could be interesting to find research approaches that also enable more systematic comparison between reflection methods in which playful tools and formats are used, and reflection methods in which no tools but e.g., regular focus group-like facilitation techniques are applied. In that, a realist evaluation approach (cf. Pawnson & Tiley, 1997) could be considered, as this enables researchers to unravel the dynamics between context, mechanisms and outcomes.

A special, last point for further investigation, within or beyond the directions described above, is the interplay between the playfulness design elements. More studies into conceptualizations of, and synergies and trade-offs between, the playfulness design elements could eventually allow the development of prescriptive heuristics. Such heuristics could help researchers and facilitators in designing new playful RRI-reflection methods, and in evaluating them. Based on the findings of this thesis, I have developed some example-heuristics (see Textbox 10.1). Hopefully my thesis inspires other researchers and practitioners to take up these ideas for further investigations into, and practices of, RRI-reflection to thereby realize RRI in various new and emerging R&I fields.
Chapter 10

Textbox 10.1: an example heuristic for the design of a playful RRI-reflection method.

1. When designing an RRI-reflection method, first consider the R&I at stake. Is it.....
   - Emerging but not controversial? Are you sure? Reflection processes based on activity principles ‘imagination’ and ‘action-reflection’ could especially be good to do a controversy-check. Sometimes it is well hidden.
   - Emerging and controversial, but R&I practitioners, institutes or governments see no relevance or urgency for societal or stakeholder reflection? Do it anyways, convince people! You have to do it in an early stage. Succeeded in convincing? Move to step 2.
   - Emerging, controversial, and practitioners or institutes in the field, or governments desire societal or stakeholder reflection? Very good; you are ready for step 2 right away.

2. What do you foresee as major challenges in designing the reflection method, to start with?
   - There are many diverse actors with many different viewpoints, and they are ‘on tenterhooks’.
     - Go for ‘narration’-based reflection. Make 2 to 4 narratives that represent different lived experiences on the R&I at stake, or on one particular issue related to the field. Develop a workshop in which participants view/listen to these narratives, analyze them, and discuss their own viewpoints too. Make sure that one step in the reflection process, systemically, addresses values and assumptions, and how these relate to the various discussed viewpoints. Done? Go to step 3.
     - Independent from, or in addition to the previous option, give participants a ‘co-creation’ assignment: let participants work in small groups of ± 4 persons and provide them with simple mock-up materials, such as pepper foam balls and other shapes, crêpe paper, markers, stickers, tape, sate sticks, LEGO/Playmobil, etc. Give them the task to visualize the R&I at stake, a particular application, use-context, scenario or moral-ethical dilemma. Emphasize that the creation task functions as a means to the exchange of and negotiation on viewpoints, and preferably values and assumptions as well, e.g., by letting one participant making notes of the group’s conversations. Let groups present their created object (plus rationale behind it) to one another, and extensively reflect on differences and commonalities. Done? Go to step 3.
   - The R&I is pretty intangible, little real applications exist yet.
     - Go for ‘imagination’: contact artists, designers/architects, photographers, filmmakers and others, and assign them to develop ambiguous, fictitious objects, exhibits or installations about the R&I at stake (e.g., using ‘co-creation’ as given above). Choose an interesting space/place to present the outcomes in public (e.g., so that ‘unusual suspects’ engage). Find a way to stimulate thinking and dialogue, either built-in or in addition to the created environment e.g., by means micro-dialogues moderated by facilitators. Done? Go to step 3.
     - Go for ‘action-reflection’: develop sketches about potential futures with the R&I at stake, in which one or two moral-ethical dilemma’s are laid out, and organize a debate around these. Preferably, sketches are played by improvisation actors, and make participants engage in a role-play themselves, so that people’s ideas can be tested (played) on stage right away and used for further reflection. Done? Go to step 3.

3. Make sure, at all times, that all playfulness process conditions are applied too:
   - ‘Focus’: demarcate the topic to reflect on, and when you aim to cover the various topics, let them come in logical, carefully built, explicit steps.
   - ‘Experimentation space’: arrange a friendly, calm, and large space, and friendly hosts. Be flexible and anticipate to unexpected, potentially interesting happenings, give thinking time, so that people can try/develop alternative solutions/pathways to answer your questions/to fulfill tasks given; stimulate opinion change.
   - Stimulating guidance:
     - Provide means such as topic cards and facilitators that ensure the ‘focus’ at stake in each task (without becoming too rigid).
     - Whenever needed, re-emphasize the ‘experimentation space’-based principles.
     - Encourage everybody to participate verbally and/or physically.
     - Continuously reward participants for their contributions, or let them reward one another.