Supplementary Material to a Paper published in the Journal Responsible Innovation:

IMAGINE RRI.

A Card-based Method for Reflecting on Responsibility in Life Science Research

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Paper Abstract: Responsible Research and Innovation (RRI) has become a new buzzword in science policy, pointing to a shift in the role of research in contemporary societies. While on a discursive level responsibility is easily welcomed, implementing RRI in research practice appears challenging. RRI as an agent for change must compete with other forces shaping the current research system and its institutions, such as innovation orientation, competition and indicator-driven evaluation cultures.

To address these challenges, we created a new format for engaging life science researchers in reflections on the meaning of responsibility in their own research practices. In this conceptual paper, we present and discuss a card-based method: IMAGINE RRI. The method's aim is twofold. First, it is meant to empower researchers to appropriate RRI through shared reflection while connecting it to their practices. Second, it aims to enable researchers to reflect on how the institutional context of their work and the embedded values fosters or hinders responsible research practices.

This supplementary material provides a brief description and materials for facilitating the card-based discussion method „IMAGINE RRI" with groups of researchers in the academic life sciences. Detailed information on the development, design, aims and facilitation of the method is provided in the full paper.

Table of Contents:

1. Brief Summary of Objectives and Course of the Discussion

The main objectives of our card facilitated discussion method are to engage groups of life scientists (6-8 researchers/group) in reflections on (1) their own role as researchers in relation to different understandings of their responsibilities to society, (2) particular moments when issues of responsibility emerge in their own research practices, and (3) structural contexts that may support or constrain their capacity to consider questions of responsibility in making research-related decisions. The discussion proceeds in three rounds of debate corresponding to these objectives. The overall duration of one discussion is about three hours:

- After an introductory round of the participants the facilitator briefly explains the basic logic and purpose of the game. (In case the facilitators intend to record the discussion for research purposes, the conditions of how the recorded data will be handled and used are explained, and agreement on these conditions is sought by an open discussion and an informed consent form.)

- Approx. 45 minutes are devoted to each round. A break of roughly 15 minutes is recommended after round two. Each round is supported by a specific deck of cards (*statement cards, practice cards, context cards*).

- Each participant is provided with a *discussion map* that visualizes the way the debate is structured and with three decks of cards. In each round participants are asked to read through and pick cards along rules specified by the facilitator.

- The cards allow the participants to choose issues that either strongly resonate with their own opinion and practice, or that they disagree with. The cards provide participants with a repertoire of narratives that they can choose from, relate to and creatively use in the course of the debate.

- In each round, also blank cards are available to the participants to express positions and concerns of their own, which are not (adequately) covered by the cards.

2. Statement Cards

Statement Card - A	Statement Card - B	Statement Card - C
Applications	**Only Science**	**Give back to Society**
A responsible researcher thinks about his/her research in relation to possible applications. Scientists have to be neutral in their search for the truth, but cannot be neutral as to the use of that truth once found. If you know more than other people, you have more responsibility, rather than less.	**A responsible researcher focuses on doing his/her research very well and doesn't care about much else.** Researchers should only follow their scientific curiosity. They are not responsible for the laws of nature, only to find out how they operate. It is not possible to anticipate how people will apply them later on.	**A responsible researcher has to respect the fact that s/he is a publicly funded figure.** Employed by the university or research funds, researchers need to be transparent on how the money is spent. It's give and take: you receive from society, and in return you give something back that benefits society.

Statement Card - D	Statement Card - E	Statement Card - F
Citizen	**Economic Value**	**Knowledge Base**
A responsible researcher is a citizen like everybody else. And – just like everybody else – researchers are responsible to society for what they are doing. Scientists, therefore, are responsible for their research, not only intellectually but also morally.	**A responsible researcher has a responsibility towards society to produce something useful.** In particular, researchers should try to do something that has economic value or that creates jobs: to transfer knowledge to industry, to create a start-up or patent so that it is accessible for users.	**A responsible researcher is basically what every proper researcher is anyway.** They all want to do something good for society. Researchers are responsible to enlarge the objective knowledge base of humanity to solve societal problems. Every research can benefit society in the long run.

Statement Card - G

Public Intellectual

A responsible researcher should be a public intellectual and engage in public debates around his/her research topics. Research shapes our societies and scientists have the responsibility to provide guidance in developing a worldview that fits our techno-scientific societies.

Statement Card - H

Global Challenges

A responsible researcher is motivated by the great challenges of humanity: climate change, food security, infectious diseases, etc. We will need all intellectual resources to overcome these global problems. They should be the driving force of research and guide the choice of research questions.

Statement Card - I

System

A responsible researcher is just one element of the whole research system. Individual researchers cannot do much. The whole system – policies, funding mechanisms, universities, industry – should be organised to care for our future. We basically just do what the system expects us to.

Statement Card - J

Interaction

A responsible researcher interacts with people outside academia – be it big industry, smaller companies, governmental actors, patient groups or other citizens. This exchange is necessary to find out about societal problems and to contribute to solutions for them.

Statement Card - K

Diversity

A responsible researcher should consider gender issues, and diversity in general. It is important to include a diversity of perspectives in the research process. You may not notice right away, but research quality benefits from diversity. This research will be better equipped to serve society.

Statement Card - L

Diligence

A responsible researcher conducts his/her research very diligently. This is the only real responsibility of researchers: to follow the rules of scientific work and keep good records of the research process. This ensures objective results that can be repeated and verified by other researchers.
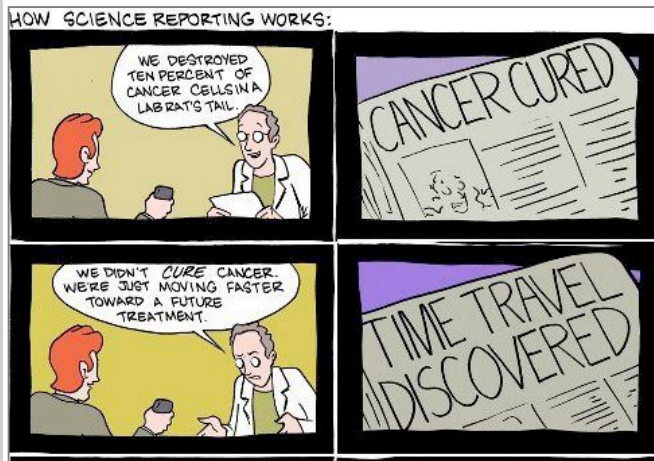
Statement Card - M

A responsible researcher...

3. Practice Cards

Practice Card - A	Practice Card - B	Practice Card - C
Science Communication	**Ethics Regulations**	**Handling of Data**

Practice Card - A

Science Communication

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Science communication is not always easy.

Do researchers need to communicate their research in a comprehensive way? And, how can they handle the risk of communication?

Practice Card - B

Ethics Regulations

"Do everything ethically ... within reason, of course."

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Ethics-parts in project proposals and ethics committees are often seen as necessary evil that is part of the annoying administrative work.

How could ethical reflection and responsibility become an inherent part of research designs instead of simple add-ons?
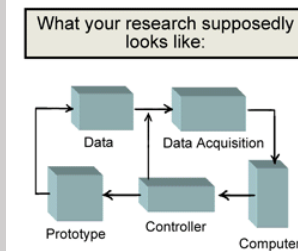
Practice Card - C

Handling of Data
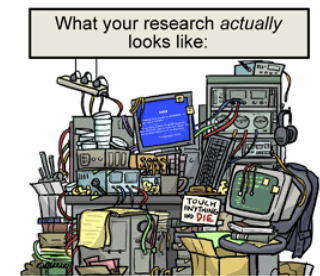

„Piled Higher and Deeper" by Jorge Cham, www.phdcomics.com

In the rush of everyday work, research is often messier than the cleaned-up published version.

Is it legitimate to leave out the messier parts of a research process when you publish? And if yes, up to what degree?

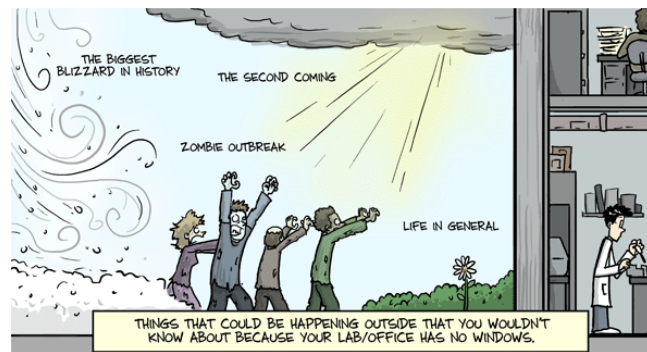| Practice Card - D	Practice Card - E	Practice Card - F
Methods & Model Organisms	**Choosing a Research Topic**	**Creative Funding**

Practice Card - D — Methods & Model Organisms
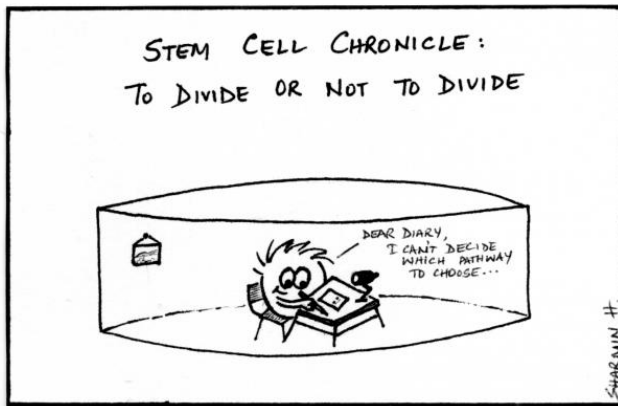
The choice of research methods and model organisms is subject to critical scrutiny and moral debate (e.g. animal experiments, stem cells).

How far should moral considerations interfere with research interests? And, who should be allowed to decide what an ethically acceptable research method or model organism is?

Practice Card - E — Choosing a Research Topic

Research policies today call for more consideration of the grand challenges of our time (e.g. health, aging, environment, …) when research topics and questions are chosen.
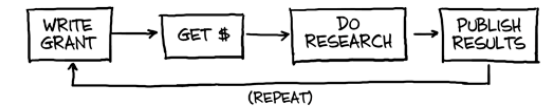
How far do researchers have a responsibility to consider these issues in choosing the lines of research and the research questions? Or does this distract research from its internal development?

Practice Card - F — Creative Funding

To ensure continuous and innovative research, many researchers say that they need to handle funds creatively and cross-finance curiosity-driven research through other funds.

How far is such a creative handling of funds legitimate? Should there be limits to the flexibility in how to spend funds?

Practice Card - G

Secrecy in Publications
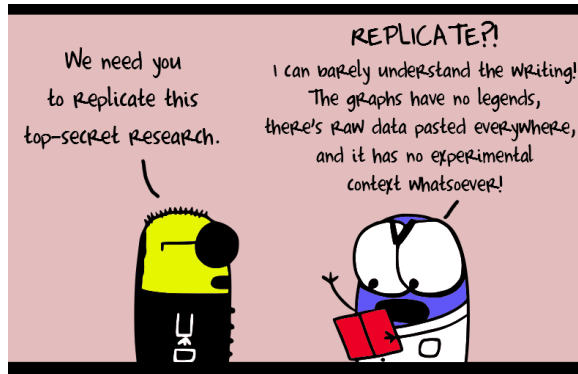
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The purpose of publishing research results is to allow others to replicate and verify results, therewith making knowledge commonly available to others.

How far do researchers have the responsibility to include all necessary information in a paper to allow replication? Is it justified to leave some of this information out to secure a competitive edge?

Practice Card - H

Authorship Negotiations

*used with permission, BP Coppola*
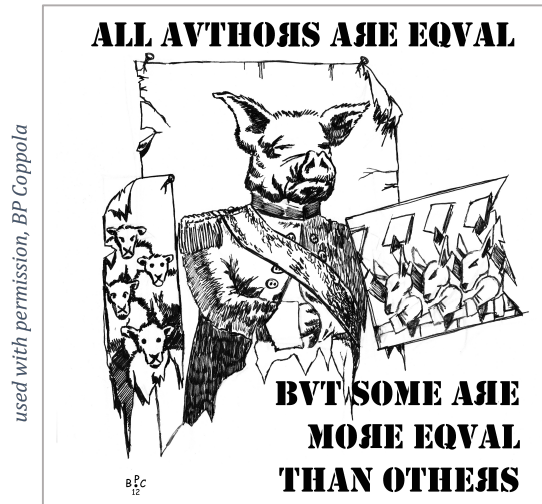
Publications are a crucial for continuing an academic career. Being first or last author is most valuable and struggles over authorship are frequent.

How can authorship issues be dealt with in a responsible way? When should someone become an author? Who should be responsible for these decisions?

Practice Card - I

Teamwork & Supervision
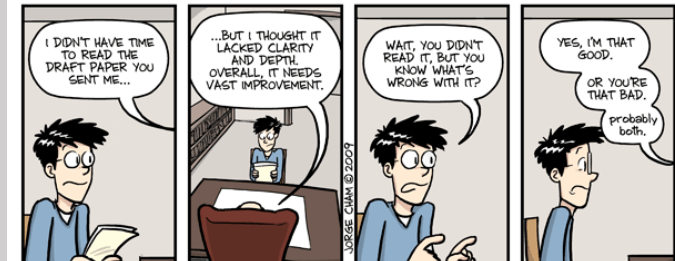
„Piled Higher and Deeper" by Jorge Cham, www.phdcomics.com

Researchers often emphasise that the quality and efficiency of research depends on teamwork in the lab, feedback and supervision.

Does everybody have the responsibility to support others and supervise? Can too close collaboration also become problematic? When is it ok to not spend time on supporting others?

Practice Card - J	Practice Card - K	Practice Card - L
Gender	**Taboos**	**Expectation & Work Reality**

Gender

"That's an excellent suggestion, Miss Triggs. Perhaps one of the men here would like to make it."

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The hiring regulations of Austrian universities include a policy to prefer women over equally qualified men. Still however, only 1/3 of tenure-track positions are held by women.

How are gender issues visible in everyday research? Who has the responsibility to work against such disparity? Do all researchers hold responsibility? And if so, what would need to be done?

Taboos

"HONESTLY? I PREFERRED WHEN WE DIDN'T TALK ABOUT THE ELEPHANT"
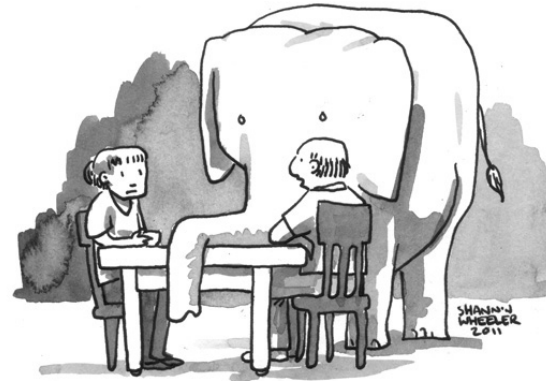
used with permission, Shannon Wheeler, www.tmcm.com

Moral aspects – like ethical, religious or societal concerns or problems in the lab – are often taboo (i.e. the elephant in the room). They might cause public debate, be detrimental to the labs' reputation or lead to losing some funding.

How far do we have the responsibility to raise such issues and critically discuss them within our work environment and in the public?

Expectation & Work Reality
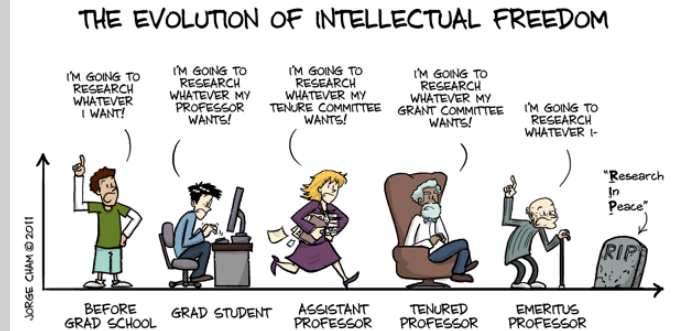
*„Piled Higher and Deeper" by Jorge Cham, www.phdcomics.com*

At the start of an academic career, researchers often have very idealistic imaginations. Yet, they quickly encounter the limits of funding, publication pressure, academic performance norms and many more.

How far should/can we go to protect our intellectual freedom and internal motivations?

| Practice Card - M	Practice Card - N	Practice Card - O
Making (too) Nice Images and Graphs	**Conflicts of Interest**	**Promises & Uncertainties**
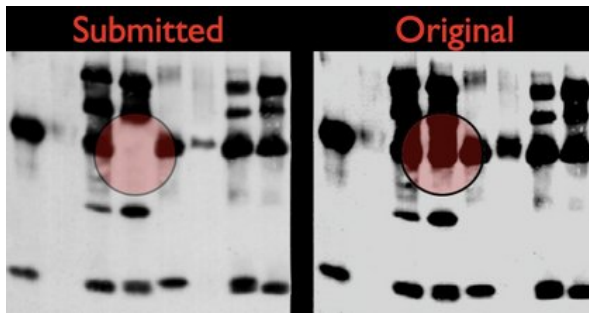
Presenting complex data is always a challenge, especially when parts of it are inconclusive. Showing a "convincing" graph or picture, however, can help to support the claims made.

Is it legitimate to clean data during an analysis to arrive at meaningful results? Where are the limits? Who is ultimately responsible for the sensible representation of data?
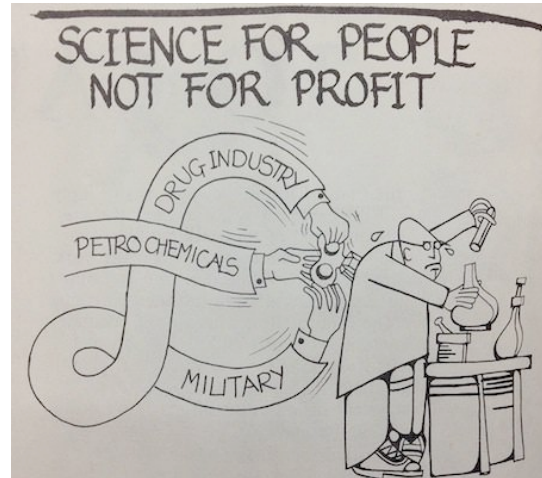
Research is often funded by third parties (e.g. industry, governments) that may have an interest in guiding research in a certain direction.

How can we protect research from such external interventions? How far is it acceptable to let research be guided by what societal actors deem relevant?

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To get research funding, you have to write grant proposals that make attractive promises into the future. There are many uncertainties as to whether research will lead into the expected direction or not.

How far do researchers have the responsibility to not overpromise what can be achieved? Should projects and researchers be evaluated against what they promised?

Practice Card - P

4. Context Cards

Context Card - A

Competition & Secrecy

„In academia, I sometimes saw that one researcher might have a solution to another's problem but deliberately would not mention it. That upsets me incredibly because no one works for the collective endeavour, but everybody works for him- or herself. Because everybody seems to fear that someone else will publish their results five seconds before they do."

Context Card - B

Metrics & Quantification

"The 'currency' with which we are paid is completely weird: it's not about whether it was scientifically nice, whether it was something important in your field. Publications are the only things that count! We do so many other things – like education and supervision – but that's not considered at all. And, honestly speaking, it's not creating personal satisfaction to have a paper."

Context Card - C

Projects & Careers

"The higher you rise in the career, the more the pressure rises. There are interesting projects, but you know it will be hard to find funding. If the reviewers say: This is interesting, but it is not en vogue, it will also be hard to publish that. So, you really start planning early on – what will I be able to publish, which experiments do I need, etc."

Context Card - D

Time Pressure

"Everything must be productive in a sense. And I think that can have negative consequences for research. Because maybe the quality is compromised when people have the feeling they must publish, publish quickly; I think that a lot of bad things happen then."

Context Card - E

Institutional Priorities

"The universities and research institutions I know have never really cared for anything else but scientific output. For them it is important that you contribute to the international reputation and that you deliver output; basically, publications and theses, master and PhD. If you do something beyond, that is not really rewarded."

Context Card - F

Dependence vs. Independence

"You depend a lot on the guidance of lab leaders or supervisors. In an early scientific career, you cannot speak of independence. In fact, we have a lot of it in daily work, but we cannot really decide substantial things like the overall direction of our research. That depends on the lab and the projects that are carried out there."

Context Card - G

Skills & Education

"We are well educated to carry out research in a good scientific manner. But we do not learn how to think about ethical stuff or how our research relates to overall societal questions. I really couldn't say how my research will relate to some kind of application. This is not part of what we get skilled for."

Context Card - H

Planning vs. Unpredictability

"We are really doing basic research. Of course, it would be good to think about research in a long-term way… but there are moments in research that change its direction completely. So, it is very difficult to think about long-term implications: this is just not how research works, it is too unpredictable!"

Context Card - I

Temporary Contracts

"You really get used to thinking in a project frame: what can I do to achieve something within a time frame of three or four years. You need this to be able to continue your career. It would be nice to think more about planning the scientific stuff, but the way it is right now, we're mostly planning our own future."

Context Card - J

Funding & Contracts

"Funding from industrial partners often includes specific demands on our research. I cannot decide for myself, what techniques I use, because my industry partner uses a certain model system or technology that we have agreed to work on. So, there is not so much flexibility."

Context Card - K

Too Little Reflection

"I rarely get the opportunity to reflect on the relation of research to society. If I do, it is with my family or friends, they discuss my research critically with me. Or when I am invited to speak about my research in public, then I am forced to think in other directions and think about what good – or harm – my research will do for society."

Context Card - L

Mobility & Societal

"Responsibility towards society sure sounds fine, but I wonder, which society we talk about. As researchers, we are mobile and travel a lot: we may be educated in one place, but then work somewhere else and our research may be relevant for yet another place. I wonder, is society just the place we happen to live in? Or 'humanity' in a broader sense?"

Context Card - M	Context Card - N
Work-Life Balance	
"If you want to stay in academia, you work more than average people and you need to be deeply involved in what you do. The lab is your home in a way. Of course, I want to engage with society or something like that, and be responsible. But there's simply no time left – that is, if you also want to keep some private life."	

5. Discussion Map

DISCUSSION MAP

Statement Card AGREE		Practice Card	Practice Card		Context Card

Statement Card AGREE
put down card

Statement Card DISAGREE
put down card

Practice Card
put down card

Practice Card
put down card

Context Card
put down card

Context Card
put down card
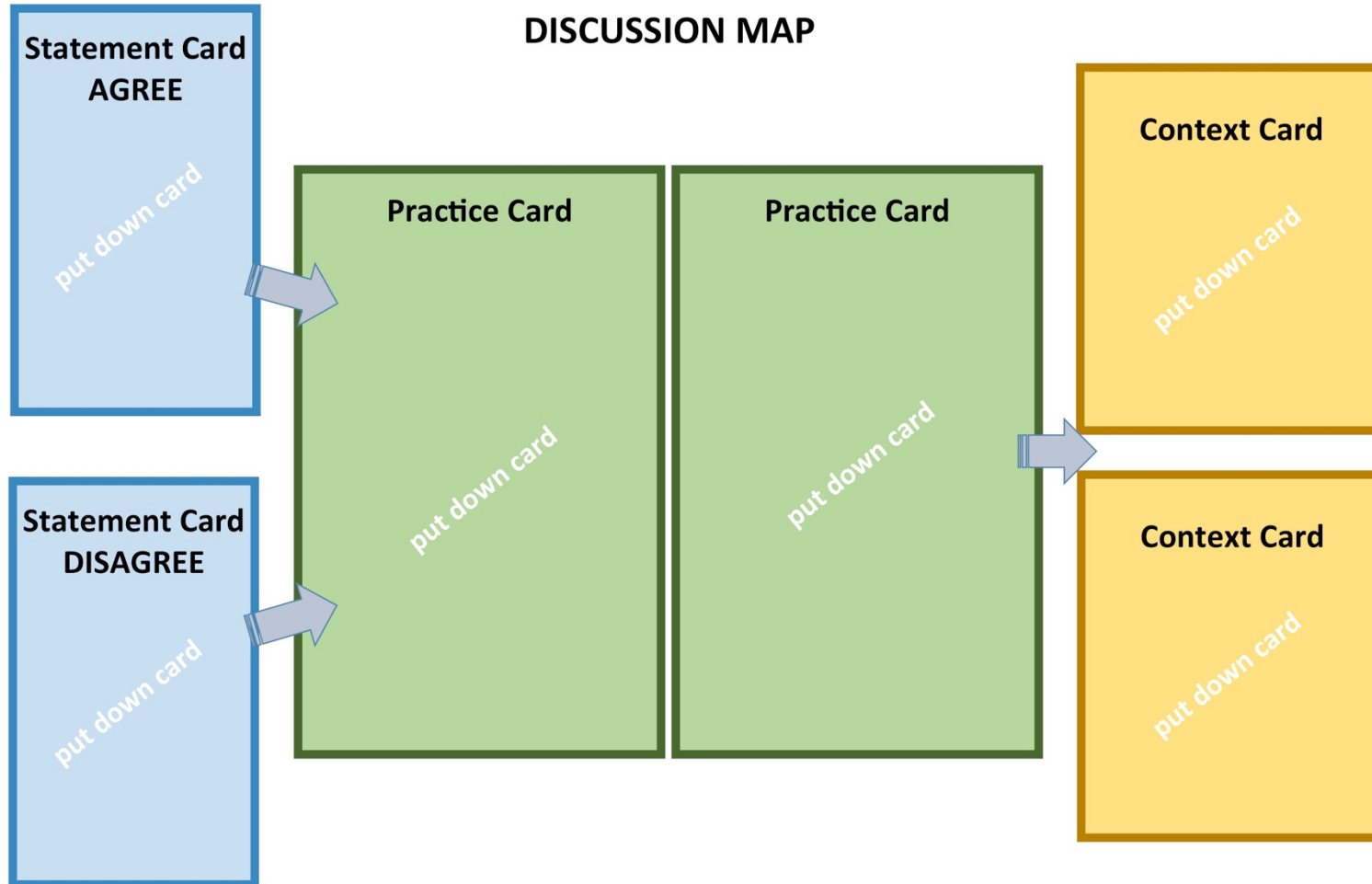
6. List of References

a. Statement Cards

The statement cards depict different opinions about the relationship between science and society. In developing the cards, the choice of statements was informed by studies on different imaginations of societal responsibility between science and society as well as on previous research of the research team. Some of the statements build on original quotes, but were rephrased for the cards.

Statement Card A: Applications
Original Quote: "A scientist has to be neutral in his search for the truth, but he cannot be neutral as to the use of that truth when found. If you know more than other people, you have more responsibility, rather than less." — Baron C.P. Snow Source: Attributed as a quote, without citation, in J. Robert Moskin, Morality in America (1966) Link: https://todayinsci.com/QuotationsCategories/R_Cat/Responsibility-Quotations.htm (07.03.2017) Notes: quote chosen to represent an ethics of knowledge possession as conditioning for more responsibility

Statement Card B: Only Science
Original Quote: "The scientist is not responsible for the laws of nature. It is his job to find out how these laws operate. It is the scientist's job to find the ways in which these laws can serve the human will. However, it is not the scientist's job to determine whether a hydrogen bomb should be constructed, whether it should be used, or how it should be used. This responsibility rests with the American people and with their chosen representatives." – Edward Teller Link: http://todayinsci.com/QuotationsCategories/R_Cat/Responsibility-Quotations.htm (07.03.2017) Notes: Quote chosen to represent "reflexivity rationality" (Glerup/Horst 2014)

Statement Card C: Give back to Society
Quote: fictional Notes: Quote designed to represent "reciprocity ethics" or "ethics of the neighbourhood" (Owen et al. 2013)

Statement Card D: Citizen
Original Quote: "Scientists, therefore, are responsible for their research, not only intellectually but also morally. This responsibility has become an important issue in many of today's sciences, but especially so in physics, in which the results of quantum mechanics and relativity theory have opened up two very different paths for physicists to pursue. They may lead us - to put it in extreme terms - to the Buddha or to the Bomb, and it is up to each of us to decide which path to take." — Fritjof Capra Link: http://todayinsci.com/QuotationsCategories/R_Cat/Responsibility-Quotations.htm (07.03.2017) Notes: Quote designed to represent the public responsibilities of researchers as citizens

Statement Card E: Economic Value
Quote: fictional
Notes: Quote designed to represent societal responsibility in terms of economic use

Statement Card F: Knowledge Base
Quote: fictional
Notes: Quote designed to represent responsibility in terms of the "linear model of innovation" (such as described by Godin 2006)

Statement Card G: Public Intellectual
Quote: fictional
Notes: Quote designed to represent societal responsibility in terms of being a public intellectual (Cummings 2003)

Statement Card H: Global Challenges
Quote: fictional
Notes: Quote designed to represent societal responsibility in terms of solving/overcoming societal challenges (e.g. as promoted by the European Commission, Horizon 2020)

Statement Card I: System
Quote: fictional
Notes: Quote designed to represent a rationality of institutionalised responsibility (cf. ResAGorA, FP7), akin to some understandings of a care ethics (Owen et al. 2013)

Statement Card J: Interaction
Quote: fictional
Notes: Quote designed to represent "contribution rationality" and "integration rationality" (Glerup/Horst 2014); akin to complex, dynamic innovation models building on knowledge flows between different societal actor groups (Lundvall [1992] 2010, Gibbons et al. 1994, Leydesdorff/Etzkowitz 1998)

Statement Card K: Diversity
Quote: fictional
Notes: Quote designed to represent responsibility in "gendered innovations" (Schiebinger/Klinge 2013)

Statement Card L: Diligence
Quote: fictional
Notes: Quote designed to represent responsibility in terms of a "demarcation rationality" (Glerup/Horst 2014)

b. Practice Cards

The practice cards depict moments in research in which responsibility is an issue in everyday research. The cards show a cartoon, a short description of the moment and questions to open up a debate on options to act in these moments.

Practice Card A: The Figure shows two thirds of a cartoon by Zach Weinersmith, it is used with permission for the publication of this method; link: http://www.smbc-comics.com/?id=1623 (06.03.2017)

Practice Card B: Cartoon licence purchased from Cartoonstock.com; link: https://www.cartoonstock.com/directory/c/corporate_responsibility.asp (06.03.2017)

Practice Cards C, E, F, I, L: Cartoons by "Piled Higher and Deeper" by Jorge Cham; link:

www.phdcomics.com (09.12.2016)

Practice Card D: Cartoon by Sharmin Haideri, used with permission; link: http://www.eurostemcell.org/image/stem-cell-cartoon (16.12.2016)

Practice Card G: Cartoon by Nik Papangeorgiou, used with permission; link: theupturnedmicroscope.com (09.12.2017)

Practice Card H: Cartoon by Brian Coppola, used with permission; link: https://sites.lsa.umich.edu/bcoppola/2017/01/28/you-just-never-know/ (23.11.2016)

Practice Card J: Cartoon license purchased from Punch Ltd; link: www.punch.co.uk (14.12.2016)

Practice Card K: Cartoon license purchased from Shannon Wheeler; link: http://www.tmcm.com/tmcm/ (15.12.2016)

Practice Card M: Permission to use cartoon requested from Jeff R. Young; link: http://pharmagossip.blogspot.co.at/2008/05/photoshop-and-science-oil-and-water.html (09.12.2016); and Cory Doctorow; link: http://craphound.com/images/tamperinginscience-1.tiff.jpg (09.12.2016); since we did not get any response we take this as a temporary permission until further notice by the originator.

Practice Card N: Permission to use cartoon requested from Socialist Party of Great Britain blog; since we did not get any response we take this as a temporary permission until further notice by the originator.

Practice Card O: Cartoon licence purchased from Cartoonstock.com (12.12.2016)

c. Context Cards

The context cards capture conditions in everyday research environments that researchers may experience as limiting or broadening spaces of reflection. The quotes on the cards are mostly fictional (Cards E, G, H, J, K, L, M), but some are rephrased versions of original quotes from interviews with life scientists in previous research projects of the developers of the method.[1]

Context Card A: Competition & Secrecy

Original Quote: So, [in academia], when people discuss things, one person might have a solution to another's problem but deliberately would not mention it. That upset me incredibly because no one works for the collective endeavour, but everybody [works] for himself … Because everybody seems to fear that someone else will publish their results five seconds before they do. (researcher; project X)

Context Card B: Metrics & Quantification

Original Quote: The currency with which we are paid is completely weird… it's not about whether it was scientifically nice, whether it was something important in your field. It only counts how many publications you have, right? How many… points you have… We do so many other things too and… basically that's not considered at all. And honestly speaking it's not creating… personal satisfaction to have a paper. ... So, I can't really find my way around that… (PhD researcher; project Y)

Context Card C: Projects & Careers

Original Quote: The higher you rise on the career ladder, the more the pressure rises when you […] choose a project. There are interesting projects, but you know it will be hard to find funding for them. Because if the reviewers assessing it say: This is interesting, but it is just not en vogue at the moment. Then it will also be hard to publish that. So, you really start planning at the very beginning [of the project]—what will I be able to write in a paper, which experiments do I need, and so on. It sounds much more calculating than you would assume it to be when you start out naïvely into a research career. (Postdoctoral researcher; project Z)

Context Card D: Time Pressure

Original Quote: We are really doing real basic research. And that's not appreciated any more. Everything must… be productive in this sense. And I think that can have negative consequences for research… Because maybe the quality is compromised when… people have the feeling they must publish, publish quickly; I think that then a lot of bad things happen. (PhD researcher; project Y)

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[1] The project names have been removed in this version to allow a double-blind peer review process, but will be included as sources of the original quotes in the version published.

Context Card F: Dependence vs. Independence

Original Quote: …particularly in those areas in which there are rather short-term contracts and in which you depend on the advocacy of heads of department or things like that. Because in a young scientific career you cannot speak of independence. In fact, we have a lot of it, not in the way we work but we have it, right? (Postdoctoral researcher; project Z)

Context Card I: Temporary Contracts

Original Quote: In our situation, it is very difficult to plan something. If I could I would really like the feeling of having more than three or five years to work on certain projects… then we could be concerned more about planning the scientific stuff… but the way it is right now, we're mostly planning our own futures. (Postdoctoral researcher; project Y)

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