



Responsible Research and Innovation (RRI) Prompts and Practice Cards: a Tool to Support Responsible Practice

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ABSTRACT

Researchers often find it hard to know where, when and how to start when applying Responsible Innovation approaches to their own research projects and proposals. Based on experience supporting a range of researchers and projects, we have developed a small set of concept cards, the Responsible Research and Innovation (RRI) Prompts and Practice cards, which highlight 18 different aspects of RRI, each with key questions and prompts for action. Initial use with groups of researchers and PhD students has found them to be accessible and effective in prompting reflection and discussion, including raising previously unconsidered aspects of responsible innovation. Based on this feedback we are now developing a second release of the cards.

CCS CONCEPTS

• **Social and professional topics** → Professional topics; Computing profession; Codes of ethics; Professional topics; Computing and business; Socio-technical systems; • **Software and its engineering** → Software creation and management; Software development process management; Risk management.

KEYWORDS

Responsible Innovation, concept cards

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1 INTRODUCTION

We understand Responsible Innovation (RI) as an inclusive, iterative process that should be embedded throughout the lifespan of a

project, involving critical and contextual thinking about the broader implications of research or innovation outputs. A key aspect of RI is that it provides an opportunity to think about the future – to anticipate intended and unintended consequences of research and innovative products and processes – and to plan and act “in the present” [18] to minimize potential risks. The nature and speed of innovation makes it crucial to apply responsible innovation (RI) principles [10, 18] to the design and deployment of Autonomous Systems (AS) as a form of anticipatory governance, in order to foster sustainable, ethically acceptable, socially desirable [23] and trustworthy outcomes.

The work presented here is linked to two UKRI-funded research programs at a UK University, both of which have a strong commitment to RI. Our focus has been on supporting researchers (including researchers-in-training) working on technology-oriented projects (especially ICT, but also much more generally). Working in this context Portillo et al. [14] have identified several facilitators and barriers to RI practice, including conflicting priorities and time pressures, difficulties in identifying relevant tools and a real need to bridge the gap between RI theory and practice.

Having had positive experiences with other sets of cards (in particular the Moral-IT cards [22]), our initial vision was to respond to these challenges by creating a “high-level” and broadly applicable deck of RI cards that might be useful at any stage in a project, more immediately accessible in terms of time and content and more ‘lightweight’ than the Moral-IT cards and similar tools. Our aim was to develop a set of cards to provide an accessible and tangible entry point to the complex conceptual domain of RI, help to elicit reflection, identify stakeholders and potential strengths and risks of a project, discuss priorities for RI and plan accordingly. This paper describes the development of the first public version of the Responsible Research and Innovation (RRI) Prompts and Practice cards, presents our initial experiences of using the cards to support RI practice and training, and outlines current plans for the cards.

2 RELATED WORK

Many tools and frameworks have been developed to assist researchers and innovators in putting RI into practice. They include self-reflective approaches [16], often based on the topics from the EU RRI policy agenda: engagement, gender, ethics, science education, open access and governance. The EU Ethics Guidelines for Trustworthy Artificial Intelligence (AI) self-assessment checklist

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[9] comprises a broad set of questions specifically for developers and deployers of trustworthy and ethical AI.

In the UK the Engineering and Physical Sciences Research Council (EPSRC) – now part of UKRI – adapted the European vision of RRI to develop a framework for RI [18] known as the AREA framework (Anticipation, Reflection, Engagement and Act) [21]. This framework was further expanded within the ICT sector into the AREA-Plus framework, with “4Ps” to add focus on Purpose, Process, People and Product [10]. AREA and the 4Ps form a matrix, and for each cell in the matrix one or more questions are posed. However, applying and embedding this framework into practice is left open to researchers and innovators for interpretation. A particular difficulty is the question of in what order to work on the frames, as AREA is not a ‘process-model’ but rather a collection of interrelated concerns and approaches.

Cards activities have been designed and used in many contexts as reflective and methodological tools to support problem solving [7]. Within ICT they have been used with a human-centric approach to address human values in design, [6] to make online privacy more comprehensive [1, 4, 11], and to prompt researchers and innovators to reflect on ethical aspects of technology development [22]. Card-based tools have also been developed to engage scientists (life science researchers) on the meaning of responsibility and support their reflection on their practices [5]. Other tools focus on organizational and institutional self-assessment [17] and challenges of implementing RRI within institutions [15].

However, in our experience, current card-based tools for researchers require a significant amount of time to use (1-2 hours or more) and are based on their own specific scenarios [5], provide a specific lens through which to view a project [22], or fail to provide practical directions [16]. Consequently, there is a need for a high-level RI tool to support technology focused work that is easy to apply in a relatively short time, and that leads to actionable suggestions to complement existing tools.

3 DEVELOPING THE CARDS

In our development phase, we started by defining the intended use for the cards, and then stepped through the process of development, ending with printing and publication.

3.1 Requirements

Responding to the challenges identified above, the guiding principles for creating the deck were:

- There should be a limited number of cards, to be used in a relatively short activity (e.g. 20-60 minutes).
- Each card should be distinct and coherent, with a central concept or concern.
- Together the cards should cover a broad range of RI issues and concerns, including those which might be otherwise overlooked.
- The cards should provide an immediate “pay off” for using them, including clear and practical activities to respond to RI issues and concerns.

3.2 Development

We began by reviewing various definitions and decompositions of responsible research and innovation. These included: the TAS Hub’s [19] definition of a Trustworthy AS; Von Schomberg’s [24] normative principles; the EU’s six keys of RRI [3]; Wickson and Carew’s [25] rubric for RRI; and Jirotko et al.’s [10] AREA-Plus framework. Stakeholder involvement and co-design is a key element of RI and was therefore a foundational technique in our project. At the start of the project we established a multidisciplinary advisory group whose members have diverse backgrounds including ethics, RI, law, computer science, and social science, plus experience of projects relating to trustworthy AS. The initial feedback from this group was that we needed to identify and articulate a clear rationale for the choice of cards.

Working in a UKRI-funded project, we turned to the AREA-Plus framework [10] as our starting point, adopting the AREA-Plus axes and the matrix they form as the basis for the cards; the basic deck would therefore have (about) 16 cards, each aligned to one AREA component and one of the 4Ps. For each potential card we identified one (or in some cases two) key concept(s) and a short title for that concept. We assigned the relevant questions from the AREA-Plus framework to that card. We also chose to ensure that the EU’s six keys of RRI were clearly reflected in the cards.

We then iteratively revised the draft cards in line with the principles above, seeking to balance the coherence and distinctness of each card with a broad range of RI considerations, anchored in the axes of AREA and the 4Ps. Over time, the key concept selected for each card (manifested as the card’s title) was used to refine the list of questions for each card, e.g. re-assigning, rewording or adding further questions. These questions we refer to as “Prompts”, primarily for anticipation and reflection. The titles were in turn also checked and revised. The first full deck comprised 18 cards, with two cards for Anticipate-Product (Socially Desirable and Sustainable) and two cards for Act-People (Training and Science Education), because we were concerned that merging these might encourage people to neglect one of the aspects we had identified.

We wanted to give users of the cards an immediate and practical outcome or incentive for using them, rather than feeling like an activity done for its own sake or only for someone else’s benefit. We therefore added a short list of “example actions” or RI “practices” to each card. These were specific to each concept card and aligned with the findings of Portillo et al. [14] and our experiences in supporting RI. The intention here was non-normative but rather to suggest or inspire, not to dictate or be exhaustive. We also defined a small set of additional cards (titled “Can you agree?”) that could be used to help structure a simple prioritization activity.

A complete draft of the deck was reviewed (online) during a project meeting, which suggested few clarifications to wording. This was also further proof-read, ready for printing. The visual design of the cards was deliberately simple, (see Figure 1). The color scheme was based on that used by ORBIT [12] for the AREA-Plus framework. Creating the card images was automated using the Cardographer web platform [2]. Initial sets of the cards (version 2.1) (see Figure 2) were professionally printed and made available online with a Creative Commons license. A small number of exemplary activities using the cards were also made available online [20].

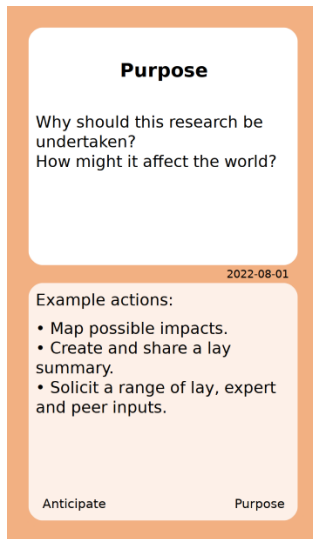


Figure 1: Example RRI Prompts and Practice card front (“Purpose”). Note the RI activity (Anticipate, Reflect, Engage or Act) and the relevant “P” (Purpose, Process, People or Product) the concept card refers to at the bottom.



Figure 2: Full set of RRI Prompts and Practice cards (version 2.1)

4 INITIAL EXPERIENCE

At the time of writing, we have run twelve sessions (face-to-face or online) using this version (2.1) of the cards as part of RI related activities supporting projects within our research programs and other related projects. Most sessions were facilitated by one or two researchers familiar with the cards and included multidisciplinary groups (average of 14 people), whose research mainly focused on trustworthy autonomous systems or uses of personal data. Typical activities included discussing the relevance of individual cards or

prioritizing from among all the cards or each suit to prompt further discussion.

The cards have been consistently well received, with many people wishing to obtain physical copies. The activities using the cards have provoked reflection, discussion, critical thinking and helped to identify priorities for RI within several research projects. For instance, first year CS postgraduate students used the cards in an activity to help prepare an RI action plan required as part of their PhD project proposal. They found the cards to be very useful, helping many of them to think about aspects within their project that they had not considered before (e.g., to anticipate possible risks of process and outcomes and plan accordingly, and to have RI reflective sessions throughout their project).

One of the biggest virtues, but also a great challenge of this deck of cards, is the small number: just 18 concept cards and 5 “Can you Agree” cards. That has made it possible to engage with the entire deck in a relatively short time (e.g., 20-30 minutes) and provides immediate positive feedback. Card users found the deck easy to use and handle, versatile, and found most of the concepts clear and relevant to RI. The cards also specifically encourage anticipatory and reflective thinking on sustainability (e.g., sustainable products, outcomes and processes) often overlooked in the RI literature within the technology sector.

Feedback was provided during the activities and facilitators also shared their observations from the cards’ sessions. Feedback on the cards’ content and design was also provided by team members and colleagues with expertise in developing and using ideation cards in research. Feedback was also received from the advisory group. Some people suggested having 16 concept cards instead of 18 to better match the AREA/4Ps grid, and a range of visual enhancements were suggested, including showing the 4Ps more clearly and using larger titles (especially for online use). Many suggestions were made for additional prompts and actions. One card title (“Hard to reach”) was felt to be inappropriate, and some cards were more often felt to be self-evident (“Research Conduct”, “Training”, “Open Science”), irrelevant (“Science Education”) or too narrow (“Shaping Policy”). Some voiced the need to add some explanatory cards and a “Blank” card for any extra elements that may need consideration.

We have collated and synthesized this feedback and are in the process of creating a new version of the card deck, which will be released under a Creative Commons CC-BY license. After discussion with the advisory group we have also switched to use the term “Responsible Innovation” rather than RRI, as it is less tied to a specific policy perspective and better reflects the deck’s grounding in the AREA Framework [10].

5 CONCLUSIONS

The RRI Prompt and Practice cards provide a high level and – from our experience to date – effective tool to help put RI into practice as part of a research project or proposal. This compact deck has encouraged consideration of key elements of RI that are often overlooked by researchers and innovators, with their busy schedules and competing project priorities. We found that the cards can be used at any time throughout the lifespan of a project, from proposal development to planning follow-up activities and future project ideas. The use of these cards benefited from facilitation, and we

hope that adding some supporting cards (e.g., what is RI?, instructions and activities) will better support independent use of the cards.

Embedding RI into practice requires different approaches depending on the project's stage and needs. Compared to other tools the distinctive qualities of these RRI Prompts and Practice cards are: 1) there are only 18 concept cards, allowing the whole deck to be considered in a relatively short time; 2) each concept card includes elements to reflect on as well as possible actions or solutions; 3) they are applicable to a range of projects and stages within a project. However, simply using these cards – or any other RI related tool or framework – does not mean that RI can be considered “done”, but they can provide an effective mechanism to facilitate discussion, planning and critical thinking on RI.

There are also other challenges for the integration of RI that have been discussed elsewhere, from multidisciplinary projects [5] to institutional and research funding levels [13]. We believe that supporting researchers and innovators' views and learning from their experiences from applying RI is key to addressing their needs. That support should be multifactorial: at project, program, and institutional levels, and sustained beyond the span of a project to support the process of institutionalizing RI as part of good practice. Once the new version of the deck is finalized, we will make it freely and publicly available to the TAS community and beyond.

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Data access statement: version 2.1 of the RRI Prompts and Practice cards can be downloaded from [8]. Example exercises using the cards can be found at [20]. Or search for “RI Prompts and Practice cards version 3”.

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