GRAND CHALLENGE 2020
REPORT

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Royal College of Art
Postgraduate Art & Design

CONTENTS LIST

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EXECUTIVE SUMMARY

Our world has shifted radically on its axis, creating new challenges and issues which are becoming much more pressing and immediate. It is clear that traditional design approaches and a problem-solution focus are limited and unable to tackle the risks currently facing human and ecosystem safety and wellbeing. The fundamental question facing design is how do we approach these large-scale projects from a design perspective? We need a new model for design.

Against this background, the Design for Safety Grand Challenge sponsored by Logitech was implemented between November 2020 and February 2021, bringing together our ambitions for large-scale design and research to address this urgent design need. Established as a collaborative project, the Design for Safety Grand Challenge was not intended to find immediate answers to global challenges, but to focus a conversation about how we approach and design safer future societies.

This report provides an overview and analysis of key findings from the project. Over 400 students participated in the project from a wide range of disciplines and cultures — spanning technology, science, design products, services, materials, innovation, and craftsmanship, involving a multiplicity of stakeholders ranging large technological companies, world-renowned scientific institutions, academic experts, think-tanks, civil society, and public sector organisations. The students – many of whom had never met each other before – collaborated remotely online in teams of 4-5 people from around 50 countries. The effort of this group amounted to some 64,000 hours of creative design thinking aimed at making the future of the world a safer place. They were supported by a group of over 30 academic staff and invited guests and experts.

We believe that building long-term strategic partnerships is key to tackling large-scale problems. By bringing universities, businesses, and organisations across the globe together we aim to make a real difference to people's lives. In this context, building multi-stakeholder partnerships for society-specific issues can create significant opportunities to improve people's lives, boost impactful and conscious innovation, and develop skills. The Grand Challenge works with key leadership in strategic areas of intervention to ensure that design becomes a robust and transformative tool for society.

The pre-phase consisted of several talks and panel sessions around our key themes. A week-long intensive design phase followed, resulting in a shortlisted number of groups sponsored to develop their design for a final competition where three winners would be selected. Our process involved drawing in experts and researchers to map the issues at hand from a range of predefined themes. The design teams then approached this grounded process proactively and prospectively to design novel proposals.

All the groups designed contributions towards making the world a safer place while the winning designs engage with complex wicked problems from transport security to lifelong mental health support.

The report is designed to be read as a visual diagrammatic narrative that communicates the data, quantitative and qualitative findings, and the thinking and relationships between ideas that emerged during our research. Our methodological approach was emergent allowing new grounded ideas and relationships to emerge as we designed and researched. Diagrams are the main tool to represent and convey information and insights. They are accompanied by a detailed caption explanation to facilitate their comprehension. The format allows this report to be used as an information resource and touchpoint for future conversations and research around designing for a safer and more resilient future society.

The report is structured in four chapters:

Chapter 1 provides an overview of the Grand Challenge 2021 including the brief, student locations, the design of the digital hub, the assessment process, and the research method implemented to collect and analyse the data.

Chapter 2 provides a discussion section where we present evidence on the impact of the implementation of the digital hub, participant observations including student's performance, double diamond performance, as well as, group dynamics and decision making trials, action research including experts key insights, MRes preliminary and formative insights, and the finalists and winners design process insights. This chapter concludes with a set of conclusions pointing towards a resilient design framework.

Chapter 3 presents a summary of the key strategies and technologies emerging from the GC 2021. It concludes with a set of conclusions regarding the GC and a set of next steps pointing towards the creation of a new research lab at the intersection of data, society, and the environment. This new development is framed around three core missions and a set of key actions prescribed for each of the outlined missions.

Chapter 4 provides an updated version of the design framework.

The work presented in this report favours a visual approach to represent the current tendency in design to highlight this aspect as distinctive from other fields. Diagrams are the main tool to represent and convey information and insights. They are accompanied by a detailed caption explanation to facilitate its comprehension.

1.1. Objectives of the GC

The GC is a world-leading study that is pioneering the use of design in large-scale problems in a structured, systematic, and ethically robust manner to enable design to address problems at a scale. The objectives of the GC 2021 were to build methods, systems, and evidence on the risks associated with events-related safety issues of the COVID-19 virus; the global characteristics of these events and surrounding activities; and, the extent to which risk-mitigation strategies can be designed and implemented.

1.2. GC Programme design, design framework, and data analysis

Programme Design

The Grand Challenge was led by Professor Paul Anderson, Dean of the School of Design, along with Professor Ashley Hall, Dr. Laura Ferrarello, Clive Grinyer, Dr. John Stevens, Dr. Chang Hee Lee, and researchers Fernando Galdon and Rute Fiadeiro. The programme design drew upon an existing Design for Safety Framework for designing events that was developed by the leading members of the Grand Challenge Research Group (GCRG). Research associates collected a significant amount of mixed-data - quantitative, qualitative, and visual - before, during, and after the implementation of the GC, including: experts reviews; detailed monitoring of participants; video capture and analysis of creative behaviours; and surveys. This report focuses on findings from the data collected towards an emerging framework to deal with large-scale issues.

The analyses associated with these studies emerged in the process and will be published in line with the best research practices. Risk factors for the success of the project that were reflected upon include cultural differences, different backgrounds, engagement, and participation. The Grand Challenge Research Group (GCRG) looked at the implementation of prevention and control strategies for cohort cohesion including social forums in the platform, and periodic posts in social media to reflect community engagement.

Design Framework

The programme was structured in four parts; (1) the Grand Challenge Research Group (GCRG) identified a meta-theme; (2) the meta-themes were structured in seven sub-topics; (3) a range of symposiums were organised around the sub-topics and three experts were invited to provide key insights and potential areas of intervention; (4) MRes students conducted preliminary research in each sub-topic to further inform designers; (5) circa 400 students were distributed in teams of 4/5. Each team was composed of different design specialities; (6) students developed the intervention during 4 weeks using the double diamond as a guide. They were supported by a team of tutors; (7). Each tutorial team assessed the work weekly, and selected a final project in week 4 to represent the topic in the final; (8) a panel of high-level experts selected three final winners.

Data Analysis

Drawing on grounded theory, the data collected was iterated throughout the analysis to fully capture the topics discussed in the collaborative project. In this way, the final themes emerging from the coding framework cover the topic discussed by participants and form the basis of this report. The outputs were categorised, for example by topic, to provide contextual understanding of the main issues at hand; Design for Safety, and operationalizing large scale projects. A quality assurance process was undertaken to ensure consistency across analysis and categorisation. Whilst the data already provides a rich picture of these events, it is important to note that there are some limitations.

1.4. Limitations and interpretation

The complexity of the GC to generate any direct evidence due to the remote conditions was identified by the Grand Challenge Research Group (GCRG) at the outset of the module. This process reflected: (a) the event being sufficient in scale, scope, and impact, and (b) the remote condition of the project. Nonetheless, it was judged that a mixed-method would still generate evidence on large scale projects operationalization, creative processes, and Design for Safety strategies with the potential to improve society and inform policy by mitigating risks.

Findings from the GC should be interpreted in relation to the wider context in which they operated. The evidence that was collected has, however, contributed to our understanding of large scale project operationalization, group dynamics, and the design and management of risk factors. To build further evidence around them, it will be important to: study additional areas with significantly large-scale impact; improve the pre and post-event data collection via structured forms and surveys; and a research approach to link emerging data in groups dynamics and decision making more systematically (an approach trialled this year). Additional capacity and changes to the data collection infrastructure will be needed to provide this evidence.

Next year we aim to build from this year legacy to expand our findings. These additional data points will provide the opportunity to generate further evidence around the implementation and operational considerations of the findings generated this year. Next year's project also aims to address these limitations and provide further data that can be collated cumulatively across different events to provide additional statistical power to the evidence already generated.

1.5. Key observations

Observation 1: Participants broadly agreed that Design for Safety should not just be considered as a threat to be managed, instead a prospective approach must be implemented and embrace this perspective as an opportunity to drive productivity and innovation across the economy, fuel research, revolutionise the public sector and create a fairer and more prosperous society for all. Experts also highlighted the potential of design for safety to support wider government priorities, such as those set out in the Integrated Review we are presenting, as well as our ambitions to build a better society. This perspective is supported and complemented by numerous case studies emerging from this project.

Observation 2: Projects stressed the need to ensure that safe design is inclusive and works for everyone, everywhere. This included drawing attention to specific challenges around incorrect or inappropriate uses of data (often expressed as data bias), digital inclusion and connectivity, as well as the need for all citizens to have the appropriate skills to operate and thrive in a data-driven economy.

Observation 3: With this in mind, projects highlighted the importance of continued stakeholder engagement. This will help bring in diverse perspectives from across industry, academia, civil society, and the wider public to support implementation and inform future policy development. Creating a trustworthy society aiming at maintaining safe interactions will ensure that the benefits of the digital and environmental revolutions are felt by all people, in all places. In this process, we recommend action across three missions.

Observation 4: The quality and quantity of outputs, as well as the commitment of participants in a process demanding them to work with people they did not know, come from different cultures, and have been trained in different fields and specialities highlight the ability and resilience of the GC to approach large-scale projects. The process implemented in the GC encouraged participants to bring in diverse perspectives from across fields, cultures, and specializations to support implementations and inform future technological and social developments. Creating a resilient design practice aimed at transforming the world will ensure that the benefits of technological revolutions are transformational for the many, and not the few.

Observation 5: The assessment work undertaken as part of our studies provided a much richer insight into the design process. Participants were in general motivated to follow the double diamond as a general framework. It was notable that communication and critical engagement combined with professionalism and ethics emerged as the dominant attributes for group performance. The impact of social distancing compliance was addressed with the creation of a central digital hub. The weekly visual assessment is linked with higher satisfaction. The combination of these strategies resulted in more effective crowd management. This perspective is supported by specific surveys conducted at the completion of the project.

Observation 6: It is challenging to generate robust, generalisable evidence associated with particular creative events. Measurements and observations were necessarily limited in scale and took place in a remote condition during a period of four weeks. However, they were sufficient in scale, scope, and study designs to generate a preliminary evidence based on the data collected. Therefore, categorical evidence should be treated with caution, yet the scope of circa 400 students and 80 groups provides a reliable test-bed to support claims. A long-term perspective would be beneficial to increase the robustness of the insights generated.

Observation 7: We encouraged all of our design teams to use the double diamond (DD) design method. This allowed a cross-design discipline creative journey and redirected methods from individual disciplinary perspectives into collaborative interdisciplinary designs. Our assessments methods were based week by week on stages of the DD process to provide diagrammatic assessment feedback. This allowed groups to tune their creative bandwidth and received supportive feedback and assessment.

CHAPTER I
Introduction

1. Grand Challenge 2020

GRAND CHALLENGE	DESIGN FOR SAFETY
388 POSTGRAD DESIGNERS	**77** GROUPS 5 DESIGNERS
50 COUNTRIES	**64,000** HOURS OF CREATIVITY
20 ACADEMICS	**11** PARTNERS

COLOUR CODE	ACTION RESEARCH	PARTICIPANT OBSERVATION	WEBSITE

(Spinney, 2017)
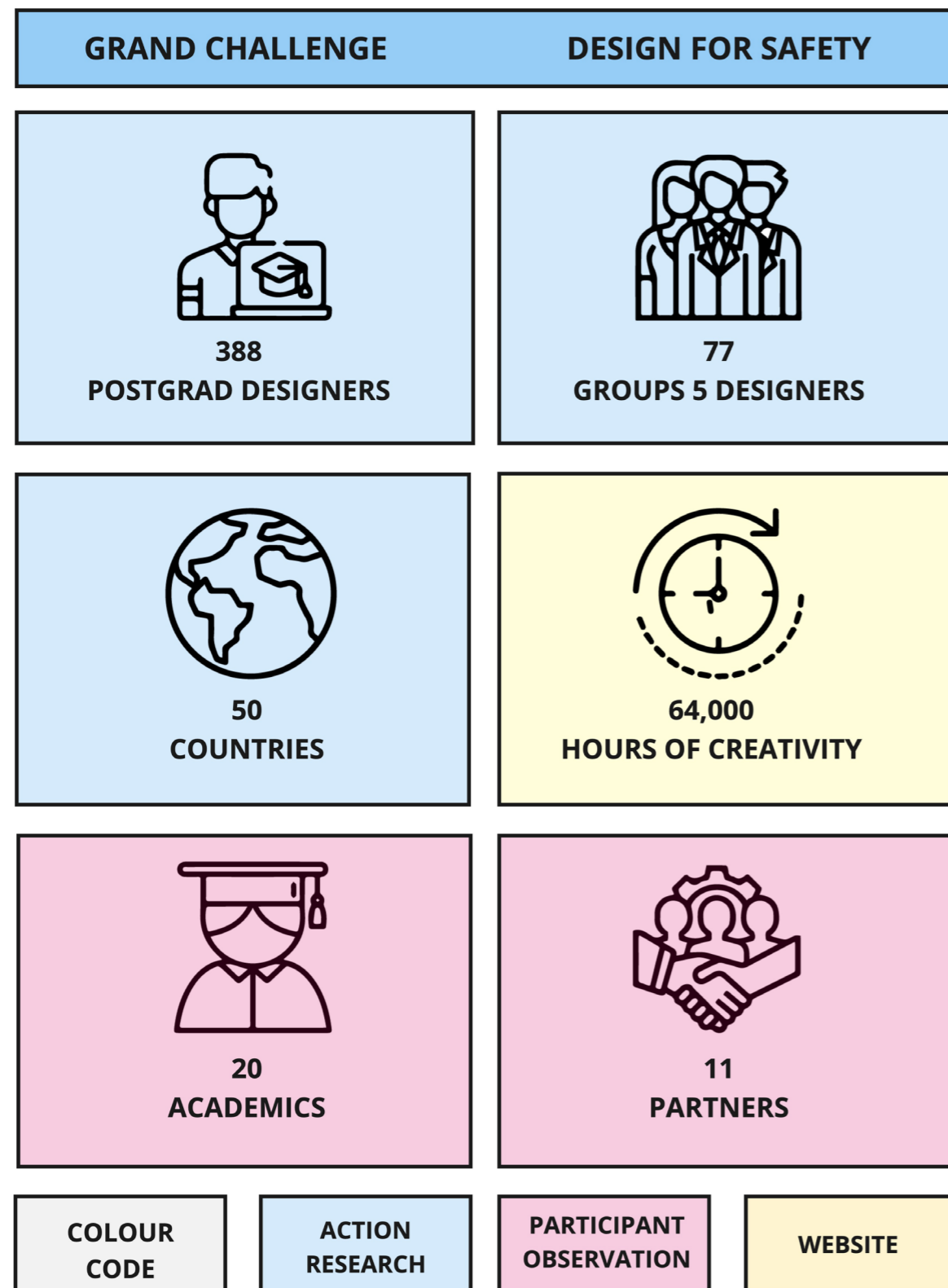
Figure 1. The Design for Safety Grand Challenge was implemented between November, 2020 and February, 2021, bringing together our ambitions for Safety within a single, coherent narrative. Established as a collaborative project, the Grand Challenge Design for Safety was not intended as the final answer, but as part of a conversation about how we approach and design safety.

2. Grand Challenge 2020 Brief

We need a **new model** for design
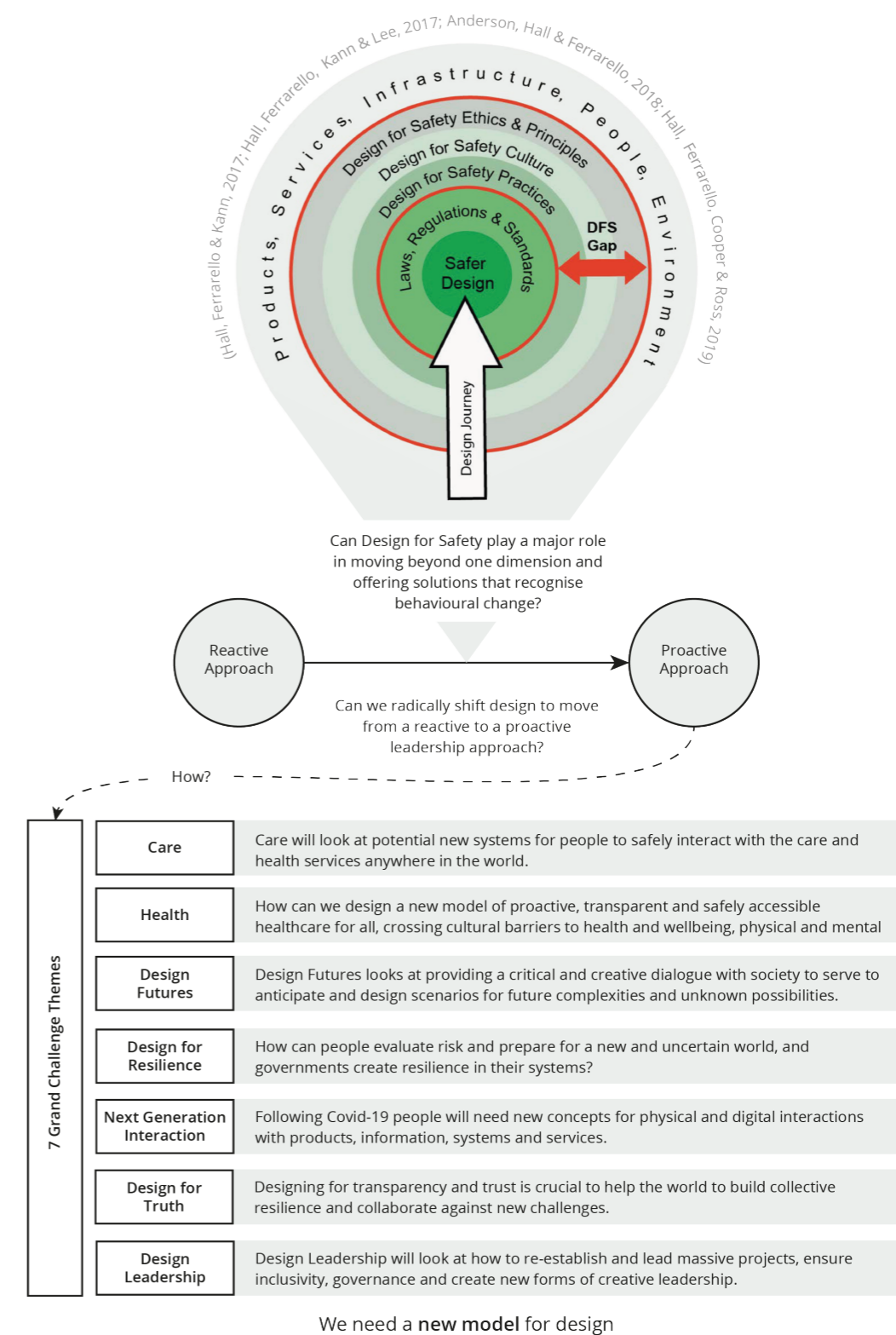
Figure 2. To reach the objective of developing a new model for design able to address, and include, the complexity of social challenges the Grand Challenge (GC) engaged with seven themes - Care, Health, Design Future, Design for Truth, Design for Leadership, Design for Resilience, and Next Generation of Interactions. The research project builds from previous work conducted by the authors which explored what role design can play in mitigating risks for improving safety.

3. Student Locations

Figure 3. Designers were located across the world in different time-zones, some of whom had never been to the UK. Thus, the seven themes were tackled by designers from different cultures, backgrounds and design disciplines.

4. Student Location Diversity

DIVERSITY MARK | 1 = SAME COUNTRY (UK) | 1.5 = SAME COUNTRY (CHINA)

| 2 = 1P DIFFERENT COUNTRY | 3 = 2 PP ONE COUNTRY & 3 PP OTHER

| 4 = 3 COUNTRIES | 5 = 4 COUNTRIES
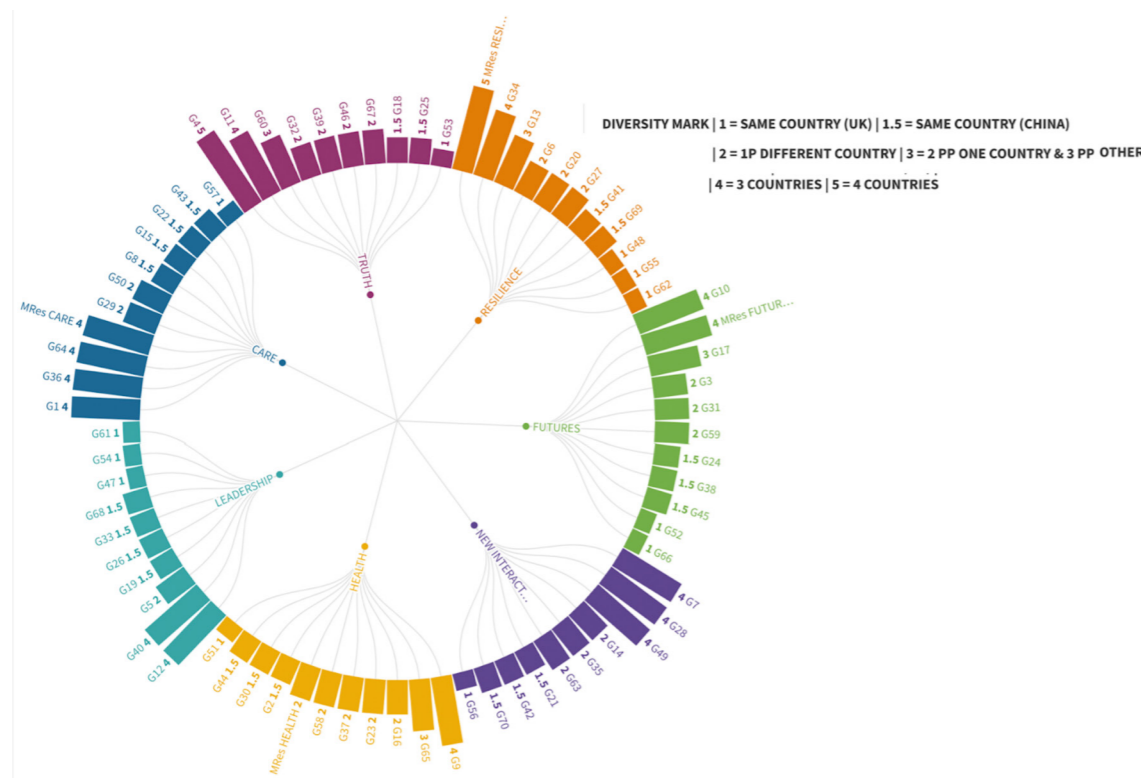
Figure 4. To ensure sustainable collaborative teamwork, groups were composed of designers within similar time-zones. The diag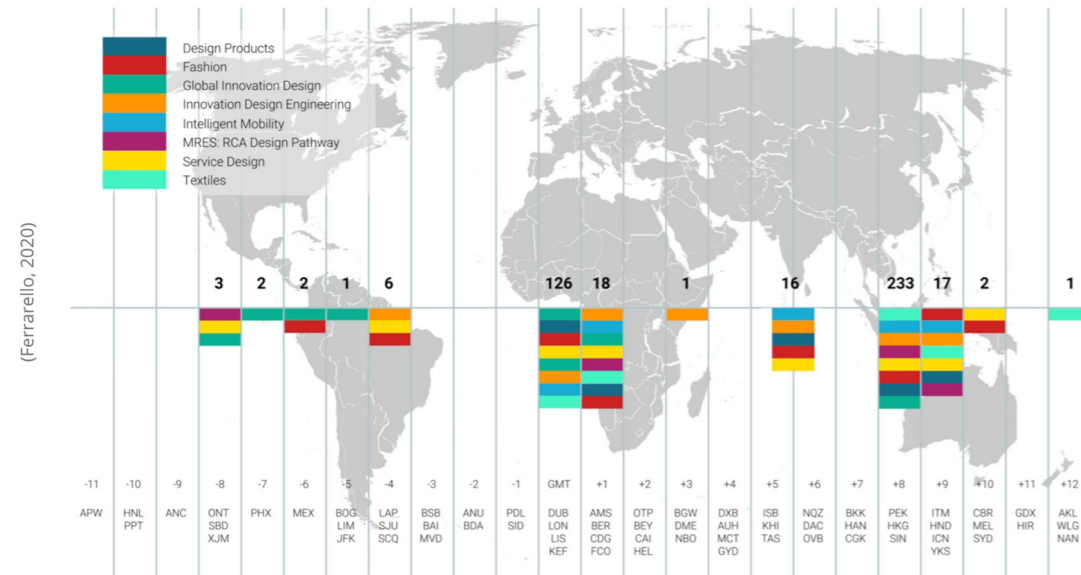ram is a representation of the distribution of student groups across different locations. Unfortunately, this data did not allow us to fully comprehend the influence of diversity on students' design approaches due to students being located in countries other than their national countries.

5. Grand Challenge Timeline
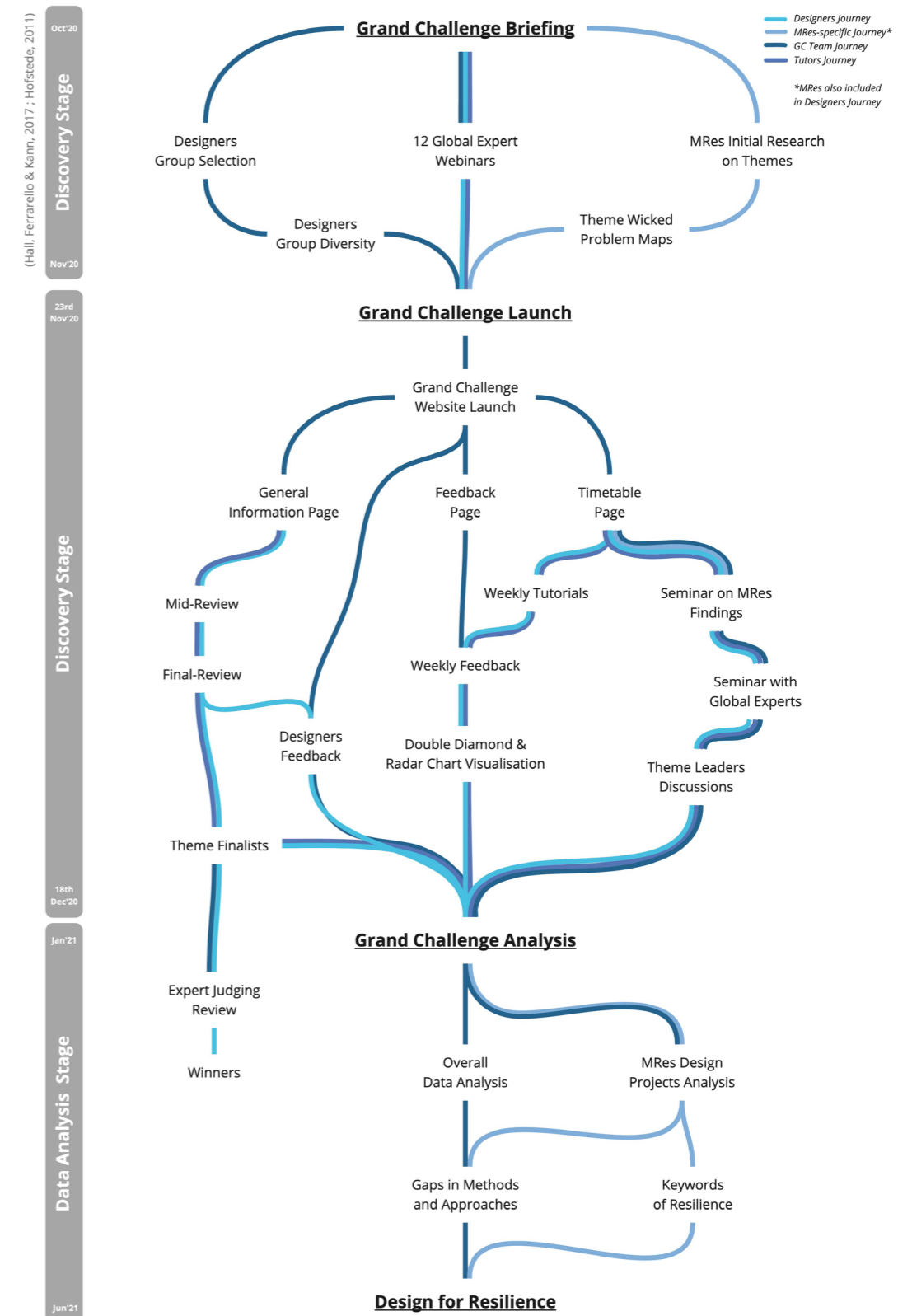
Figure 5. The project was developed over a period of three months. In the first phase, we launched a series of panel discussions through which the students could discuss with global experts across sectors about the challenges related to the seven themes. During this phase, a group of students from the MRes in Design developed a literature review that helped identify key issues per theme. In the second phase, the groups had to translate any concept and insight into design proposals; and in the last phase, the research team analysed the data.

CHAPTER 2

Methodology

1. Methodology
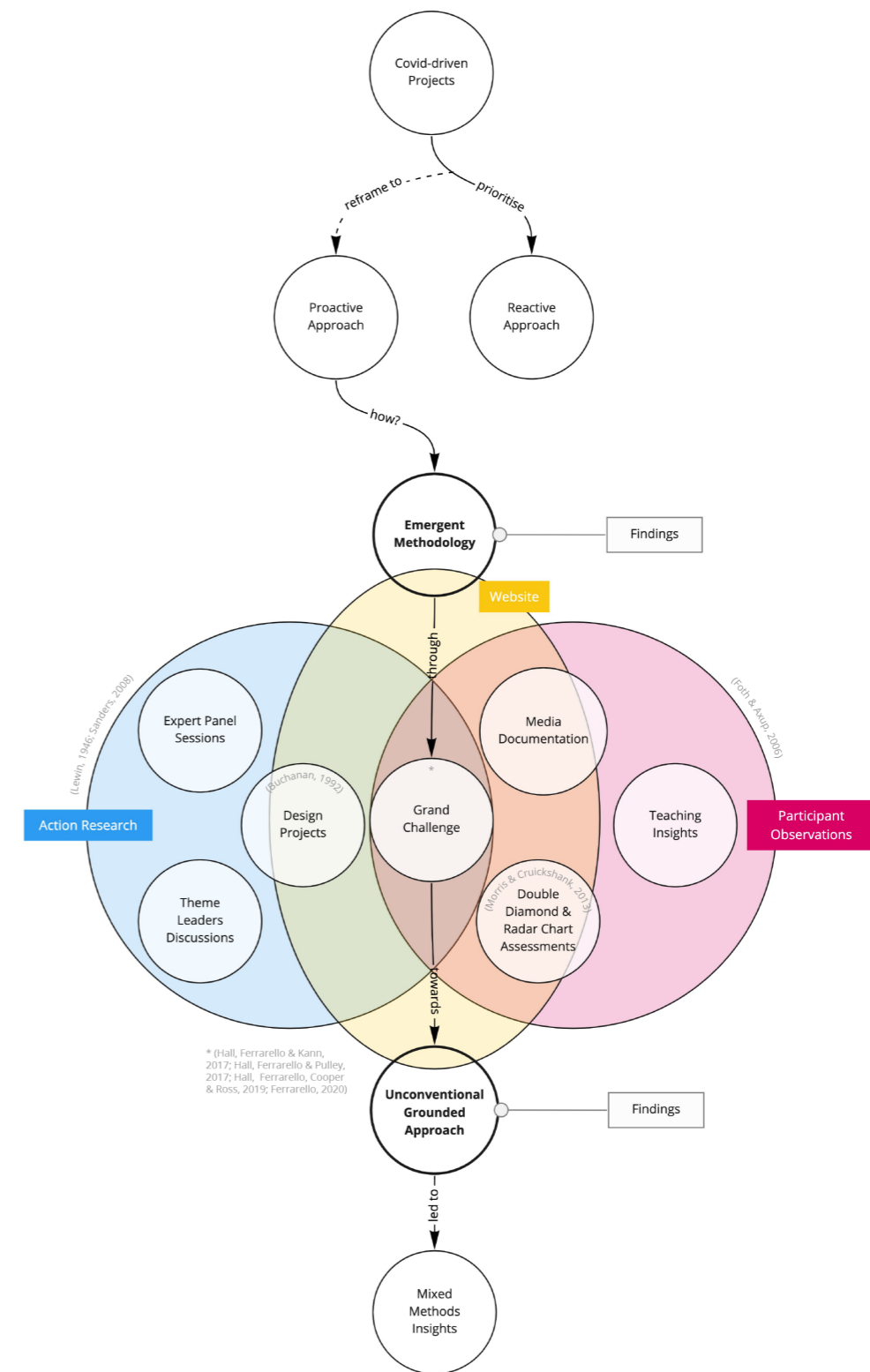
Figure 6. The research's motivation started from recognising the need to reframe the way designers have operated during the covid-19 pandemic, from reactive to proactive. To respond to this we undertook a research primarily driven by action and participant observation to explore an unconventional grounded approach where we were able to start codifying clusters of insights from qualitative (double diamond process group analysis) and quantitative (design projects, teaching insights, expert panel sessions and a panel where researcher theme leaders discussed their combined conclusion) mixed methods insights.

2. Designing the Website
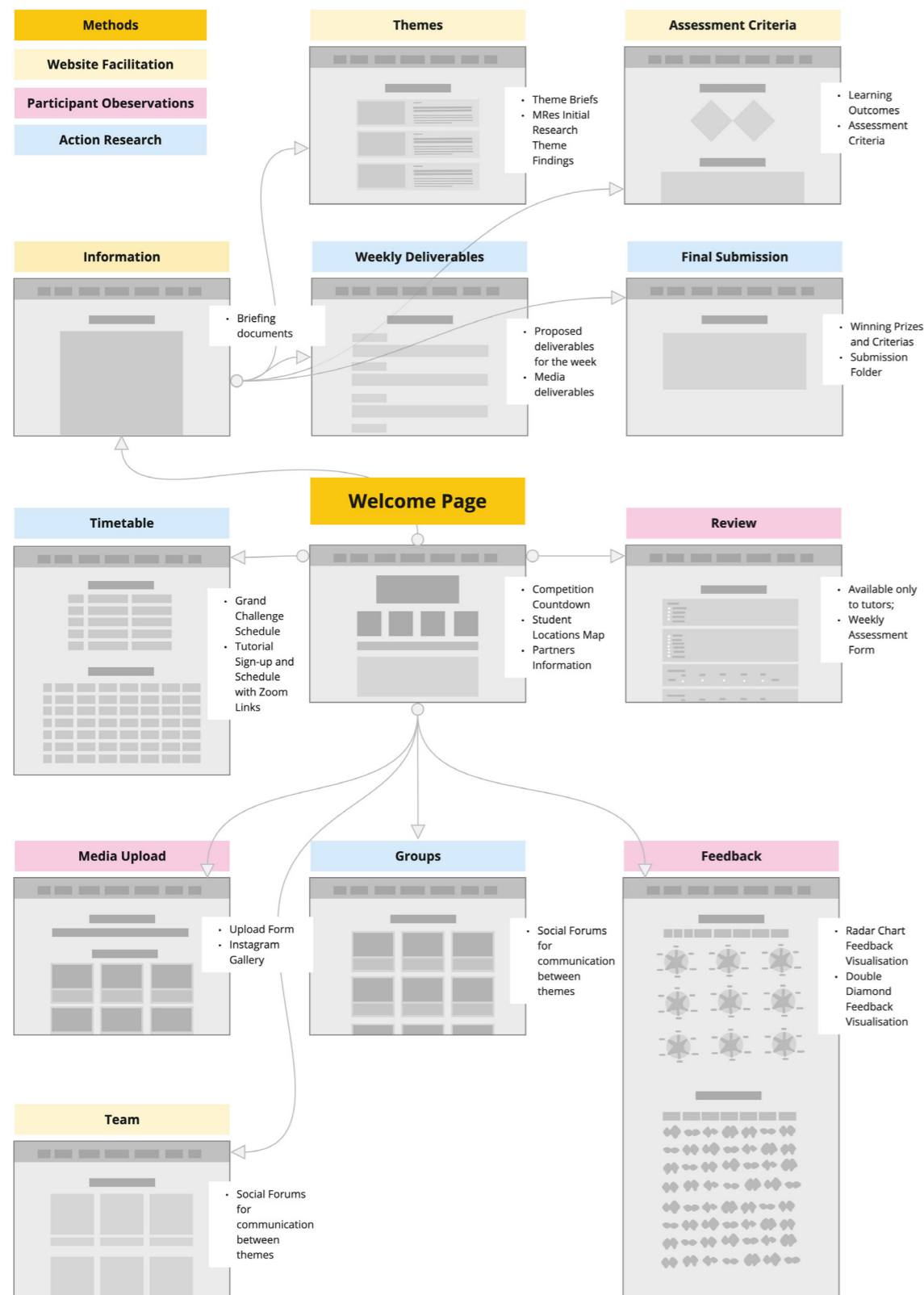
Figure 7. As the GC took place during the 2020 pandemic where students were working remotely around the world, regular communication and engagement would be key to the success of the research. As such, a website, designed through Wix, was developed as the central operating system of the GC where information was shared, feedback was displayed, and tutorials were booked.

3. Assessment Process
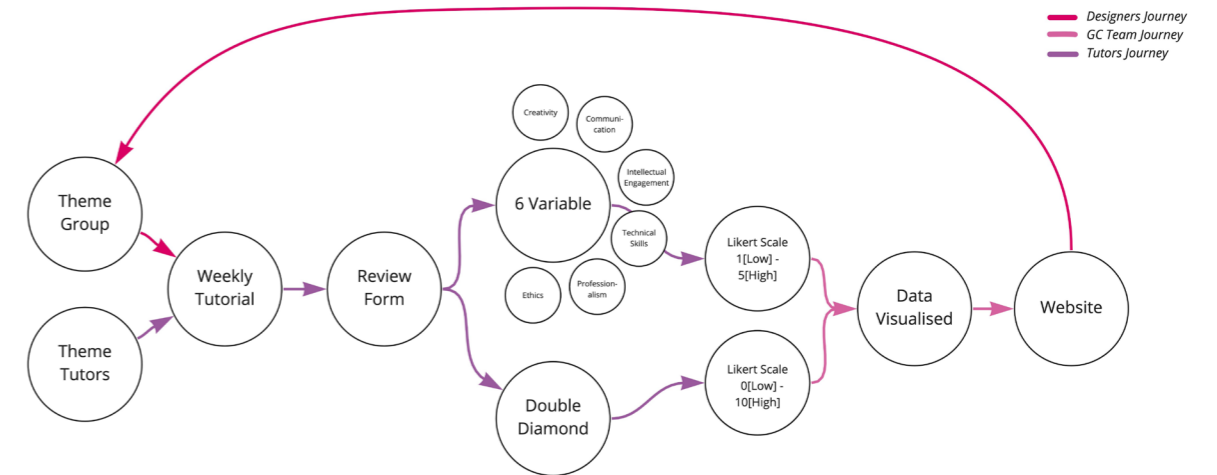
Figure 8. The 77 groups were assessed weekly by 12 multidisciplinary tutors across 4 weeks through a Google Form. The feedback was then displayed on the Grand Challenge website in real-time. The visual assessment was developed in response to the different geographical locations of team members in the world, which has helped generate an organic process of learning leveraging the fact that some of the groups never met in person during the time of the research.

3.1 Variable Assessment
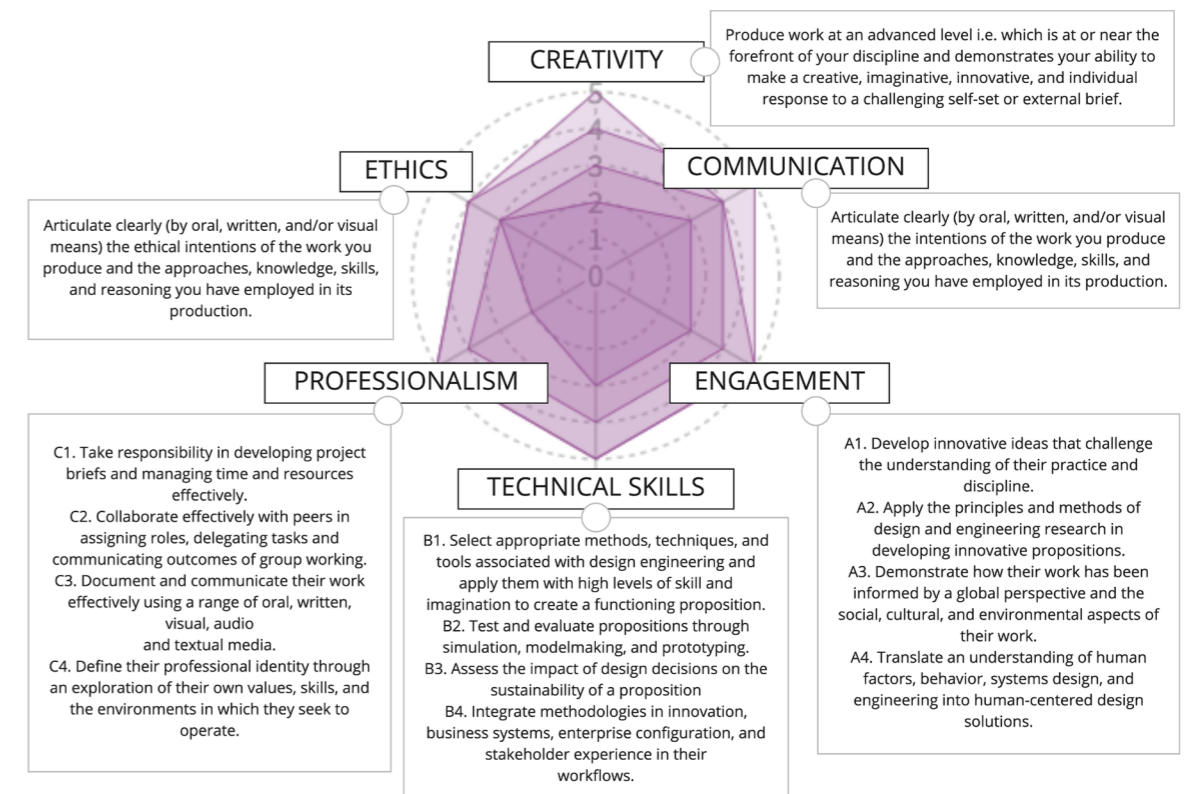
Figure 9. Using a radar chart as a visualisation tool - a range of variables, including communication, intellectual engagement, technical skills, creativity, professionalism, and ethics, were used to assess the progress of the research as a collaborative group effort. This was executed using Flourish, a data visualisation and storytelling software (Flourish, n.d.).

3.2 Double Diamond Assessment
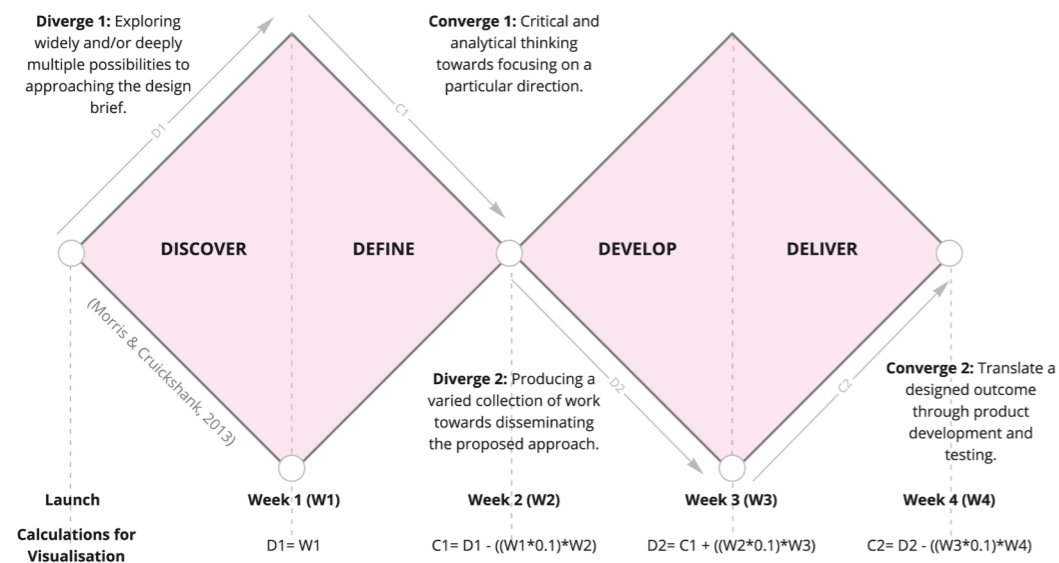
Figure 10. The double diamond (DD) was launched in 2004 by the Design Council in the United Kingdom as a visual framework of the design process (Morris & Cruickshank, 2013, September). Here, the Grand Challenge used the DD framework as a visual assessment tool to help guide and direct the students through the divergent and convergent design process. In order to develop the DD "effect" the calculations above were developed. These were then used and applied to an area chart (streamgraph) chart type equally using Flourish (Flourish, n.d.).

3.3 Example of Groups Design Process and Assessment

Figure 11. As illustrated in the diagram above, one of the teams, named Inaya, used various design methods and tools to systematically develop their project focus in relation to the DD diverging and converging stages. For example, using research and ideation to diverge and primary research and product development to converge.

3.5 Using the Double Diamond

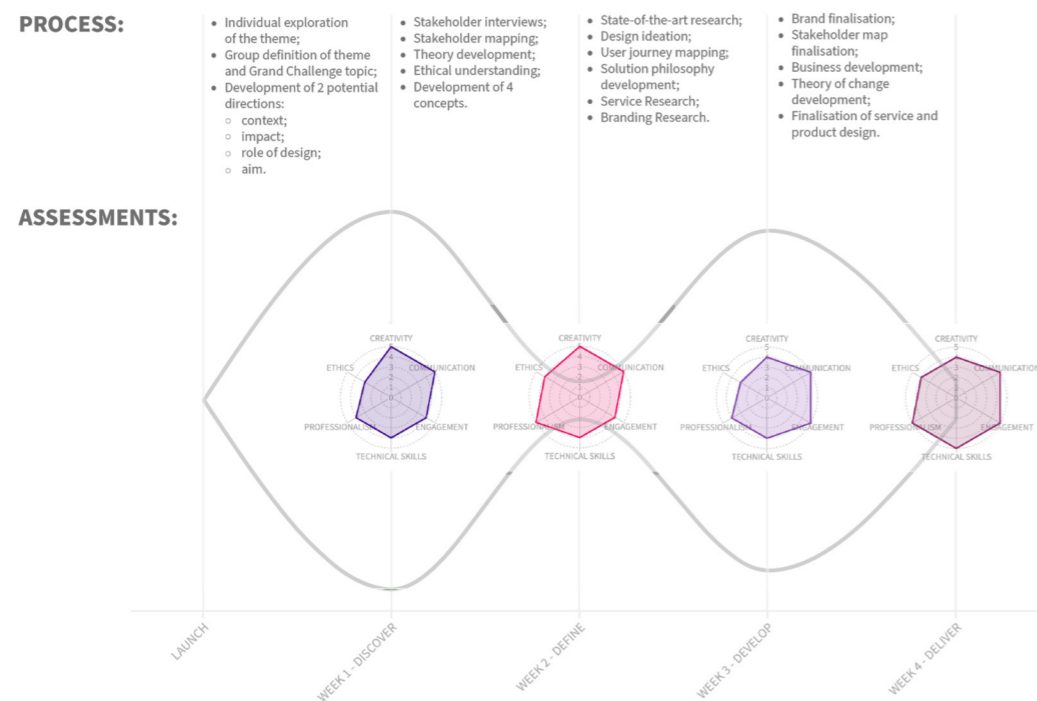The double diagram (DD) was introduced in 2003 by the Design Council in UK. Its aim was to promote a strategic approach to design. Although design models had been used from the 60s, they were not shared and lacked visibility (Council, 2021a). This fact prompted the Design Council to develop this model. Led by Richard Eisermann, Design Council's then Director of Design and Innovation, a team of designers such as Clive Grinyer were tasked with describing the design process. The Double Diamond is described by the Design Council as "a visual representation of the design and innovation process. It's a simple way to describe the steps taken in any design and innovation project, irrespective of methods and tools used" (Council, 2021a).

This model aimed to explain the process of design to designers and non-designers. It is structured in 4 phases; *Discover, Define, Develop, and Deliver*. *Discover* aims to expand knowledge in order to contextualize and understand the issue at hand. *Define* builds from these preliminary insights and aims to help the designer to define and focus the key elements to tackle the challenge in a different way. *Develop* encourages the designer to clearly define the problem by integrating a range of stakeholders impacted by the potential intervention. Finally, *Deliver* involves testing the potential outputs at a small scale to reject those not working, until a desirable solution is reached. The main dynamics in the system, as defined by the Research Council, are that "The two diamonds represent a process of exploring an issue more widely or deeply (divergent thinking) and then taking focused action (convergent thinking)" (Council, 2021b).

This framework operates very well in design because this practice is not linear. This element allows practitioners to learn something unexpected, as they are not confirming or refuting a hypothesis, but learning and iterating in the process. The Design Council provides a portfolio of authored, adapted, or adopted methods to operationalize the framework. They have structured these methods in three areas to help practitioners use the design process to explore, shape or build: Explore (challenges, needs, and opportunities), shape (prototypes, insights, and visions), and Build (ideas, plans, and expertise). It encourages Leadership and Engagement.

In this context, the DD has been used as an operational framework, but in the review conducted, we could not find any model using this framework as an assessment tool. In this section, the authors redesigned the DD as an assessment tool by integrating a range of variables critical to the process to complement the divergent/convergent dynamics; creativity, communication, intellectual engagement, technical skills, and professionalism

4. Quadruple Diamond Action Research
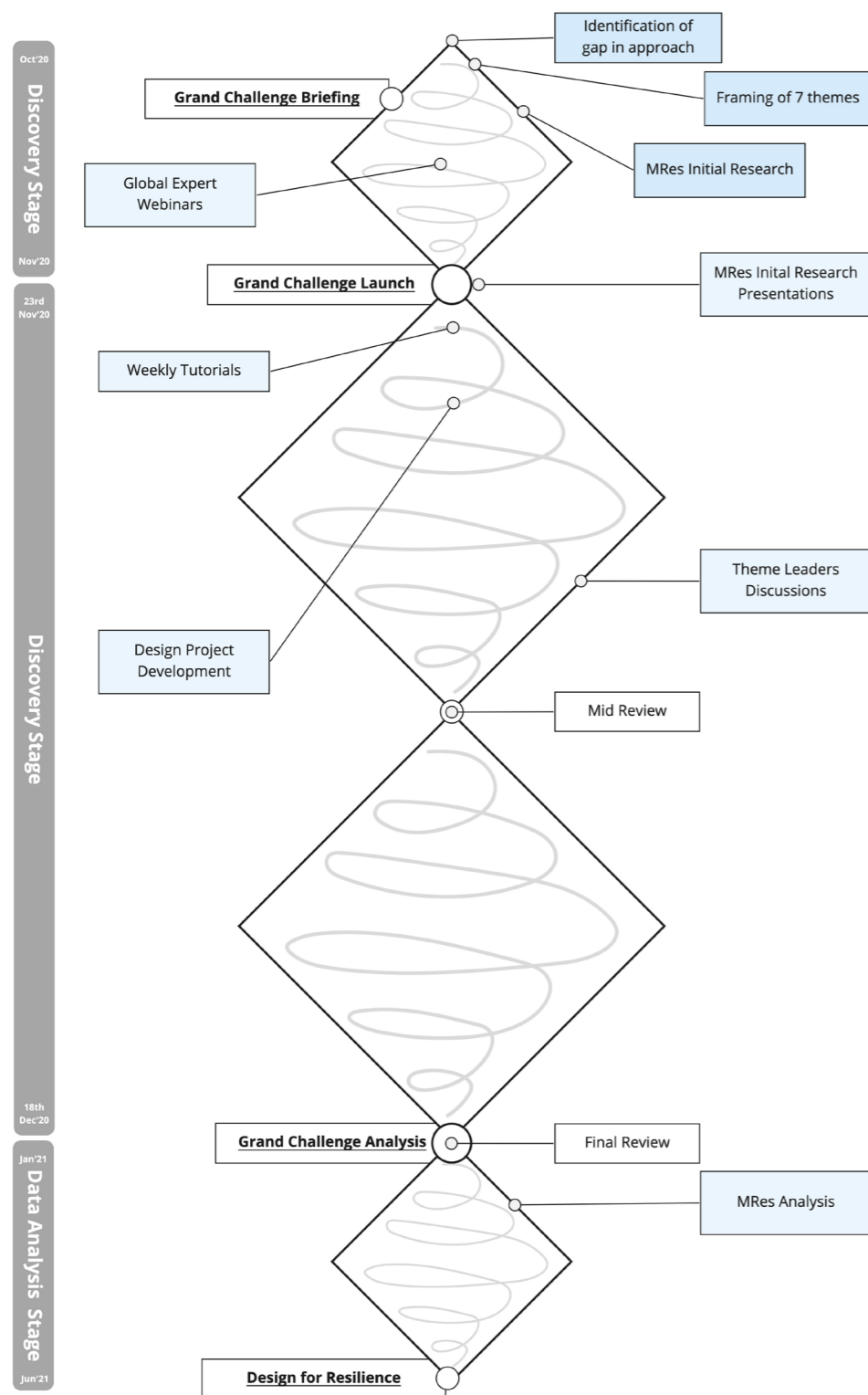
Figure 12. The GC was a continuous unfolding of action research which took the form of a Quadruple Diamond (QD). The extension of the double diamond (DD) has previously been developed into a triple diamond in order to include the commercial process (Chen, 2020). Centred in the middle of the QD is the unfolding of the GC, where in-fact multiple DDs took place - as seen in section 4.2. The DD process is then complemented with a diamond on either end which supported the development of the research and the collated outputs. The diagram is a demonstration of how the various interactions between designers, global experts, academics and more played a key role to the development of the GC.

CHAPTER 3

Discussion
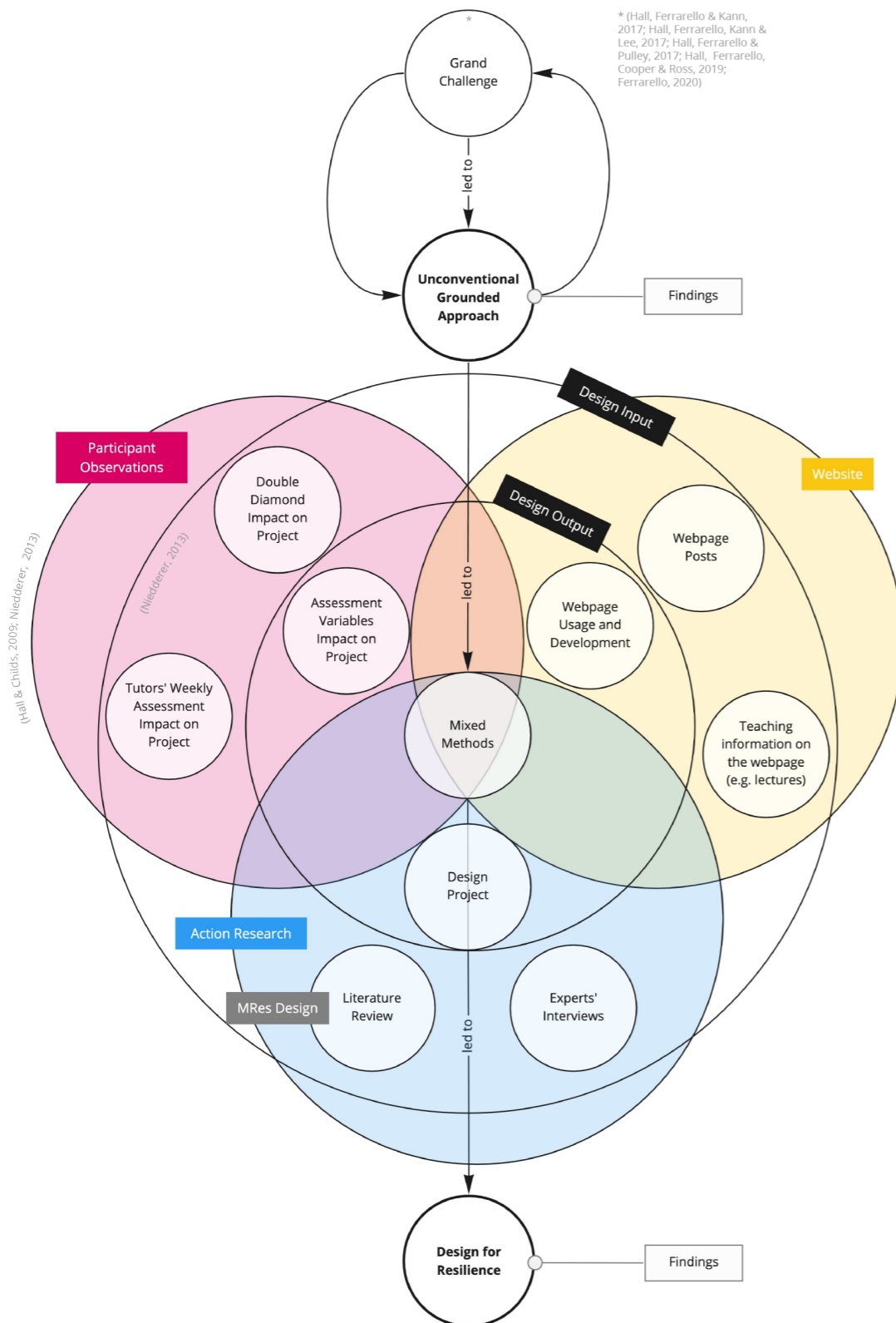
1. Discussion

Figure 13. Through the unconventional grounded approach, mixed methods insights were generated through a combination of design output, generated during the GC, and inputs, generated through the feedback on the experience of interacting with the GC framework which was provided by the designers. More specifically, the MRes Design cohort developed a further input of analysing the final design projects and process while questioning where design resilience may be emerging.

WEBSITE

Discussion

2. Website Feedback

Site Traffic

4000 views
1000 views   350 views
650 views

Themes

"More information; more relevant materials like reference works or papers; maybe every group's work can be show partly on the web.."

Assessment Criteria

"Very comprehensive and detailed, giving a great introduction and oversight to the project,"

Information

"Very helpful to have all the information we needed in one place. Was challenging to navigate, kind of felt like fun graphics were prioritized over clear information."

Weekly Deliverables

"More information; more relevant materials like reference works or papers; maybe every group's work can be show partly on the web.."

Final Submission

Timetable

"Perhaps and upgrade to a more engaging content-driven and connect it to weekly tutorial "

Welcome Page

Review

"it's a well designed website, somehow nobody joined the activities on it. maybe we can add things like group sharing, and people can comments and discuss under the post "

"In general, it was great. but I am sure there is a room to develop further to support our project process. "

"Less time on using the website, it's a pity I only use it to check feedback."

Media Upload

"I felt like the website made all the groups competitors than a unifying. Just being a number (G56) made it less personal. would be nice to see who where behind each group."

"We are too busy to update information on the website and discuss in the forum. maybe this part doesn't work....."

Groups

"The forum didn't get fully used among students"

"The website didn't build a GC community, as there was not much time for engagement through an online setting across all groups of all themes. I would have loved to seen other groups work throughout the 4 weeks, as I think it would helped bring each other closer as a wider community by inspiring each other and we could have also provided feedback to one another. I felt an online setting brings a great disconnect and so it would have been nice to had time for more interaction with all members from Truth for example."

Feedback

"Less time on using the website, it's a pity I only use it to check feedback."

"Pretty cool, I love this style and how it illustrate our feedback."

Team

Figure 13. Following the end of the GC we were able to draw out the website usage through Wix's analytic tools. As we can see 'feedback', 'timetable', and the home page were understandably the most popular pages due to real-time communication. Equally, designers offered their feedback regarding how the website facilitated their journey. For them, the website was a helpful and effective tool that helped develop the projects. However, they felt that the website didn't build the "studio" community and thus more real-time features should be introduced where students could share their progress, post updates, and engage with one and other.

PARTICIPANT OBSERVATION

Discussion

3. Assessment Framework

EXPERIMENT DESIGN

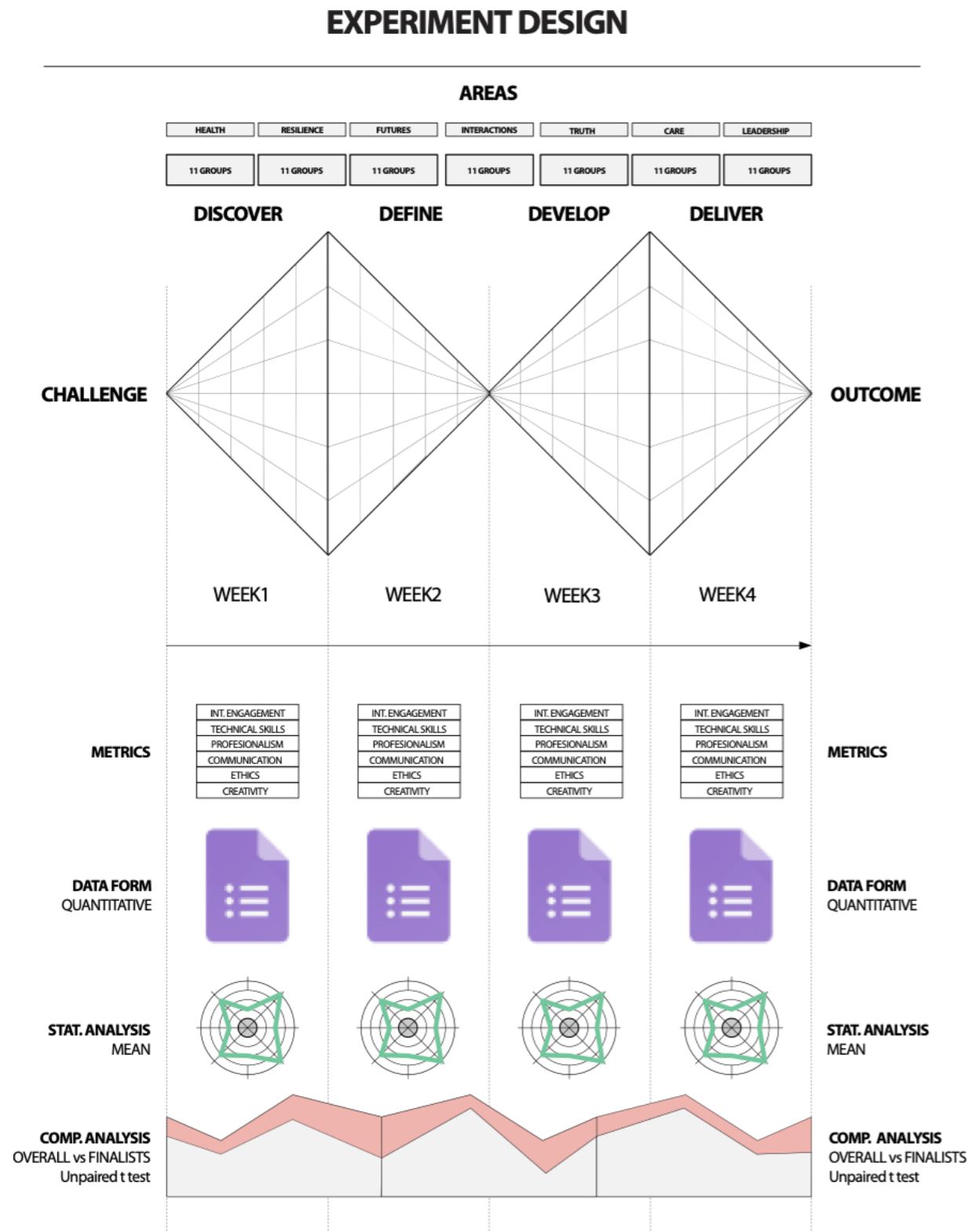*Figure 14.* The project was implemented over the course of four weeks. At the end of each week an assessment form was distributed among tutors to rate the performance of the group in each of the seven variables; intelligence, engagement, technical skills, professionalism, communication, ethics, creativity, and divergent/convergent. Each week's form represented one of the four stages of the DD; discover, define, develop, and define. The form used a 5-points Likert scale. Finally, we implemented unpaired t test results or independent samples t test, which addresses the difference between the means of two groups.

4. Double Diamond Results
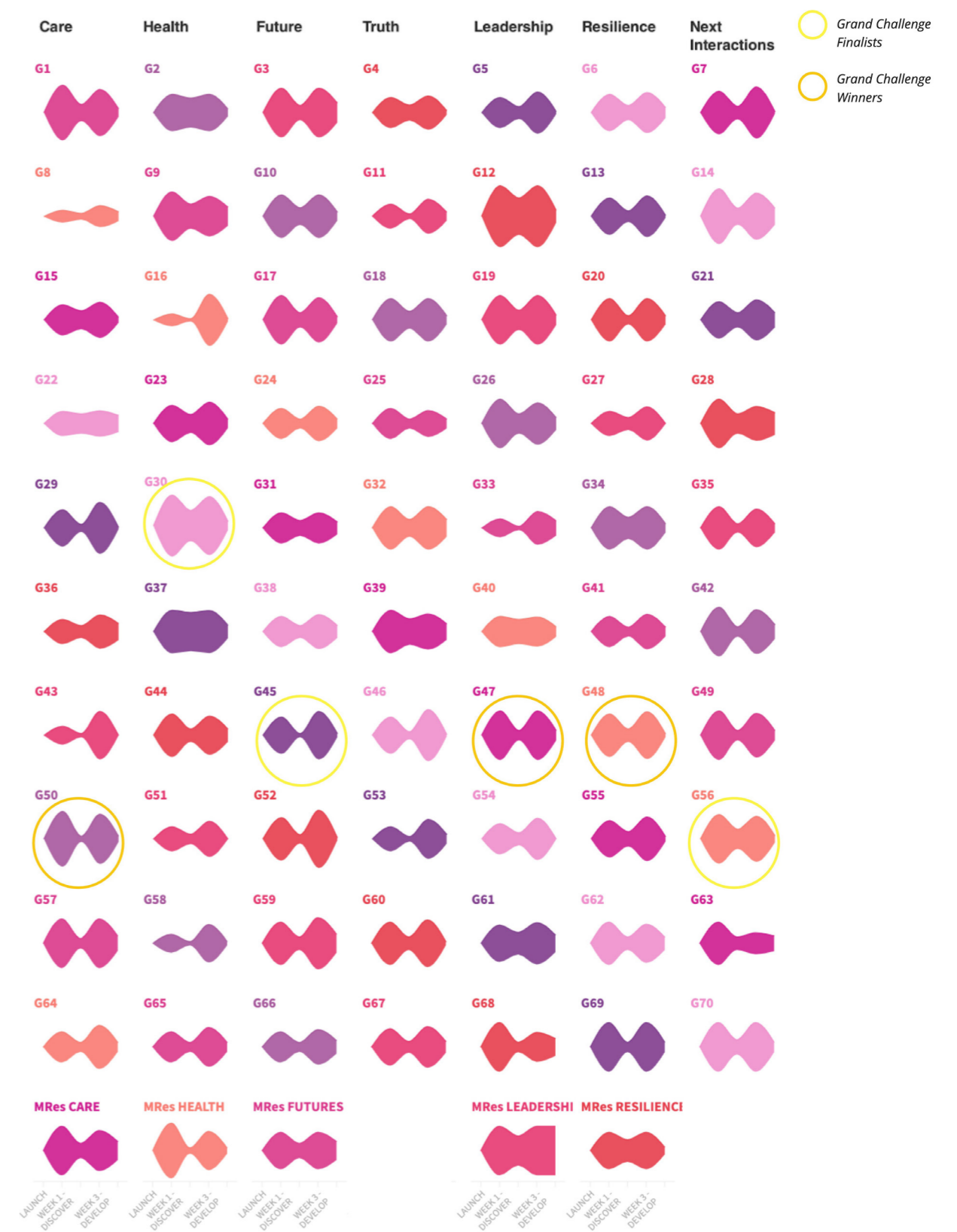
Figure 15. At the end of each week, designers would be able to find their feedback on the website and see their design process' evolution in real-time. Having all the DDs displayed side by side also allowed both the researchers but also designers to cross-compare their development to other groups. As we can see from the highlighted DD, GC groups that best addressed the given themes displayed a consistently high performance in diverging and converging.

5. Variables Results
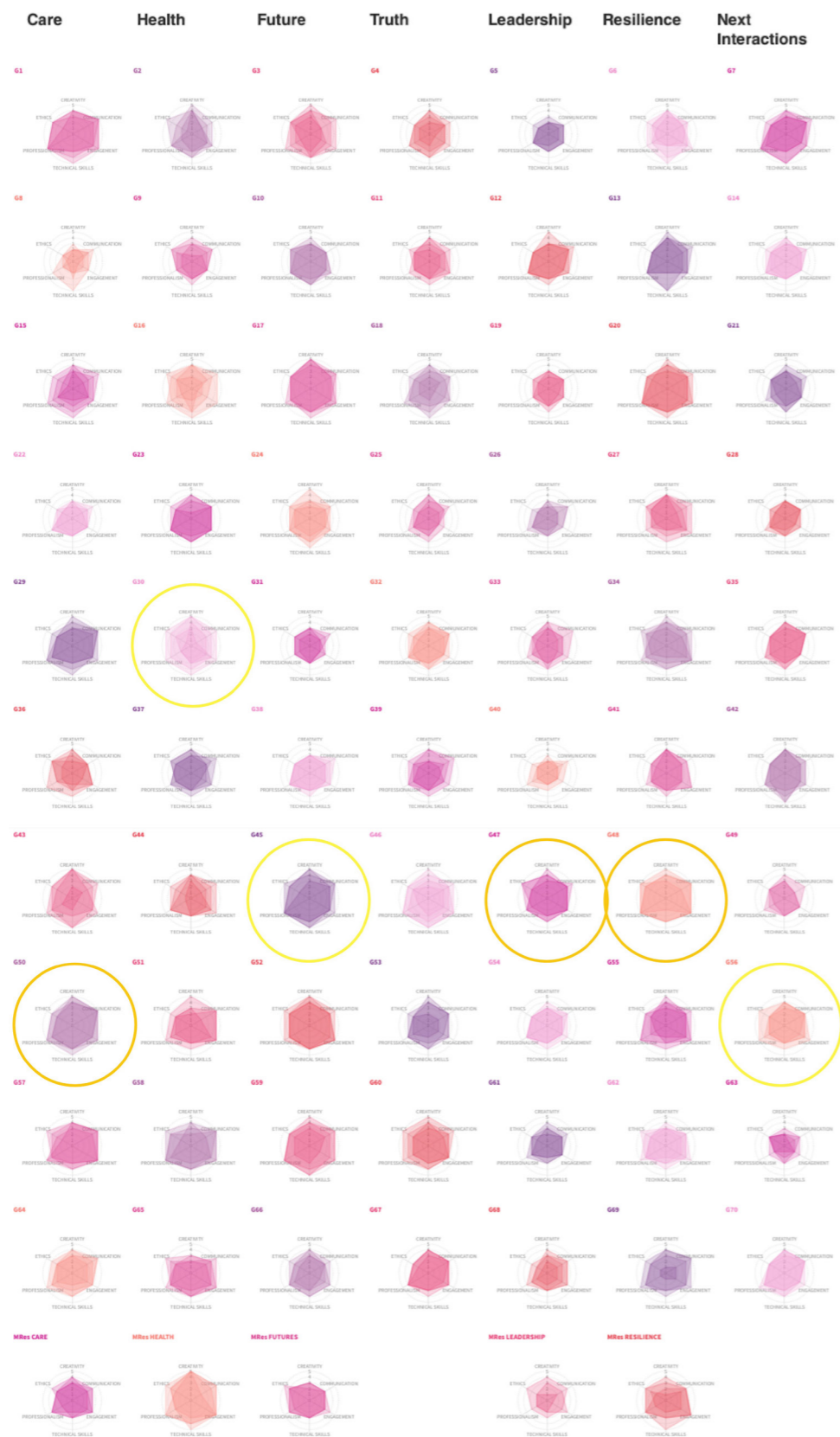
Figure 16. The feedback was visualised, likewise through Flourish, in the form of a radar chart where each translucent layer represents a different week. By mirroring this diagram with the DD results, we can visually see how those achieving highest across the 6 variables would perform the best in the DD process.

6. Assessments Analysis
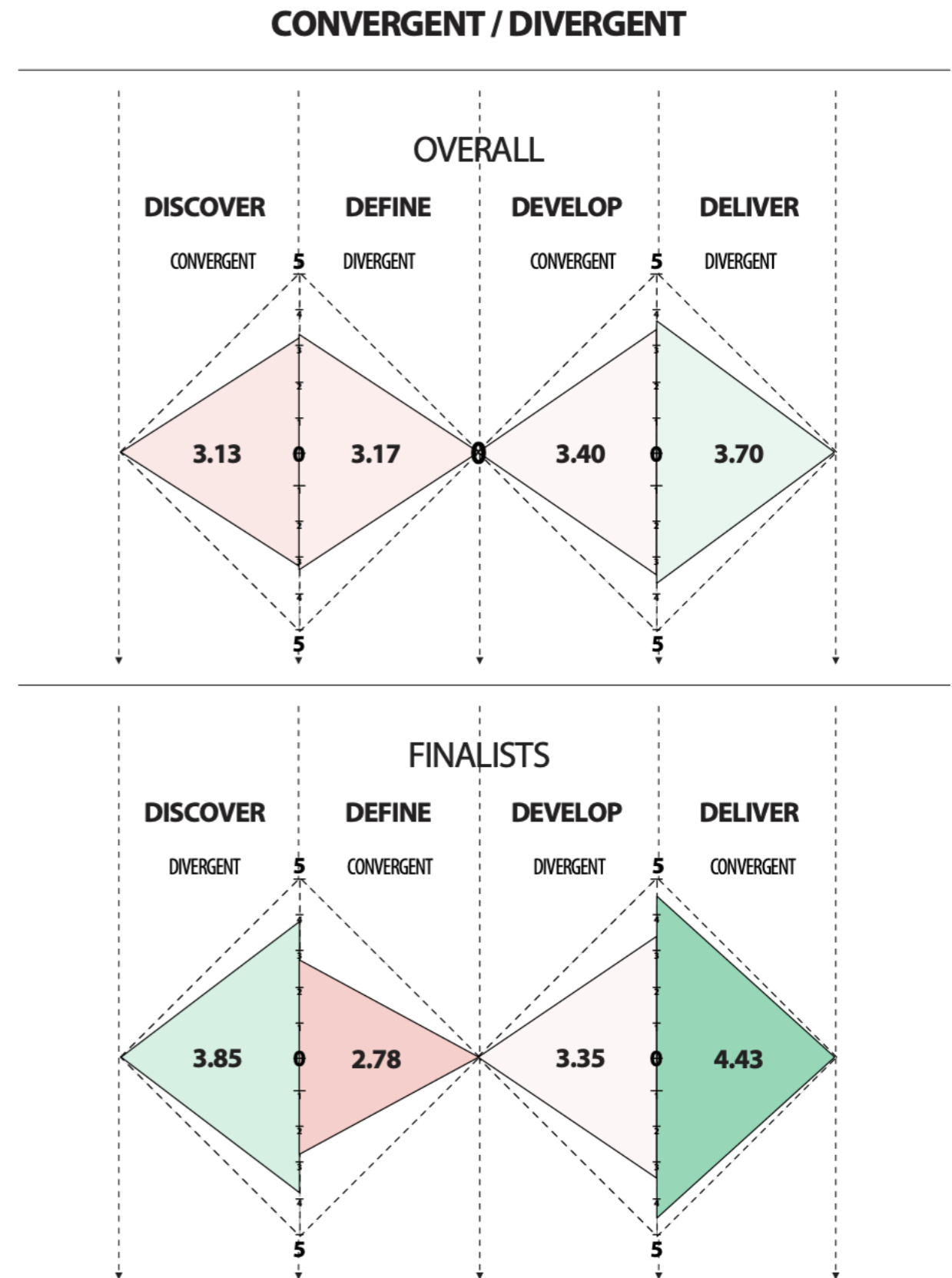
Figure 17. Convergent/Divergent variable. Comparative study between overall groups (n=77) and finalists (n=7).

COMMUNICATION

OVERALL

DISCOVER	DEFINE	DEVELOP	DELIVER
3.51	3.63	3.51	3.92

FINALISTS

DISCOVER	DEFINE	DEVELOP	DELIVER
4.14	3.71	4.42	4.57
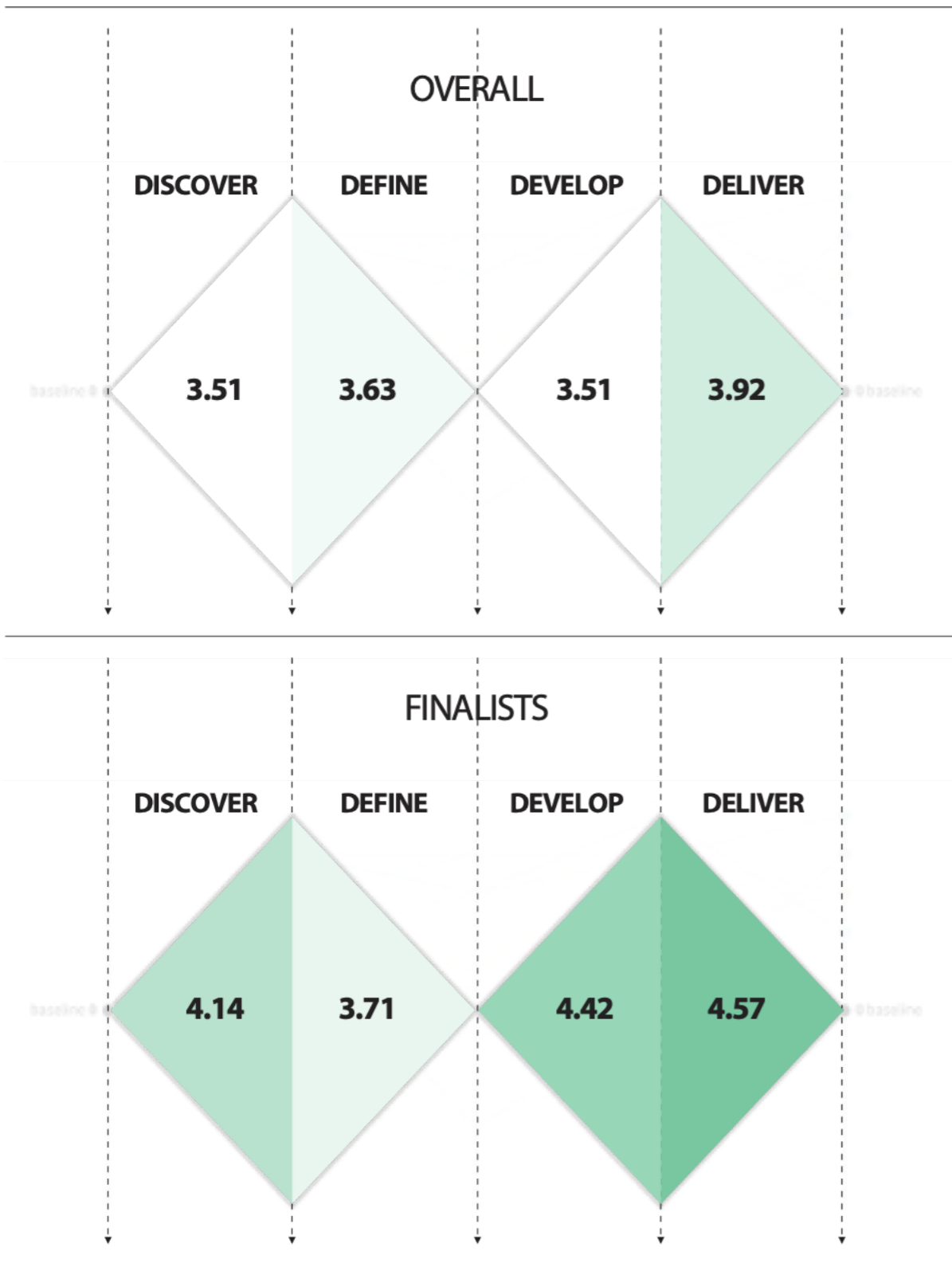
Figure 18. Communication variable. Comparative study between overall groups (n=77) and finalists (n=7).

INTELLECTUAL ENGAGGEMENT

OVERALL

DISCOVER	DEFINE	DEVELOP	DELIVER
3.44	3.55	3.63	3.73

FINALISTS

DISCOVER	DEFINE	DEVELOP	DELIVER
3.85	4.28	4.28	4.71
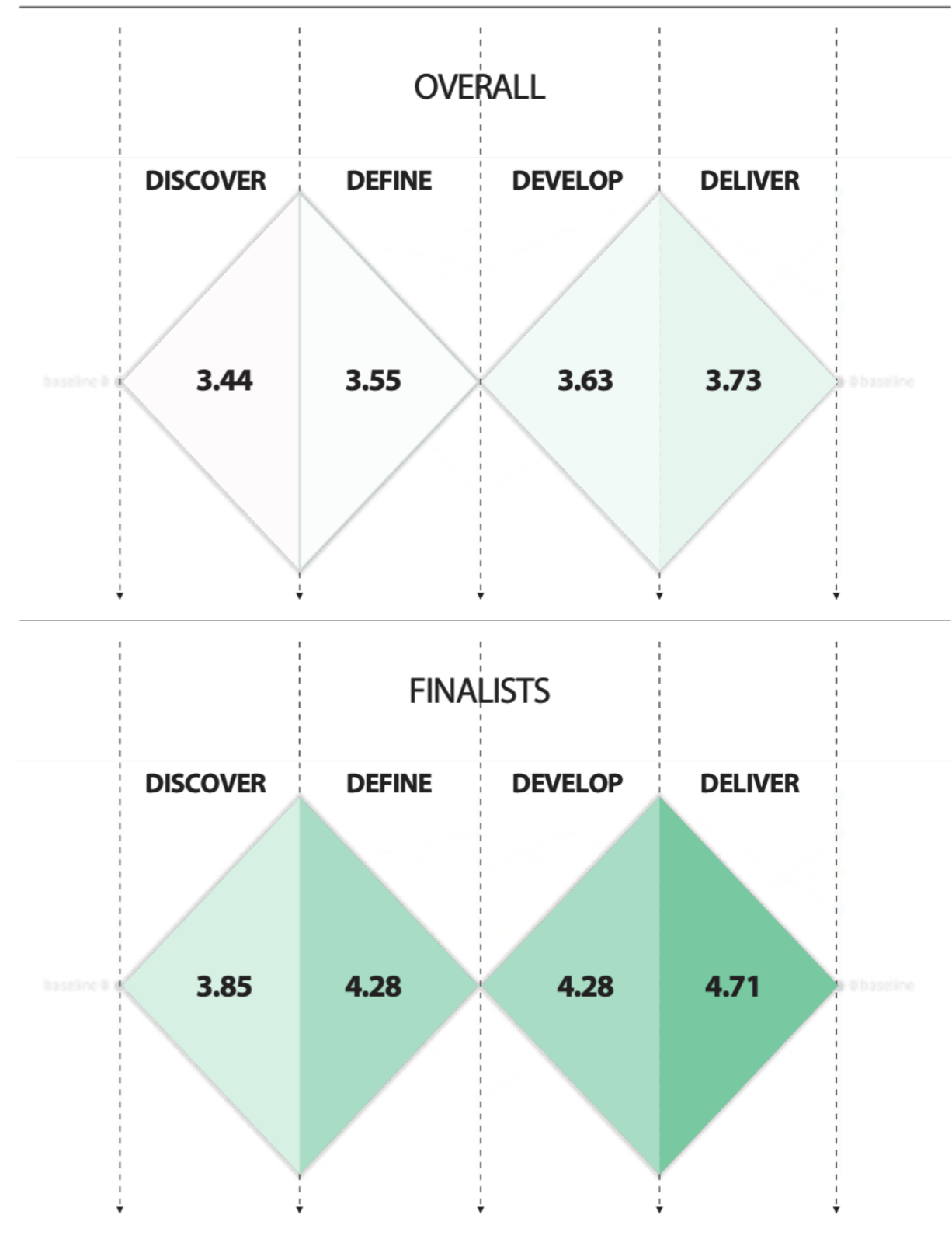
Figure 19. Intellectual engagement variable. Comparative study between overall groups (n=77) and finalists (n=7).

CREATIVITY

OVERALL

| DISCOVER | DEFINE | DEVELOP | DELIVER |
| 3.36 | 3.23 | 3.59 | 3.70 |

FINALISTS

| DISCOVER | DEFINE | DEVELOP | DELIVER |
| 3.57 | 3.71 | 4.28 | 4.57 |

Figure 20. Creativity variable. Comparative study between overall groups (n=77) and finalists (n=7).

TECHNICAL SKILLS

OVERALL

| DISCOVER | DEFINE | DEVELOP | DELIVER |
| 3.03 | 3.13 | 3.53 | 3.81 |

FINALISTS

| DISCOVER | DEFINE | DEVELOP | DELIVER |
| 3.28 | 3.71 | 4.00 | 4.42 |

Figure 21. Technical variable. Comparative study between overall groups (n=77) and finalists (n=7).

PROFESSIONALISM

OVERALL

DISCOVER	DEFINE	DEVELOP	DELIVER
3.43	3.55	3.75	4.03

FINALISTS

DISCOVER	DEFINE	DEVELOP	DELIVER
3.53	4.14	4.14	4.85

Figure 22. Professionalism variable. Comparative study between overall groups (n=77) and finalists (n=7).

ETHICS

OVERALL

DISCOVER	DEFINE	DEVELOP	DELIVER
2.91	3.05	3.27	3.52

FINALISTS

DISCOVER	DEFINE	DEVELOP	DELIVER
2.71	3.71	3.85	4.57
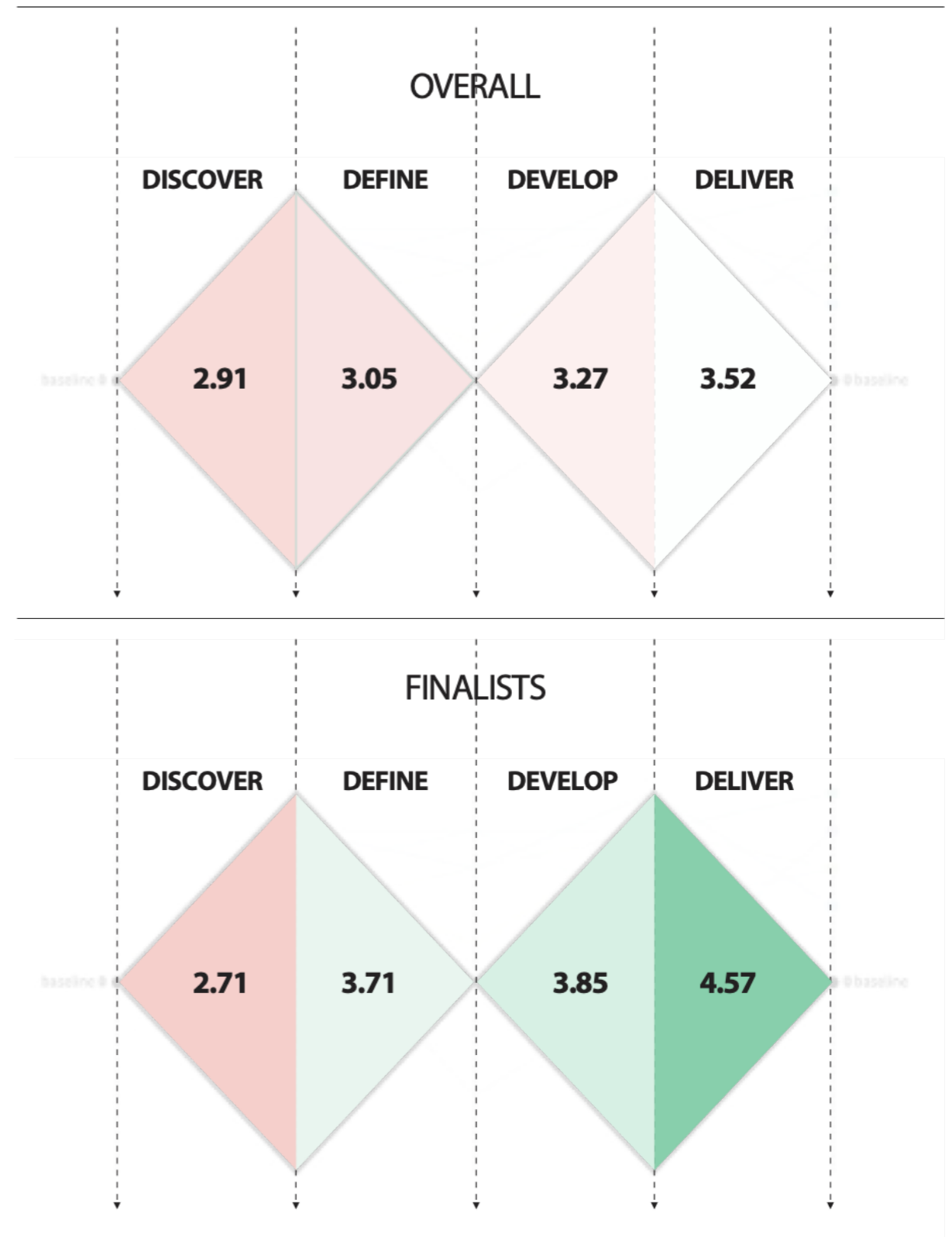
Figure 23. Ethics variable. Comparative study between overall groups (n=77) and finalists (n=7).

Figure 24 chart:

	-0,00	-0,50	-1,00
	NO SIGNIFICANT	STATISTICALLY SIGNIFICANT	VERY SIGNIFICANT	EXTREMLY SIGNIFICANT

INTELLECTUAL ENGAGEMENT — EXTREMLY STATISTICALLY SIGNIFICANT
-0,7024

COMMUNICATION — VERY STATISTICALLY SIGNIFICANT
-0,5776

CREATIVITY — VERY STATISTICALLY SIGNIFICANT
-0,5690

ETHICS — VERY STATISTICALLY SIGNIFICANT
-0,5310

PROFESSIONALISM — VERY STATISTICALLY SIGNIFICANT
-0,4952

TECHNICAL SKILLS — VERY STATISTICALLY SIGNIFICANT
-0,4871

CONVERGENT/DIVERGENT — EXTREMLY STATISTICALLY SIGNIFICANT
-1,3157

DIVERGENT — VERY STATISTICALLY SIGNIFICANT
-1,3496

CONVERGENT — VERY STATISTICALLY SIGNIFICANT
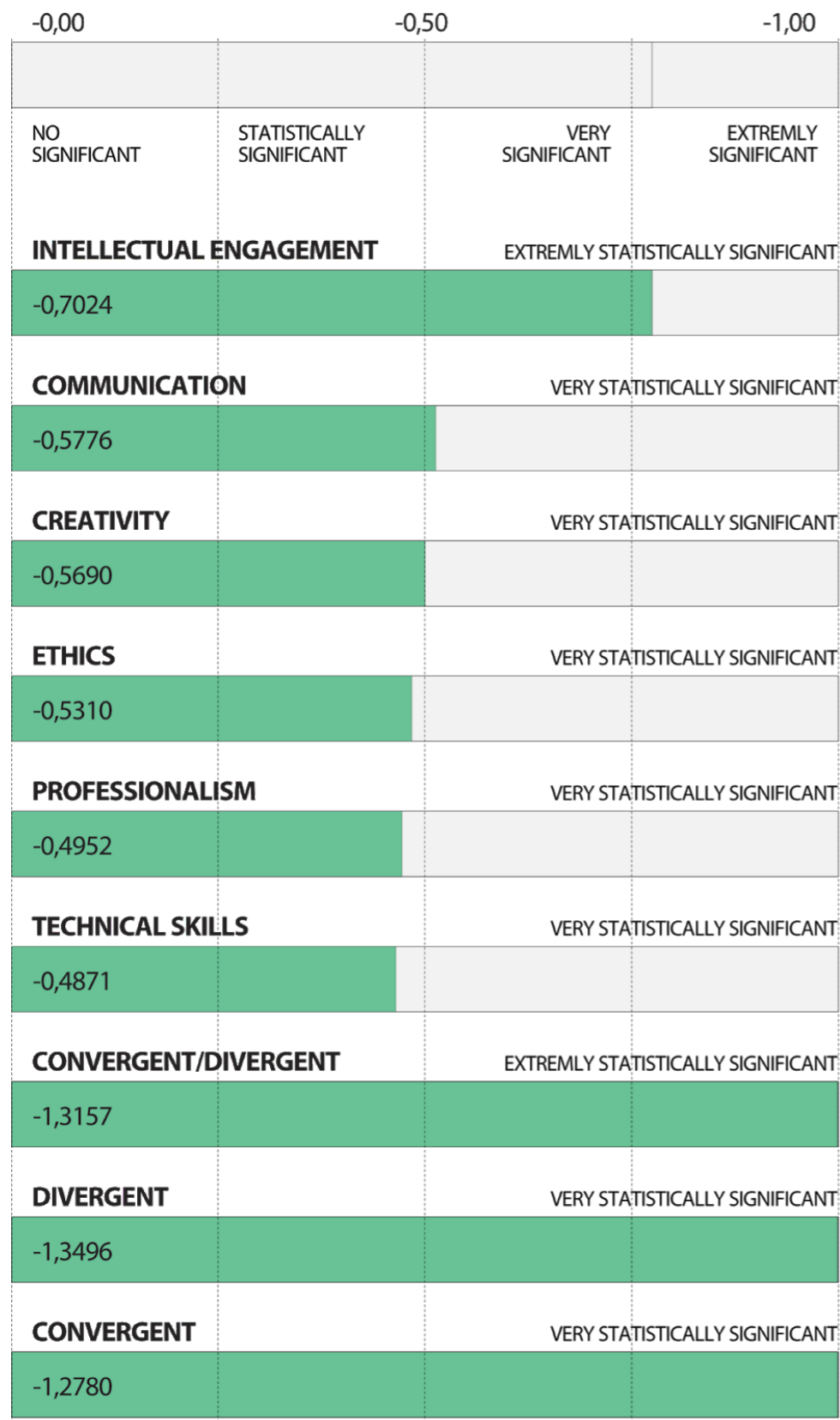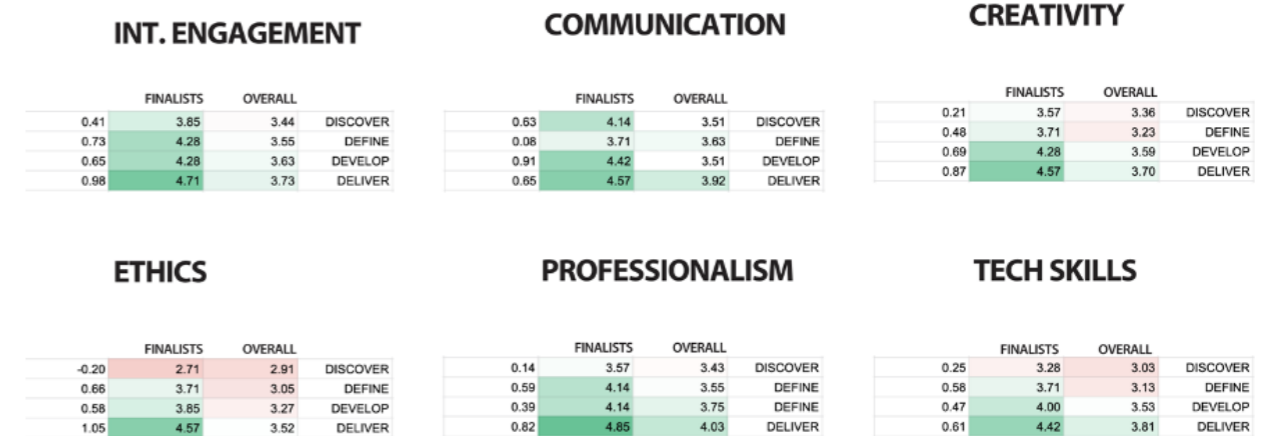-1,2780

Figure 24. In this study, we calculate the overall mean and compare it against the finalists' mean to obtain the difference between them. This differential analysis enabled us to classify the different variables to understand which of them made a difference for the finalists and at which stage/point. As can be seen from the unpaired t test results by variables, intellectual engagement is the variable most differentiated between the overall and the finalist with an extreme statistical significance. It is followed by communication, creativity, ethics, professionalism, and technical skills with key statistical significance.

COMPARATIVE STUDY

INT. ENGAGEMENT
	FINALISTS	OVERALL	
0.41	3.85	3.44	DISCOVER
0.73	4.28	3.55	DEFINE
0.65	4.28	3.63	DEVELOP
0.98	4.71	3.73	DELIVER

COMMUNICATION
	FINALISTS	OVERALL	
0.63	4.14	3.51	DISCOVER
0.08	3.71	3.63	DEFINE
0.91	4.42	3.51	DEVELOP
0.65	4.57	3.92	DELIVER

CREATIVITY
	FINALISTS	OVERALL	
0.21	3.57	3.36	DISCOVER
0.48	3.71	3.23	DEFINE
0.69	4.28	3.59	DEVELOP
0.87	4.57	3.70	DELIVER

ETHICS
	FINALISTS	OVERALL	
-0.20	2.71	2.91	DISCOVER
0.66	3.71	3.05	DEFINE
0.58	3.85	3.27	DEVELOP
1.05	4.57	3.52	DELIVER

PROFESSIONALISM
	FINALISTS	OVERALL	
0.14	3.57	3.43	DISCOVER
0.59	4.14	3.55	DEFINE
0.39	4.14	3.75	DEFINE
0.82	4.85	4.03	DELIVER

TECH SKILLS
	FINALISTS	OVERALL	
0.25	3.28	3.03	DISCOVER
0.58	3.71	3.13	DEFINE
0.47	4.00	3.53	DEVELOP
0.61	4.42	3.81	DELIVER

HIERARCHICAL STUDY

DISCOVER
+0.63 COMMUNICATION
+0.41 INT. ENGAGEMENT
+0.25 TECHNICAL SKILLS
+0.21 CREATIVITY
+0.14 PROFESSIONALISM
-0.20 ETHICS

DEFINE
INT. ENGAGEMENT +0.73
ETHICS +0.66
PROFESSIONALISM +0.59
TECHNICAL SKILLS +0.58
CREATIVITY +0.48
COMMUNICATION +0.08

DEVELOP
+0.91 COMMUNICATION
+0.69 CREATIVITY
+0.65 INT. ENGAGEMENT
+0.58 ETHICS
+0.47 TECHNICAL SKILLS
+0.39 PROFESSIONALISM

DELIVER
ETHICS +1.05
INT. ENGAGEMENT +0.98
CREATIVITY +0.87
PROFESSIONALISM +0.82
COMMUNICATION +0.65
TECHNICAL SKILLS +0.61

DISCOVER
COMMUNICATION
INT. ENGAGEMENT
TECHNICAL SKILLS

DEFINE
INT. ENGAGEMENT
ETHICS
PROFESSIONALISM

DEVELOP
COMMUNICATION
CREATIVITY
INT. ENGAGEMENT

DELIVER
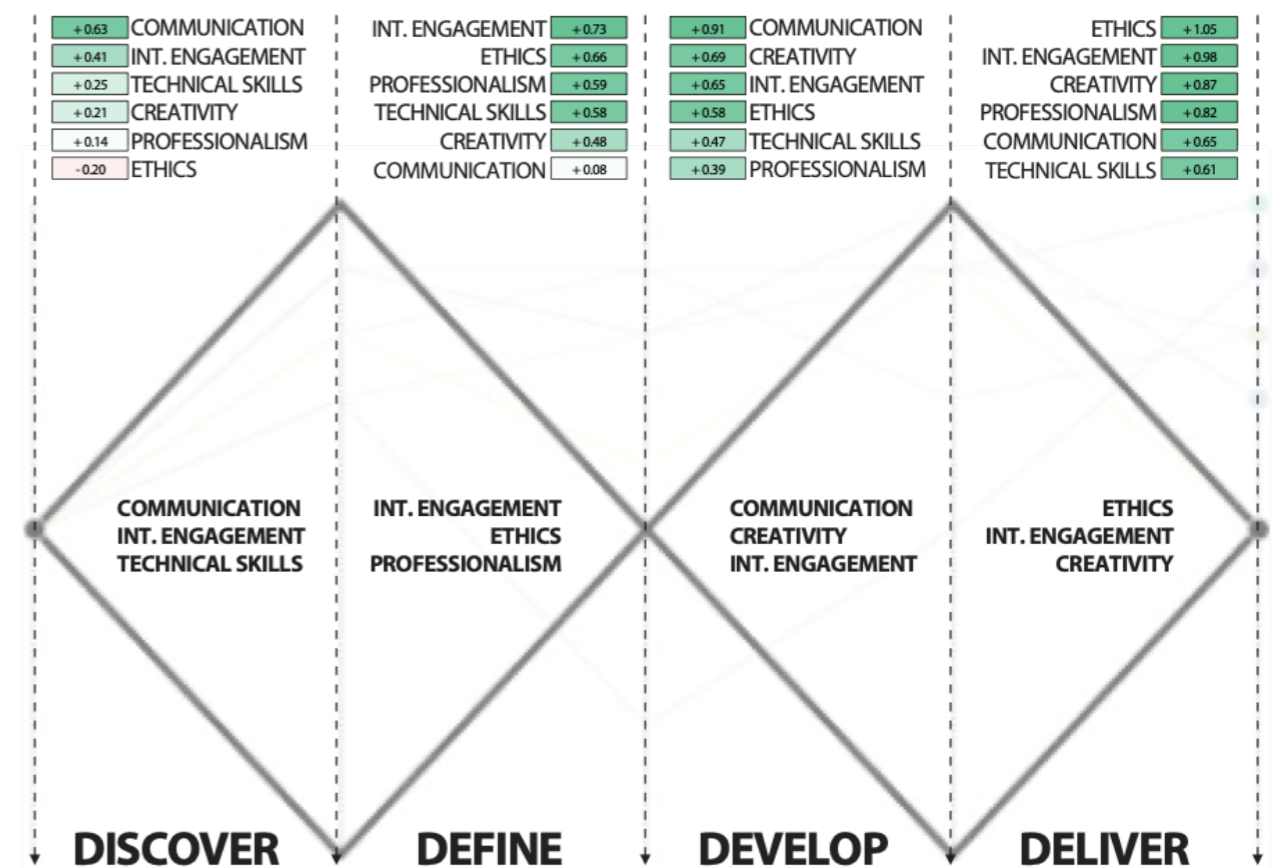ETHICS
INT. ENGAGEMENT
CREATIVITY

Figure 25. A comparative analysis was implemented to generate a hierarchy of the impact of each variable in each stage to understand what made the difference among the overall and the finalist groups. Comparative study between overall groups (n=77) and finalists (n=7)
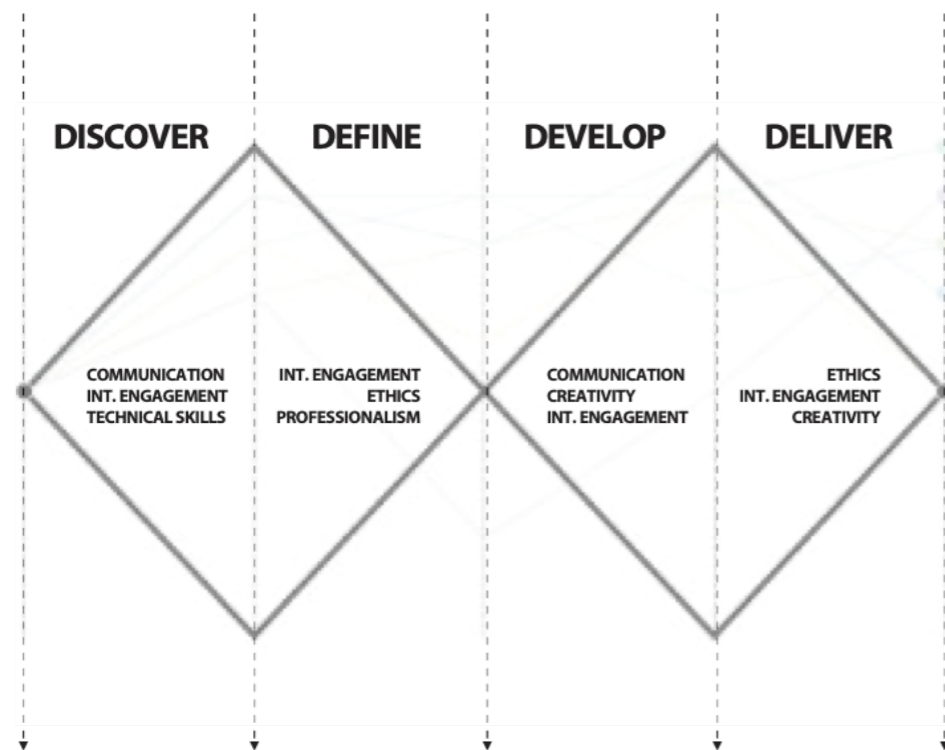
FINALISTS KEY ATTRIBUTES HYERARCHY BY STAGES

Figure 26. Key attributes of variables by the different stages of the Double Diamond.

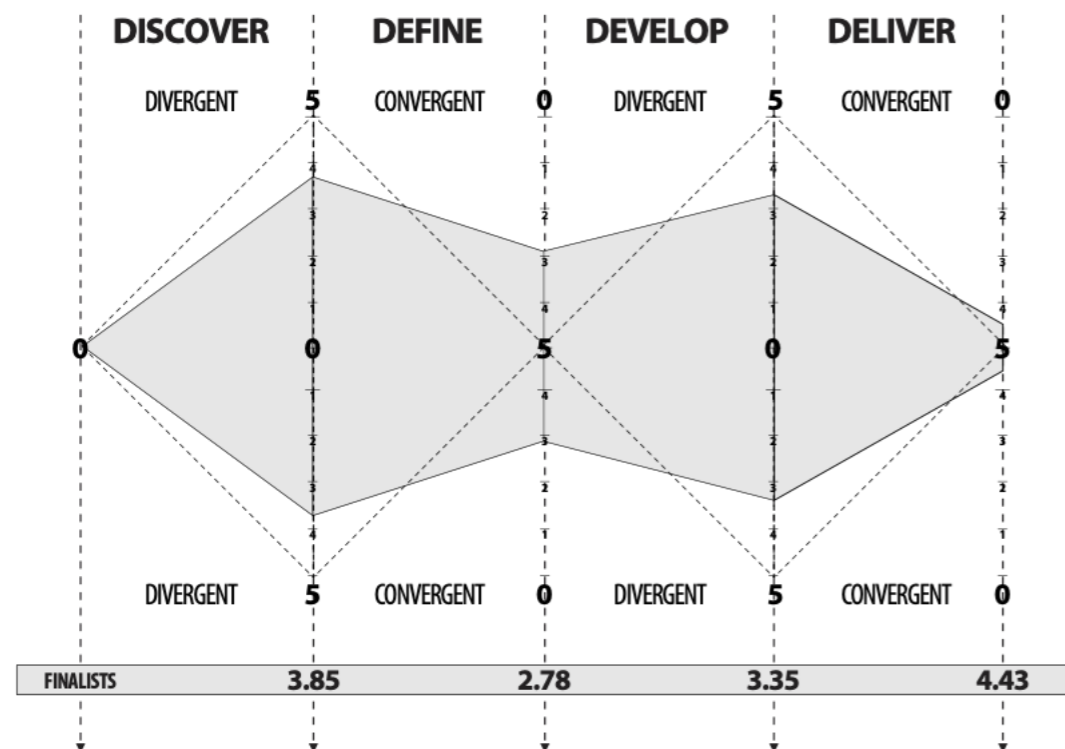## FINALISTS DOUBLE DIAMOND SHAPE

Figure 27. The journey of the finalists through the Double Diamond in the GC.

6.1. Assessment Analysis Conclusions

In this study, we calculate the overall mean and compare it against the finalists' mean to obtain the difference between them. This differential analysis enabled us to classify the different variables to understand which of them, and where, they made a difference for the finalists.

As can be seen from the unpaired t test results by variables, intellectual engagement is the variable which differentiated the most between the overall and the finalist with an extreme statistical significance. It is followed by communication, creativity, ethics, professionalism, and technical skills which were very statistically significant.

In terms of stages, in the discovery phase, communication (+0.63) and intellectual engagement (+0.41) are the most defining attributes. They are followed by technical skills (+0.25), creativity (+0.21), professionalism (+0.14), and ethics (-0.20). In terms of ethics, the finalists performed lower than the overall mean. This is the only instance in the measurements where this is the case. In the defining phase, intellectual engagement (+0.73) and ethics (+0.66) are the most defining attributes. They are followed by professionalism (+0.59), technical skills (+0.58), creativity (+0.48), and communication (+0.08). In the developing phase communication (+0.91) and creativity (+0.69) are the most defining attributes. They are followed by intellectual engagement (+0.65), ethics (+0.58), technical skills (+0.47), and professionalism (+0.39). Finally, in the delivering phase ethics (+1.05) and intellectual engagement (+0.98) are the most defining attributes. They are followed by creativity (+0.87), professionalism (+0.82), communication (+0.65), and technical skills (+0.61). In terms of ethics, the finalists performed beyond +1.00-point difference than the overall mean. Likewise, this is the only case in the measurements where this occurs.

Another interesting insight from this study is the divergent and convergent processes. The finalists performed very well in the discovery stage (stage 1), and excellent in the delivery (stage 4), however, they performed poorly in the defining stage (stage 2), and performed well in comparison to the overall in the developing phase (stage 3). The results in the defining stage were unexpected. The theory and the DD illustration seem to suggest that the better you define a case the better you will deliver (the Double Diamond intersects at one point). Contrary to this representation, the results seem to suggest otherwise. It seems to suggest ambiguity and lack of definition. The processes are more related to Design practice. These processes are antagonistic to scientific methods, which demand a clearly defined path. Design seems to operate in space better when it is semi-defined and ambiguous. Design, when combined with intellectual engagement and ethics in its defining stage, and communication and creativity in its developing stage, produces excellent results capable of delivering a real-world intervention with ethical considerations.

This study integrated a range of variables to address different attributes implicit in the design process. Using the results presented, we can validate their efficacy. As can be observed in the illustrative diagram, any of the six variables is part of the three main attributes in each stage, however, the nature of the stage determines the right combination. The initial stage demands a combination of communication, intellectual engagement, and technical skills. The defining stage demands a combination of intellectual engagement, ethics, and professionalism. The developing stage demands a combination of communication, creativity, and intellectual engagement. Finally, the delivering stage demands a combination of ethics, intellectual

engagement and creativity. The performance in these combinations is what enabled the finalists to outperform the rest of the groups.

This study was conducted in the context of Design for Safety aiming for real-world interventions to deliver impactful solutions. Further research will be needed to understand to which extent the results can be generalized to other contexts and other purposes of the examined in this paper. The intention of the researchers is to build on these results in future embodiments of this cross-departmental project.

7. Double Diamond Feedback

How much did the double diamond help you process in your project?
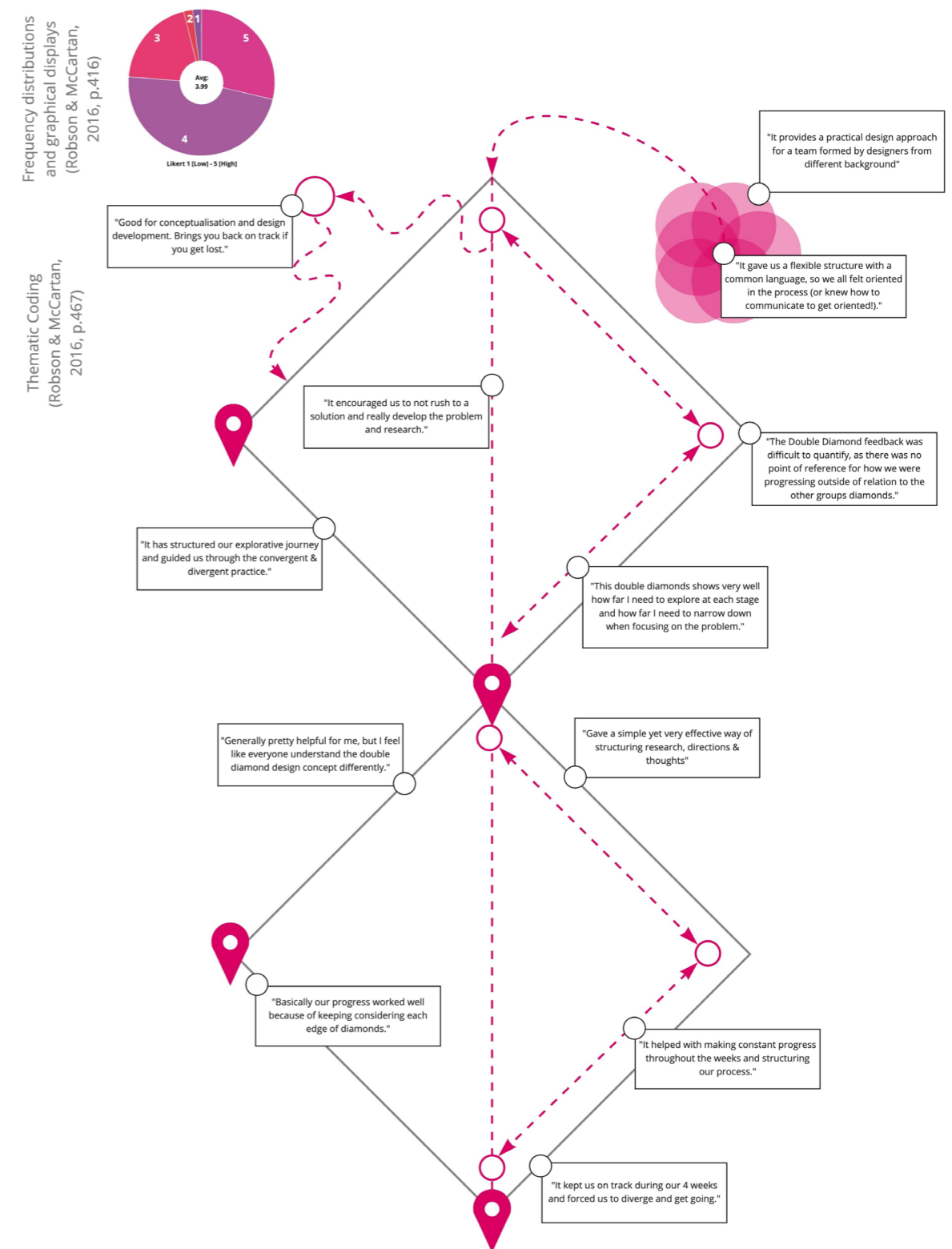
Figure 28. Following the end of the GC, designers offered their feedback regarding the use of the DD. Overall, designers believed that the DD offered their group an effective guiding framework throughout the duration of the project. Of course, due to the ambiguity of the DD, its interpretation was equally different for both tutors and designers and therefore was challenging in understanding the quantifiable desired direction.

8. Variables Feedback

How much did the weekly assessment help your project assessment?

Rank the relevance of the variables we used to assess you
- **Evaluation Overall**
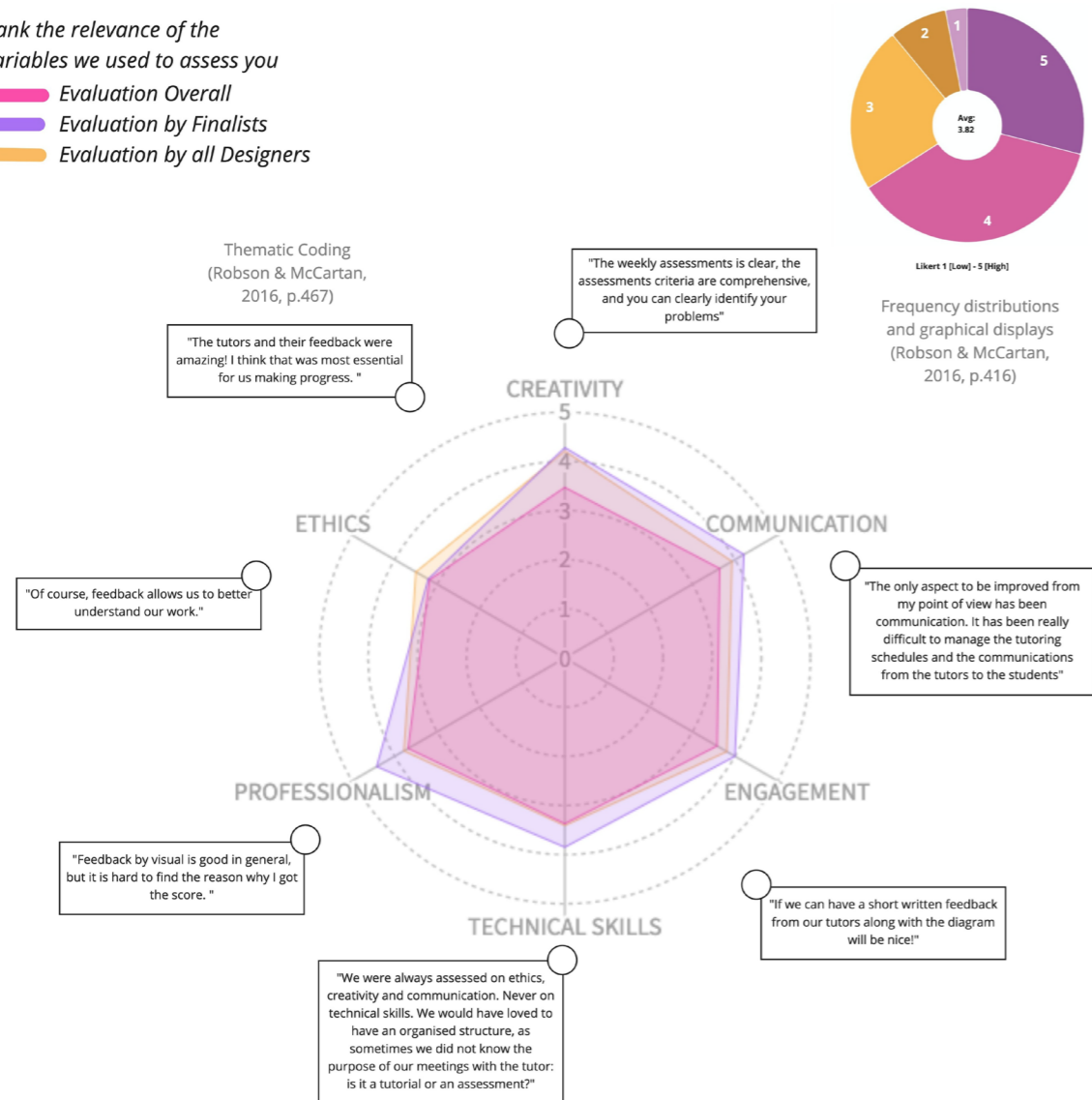- **Evaluation by Finalists**
- **Evaluation by all Designers**

Thematic Coding (Robson & McCartan, 2016, p.467)

"The tutors and their feedback were amazing! I think that was most essential for us making progress."

"The weekly assessments is clear, the assessments criteria are comprehensive, and you can clearly identify your problems"

Avg: 3.82

Likert 1 [Low] - 5 [High]

Frequency distributions and graphical displays (Robson & McCartan, 2016, p.416)

"Of course, feedback allows us to better understand our work."

"The only aspect to be improved from my point of view has been communication. It has been really difficult to manage the tutoring schedules and the communications from the tutors to the students"

"Feedback by visual is good in general, but it is hard to find the reason why I got the score."

"If we can have a short written feedback from our tutors along with the diagram will be nice!"

"We were always assessed on ethics, creativity and communication. Never on technical skills. We would have loved to have an organised structure, as sometimes we did not know the purpose of our meetings with the tutor: is it a tutorial or an assessment?"

Figure 29. In the feedback form, designers were asked to rank the relevance of variables used to assess them. Overall, communication, professionalism were considered the most relevant variable. Surprisingly, 'ethics' being considered as the least relevant form of assessment. This could be considered as a reflection of the ambiguous framing of ethics in figure 9, and better framing of this must be considered. Finally, the students found that although the quantitative visual assessments were helpful, they found the lack of qualitative feedback challenging to justify their grade. Further development could consider how to simultaneously visualise both quantitative and qualitative assessments.

9. Group Experience Feedback

How much did you enjoy your experience working as a group?

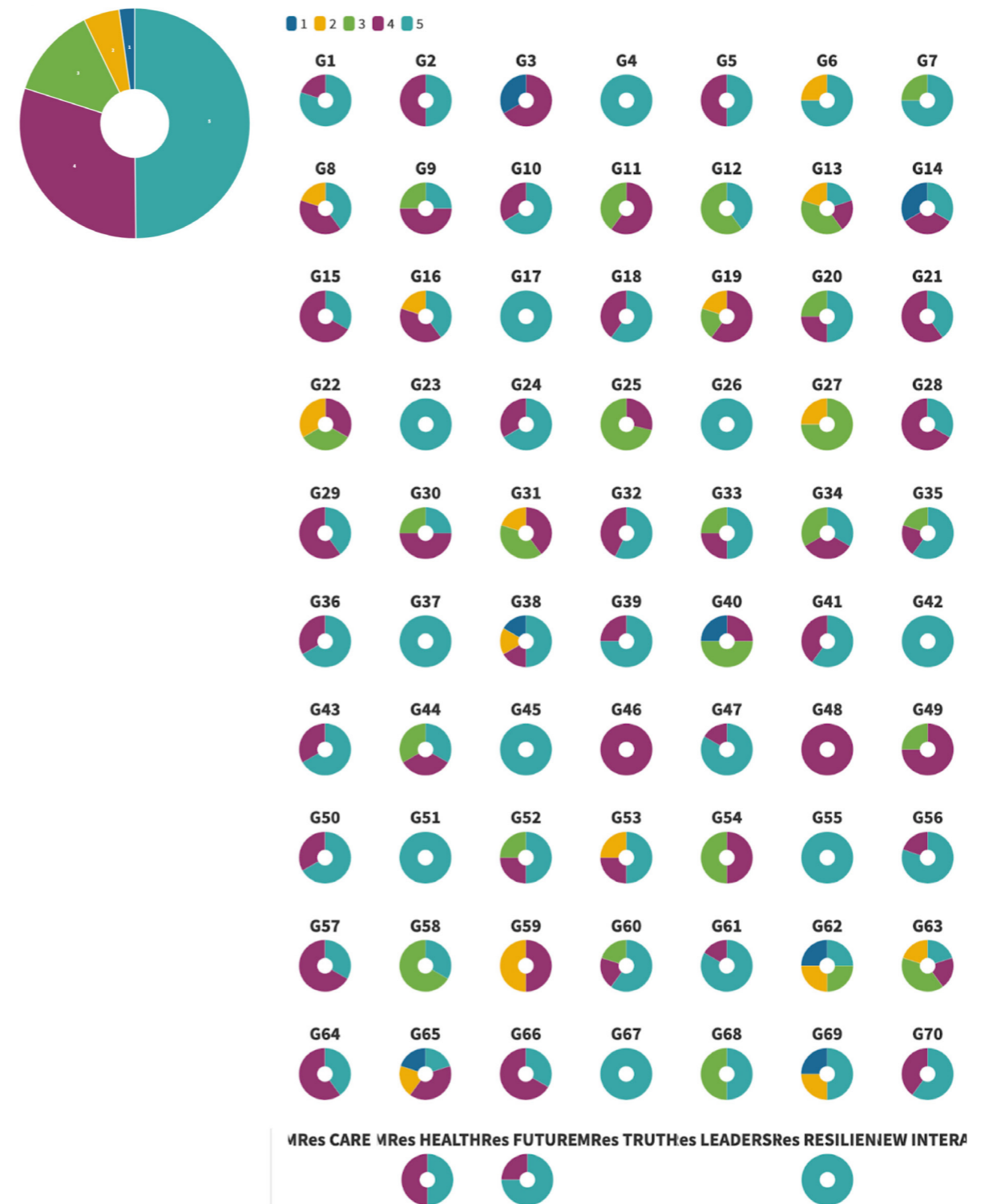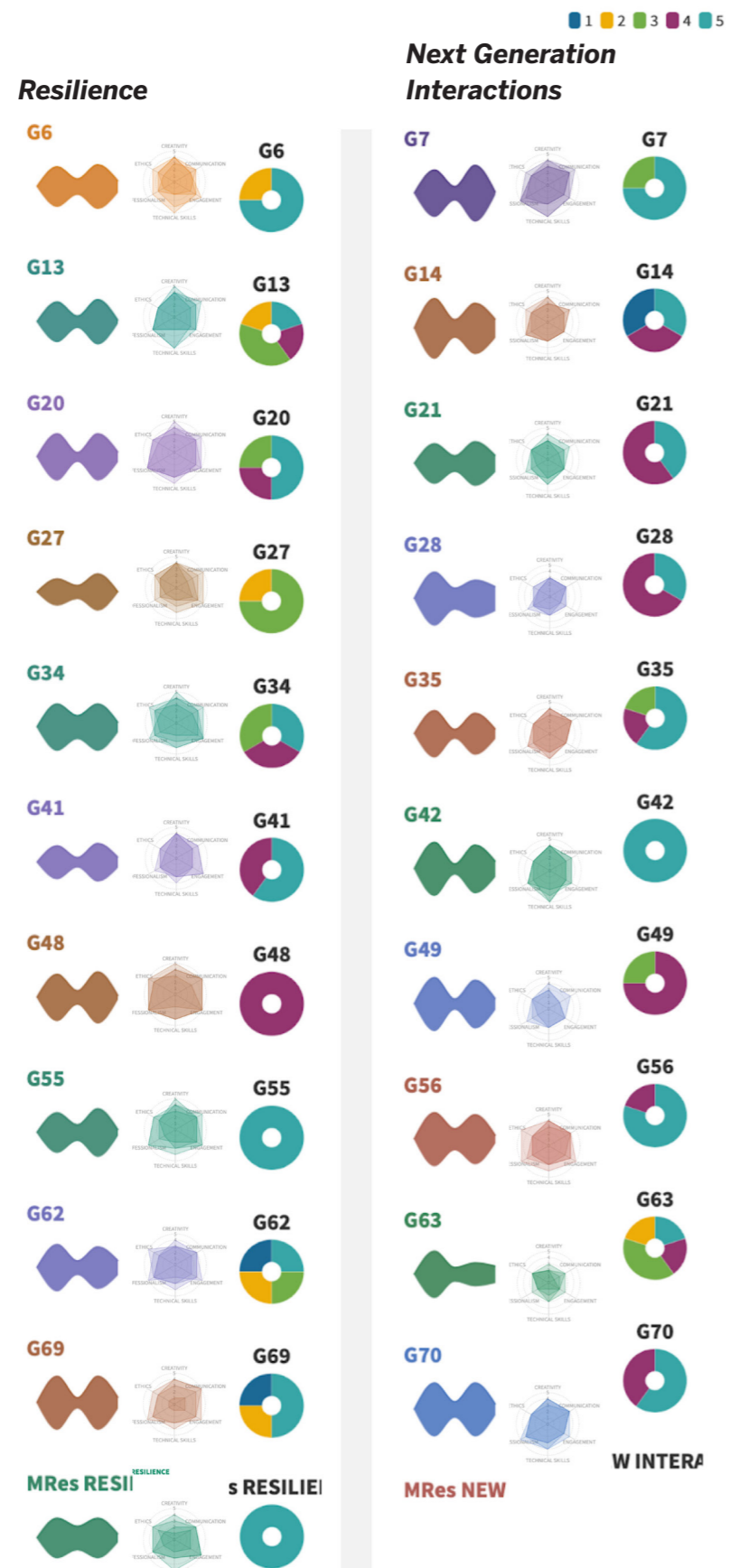**1) Overall**

2) Groups

Figure 30. Furthermore, designers shared how much they enjoyed working as a group during the Grand Challenge. Positively, roughly half of the students rated their experience the highest value [5] with many groups having an overall positive experience between all designers. This brings into question: what leads to designers enjoying working as a group? Has the GC created a space that facilitates positive group work? What elements have contributed to this?

10. Cross-assessment and Group Dynamics Comparison

Figure 31. Through the cross-comparison of assessments, we may begin to understand how closely the journey of the designers through the double diamond related to their experience as working in a group. However, upon closer inspection, the relation is not consistent. The results for groups with a consistent double diamond journey were varied: some group dynamics and experiences were positive overall, and others reported low scores for this area. As mentioned before, what other factors may be influencing this?

Resilience

Next Generation Interactions

Legend: 1 2 3 4 5

G6, G13, G20, G27, G34, G41, G48, G55, G62, G69

G7, G14, G21, G28, G35, G42, G49, G56, G63, G70

MRes RESILIENCE | s RESILIENCE

MRes NEW | W INTERACTIONS

11. Group Dynamics: Communication and Intellectual Engagement as Strategy to Build Resilience

For every group of 10 teams you have a distribution of;
- 2 groups performing excellently.
- 2 groups performing very well
- 2 groups performing good
- 2 groups performing satisfactory
- 2 groups performing poorly

This preliminary distribution may swing depending on four fundamental behaviour-led variables; intellectual engagement and communication, complemented with professionalism and ethics. Creativity and technical skills are additional rather than critical for group performance.

In the results below we use an Association Discovery algorithm. This system is a rule-based unsupervised Machine Learning method for discovering relations between variables in high-dimensional datasets. The main motivation behind the technique is to arrive at statistically significant rules discovered as per a given measure of interestingness. Associations go beyond simple variable correlations by revealing complex set of rules that state which particular values of a given set of variables imply the existence of other variables in your dataset that assume specific values of their own.

COMMUNICATION > 4

INTELLECTUAL ENGAGEMENT > 4

PROFESSIONALISM > 4

ETHICS > 4

All fields
Associations (K): 26
Leverage: 5.8151%

3 < INTELLECTUAL ENGAGEMENT <= 4
3 < PROFESSIONALISM <= 4
3 < COMMUNICATION <= 4
COMMUNICATION > 4
2 < ETHICS <= 3
INTELLECTUAL ENGAGEMENT > 4
PROFESSIONALISM > 4
2 < TECHNICAL SKILLS <= 3
2 < INTELLECTUAL ENGAGEMENT <= 3
3 < ETHICS <= 4
2 < CREATIVITY <= 3
2 < COMMUNICATION <= 3
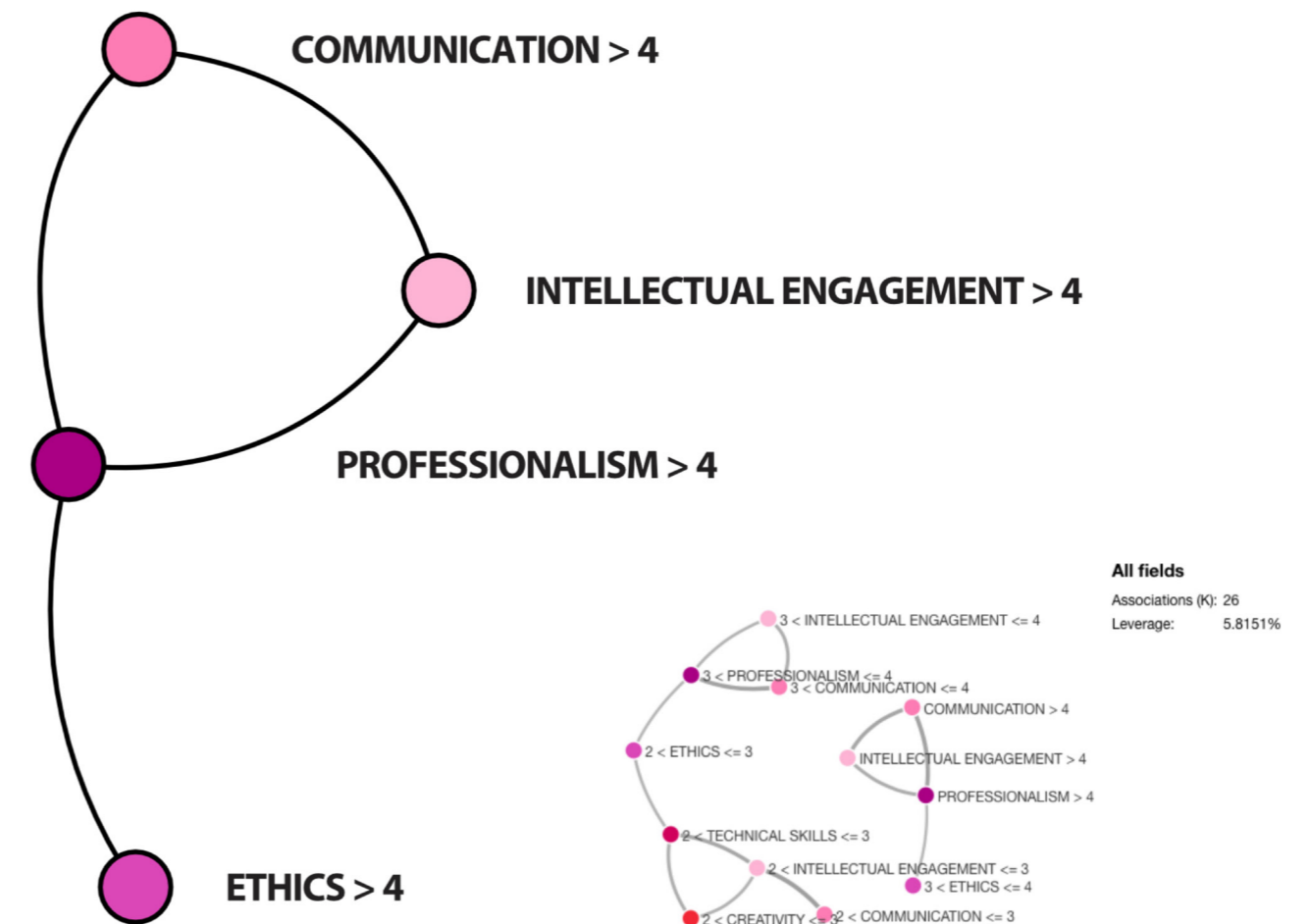
Relational study

WEEK 4 - DELIVER			W4 FINAL	COMMUNICATION	INTELLECTUAL	PROFESSIONAL
WEEK 4 - DELIVER	CARE	G22	3.33	4	3	4
WEEK 4 - DELIVER	CARE	G8	3.33	4	3	4
WEEK 4 - DELIVER	CARE	MRes CARE	3.67	4	4	4
WEEK 4 - DELIVER	CARE	G36	3.83	3	4	5
WEEK 4 - DELIVER	CARE	G57	4.17	5	5	5
WEEK 4 - DELIVER	CARE	G64	4.33	5	4	5
WEEK 4 - DELIVER	CARE	G15	4.50	5	4	5
WEEK 4 - DELIVER	CARE	G29	4.50	5	4	5
WEEK 4 - DELIVER	CARE	G43	4.50	4	4	5
WEEK 4 - DELIVER	CARE	G1	4.67	5	5	5
WEEK 4 - DELIVER	CARE	G50	4.67	5	5	5
WEEK 4 - DELIVER	FUTURES	G31	2.17	2	2	2
WEEK 4 - DELIVER	FUTURES	G3	2.67	2	2	3
WEEK 4 - DELIVER	FUTURES	G66	2.67	3	2	3
WEEK 4 - DELIVER	FUTURES	G59	2.83	3	2	3
WEEK 4 - DELIVER	FUTURES	G24	3.00	3	3	3
WEEK 4 - DELIVER	FUTURES	G38	3.17	3	3	4
WEEK 4 - DELIVER	FUTURES	G10	3.50	3	3	4
WEEK 4 - DELIVER	FUTURES	MRes FUTURES	3.50	3	4	4
WEEK 4 - DELIVER	FUTURES	G52	4.00	4	4	4
WEEK 4 - DELIVER	FUTURES	G17	4.33	5	4	5
WEEK 4 - DELIVER	FUTURES	G45	4.50	5	4	5
WEEK 4 - DELIVER	HEALTH	G9	3.50	4	3	3
WEEK 4 - DELIVER	HEALTH	G37	3.83	5	4	4
WEEK 4 - DELIVER	HEALTH	G44	3.83	4	4	4
WEEK 4 - DELIVER	HEALTH	G16	4.00	4	3	4
WEEK 4 - DELIVER	HEALTH	G2	4.00	4	4	4
WEEK 4 - DELIVER	HEALTH	G23	4.00	4	4	4
WEEK 4 - DELIVER	HEALTH	G65	4.00	4	4	4
WEEK 4 - DELIVER	HEALTH	G51	4.67	5	5	5
WEEK 4 - DELIVER	HEALTH	G58	4.67	5	5	5
WEEK 4 - DELIVER	HEALTH	MRes HEALTH	4.83	5	5	5
WEEK 4 - DELIVER	HEALTH	G30	5.00	5	5	5
WEEK 4 - DELIVER	LEADERSHIP	G26	2.33	2	2	3
WEEK 4 - DELIVER	LEADERSHIP	G40	2.33	3	2	3
WEEK 4 - DELIVER	LEADERSHIP	G68	2.83	3	3	3
WEEK 4 - DELIVER	LEADERSHIP	G33	3.00	3	3	3
WEEK 4 - DELIVER	LEADERSHIP	G5	3.00	3	3	3
WEEK 4 - DELIVER	LEADERSHIP	G19	3.17	3	3	3
WEEK 4 - DELIVER	LEADERSHIP	G61	3.17	4	3	3
WEEK 4 - DELIVER	LEADERSHIP	G12	3.33	4	3	4
WEEK 4 - DELIVER	LEADERSHIP	G54	3.83	4	4	4
WEEK 4 - DELIVER	LEADERSHIP	G47	4.17	4	4	4
WEEK 4 - DELIVER	NEW INTERACTIONS	G63	1.83	1	2	2
WEEK 4 - DELIVER	NEW INTERACTIONS	G28	2.83	3	2	4
WEEK 4 - DELIVER	NEW INTERACTIONS	G21	3.17	3	3	3
WEEK 4 - DELIVER	NEW INTERACTIONS	G14	3.50	3	3	4
WEEK 4 - DELIVER	NEW INTERACTIONS	G35	3.67	4	3	4
WEEK 4 - DELIVER	NEW INTERACTIONS	G42	3.67	3	3	4
WEEK 4 - DELIVER	NEW INTERACTIONS	G70	3.67	4	3	4
WEEK 4 - DELIVER	NEW INTERACTIONS	G7	4.50	5	4	5
WEEK 4 - DELIVER	NEW INTERACTIONS	G56	4.50	4	5	5
WEEK 4 - DELIVER	RESILIENCE	G62	3.50	4	4	4
WEEK 4 - DELIVER	RESILIENCE	G6	3.67	3	5	3
WEEK 4 - DELIVER	RESILIENCE	G41	3.83	4	5	4
WEEK 4 - DELIVER	RESILIENCE	G69	4.00	5	4	4
WEEK 4 - DELIVER	RESILIENCE	G13	4.17	5	4	4
WEEK 4 - DELIVER	RESILIENCE	G27	4.33	5	5	4
WEEK 4 - DELIVER	RESILIENCE	MRes RESILIENCE	4.33	4	5	4
WEEK 4 - DELIVER	RESILIENCE	G20	4.50	5	5	5
WEEK 4 - DELIVER	RESILIENCE	G34	4.50	5	5	4
WEEK 4 - DELIVER	RESILIENCE	G55	4.50	5	5	5
WEEK 4 - DELIVER	RESILIENCE	G48	4.83	5	5	5

WEEK 4 - DELIVER						
WEEK 4 - DELIVER	TRUTH	G32	3.17	3	3	3
WEEK 4 - DELIVER	TRUTH	G25	3.50	3	3	4
WEEK 4 - DELIVER	TRUTH	G11	3.67	3	4	4
WEEK 4 - DELIVER	TRUTH	G53	3.67	4	3	4
WEEK 4 - DELIVER	TRUTH	G4	3.83	4	4	4
WEEK 4 - DELIVER	TRUTH	G67	3.83	4	4	4
WEEK 4 - DELIVER	TRUTH	G18	4.17	4	4	4
WEEK 4 - DELIVER	TRUTH	G39	4.17	5	4	4
WEEK 4 - DELIVER	TRUTH	G60	4.67	5	4	5
WEEK 4 - DELIVER	TRUTH	G46	4.67	4	5	5

We can observe in this study the relationship between communication and engagement and result. The better groups perform in these aspects the better they deliver.
The key element in this area is that a group performing excellently creates a space where they can criticize the project, but this process does not divide/collapse the group. Rather, it propels the project to a unique space. However, this balance is really difficult to archive. The critical thresholds are decisions in week 2 and 3 when they have to define the final direction of the project.

One fundamental question is how groups make decisions? Focusing on the observations on two themse: futures, and truth, three main strategies emerged;

- A dominant leader - in this case, a dominant leader overrules collective decisions in favor of his preferred option. In this case, the group is dependent on the talent of the leader.
- Maneuver - in this case, one of the members convince a majority to develop the project on his/her preferred option. As you can observe in the result presented earlier they were the worst teams.
- Consensus - this is the preferred strategy used in group projects. However, we have two options; ideas and impact. When a group is lost or generates two or more dominant ideas, the question is how do you generate consensus to get everybody involved?. In the first case, ideas operate as an element to foster consensus. The main problem is that what creates consensus does not necessarily create impact or is relevant. It just avoids conflict. In the cases generating consensus by choosing the most impactful idea, they normally performed in the higher spectrum of results.

FUTURES				FUTURES
	G24			
	G17			
	G38	G59		
	G66	G52	G31	
	G10	G45	G03	
DOMINANT IDEAS	IDEAS **CONSENSUS** IMPACT		IDEAS **MANEUVER**	
G67	G53	G46		
G25	G04	G39		
	G11	G60		
	G18			
	G32			
TRUTH				TRUTH

48

49
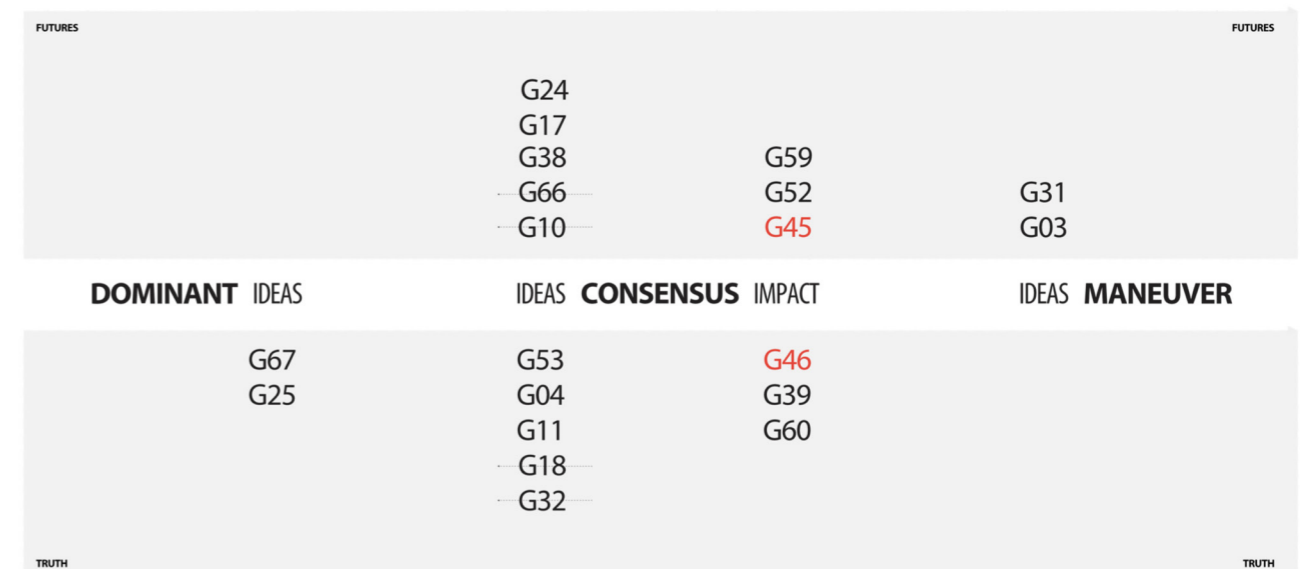
Additionally, a tracking assessment was conducted on these two themes by assessing weekly the level of connectedness and whether they were reactive or proactive. Proactive means the group came to tutorials and took the initiative by presenting what they have done and performing a set of questions previously constructed. Reactive means groups attended tutorials with a passive attitude waiting for tutors to ask them questions and instructing the following steps. Finally, connectedness is the connection, good vibe, and togetherness within the group.

	WEEK 0		WEEK 1		WEEK 2		WEEK 3		
G66	PROACTIVE	CONNECTED : 2	PROACTIVE	CONNECTED : 3	PROACTIVE	CONNECTED : 3	REACTIVE	CONNECTED : 3	
G59	PROACTIVE	CONNECTED : 3	PROACTIVE	CONNECTED : 3	PROACTIVE	CONNECTED : 4	PROACTIVE	CONNECTED : 4	
G52	PROACTIVE	CONNECTED : 5	PROACTIVE	CONNECTED : 5	PROACTIVE *LOST*	CONNECTED : 4	PROACTIVE	CONNECTED : 5	
G45	PROACTIVE	CONNECTED : 5	PROACTIVE	CONNECTED : 5	PROACTIVE	CONNECTED : 5	PROACTIVE	CONNECTED : 5	FINALISTS
G38	REACTIVE	CONNECTED : 0	REACTIVE	CONNECTED : 3	REACTIVE	CONNECTED : 3	REACTIVE	CONNECTED : 3	
G31	REACTIVE	CONNECTED : 0	REACTIVE	CONNECTED : 0	REACTIVE	CONNECTED : 2	REACTIVE	CONNECTED : 3	
G24	REACTIVE	CONNECTED : 1	REACTIVE	CONNECTED : 12	PROACTIVE	CONNECTED : 3	PROACTIVE	CONNECTED : 4	
G17	REACTIVE	CONNECTED : 1	REACTIVE	CONNECTED : 1	PROACTIVE	CONNECTED : 3	PROACTIVE	CONNECTED : 4	
G10	PROACTIVE	CONNECTED : 3	REACTIVE	CONNECTED : 1	PROACTIVE	CONNECTED : 2	REACTIVE	CONNECTED : 3	
G03	PROACTIVE	CONNECTED : 4	PROACTIVE	CONNECTED : 4	PROACTIVE	CONNECTED : 3	PROACTIVE	CONNECTED : 2	

	WEEK 0		WEEK 1		WEEK 2		WEEK 3		
G67			REACTIVE	CONNECTED : 3	REACTIVE	CONNECTED : 3	REACTIVE	CONNECTED : 3	
G60					PROACTIVE	CONNECTED : 4	PROACTIVE	CONNECTED : 4	
G53					PROACTIVE	CONNECTED : 4	PROACTIVE	CONNECTED : 4	
G46			PROACTIVE	CONNECTED : 5	PROACTIVE	CONNECTED : 5	REACTIVE *LOST*	CONNECTED : 2	FINALISTS
G39			REACTIVE	CONNECTED : 3	PROACTIVE	CONNECTED : 4	REACTIVE	CONNECTED : 2	
G32			REACTIVE	CONNECTED : 2	REACTIVE	CONNECTED : 2	PROACTIVE	CONNECTED : 3	
G25			PROACTIVE	CONNECTED : 4	PROACTIVE	CONNECTED : 5	REACTIVE	CONNECTED : 3	
G18			REACTIVE	CONNECTED : 2	REACTIVE	CONNECTED : 3	REACTIVE	CONNECTED : 3	
G11			REACTIVE	CONNECTED : 1	REACTIVE	CONNECTED : 1	REACTIVE	CONNECTED : 2	
G04			PROACTIVE	CONNECTED : 3	PROACTIVE	CONNECTED : 4	REACTIVE	CONNECTED : 3	

11.1. Conclusion

In conclusion, from this study, we observed the relationship among results and human behaviour attitudes within a group. intellectual engagement and communication, complemented with professionalism and ethics emerged as the dominant variables. Creativity and technical skills were additional rather than critical for group performance.

The consensus around impact emerged as a successful strategy to address critical decisions and foster resilience. Finally, the level of connectedness and a proactive attitude also affected the performance of groups. These variables set the stage for further research in the area.

ACTION RESEARCH
Discussion

12. Expert Interviews

12.1. Expert Interviews Design Framework

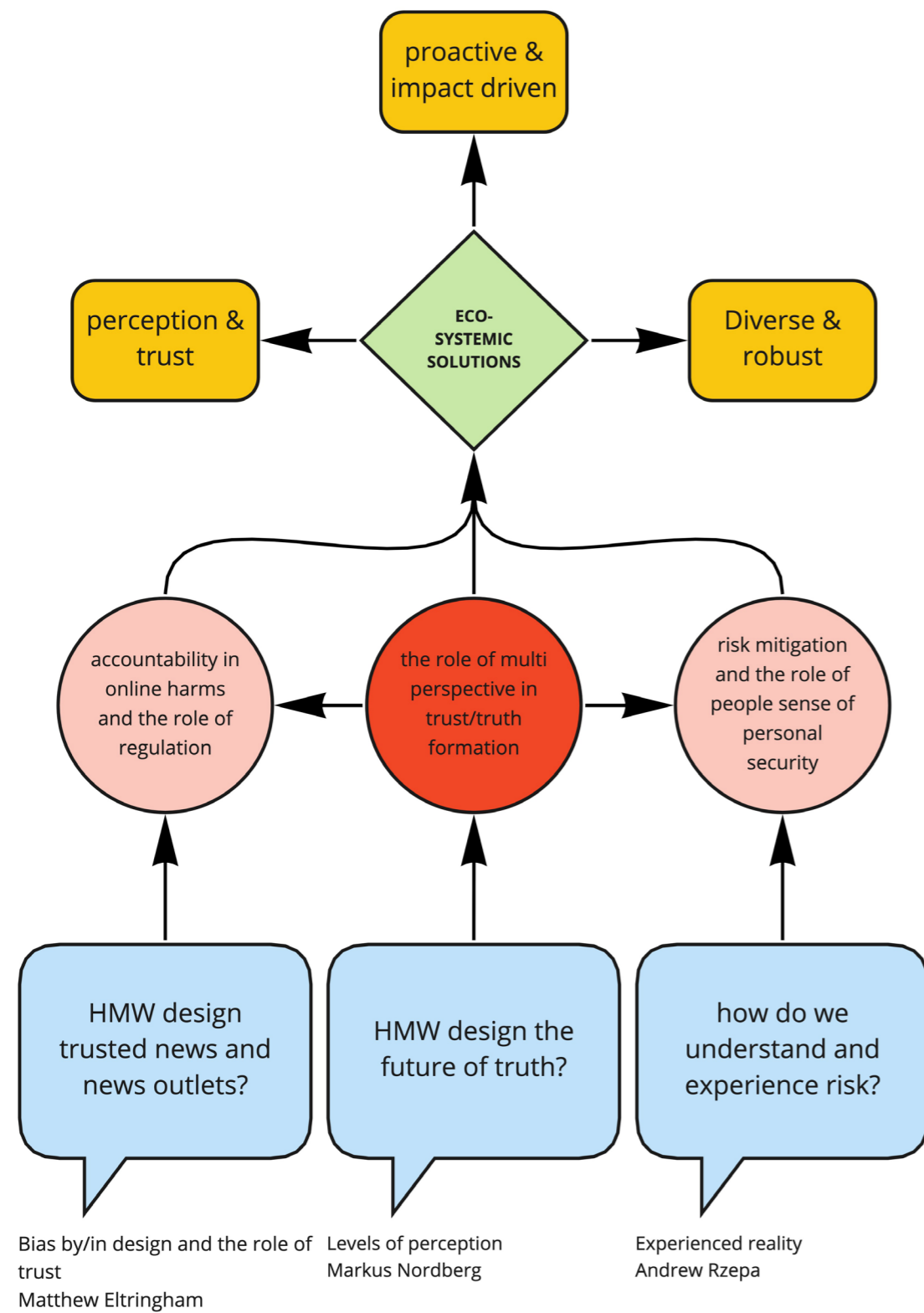## 12.2. Futures: Designing the unthinkable
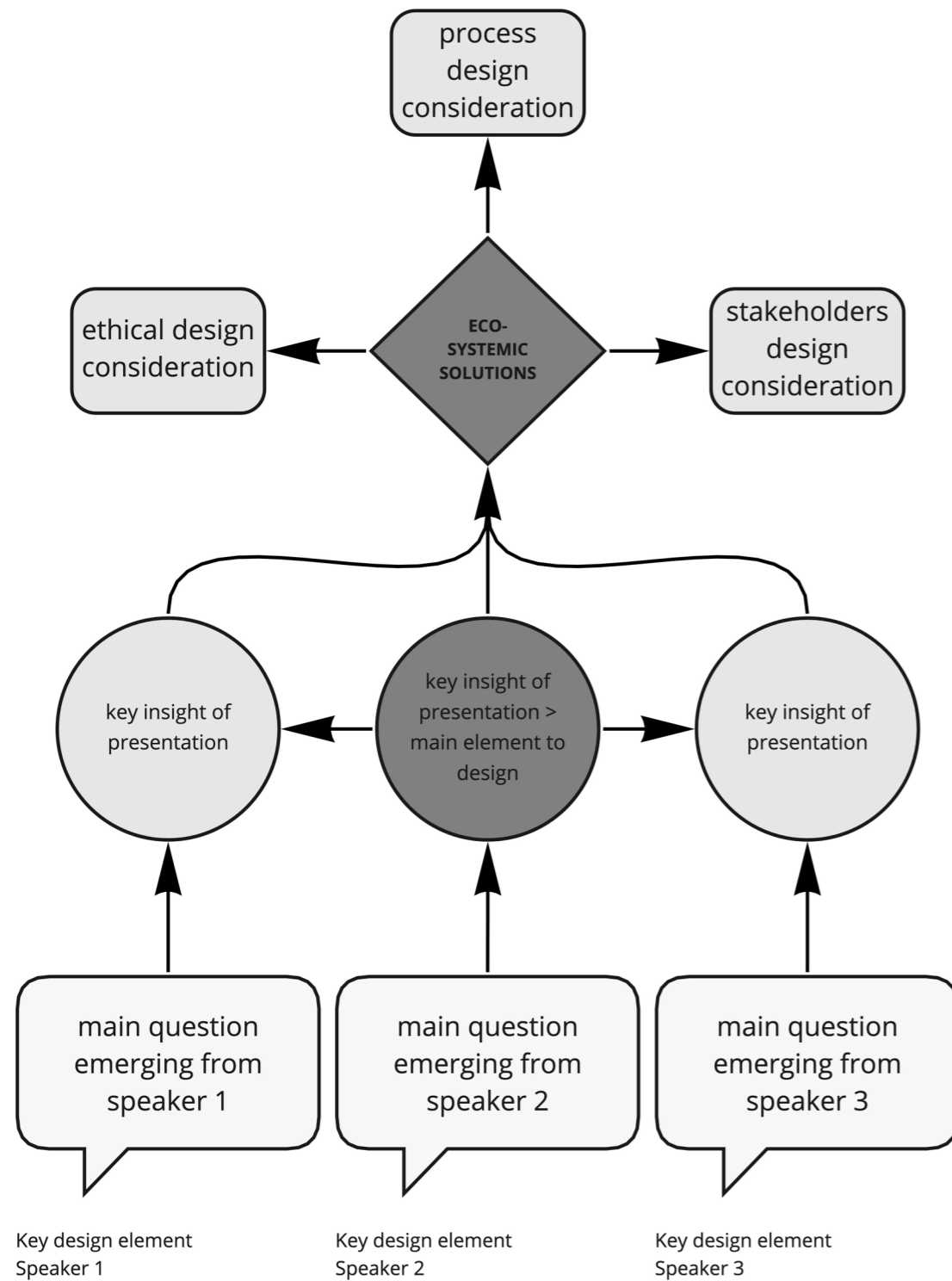
Figure 32. As seen in figure 5 on page 13, the Grand Challenge started with 12 expert interviews which took place across five webinars. The experts ranged from different fields of work from humanitarian assistance to artificial intelligence. All sharing the most prominent questions and strategies being asked and used in their industry.
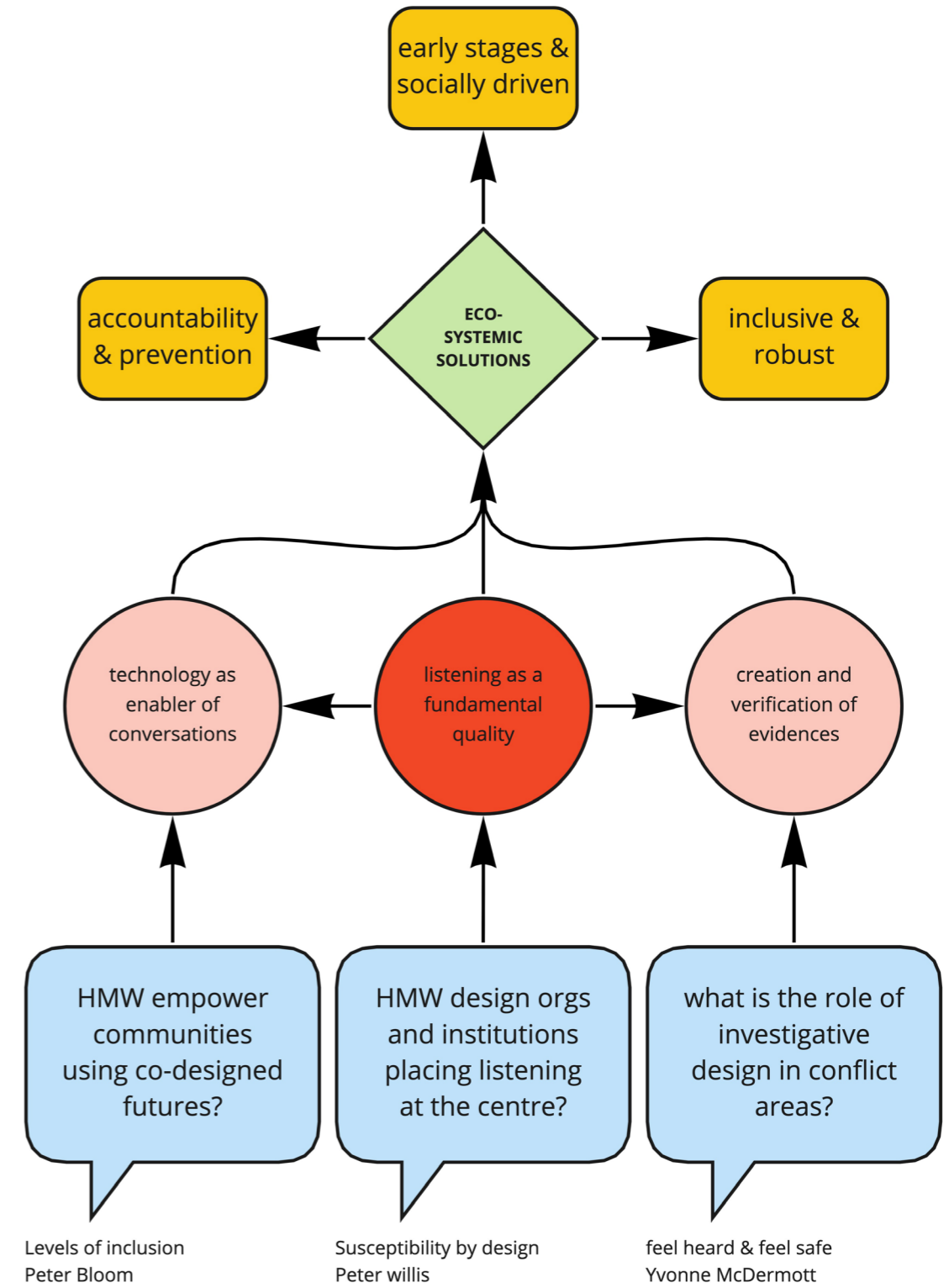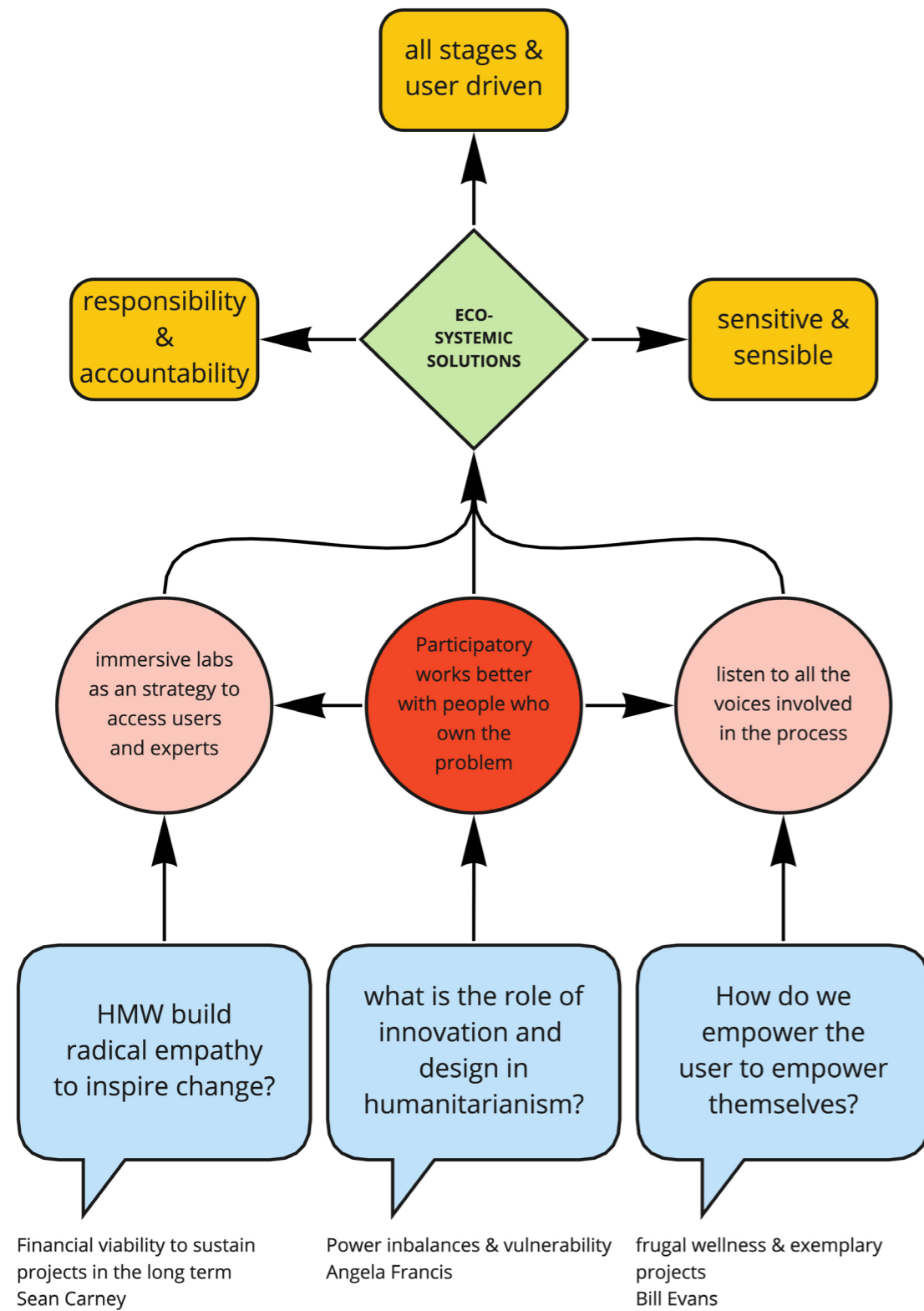
12.3. Truth: Designing truth

proactive & impact driven

perception & trust

ECO-SYSTEMIC SOLUTIONS

Diverse & robust

accountability in online harms and the role of regulation

the role of multi perspective in trust/truth formation

risk mitigation and the role of people sense of personal security

HMW design trusted news and news outlets?

HMW design the future of truth?

how do we understand and experience risk?

Bias by/in design and the role of trust
Matthew Eltringham

Levels of perception
Markus Nordberg

Experienced reality
Andrew Rzepa

12.4. Care and Leadership: Designing listening

early stages & socially driven

accountability & prevention

ECO-SYSTEMIC SOLUTIONS

inclusive & robust

technology as enabler of conversations

listening as a fundamental quality

creation and verification of evidences

HMW empower communities using co-designed futures?

HMW design orgs and institutions placing listening at the centre?

what is the role of investigative design in conflict areas?

Levels of inclusion
Peter Bloom

Susceptibility by design
Peter willis

feel heard & feel safe
Yvonne McDermott

12.5. Health and Resilience: Designing participation

all stages & user driven

responsibility & accountability

ECO-SYSTEMIC SOLUTIONS

sensitive & sensible

immersive labs as an strategy to access users and experts

Participatory works better with people who own the problem

listen to all the voices involved in the process

HMW build radical empathy to inspire change?

what is the role of innovation and design in humanitarianism?

How do we empower the user to empower themselves?

Financial viability to sustain projects in the long term
Sean Carney

Power inbalances & vulnerability
Angela Francis

frugal wellness & exemplary projects
Bill Evans

12.6. Next Generation Interactions: Designing data interactions

early stages & user driven

transparency & anonymity

ECO-SYSTEMIC SOLUTIONS

inclusive & reflective

capturing data from users and design it safely to increase perception

Data anonymity and ask users for permission to use it

personal data experiences; listen to your own voice

HMW design urban infrastructures with data?

how do we design data driven voice interactions in black boxes?

How do we design hyper-interactive systems?

Data as tangible/intangible asset
Ryan Jongwoo

Antropomorphism and inclusion
Vincent Slavin

Hyper-temporal interactions
YingJia Yao

13. MRes Initial Research

Wicked problem maps: Mapping complex issues
This section illustrates 7 maps analysing the 7 themes - Leadership, Truth, Health, Next Generation of Interaction, Resilience, and Care - as Wicked Problems (Buchanan, R. (1992).

Leadership

Figure 33. This diagram maps and links different factors that help frame the understanding of leadership in relation to safety. It can be read both sides; this is to outline the biunivocal relationship between safety and "design for leadership" in relation to human factors, cultural issues but also key players hold an important role and are accountable for designing a new model of leadership to ensure safety.
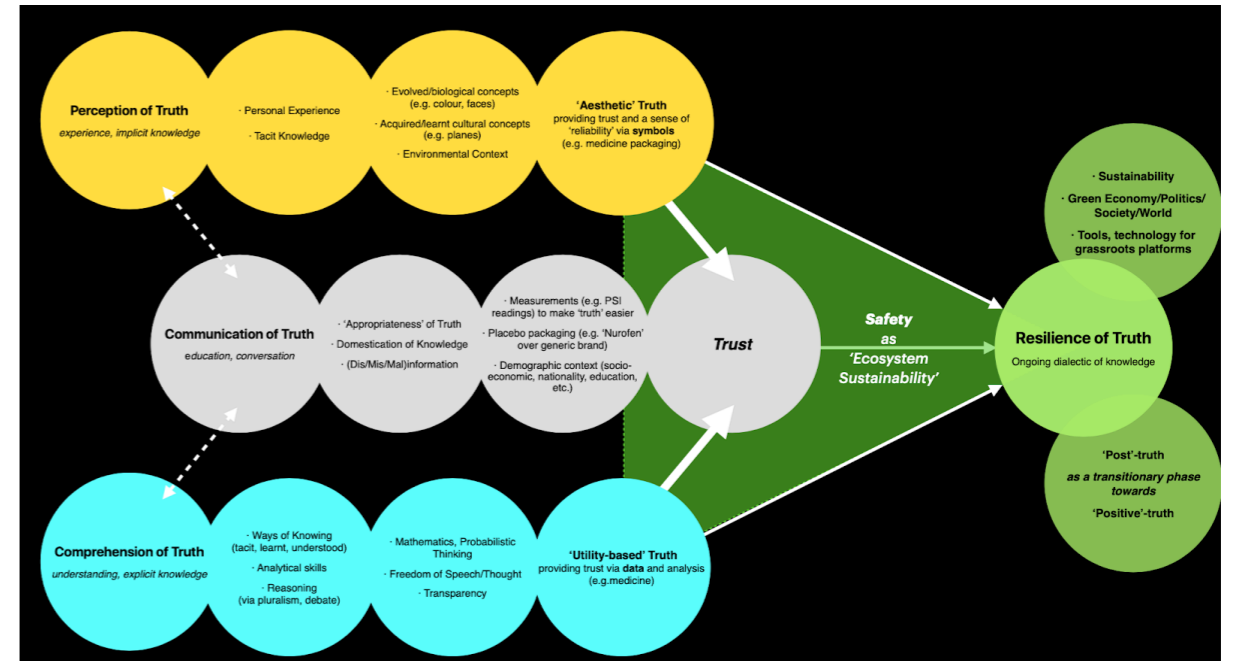
Figure 34. This diagram breaks down the theme of Truth according to three main aspects that make the concept from abstract to tangible. These three key aspects articulate how Truth is generated and draws any possible connection developed by the meaning of trust in the context of Design for Safety.

Next Generation Interactions

5 topics under NGI

Figure 35. This diagram illustrates the key aspects that define the theme of Next Generation of Interaction. In particular it links this theme to key topics which have had and will have an impact on the way people (will) interact with objects, from an evolutionary to a lifestyle and wellness perspective.

Figure 37. This diagram represents the possibility of combining social, political, economical, environmental and cultural events to impact the future of Design for Dafety. By plotting these aspects as general parameters, this diagram aims to represent how the combination of these factors can direct the future of safety towards alternative possibilities driven by key drivers.

Figure 36. This diagram maps and links the different factors which help frame the understanding of the topic of resilience in relation to safety. It can be read both sides to outline the biunivocal link Resilience and Safety have in relation to safety. These aspects contribute to generate a specific meaning for design resilience under the context of Grand Challenge and outline what role people can hold for generating a methodology that designs resilience as personal and collective behaviour.

Care

Figure 38. This diagram represents the relations, expressed as negative and positive feedback loops, between key issues that influence, and have an impact on, design for care in the context of Design for Safety. The bottom of this diagram, showing the positive and negative feedback between aspects like caring for communities, individuals, is drawn from the top part which defines care under aspects like technology, culture, and organisations.

14. Finalists and Winners Design Process [MAs]

CARE	INAYA	WINNING TEAM

OVERVIEW

IDENTIFIED SAFETY RISK
Lack of safety patient mental health safety in medical journeys

APPROACH - RISK MITIGATION
Integrating celebration into the medical journey of the patients

OUTCOME
A platform providing a celebration toolbox with various products and services

DESIGN PROCESS

Exploration of Care → Definition of Care → Stakeholder Interviews & Mapping → Concepts Development

Conceptual Model ← Business Development ← User Journey Mapping ← State-of-the-art Research

ASSESSMENTS

GROUP EXPERIENCE

■ 1 ■ 2 ■ 3 ■ 4 ■ 5

G50

RESILIENCE	MOWO	WINNING TEAM

OVERVIEW

IDENTIFIED SAFETY RISK
Lack of safety measures for women travelling in public transport

APPROACH - RISK MITIGATION
Develop a system where drivers can carry less people for more money

OUTCOME
A holistic service design which includes employing women, establish bus routes, journey regulation, establishing bus stops and ticket regulation.

DESIGN PROCESS

Deconstructing resilience → Wicked Problem Map → Primary Research → State-of-the-art review

Conceptual model ← System map ← Case Study ← Systematic Review

ASSESSMENTS

G48

GROUP EXPERIENCE

■ 1 ■ 2 ■ 3 ■ 4 ■ 5

G48

Figure 39. The following diagrams represent profiles of the finalists and winners groups. Each profile contains the identified safety risk, their approach, and outcome, this is coupled with the groups' design process, that was extracted from their Miro boards, and their assessments. What is interesting about these profiles is that the groups' process often reflected their final outcome. For example, Inaya (the group above) took a very explorative and user-centric approach which led to a universal yet individual-based approach by providing a toolbox with various forms of celebration. Other projects such as Mowo (next page) focused on developing specific case studies (in their case Lima, Peru). This enabled the innovation to be very local-based and rooted in local experiences and local landscapes.

NG INTERACTIONS | THE YELLOW BOX | WINNING TEAM
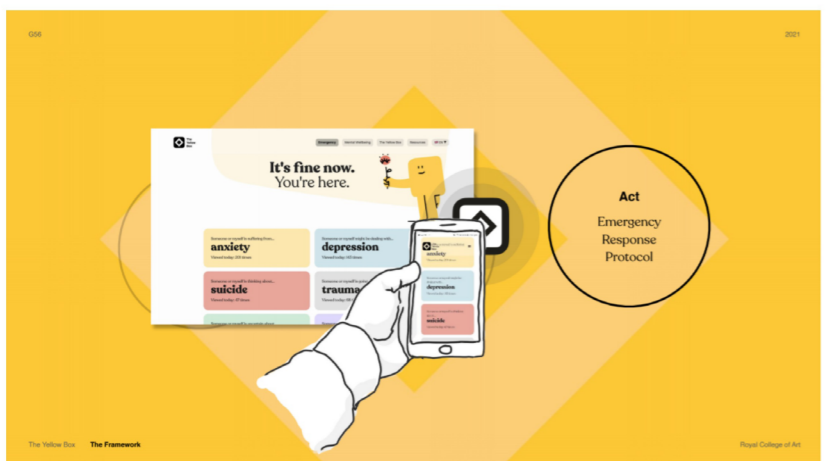
OVERVIEW

IDENTIFIED SAFETY RISK
Mental health not treated in the same comprehensive way as fire, road and health safety

APPROACH - RISK MITIGATION
Develop a universal public safety infrastructure that builds, reminds and responds to mental health

OUTCOME
A multidimensional intervention that includes education, public intervention, infrastructures, policy research & development and emergency response protocols.

DESIGN PROCESS

Note: the team have closed off their miro board from us viewing. The design process has been developed based on the MRes analysis

Theory & Data Research → User Interviews → System framework ↓
Conceptual Model ← Interviewees' Feedback ← Storyboard Development

ASSESSMENTS

GROUP EXPERIENCE

G56

CREATIVITY
ETHICS — COMMUNICATION
PROFESSIONALISM — ENGAGEMENT
TECHNICAL SKILLS

■ 1 ■ 2 ■ 3 ■ 4 ■ 5

G56
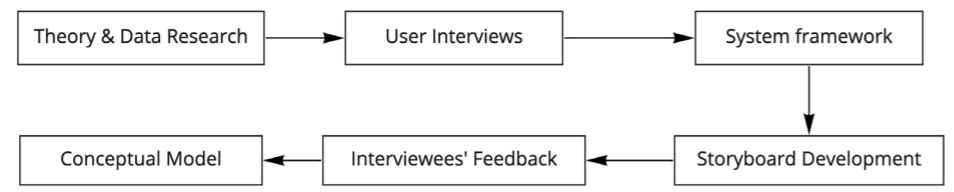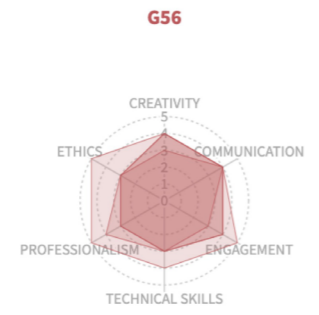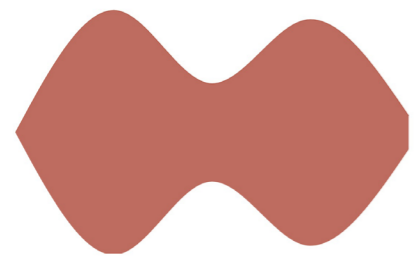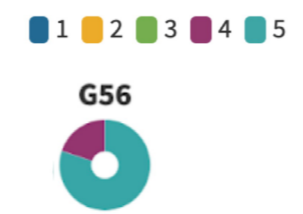
TRUTH | VIYU
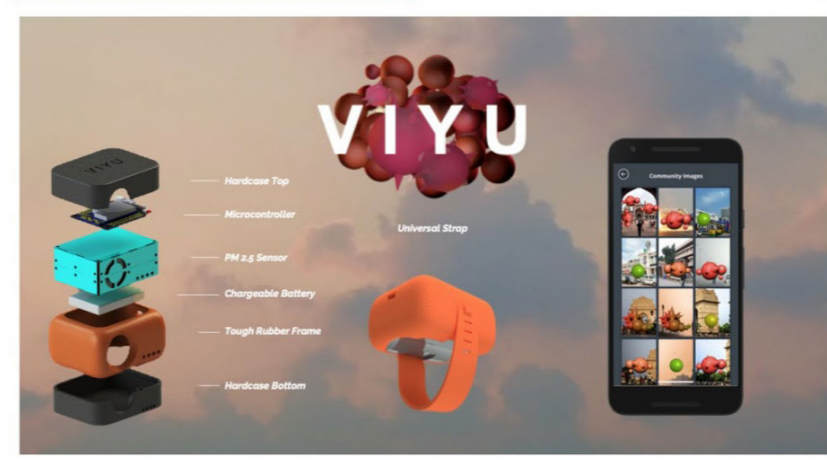
OVERVIEW

IDENTIFIED SAFETY RISK
Lack of monitoring systems lead to inconsistent air pollution data

APPROACH - RISK MITIGATION
Democratise air pollution through understandable data that raises awareness of the public health risk

OUTCOME
A portable sensor that takes scheduled readings throughout the day. The results are then visualised on a mobile app.

DESIGN PROCESS

Define safety risk → Wicked Problem Map → Analyse Stakeholders → Personas/Customer Journey ↓
Conceptual model ← System map ← Case Study ← Behavioural Science

ASSESSMENTS

G46

GROUP EXPERIENCE

G46

CREATIVITY
ETHICS — COMMUNICATION
PROFESSIONALISM — ENGAGEMENT
TECHNICAL SKILLS

■ 1 ■ 2 ■ 3 ■ 4 ■ 5

G46
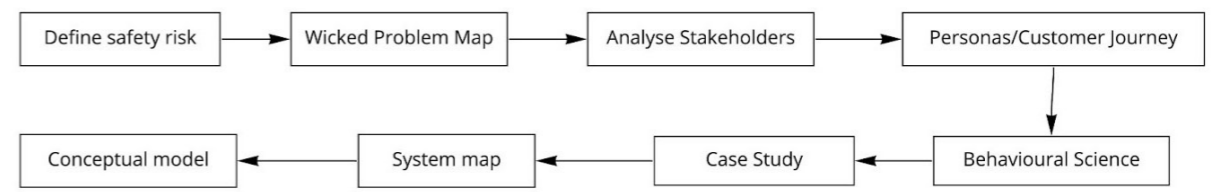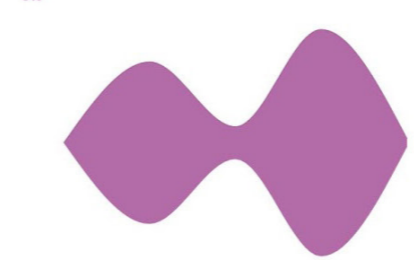
LEADERSHIP — THE SHIFT

OVERVIEW

IDENTIFIED SAFETY RISK
Human-centred leadership currently poses a risk to people

APPROACH - PREVENTATIVE
A new leadership definition that is driven by an ecological perspective

OUTCOME
An installation that provides an immersive AI experience coupled with a reflective exercise to understand the wider definition of leadership.

DESIGN PROCESS
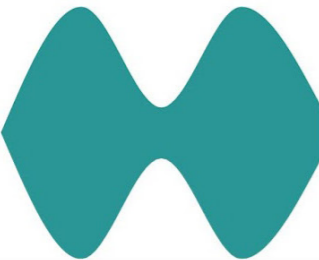
Deconstruct leadership → Wicked Problem Map → Systematic Review → Map nature leadership

Map nature leadership → Expert Interviews

Strategy for legacy ← User's experience scenario ← Conceptual model ← Expert Interviews

ASSESSMENTS

G47

GROUP EXPERIENCE

■1 ■2 ■3 ■4 ■5

G47

HEALTH — THE YELLOW BOX

Mission to Yamal Peninsula

OVERVIEW

IDENTIFIED SAFETY RISK
Permafrost thawing increasing threat of pathogens to human health

APPROACH - PREVENTATIVE
Developing a system that monitors viruses or bacteria in the permafrost

OUTCOME
An integrated product and service of drone equipment collecting data and analysing it for monitoring. Furthermore, and interactive website to inform and engage the public.
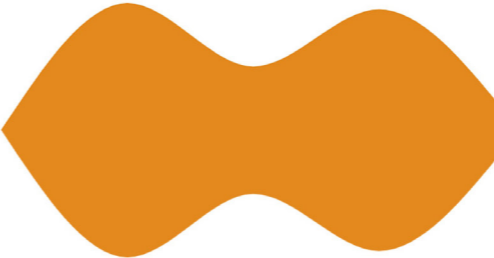
DESIGN PROCESS
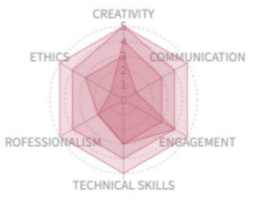
Exploration of Health → Wicked Problem Mapping → State-of-the Art Review → Stakeholder Mapping

Stakeholder Mapping → User Journey Mapping

Conceptual Model ← Ecosystem Mapping ← Ideation ← Literature Review ← User Journey Mapping

ASSESSMENTS

GROUP EXPERIENCE

■1 ■2 ■3 ■4 ■5

G30

FUTURES | **AccuM.**

OVERVIEW

IDENTIFIED SAFETY RISK
The increase of e-waste is decreasing the quality of land

APPROACH - RISK MITIGATION
Develop an e-waste recycling system that harnesses metallophite plants to mine rare metal from reduced consumption of rare metals.

OUTCOME
An independent vertical garden city system.

Recovery Rate 75%
86 Billion Dollar

Water polluted with metals
Soil with metals

2050

DESIGN PROCESS

Deconstruction of Problem Focus → Literature Review → User Research → Stakeholder Interviews

Conceptual Model ← Future Timeline Development ← Systematic Review ← User Journey Mapping

ASSESSMENTS

GROUP EXPERIENCE

CREATIVITY, COMMUNICATION, ENGAGEMENT, TECHNICAL SKILLS, PROFESSIONALISM, ETHICS

■1 ■2 ■3 ■4 ■5

G45

15. MRes Grand Challenge Data Analysis

Following the end of the designers projects during the 4-week Grand Challenge, MRes designers looked to analyse the MA and MRes projects to see where Design for Resilience may be emerging. Each designer individually looked at one or two themes (often the ones they were involved in), unearthing the different strategies, methods and approaches that projects implemented. To do this, the MRes designers looked at the projects Miro boards and final presentations to understand how their process related to the outcome.

Health and New Generation Interactions

Background Research	Preliminary Analysis	Selective Research
Design Opportunities	Identify the Failure	Further Analysis
Complementary Research	Identify Design Concept	Design Proposals
Usability Test	Develop the Proposal	Feasibility Analysis
Developed Proposal	Final Outcome	Application
Iteration	Improvement	Assessment & Analysis

Research Support | Analysis | Design Process | Outcome

Figure 40. Process of 'Design Resilience'. A flow-chart of the process of 'Design for Resilience'. This process in particular is not linear where the application reflects the end of a project, rather, it is a loop cycle with continuous assessments and analysis.

HEALTH

Mainly physical health	
Mainly large scale approach	
Focusing on finding health-related issues	

NEXT GENERATION INTERACTION

Sound usage
Wearable device
Mental health
Individual's surrounding environment
Focusing on the senses
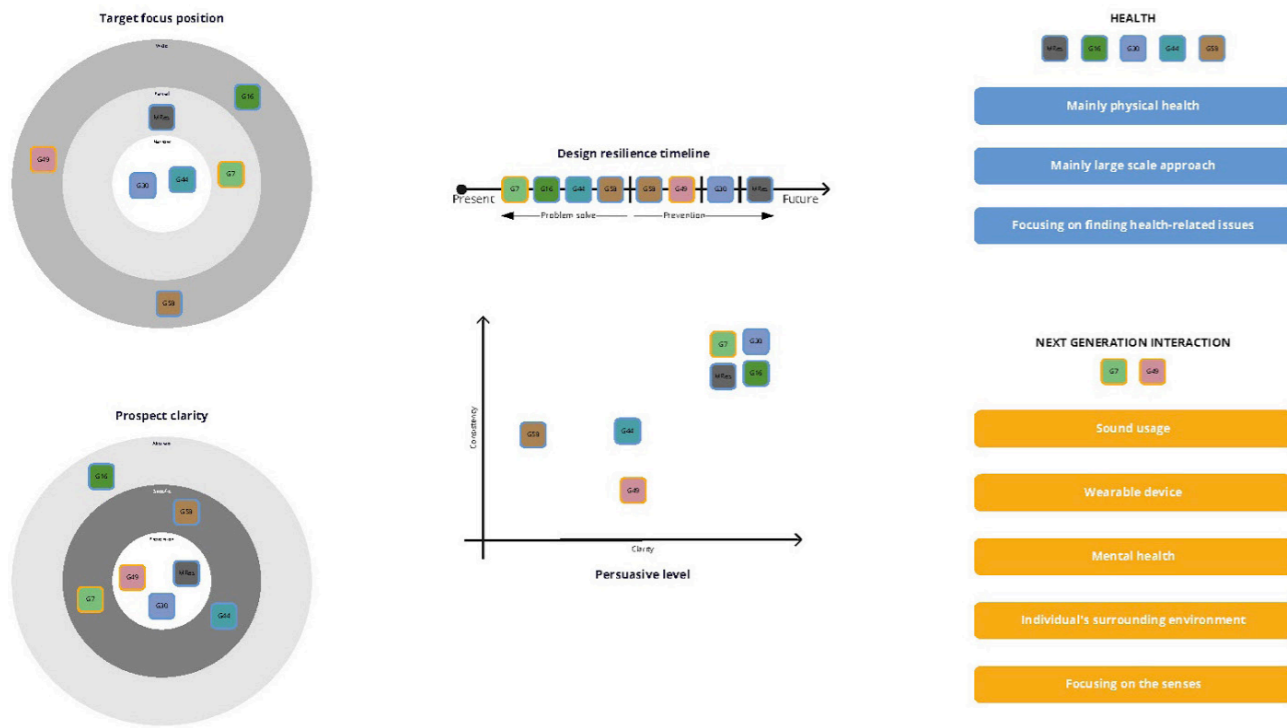
Figure 41. Design Resilience time-line and focus. Projects were analysed according to their persuasive level, prospect clarity, target focus and time-line of intervention. Focusing on one of the Health finalist G30 (profile on page 67), it becomes evident that a preventative approach with a narrow focus demonstrates a project for resilience.

	PROBLEMATIC SOLUTION	ETHICAL PROBLEM	INAPPROPRIATE APPROACH	BAND-AID
G51 PANDA			Gap 2	Gap 1
G65 PREPOD	Gap 1 Gap 2	Gap 1		
G2 MARS PROJECT	Gap 2 Gap 3	Gap 3	Gap 3	Gap 1
G21 MOOD JOURNEY	Gap 2 Gap 3			Gap 1

Figure 42. Self-critic matrix. There were 4 approaches that projects often fell under. Problematic solution: A solution that triggers new issues when implemented in complex societies. Ethical Issue: Challenges our moral standards. Misleading tone: Often framed as the solution, it can be misleading to think projects are the solutions for very serious social crises. Band-aid: Reactive approaches that don't tackle the cause of the failure. Here we can see the distribution of 4 projects across the matrix. What strategies could we implement that allow designers to self-evaluate what approach they may be falling into? How may we avoid band-aid design?

Resilience

	Team 27 - Hi!	Team 55 - Bio-Me	Team 62 - Tandem	MRes Team - Qualm
General concept	mental resilience	mental resilience	mental resilience	mental resilience
Resilience links explored	trust	reconnection	loneliness	body clock re-establishment
Stakeholders	patients in hospitals	employees	elderly and relatives	people affected by Alzheimer
Results type	system/service	product	service/product	system/product
N° of methods	four	seven	nine	seven
Key element	real time information	nature	network & physical activity	light

Figure 43. Cross-comparison of resilience group projects that fall under mental resilience as a general concept while exploring the various links.

Figure 44. GC Design Process. Above is an in-depth example of the design process of a particular group within the 'Resilience' theme.
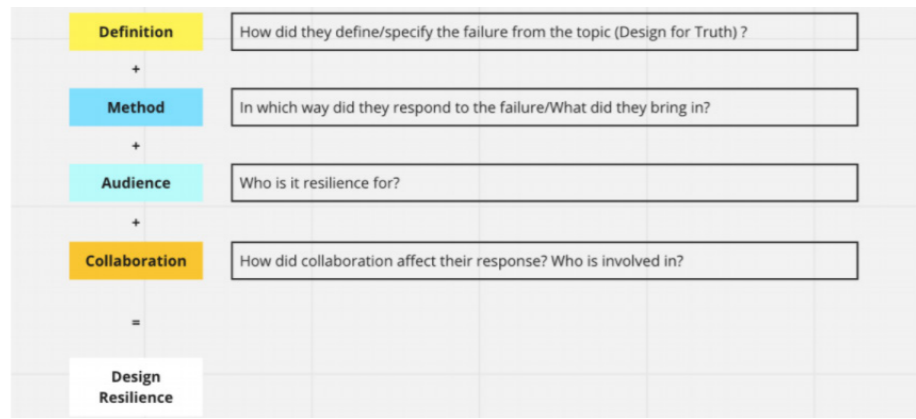
Figure 45. A formulae on how to approach design resilience projects

Leadership

Group 68	Overview						Other
	Project Summary: Make data protection democratic, Peer to peer data protection & educating its importance						
GC	Problem (Failure)	Internet users info (digital capital) are owned & managed by third party, they control us					Reactive (Preventional)
	Who's problem?	People who uses internet & at risk of encountering fraud, info leaks					
Leadership to bottom up power to resist top down data security control	Their problem Context			Their main audience : internet users			Abduction manner: Idea comes first and illustrate connection to theme
	Is it ongoing?	When	Where	pain	gain	Insights	
	Ongoing	When online	Anycountry with Internet	Being monitored & being controlled	Internet users data is protected by anonymus public by P2P	Afraid of that daily life decisions/choices are monitored & controlled by large business	
Design for Safety: Data Security & Rights	Solution Summary						Key Aspect
	Real/Concept	Product/System	Commercial?	Timeline	Touchpoint	Category	
	Realistic	Product/System (to raise awareness, educate & influence feedbacks among privacy activists' community)	Non-Profital	1-2 years (Hollzon 1)	Target audience will actively download	Behavioural Design, Changing perception&mindset (from accepting data owning by third party to resist it)	Information Architecture, designing incentives for users to keep using it
Comment	Same as first group, this team is subject & object as well, P.S. their info on persona is lacking						

Figure 46. Above is an example of how to analyse the Grand Challenge projects against design reslience. Looking into time-scales, audiences and approaches.

Care

Semantic Differentials for 4 contexts

Holistic Viewpoints
Rate how the design process and its solution incorporates the below viewpoints

	1	2	3	4	5	
user centred						environmental centred
human centred						post-human centred
systems of people						ecosystem-engaging
linear economy						circular economy
human lifecycle						non-human lifecycle
growth mindset						aware of risks and consequences

Less HiFi, More Context
Rate how the design process and its solution incorporates the below viewpoints

	1	2	3	4	5	
sympathetic						empathic
standardised						allows for personalisation
nudging						allows for informed decisions
non-objectiv						bias challenging
culture focussed						multiple cultured
tails safe						fault tolerant

Next Gen. Resilience
Rate how the design process and its solution incorporates the below viewpoints

	1	2	3	4	5	
organised						allows for play
sedate						ludic
repetitive						sensorially interactive
self-centred						sense of belonging
global						local
bundled-up						welcoming
segregating						integrating
user-focussed						co-creating

Systemic Questioning
Rate how the design process and its solution incorporates the below viewpoints

	1	2	3	4	5	
distinct						interconnected relationships
problem-solving						complexity-deconstructing
digital						social and digital
single-medial						multi-medial
problem-identifying						multi-causal
solution bound						leveraging
design focussed						multi-disciplinary

Figure 47. Design Resilience Evaluation using Semantic Differentials. A concept for a standardised way to analyse several design projects merging qualitative and quantitative analysis of the GC projects.

15.1. MRes Grand Challenge Data Analysis Synopsis Map
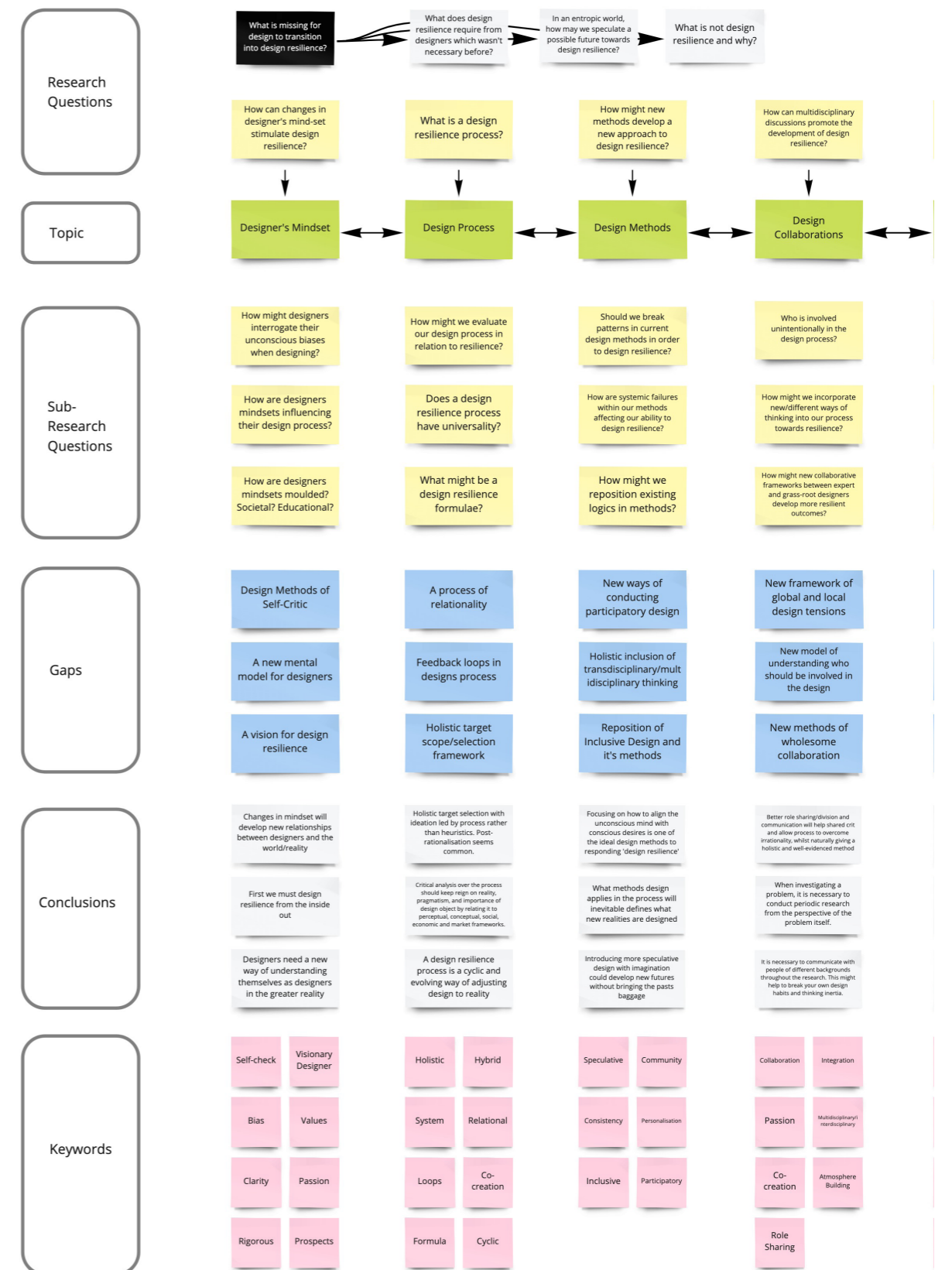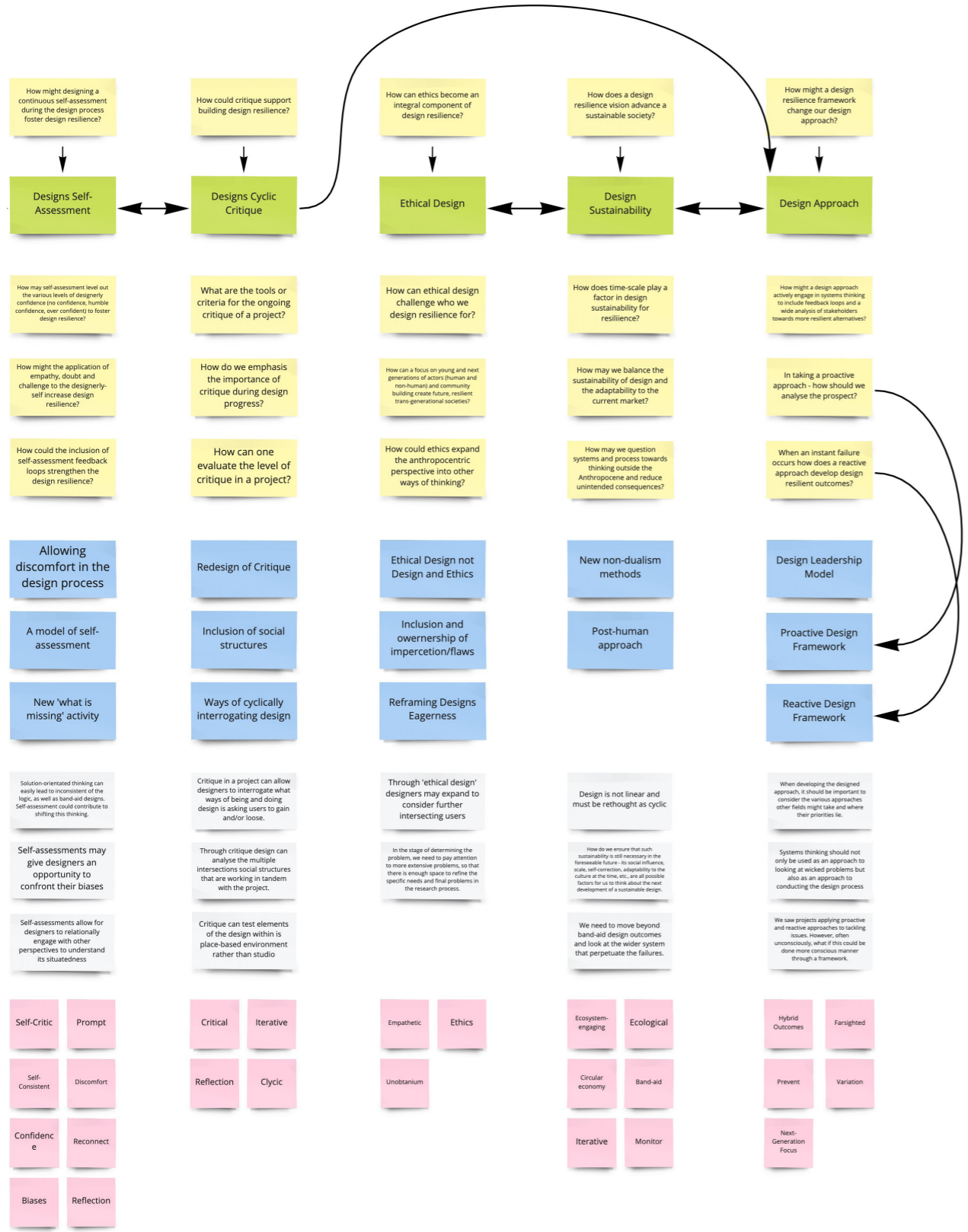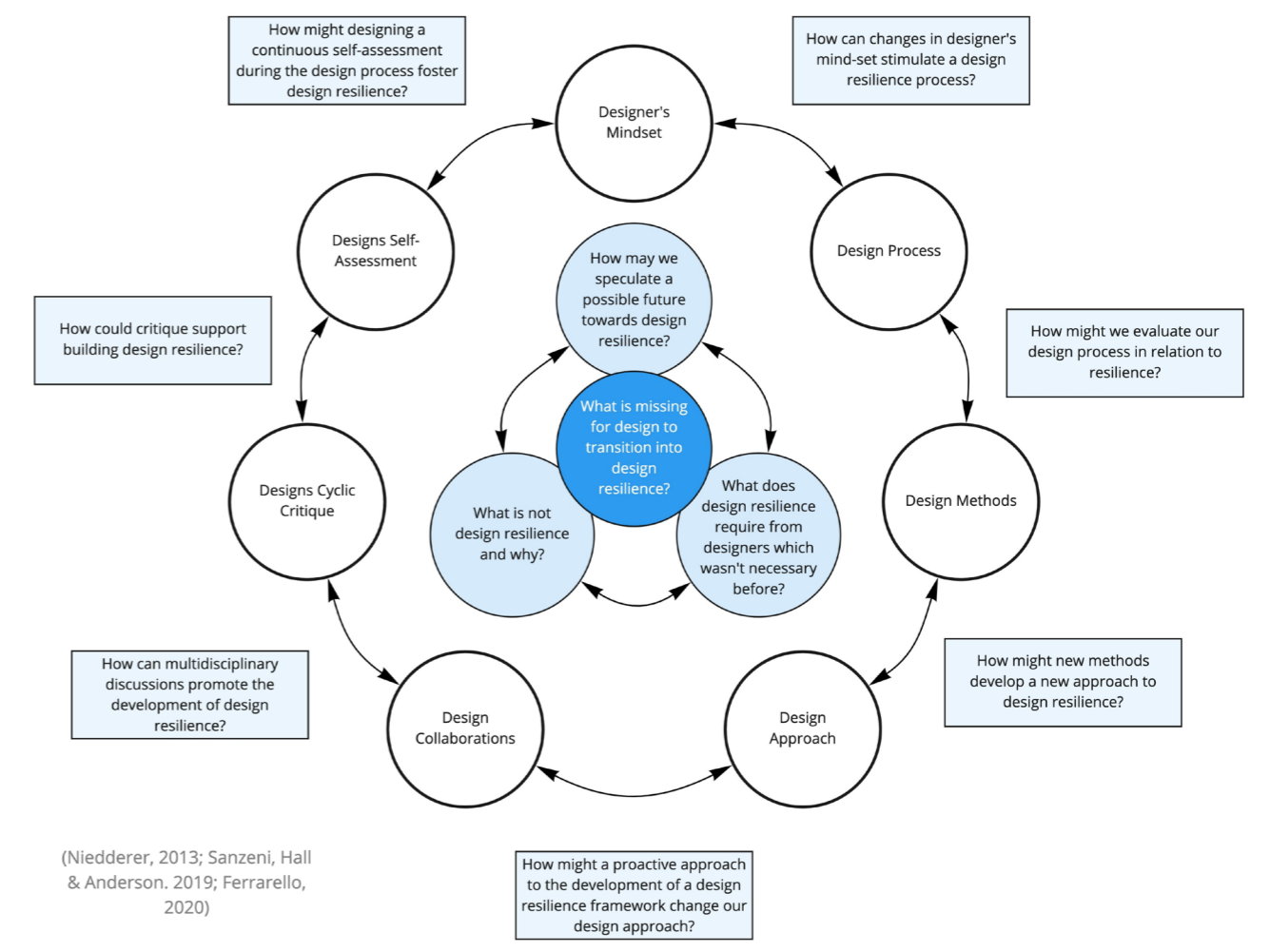
Figure 48. Following the individual MRes Designers analysis of the GC projects, collectively, the MRes designers shared and built a synopsis map of their findings. Using a thematic analysis they then categorised these into nine focused areas of design. Overall, the graph represents a holistic view of what design for resilience may entail and the questions behind it.

Figure 48 (left page diagram — synthesis of research questions, gaps and keywords)

Yellow question row 1:
- How might designing a continuous self-assessment during the design process foster design resilience?
- How could critique support building design resilience?
- How can ethics become an integral component of design resilience?
- How does a design resilience vision advance a sustainable society?
- How might a design resilience framework change our design approach?

Green category boxes:
- Designs Self-Assessment
- Designs Cyclic Critique
- Ethical Design
- Design Sustainability
- Design Approach

Yellow questions (column 1 – Designs Self-Assessment):
- How may self-assessment level out the various levels of designerly confidence (no confidence, humble confidence, over confident) to foster design resilience?
- How might the application of empathy, doubt and challenge to the designerly-self increase design resilience?
- How could the inclusion of self-assessment feedback loops strengthen the design resilience?

Yellow questions (column 2 – Designs Cyclic Critique):
- What are the tools or criteria for the ongoing critique of a project?
- How do we emphasis the importance of critique during design progress?
- How can one evaluate the level of critique in a project?

Yellow questions (column 3 – Ethical Design):
- How can ethical design challenge who we design resilience for?
- How can a focus on young and next generations of actors (human and non-human) and community building create future, resilient trans-generational societies?
- How could ethics expand the anthropocentric perspective into other ways of thinking?

Yellow questions (column 4 – Design Sustainability):
- How does time-scale play a factor in design sustainability for resilience?
- How may we balance the sustainability of design and the adaptability to the current market?
- How may we question systems and process towards thinking outside the Anthropocene and reduce unintended consequences?

Yellow questions (column 5 – Design Approach):
- How might a design approach actively engage in systems thinking to include feedback loops and a wide analysis of stakeholders towards more resilient alternatives?
- In taking a proactive approach - how should we analyse the prospect?
- When an instant failure occurs how does a reactive approach develop design resilient outcomes?

Blue boxes:
- Allowing discomfort in the design process; A model of self-assessment; New 'what is missing' activity
- Redesign of Critique; Inclusion of social structures; Ways of cyclically interrogating design
- Ethical Design not Design and Ethics; Inclusion and ownership of imperception/flaws; Reframing Designs Eagerness
- New non-dualism methods; Post-human approach
- Design Leadership Model; Proactive Design Framework; Reactive Design Framework

Grey note boxes:
- Solution-orientated thinking can easily lead to inconsistent of the logic, as well as band-aid designs. Self-assessment could contribute to shifting this thinking.
- Self-assessments may give designers an opportunity to confront their biases
- Self-assessments allow for designers to relationally engage with other perspectives to understand its situatedness
- Critique in a project can allow designers to interrogate what ways of being and doing design is asking users to gain and/or loose.
- Through critique design can analyse the multiple intersections social structures that are working in tandem with the project.
- Critique can test elements of the design within is place-based environment rather than studio
- Through 'ethical design' designers may expand to consider further intersecting users
- In the stage of determining the problem, we need to pay attention to more extensive problems, so that there is enough space to refine the specific needs and final problems in the research process.
- We need to move beyond band-aid design outcomes and look at the wider system that perpetuate the failures.
- Design is not linear and must be rethought as cyclic
- How do we ensure that such sustainability is still necessary in the foreseeable future - its social influence, scale, self-correction, adaptability to the culture at the time, etc., are all possible factors for us to think about the next development of a sustainable design.
- We saw projects applying proactive and reactive approaches to tackling issues. However, often unconsciously, what if this could be done more conscious manner through a framework.
- When developing the designed approach, it should be important to consider the various approaches other fields might take and where their priorities lie.
- Systems thinking should not only be used as an approach to looking at wicked problems but also as an approach to conducting the design process

Pink keyword boxes:
- Self-Critic, Prompt, Self-Consistent, Discomfort, Confidence, Reconnect, Biases, Reflection
- Critical, Iterative, Reflection, Clycic
- Empathetic, Ethics, Unobtanium
- Ecosystem-engaging, Ecological, Circular economy, Band-aid, Iterative, Monitor
- Hybrid Outcomes, Farsighted, Prevent, Variation, Next-Generation Focus

16. Towards designing resilience

Circular diagram labels:

Outer circles: Designer's Mindset; Design Process; Design Methods; Design Approach; Design Collaborations; Designs Cyclic Critique; Designs Self-Assessment

Centre (dark blue): What is missing for design to transition into design resilience?

Inner light-blue circles:
- How may we speculate a possible future towards design resilience?
- What is not design resilience and why?
- What does design resilience require from designers which wasn't necessary before?

Surrounding question boxes:
- How might designing a continuous self-assessment during the design process foster design resilience?
- How can changes in designer's mind-set stimulate a design resilience process?
- How could critique support building design resilience?
- How might we evaluate our design process in relation to resilience?
- How can multidisciplinary discussions promote the development of design resilience?
- How might new methods develop a new approach to design resilience?
- How might a proactive approach to the development of a design resilience framework change our design approach?

(Niedderer, 2013; Sanzeni, Hall & Anderson. 2019; Ferrarello, 2020)

Figure 49. The diagram above is a synthesis of the previous diagram (figure 48). It illustrates an initial overview of the research questions, gaps in methods and skills, and keywords that emerged from the analysis. The diagram suggests questions towards designing resilience where we systematically unpick the design process to understand what design methods/tools/approaches should remain, which should be removed and where others should emerge. Starting by looking within - at the designer's mind-set. This diagram helped the research outline any key learning able to direct more focused recommendations for designing resilience.

17. Conclusion

DEVELOP THE CONTEXT FOR THE RESEARCH
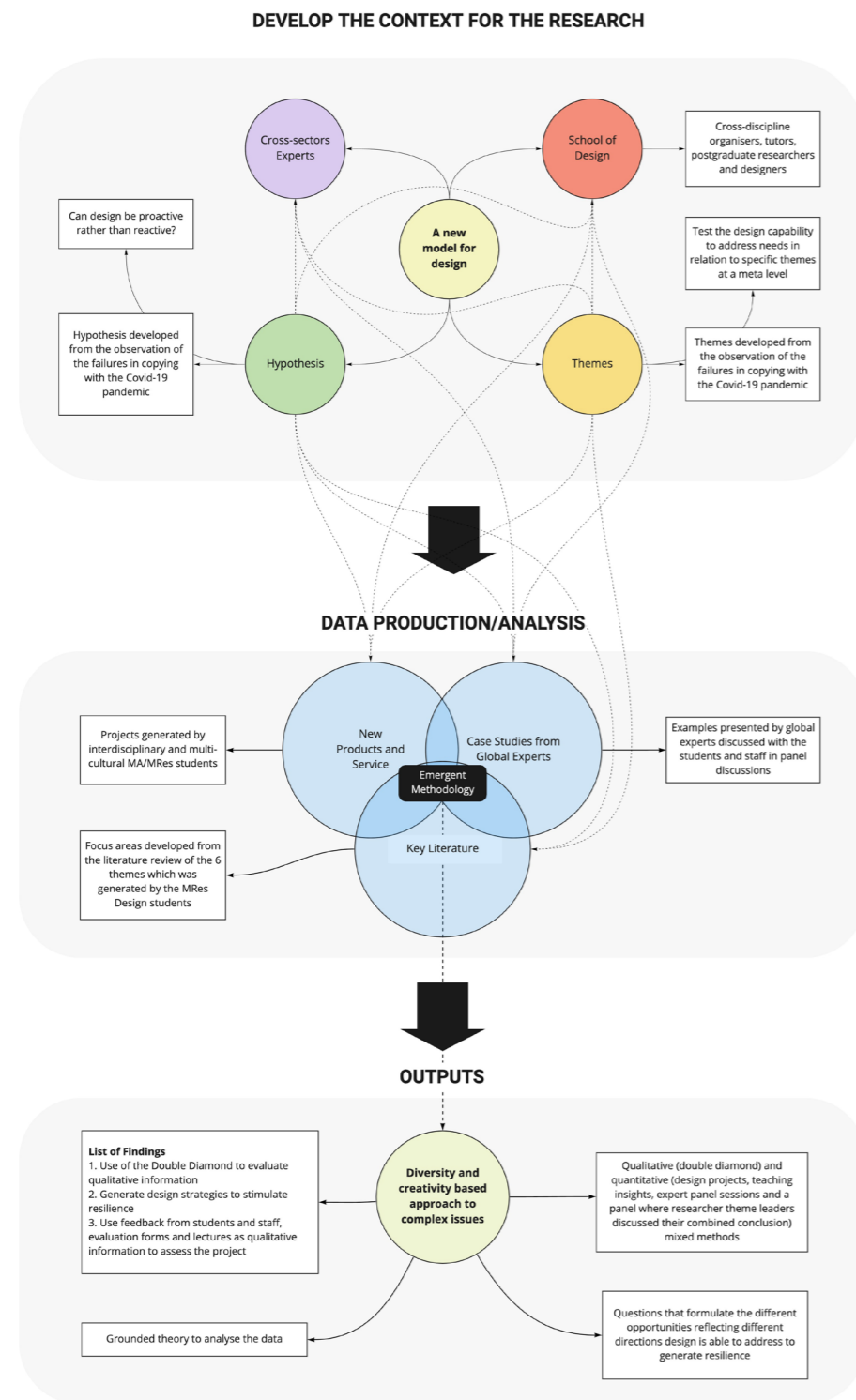
DATA PRODUCTION/ANALYSIS

OUTPUTS

Figure 50. The research started with a hypothesis looking for a new model for design. This informed the approach to the panel discussions between global experts and postgraduate designers, the literature review and the products and services that 388 interdisciplinary and multicultural groups generated to respond to the challenges related to the themes. Starting with a hypothesis-driven approach allowed the research to undertake an explorative and experimental process which helped harness the knowledge of the interdisciplinary groups working remotely from different regions in the world. This approach, which took shape through the interactions between academic, technical staff, postgraduate designers, and global experts, created a method that tackles societal issues through diversity and creativity.

CHAPTER 4

Design for Resilience

1. Emergent Strategies and Technologies

Building from a multi-stakeholder collaborative project on Design for Safety, this section will provide an overview and analysis of the key findings in terms of emerging typologies and strategies aiming at design for safety. We framed action across seven themes; care, health, futures, resilience, leadership, new interaction, and truth. The multiplicity of typologies and strategies emerging from the 75 projects analysed stressed the need to ensure that safe design should be proactive, and inclusive and work for everyone, everywhere. This included drawing attention to specific challenges around incorrect or inappropriate uses of technologies, the unintended consequences emerging from designing them, as well as the need for all citizens to have the appropriate skills to operate them. We see all this knowledge as a strategic asset that should be used for economic and social benefit.

Design Strategies

Following the completion of the Grand Challenge, student's projects were collated and analysed towards identifying and extracting the different approach patterns that may have emerged. Centred around the Grand Challenge theme of 'Design for Safety' students, through their work, had aimed to identify and address current and/or future safety risks. By focusing on how students approached these safety risks, three approaches emerged: prevention, risk mitigation and response. These were defined as follows: 'prevention' looks to avert the risk before it occurs; 'risk mitigation' aims to identify and evaluate the risk through risk-reduction strategies; 'response' seeks to support the aftermath of the risk. It is important to highlight here that these categorisations were based on the researchers' interpretation of their work and depending on the different perspective taken, interpretations may vary.
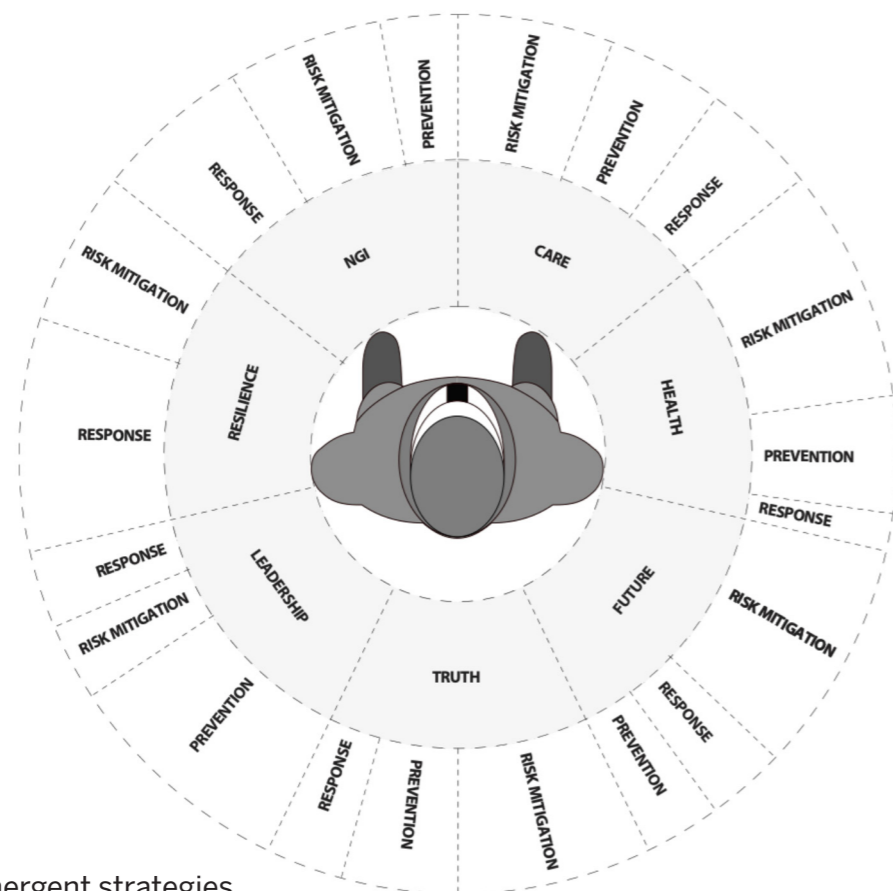

Figure 51. Emergent strategies.

The diagram in figure 51 illustrated how the different approaches were distributed across the 7 themes of the Grand Challenge. Where some themes fell more heavily on certain approaches such as Leadership in preventative approaches and Resilience in Risk Mitigation and others sat evenly - Health and Care. From this, we were able to identify what type of designs led to the different approaches.

Preventative approaches, while aiming to avert risks, would often adopt a skill-training, awareness, and behavioural science type of design. For example, the project 'The Meditation Garden' under the theme' Leadership' developed an interactive public engagement experience. The project aimed to raise awareness of the potential of daily self-reflective practices that may cultivate people's self-leading force. By taking a preventative approach of training self-leadership, people will employ positive methods when confronted with future risks such as anxiety during a crisis.

Risk mitigation approaches on the other hand focused on reducing risk rather than averting it. Here, projects often focused on intervening in mental/public health issues, often exacerbated due to the current COVID-19 crisis. These projects would design risk reduction strategies through types of design such a gamification, service and product design. Where, for example, apps would be designed to help people through stages of isolation by offering services that connect people and develop group activities. Thus, reducing the risk of developing mental-health issues of loneliness.
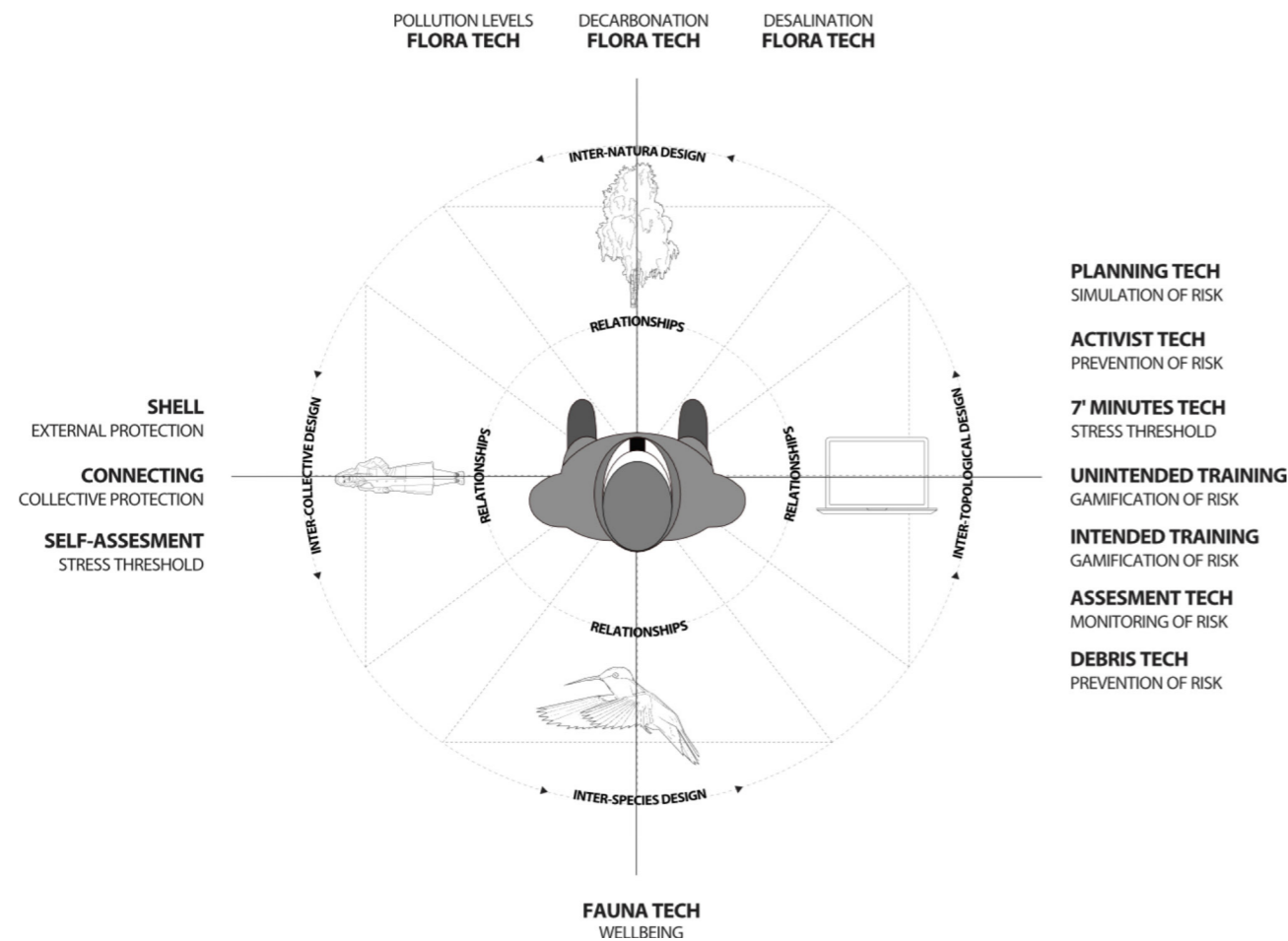
Finally, response approaches focused on supporting those who have gone through the risk. Surprisingly more prevalent in the 'Resilience' projects aimed to help those going through hardships recover from their current situations. For example, a project design for postpartum depression patients offered a combination of supportive tools of partner pillows with an app. The combination of both supported patients through both positive communication and interaction while also providing physical support for child-breeding and back pain.

RESILIENCE	RESPONSE (8)			RISK MITIGATION (4)	12
CARE	RESPONSE (4)		RISK MITIGATION (4)	PREVENTION (3)	11
HEALTH	RISK MITIGATION (7)			PREVENTION (3)	RES (1)	11
FUTURE	RISK MITIGATION (6)		PREVENTION (3)	RESPONSE (2)	11
TRUTH	PREVENTION (4)		RISK MITIGATION (4)	RESPONSE (2)	10
LEADERSHIP	PREVENTION (6)		RISK M. (2)	RESPONSE (2)	10
NEW INTERACTIONS	RESPONSE (4)		RISK MITIGATION (4)	PREVENTION (2)	10

RISK MITIGATION	**RESPONSE**	**PREVENTION**
31	23	21

Figure 51. This diagram and table map the actions against the three main strategies emergent by coding the cases; risk mitigation, response, and prevention.

Design Technologies

Building from the previous analysis, we analysed the outputs again to frame design actions across seven themes; care, health, futures, resilience, leadership, new interaction, and truth. This section maps the emerging design actions into four key areas; cyberspace, flora, fauna, and human relationships. In this process, we monitored the delivery of the actions originally briefed for the project. We see the intersection between them and design for safety as fundamental to create a trustworthy society aiming at maintaining safe interactions to ensure that the benefits of the incoming social, digital, and environmental revolutions are felt by all people, in all places. In this context intended training emerged as the preferred technological embodiment (16), it was followed by connecting people (14), and protective shells (10). These embodiments were followed by assessment (9), self-assessment (8), and unintended training technologies (4). In the middle we have technologies in activism 3), debris collection (3), pollution (2), and decarbonation (2). Finally, planning technologies simulating risk (1), desalination (1), and fauna-related technologies (1), accompanied 7' minutes tech (1) aiming to deal with the threshold of human patience.

Figure 52. This diagram and table classify the emergent technologies into four key areas; cyberspace, flora, fauna, and human.

From this typological analysis we can observe the dominant technologies for each theme. Self-assessment technologies seem to be the main strategy to deal with safety in the context of care. Shells-type embodiments emerge in the design of safety in health-related activities. Intended training dominates in the context of safety in truth-related technologies. Futures present the most distributed and fertile space for new typologies of Design for Safety. In this area, unintended training emerges as a preferred embodiment. In terms of resilience technologies, connecting people and assessment-driven technologies share the preferred types of embodiment to address design for safety. Connecting people also emerge as the dominant type of technological embodiment at the intersection of safety and leadership. Finally, intended training positions slightly ahead in the area of new generation of interactions for safety.

EMERGING TECHNOLOGIES	CARE	HEALTH	TRUTH	FUTURES	RESILIENCE	LEADERSHIP	NEW INTERACTIONS
INTENDED TRAINING	0	2	5	0	1	2	3
CONNECTING	2	2	2	0	3	4	1
SHELL	2	3	0	1	2	1	1
ASSESMENT TECH	0	1	1	1	3	1	2
SELF-ASSESMENT	4	1	0	0	0	1	2
UNINTENDED TRAINING	3	0	1	2	1	0	0
ACTIVIST TECH	0	1	0	1	1	0	0
DEBRIS TECH	0	0	0	1	1	0	1
POLLUTION	0	1	0	1	0	0	0
DECARBONATION	0	0	1	1	0	0	0
7' MINUTES TECH	0	0	0	1	0	0	0
FAUNA TECH	0	0	0	1	0	0	0
DESALINATION	0	0	0	1	0	0	0
PLANNING TECH	0	0	0	0	0	1	0
	n=11	n=11	n=10	n=11	n=12	n=10	n=10

Figure 53. This table classifies the emergent technologies across the proposed seven themes; care, health, futures, resilience, leadership, new interaction, and truth.

1.1. Conclusions of Emergent Strategies and Technologies

The multiplicity of typologies and strategies emerging from the 75 projects analysed stressed the need to ensure that safe design is inclusive and works for everyone, everywhere. This included drawing attention to specific challenges around incorrect or inappropriate uses of technologies, the unintended consequences emerging from designing them, as well as the need for all citizens to have the appropriate skills to operate them.

With this in mind, projects highlighted the importance of continued stakeholder engagement. This will help bring in diverse perspectives from across industry, academia, civil society, and the wider public to support implementation and inform future policy development. Creating a trustworthy and resilient society aiming at maintaining safe interactions will ensure that the benefits of the incoming social, digital, and environmental revolutions are felt by all people, in all places. In this process, we framed action across seven themes; care, health, futures, resilience, leadership, new interaction, and truth. We monitored the delivery of the actions originally briefed for the project. This paper underpinned the emerging strategies; risk mitigation, response, and prevention. Emerging actions were also mapped into four key areas; cyberspace, flora, fauna, and human relationships. In this context, training (intended and unintended), assessment (self and risk), shelling, and connecting people emerge as the dominant technological embodiments to design safety.

We see all this knowledge as a strategic asset that should be used for economic and social benefit. The project identified a set of emerging typologies and strategies in order to make the most of the opportunities presented by better designing safety. If we combine risk mitigation and prevention 53 out of 75 projects take a proactive approach to design for safety. Therefore, participants broadly agreed that design for safety should not just be considered as a threat to be managed, instead a proactive and prospective approach must be implemented and embrace this area as an opportunity to drive productivity and innovation across the economy, fuel research, revolutionise the public and private sector, and create a fairer and more prosperous society for all. Experts panels also highlighted the potential for design for safety to support wider societal priorities, as well as our collective ambitions to build a better society. Building on the initial set of insights made, this project sets out a framework that we can continue delivering against. This is therefore an initial list of strategies and technological embodiments to design safety, and we will keep investigating and refining the model as we identify new gaps of knowledge to drive forward the field, ensuring that the research's focus reflects the ever-evolving practice of Design for Safety.

2. Conclusions and Next Steps

The Grand Challenge has confirmed that the framework we set out to investigate regarding Design For Safety is fit for purpose and that we must now take action to ensure that we make the most of data's many opportunities. We agree with stakeholders that safety will play a vital role in delivering ambitions across a range of design areas and we will embed the framework across wider design thinking, to create a shared frame of reference that has the potential to bring together and unify an extensive portfolio of activities.

The Grand Challenge has catalysed ambition across sectors, with the project contributing to new technological embodiment in Health, Care, Leadership, Futures, Resilience, Leadership, New interactions, or Truth demonstrating how design can act as a trailblazer for better futures. The Grand Challenge; Design for Safety also outlines how design innovation and management will be critical enablers of the strategic advantage of society. As the review aims to be implemented in future projects, we will look to work with existing and new partners to capitalize on our strategic advantage as world leaders in design innovation.

This strategic advantage is also reflected in the impact of the creative industries in the UK, which notes how the design sector is a major success story for the UK and emphasises the importance of growing more creative businesses around the country building on our advantages in foundational technologies like Artificial Intelligence (AI), sustainability, and social systems. In this context we structure our strategy around four fundamental pillars;

1. **Monitoring:** We will carefully monitor the delivery of the actions of implementation. This year's exploratory model uncovered a set of critical insights on group dynamics. These preliminary insights will be further tested and complemented with new metrics. The aim would be to develop a set of high-level indicators to support our ability to monitor the overall progress of implementation.
2. **Governance:** We are developing a project outline framework to ensure clear lines for future implementation. This will empower us to deliver the priority outcomes every year. We would aim for the creation of a cross-stakeholder Steering Group to facilitate the strategy's delivery.
3. **Evaluation:** Visual feedback systems use is a relatively novel evaluation area. Building from this year's successful implementation, we are currently scoping and assessing the most effective metrics and visual embodiments for evaluating the success of our students to support implementation, as well as to ensure that The Grand Challenge delivers its intended outcomes.
4. **Engagement:** To ensure that we remain as open and collaborative in our approach as possible, we would like to create a The Grand Challenge Forum of key advocates and influencers, to generate content for our students. This process aims to outline our commitment as an open institution to ensure that diverse perspectives inform the implementation of The Grand Challenge. This initiative aims to draw together experts from a cross-section of stakeholder groups, facilitating collaboration across the innovative landscape. Given the cross-cutting nature of design and its far-reaching implications for our society and economy, it is important to recognise that the RCA cannot - and should not - deliver on the ambitions of The Grand Challenge alone. This project should be open to a multiplicity of stakeholders.

The strategic importance of design use will also be reflected in the forthcoming Grand Challenge and may be embodied in a future research Lab focusing on Resilience. We see this area as the most impactful and promising space for design. In this context, building from the design for safety study, training (intended and unintended), assessment (self and risk), and connecting people emerge as the dominant technological embodiments to design resilient societies.

2.1. Resilience Design Research Lab

Building from the analysis outlined, we have begun developing a proposition for a research lab. The research lab suggests that developing an intersection between data, society, and the environment, could potentially nurture a playground for design and technology to affect change; from the local to the global. Proactive technological embodiments have the power to galvanize communities' resilience. Technologies have the potential to be accountability tools with the power to improve people's lives, influence institutions, and even affect legislation.
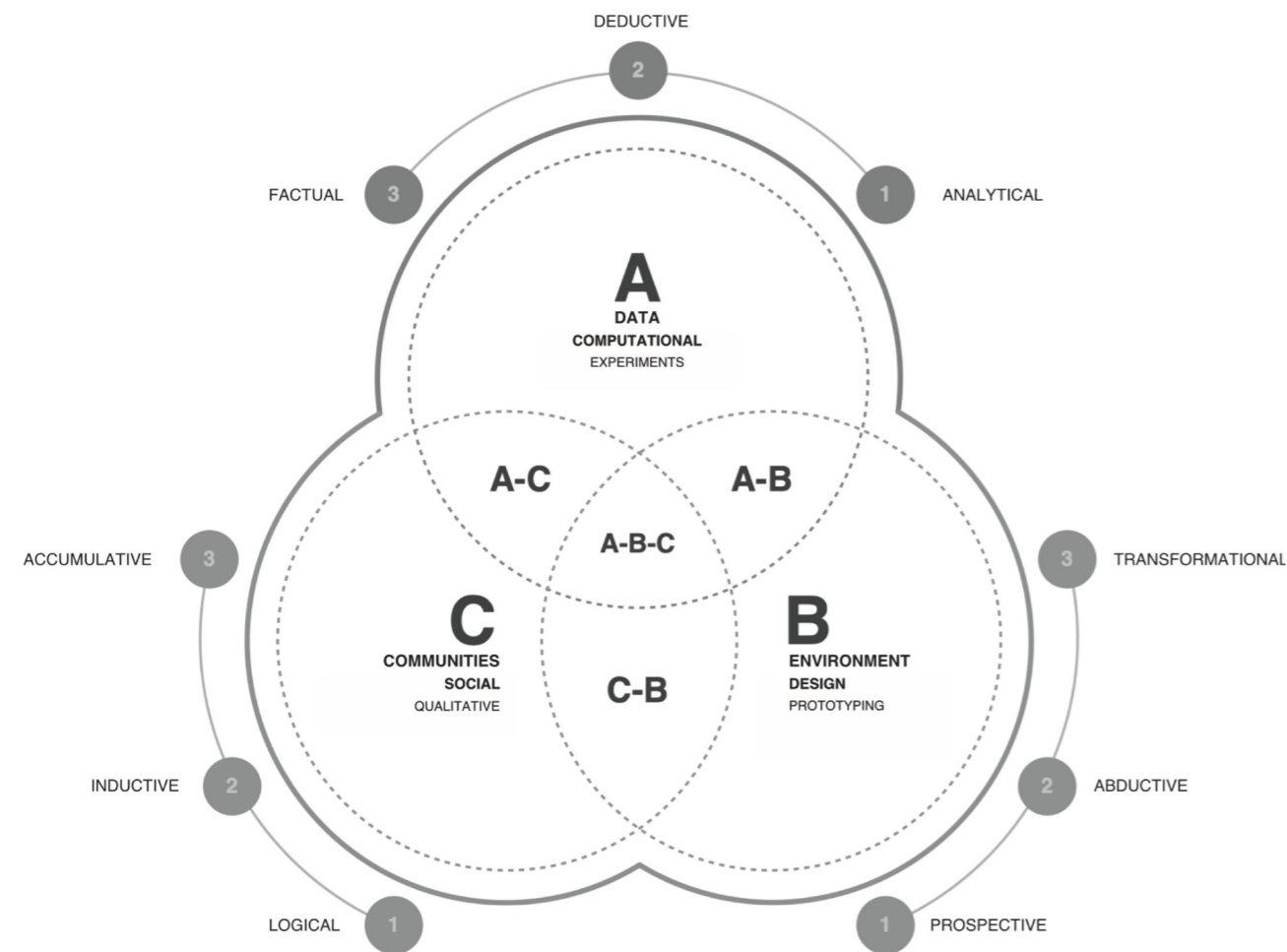

Figure 54. Resilience lab framework.

Going forward, the proposed research lab further exploring the alternation from exploration to implementation — exploring the Strategy's recommended missions areas of action for further exploration. To support effective delivery, we are structuring the implementation work programme around three core priorities.

2.2. Missions and Actions

This section maps the aforementioned three proposed core missions, which are structures around five recommended key actions. This suggested framework will be used as the primary delivery channel for the design resilience lab implementation.

This approach sets out a suggested framework that we can continue delivering against, building on the initial set of insights made. This is therefore an initial list of actions, and we will keep it updated as we identify new actions to drive forward the strategy. We will look to provide more regular updates building on this, ensuring that the strategy's focus reflects the ever-evolving picture of design.

Mission One: Unlocking the value of data

1.	Action - Hybrid-data > combining anecdotes and hard data
2.	Action - monitoring risk > assessment tech .
3.	Action - simulation of risk >
4.	Action - trust >
5.	Action - impact of risk >

Mission Two: building a resilient society

6.	Action - education > intended training
7.	Action - collaboration > connecting communities
8.	Action - prevention > unintended training (gamification)
9.	Action - conflict > patience threshold (7' minutes techs)
10.	Action -

Mission Three: protecting the environment

11.	Action - Oceans > Pollution levels, decarboration, or acidification
12.	Action - biodiversity >
13.	Action - byproducts >
14.	Action - inter-species >
15.	Action -

The lab may seek to operate in three distinctive areas; Academia, Education, and Entrepreneurship. In academic terms, in order to provide greater impact, the lab may operate in an extended academic profile. This will include potentially adopting a mixed approach to future publications. This means that we will combine short and long publications and targeted knowledge, focusing on developments relating to each of the strategy's three core missions.

The lab suggests that it may support students by providing knowledge and resources to foster entrepreneurship. These initiatives could range from equipment to internships to acceleration via a collaborative agreement with InnovationRCA. For instance, several of this year's Grand Challenge finalists have integrated the experience and knowledge gathered through the Grand Challenge into new projects.

Georgie McKenzie's soloX project is aiming to tackle safety in women by assessing perceptions of safety in public spaces. She developed a novel interaction to build a dynamic and fluid real-time model for safety. Shefali has conducted an exceptional project to improve the safety of drivers/bikers in high temperatures by developing an innovative machine learning method on shadow awareness in the city. Or Ryan Mclure, who has developed a new technology to identify the quality of water. This project was developed in the context of Northern Ireland but could be deployed anywhere in the world. This is also the case with the other two projects. The proposals were highly praised by all the tutors involved in IDE and prompted them to further develop the proposals. These potential high-impact projects would benefit tremendously by having a dedicated structure to support and nurture them.

Through these measures, we are confident that we can harness the power of design to enhance our economic and social prosperity and position the RCA at the forefront of upcoming transformations.
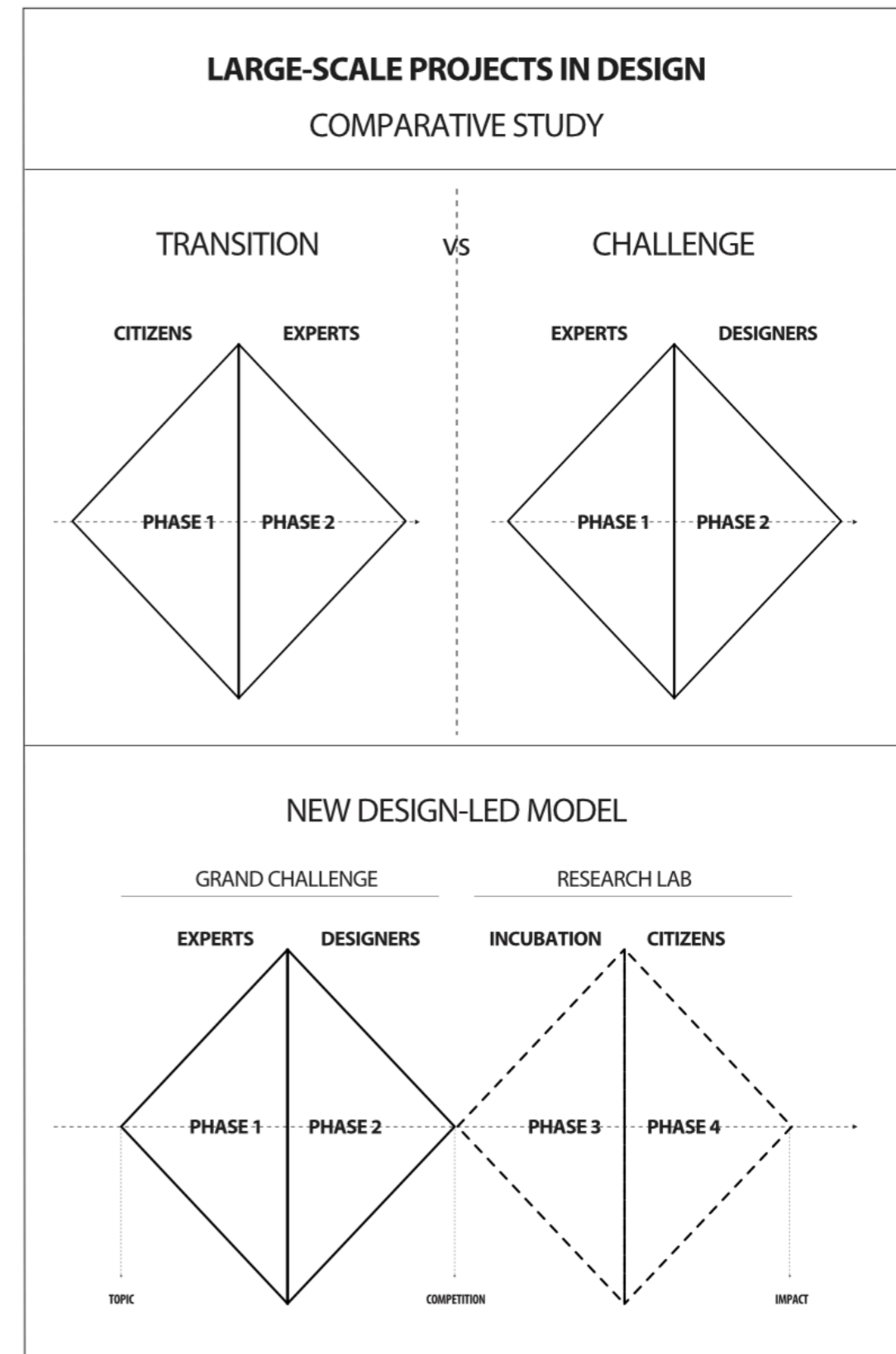

Figure 55. The new design-led model and how it differs from current models such as Transition Design.

CHAPTER 5
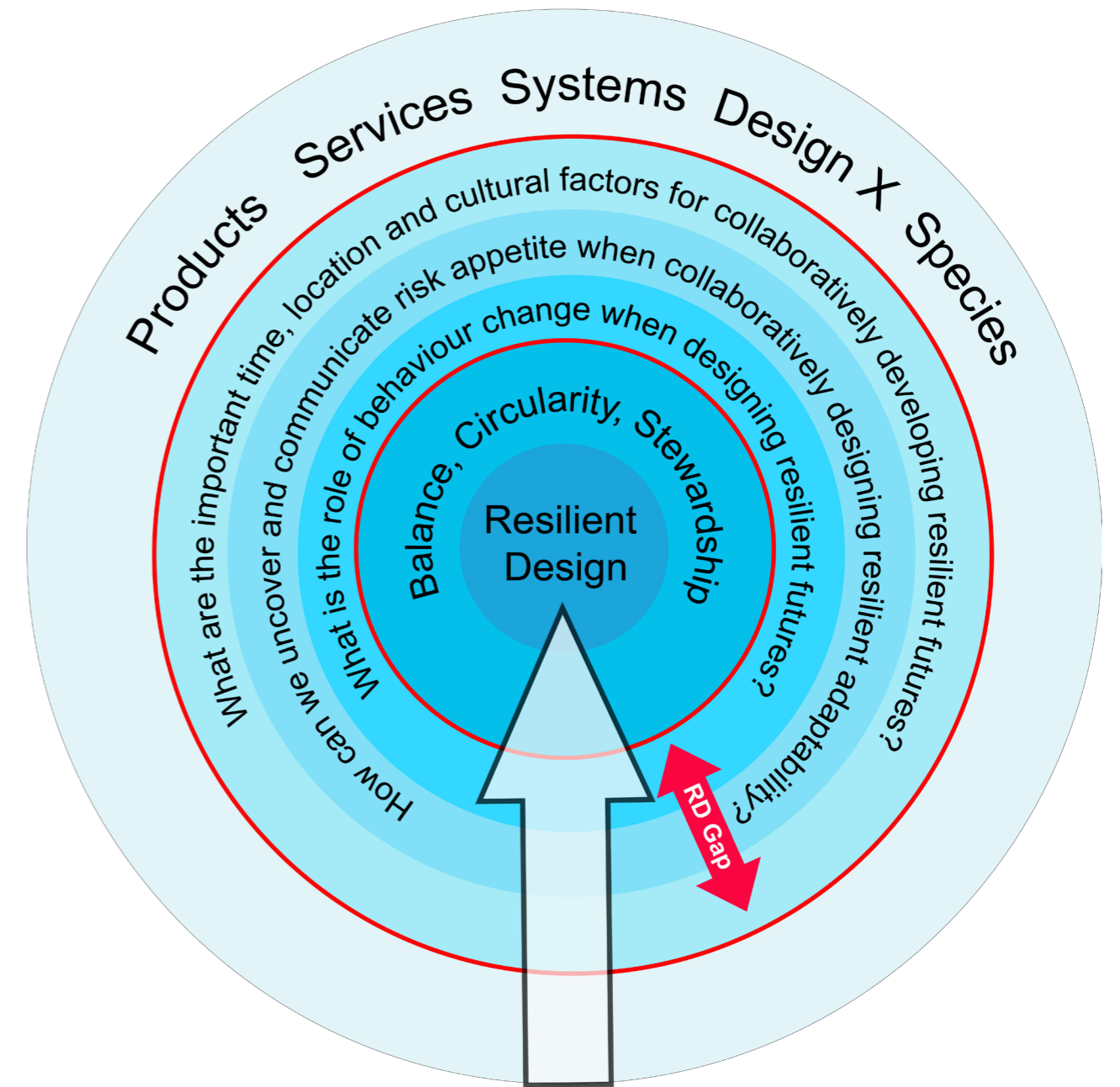
Resilient Design Development

Figure 56. The emerging opportunity of the design for safety grand challenge lies is exploring the three research question that were uncovered by our research; What are the important time, location and cultural factors for collaboratively developing resilient futures? How can we uncover and communicate risk appetite when collaboratively designing resilient adaptability? What is the role of behaviour change when designing resilient futures? These direct and underpin the future project of design resilience around the strategic partnership role for design, but also reflect the questions back onto design itself to question its methods, approach and practices.

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