

Interdisciplinary Boundary Experiences

Learning Through Conversations

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The complexity of many social systems and organisations together with the challenges the world is facing in terms of climate and health demands imagining new ideas and approaches. Interdisciplinary collaboration offers good examples of strategies and practices better able to cope with this complexity, but they are reliant upon the dynamics within collaborations and good integration of perspectives. This paper considers an example of interdisciplinary collaboration aimed at growing mindsets capable of dialoguing with other disciplines through the boundary learning. Based within the Royal College of Art Master in Research, we stimulated a learning experience that leveraged the cyclical dynamics of multi-disciplinary conversations towards an integrated space for knowledge production. This has been assessed through the students' response to a collaborative project, in which cross-discipline groups developed activities for public engagement through collective research practices. This paper specifically focuses upon the role of conversation in interdisciplinarity as a learning method that harnesses different kinds of knowledge at the boundaries of their discipline and thus facilitates interdisciplinary integration of different disciplines.

Keywords: collaboration, boundary objects, conversation theory, integration, reflection

Introduction

When Hurricane Sandy struck New York City in November 2012, President Obama created a task force to explore reconstruction strategies. There was a general agreement to rebuild the devastated areas using a more holistic approach, pivoted around the financing of the architectural competition Rebuild By Design (Ovink, H., & Boeijenga, 2018). This competition was the first of its kind in leveraging and harnessing knowledge emerging from the collaboration of stakeholders rather than selected experts (Ovink, H., & Boeijenga, 2018). The architectural solutions arising from the collective interdisciplinary experiences and approaches visualise interdisciplinary strategies that have generated multilateral knowledge and have uniloed and reframed disciplinary experiences. Building from the positive experience Rebuild By Design has generated a set of successful interdisciplinary working dynamics. This paper draws on this, fostering interdisciplinarity and a boundary experience of learning able to consider the opportunities and challenges of working across disciplines.

According to Jones (2010):

Interdisciplinarity is collaboration between two or more disciplines where actors from each discipline begin by adopting and integrating each other's concepts, methods, theories, and even epistemologies in the creation of a reciprocal hybrid practice (Jones, 2010, p.157).

The motivation to support an interdisciplinary approach within a taught postgraduate research degree lies in the way that new knowledge is generated. It is also fuelled by the need to foster working practices and experiences better able to tackle the increasingly complex issues and challenges which now face the global community. An interdisciplinary approach generates a model of thinking that integrates different theoretical frameworks (Aboelela et al. 2007, p. 341 in Tobi, H., & Kampen, J. K. (2018) and, by doing so is able to address



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complex issues harnessing the diversity of different mindsets. Under these terms interdisciplinarity starts with a conceptual framework that integrates the processes of assessing, sharing and merging different disciplines (Singer, P. A., Martin, D. K., & Robertson, D. W. 2003) which enhances diversity and 'buy-in' from the stakeholders.

Interdisciplinarity still lacks specific transferable methodologies that can leverage the value that people, and their knowledge, generate when integrating different mindsets, approaches and beliefs. The UN 2030 Agenda for Sustainable Development includes the cooperation of different cultures and sectors to generate capacity for meeting the Sustainable Development Goals (SDG) (UN Department of Economics and Social Affairs, 2021); however, this is still expressed at a meta level. Recognising these benefits for society in stimulating positive social change (The British Academy, 2016) there are a number of opportunities for education to produce methods able to train future generations for inclusive and holistic change through the intrinsic operational modalities of interdisciplinarity, specifically those created through clashes and misunderstandings that emerge from collaborating, co-creating and intermingling disciplines.

The objective of generating methodologies able to foster a conceptual framework in which different languages, methods, practices and cultures can be entangled (Fitzgerald, D., & Callard, F. 2016) has been at the heart of the pedagogic approach leading the curriculum structure of the postgraduate programme object of this paper. McClellan and Johnson (2014) draw on Penny (2009) to suggest a form of 'deep interdisciplinarity', a way of working collectively and across disciplinary boundaries, that 'celebrates the complexity and dedication critical pedagogy requires while simultaneously encouraging both instructors and students alike to see the world in altogether new ways' (2014: 6). Interdisciplinary pedagogies are not new and there is extensive literature that sets out ways in which different disciplines can inform one another in terms of usefulness (for example, Mayrath and Trivedi 2009; Blair, 2011; McClellan & Johnson, 2014). There is also a body of work that tracks pedagogical uses of interdisciplinarity in curriculum planning and development (for example: Krizek & Levinson, 2005; Collis, McKee, & Hamley, 2010; Natalie & Crowe, 2013). What this body of research and positioning papers point to is that interdisciplinary working and pedagogies is achieved not through being built around one field/approach with others critiquing or adding into, but through forging a new approach that is built and owned collectively. This co-production and co-ownership of process, method, pedagogies and outputs, is a vital element of McClellan and Johnson (2014) and Penny's (2009) notion of 'deep interdisciplinarity' in that it entails an unpacking of learned and disciplinary-located modes of working, turning away from notions of the 'expert' and all parties becoming shared learners. In extending this notion of deep interdisciplinarity this project proposes a framework capable of shifting understandings of "successful" interdisciplinary endeavours in higher education to better align with critical pedagogy's praxical roots. This sets up a principle for working interdisciplinarily that needs shared and agreed processes of co-creation and collaboration in order to successfully develop an experience of knowledge exchange based upon difference (Robertson, D. W., Martin, D. K., & Singer, P. A. 2003). What it also offers is an inclusive space where experiences, knowledges and perspectives with and beyond disciplinary frameworks can be critically evaluated collectively. This entails a heuristic approach such as that proposed by Daron Oram (2020), an approach that privileges both inclusive and narrative forms of co-working including deep listening. In this it loops back to McClellan and Johnson's 'deep interdisciplinarity', focusing upon listening carefully to disciplinary mores and embedded assumptions.

In the MRes programme we lead, we wanted to develop this idea as a pedagogical tool and generated a learning environment in which postgraduate researchers worked in multi-disciplinary teams to bring together different kinds of knowledge and the related process of negotiation, assessment and communication that generates interdisciplinarity as approach to knowledge production. Approached with both heuristic and deep interdisciplinary framing in mind, we wanted students to start from an awareness of their disciplinary biases, assumptions and forms of communication that could potentially generate negative impacts within team dynamics (Fleming, L, 2004), and thus create barriers to interdisciplinarity. We wanted them to address these barriers rather than seek to swerve them. In this paper we want to reflect upon how we designed an experience of interdisciplinarity to encompass a diversity of approaches, cultures, working practices, languages (technical and cultural), methods to research, ethics awareness, biases and assumptions within a general attitude where protecting disciplinary boundaries often triggers misalignments and disagreements. In this approach of deep interdisciplinarity we aimed to embody such contrasts intrinsically and these as strengths, strategically used to develop working dynamics. This is to address such challenges as opportunities for deep listening and to mitigate polarisation which are often a route to failure (Fleming, L, 2004), (Jones, 2010). Therefore, we initiated an approach based on leveraging difference and championing inclusivity to stimulate interdisciplinary collaborations and thus deepen the experience of working collaboratively. It needs to be noted that the context in which we worked is defined by a set of disciplines where collaboration is a normal

activity for some, but where for others this is less often the case. Hence our intervention focussed on generating processes - and dynamics - whose role was to stimulate and increase the degree of breaking boundaries for eliciting processes of integration.

The Royal College of Art (RCA) MRes curriculum creates and extends existing theoretical and practice-based approaches to interdisciplinarity by designing the dynamics of conversations, dialogue and negotiations. This is not about flattening or redistributing knowledge, but focusing on a bespoke set of heuristic practices for a specific project and outputs. For example, the unit entitled "Make it Public" was specifically created to elicit this with an open-ended evidence-focused rationale for the kinds of output realised to. This unit invites postgraduate researchers across the disciplines of art, design, communication and architecture to think through methods and modes for engaging the public in disseminating research processes in ways other than traditional papers and exhibitions. This unit is part of a programme which has an overarching ambition to develop skills for working and collaborating across disciplines in research projects. The "Make it Public" unit deploys interdisciplinary working dynamics as means to create alternative ways of engaging, which are more effectively able to communicate research to a wider audience. This unit reflects the MRes main objectives of eliciting discussion, debates and dialogues around research and research methodologies that might lead to interdisciplinary epistemologies through the convergence of disciplinary knowledge. It sets in relief disciplinary boundaries by pushing and questioning them through the exposure to other perspectives. With "Make it Public" this approach is exposed to the public for broader testing. Here we are focusing on the 2020 "Make it Public", an online festival in collaboration with the Design Museum in London to meet the limitations imposed by the COVID-19 pandemic in Spring 2020. Where the students had previously shared workshops and studio spaces in London, they were suddenly isolated from this context, some returning to home countries across the globe, removing the immediate conversation flow. What resulted, however, was that the cohort of students and staff remained committed to realising the ambition and to use these limitations as opportunities to drive them in rethinking and reframing what interdisciplinary learning and collaboration can generate when certain pre-existing assumptions and ways of working need to be 'abandoned'.

As a pandemic-enforced opportunity, the online festival has stimulated an alternative experience of learning; this is still based on the concept of integration, exchange, of disciplinary knowledge and disciplinary attitudes that form the interdisciplinary epistemologies object of this paper. These were already factors integrated in the MRes curriculum but the limitations of meeting in person stimulated new methodologies of collaboration, discussion, knowledge exchange, negotiation of language and practices which revolved around the capacity to communicate, interrogate and integrate different kinds of perspectives.

The online 'Make it Public' was able to produce these new forms of engagement and learning through the development of activities and experiences that 17 interdisciplinary groups of students created for the festival. We will describe how the form of these dialogues, expressed by the students, generated to engage the public, collectively elicited the integration of different forms of thinking and approaches to research. This is evidenced by how they leveraged diversity and supported heuristic learning and inclusivity. Their conversations generated feedback loops that stimulated agency for individuals and the groups to construct cross-disciplinary methods of learning and developing knowledge.

Methods: Designing Interdisciplinarity Through Designing Conversations

The RCA MRes is one year postgraduate degree aiming at training interdisciplinary researchers across design, art and humanities. The programme is divided into four pathways: Arts & Humanities, Architecture, Communication Design and Design. Its multidisciplinary, multinational cohort of students develops research practices through a pedagogy that privileges peer discussions and peer collaboration within and across these pathways. The curriculum is structured upon a bridged structure with both discipline-specific and cross-disciplinary units. This offers students the framework to develop research practices and skills through individual and group projects. The objective is to instil a heuristic experience of cross-disciplinary learning through which students can push the boundaries of their disciplines. Such interactive experience is facilitated by a diverse body of faculty whose own practices are transferred to the students through seminars, workshops and group discussions.

The MRes curriculum has been conceived and designed to allocate specific teaching spaces to the development of interdisciplinary forms of learning, in order to generate an environment in which the students are able to construct heuristically the means to integrate and assimilate knowledge, which is at and outside the boundaries, but can drive and innovate, their disciplines. This is built through reflection, holistic thinking, criticality and the capacity of compare and analyse (Berasategi, N., et al, 2020); these are guidelines the students are provided for communicating research intentions and objectives to their peers but also for

building a mindset that deploys conversations and dialogue in the development of a research project. As interdisciplinarity originates from a particular conceptual framework that is constructed upon negotiation, discussion and integration of different knowledge (Tobi, H., & Kampen, J. K., 2018), our strategy is to develop this through pedagogies and epistemologies that foreground heuristic and inclusive approaches. Sweeting (2015) notes that conversations help students test and learn their ability to negotiate, agree and reframe pre-existing concepts which stimulates a process where new insights emerge. However, conversing is itself a process that assumes participants hold pre-existing knowledge, an understanding of which might be maintained and deepened across the action of conversation, or it can evolve with the experience of comparing (and negotiating) this knowledge with others. Often both take place together. In this programme the practice of conversing has been assimilated into the practice of learning, where learning can be defined as a process of continuous adaptation (Scott, B., 2001). When conversing a person develops a self-awareness of their knowledge: a consciousness of both self and other (Scott, B., 2001). This particular experience of conversing draws on Gordon Pask who divided the experience of knowing in “knowing why” (cognitive) and “knowing how” (procedural) (Scott, B., 2001). The relationship between these aspects is key to learning. Hence the experience of learning can be divided into four cycles - concrete experience, reflection, abstract conceptualisation and active experimentation (Scott, B., 2001). Conversation facilitates this by interfacing the knowledge exchanged between two or more persons. They become sensitised to difference and, through this, develop new knowledge. Any conversation can be therefore defined as a form of learning which has a context, language, a form of agreement and an objective (Pangaro, P., 2017). Conversation is therefore a descriptive process embodying forms of learning, or knowing. When conversing participants might experience positive misunderstandings, or forms of miscommunication, that create moments of alienation followed by revising assumed meaning (Sweeting, 2015) through a self-awareness generated by conversations (Scott, B., 2011). Learning through conversation is therefore a process in which we evaluate our knowledge through an approximation strategy enabled by the ongoing discussion. In this cyclical process ideas and opportunities are evaluated through iterations (Dubberly, & Pangaro, 2019). These cycles might be sequential, simultaneous or a blend of both, making multi-stream modes particularly potent pedagogically for the recursive nature of conversations in generating an evolution of knowledge.

1. A Word version of your submission, name the file using your submission number, e.g. 120.docx (see Figure 1.)
2. A PDF version of your submission, name the file using your submission number, e.g. 120.pdf

The Word file will be used to compile the proceedings. The PDF will be made available to conference delegates prior to the conference via the online conference programme.

As cyclical, any interaction in a conversation is key to enabling convergence of knowledge, which is stimulated by a process of negotiation through which participants reach an agreement (Dubberly, & Pangaro, 2019). Under this perspective conversation becomes an act of shaping “reframed knowledge” evolved from the collective action of negotiation. Through this process any participant develops self-awareness that, in its turn, stimulates the group in generating new ideas and each peer in redefining the understanding of the object of discussion (Figure 01).

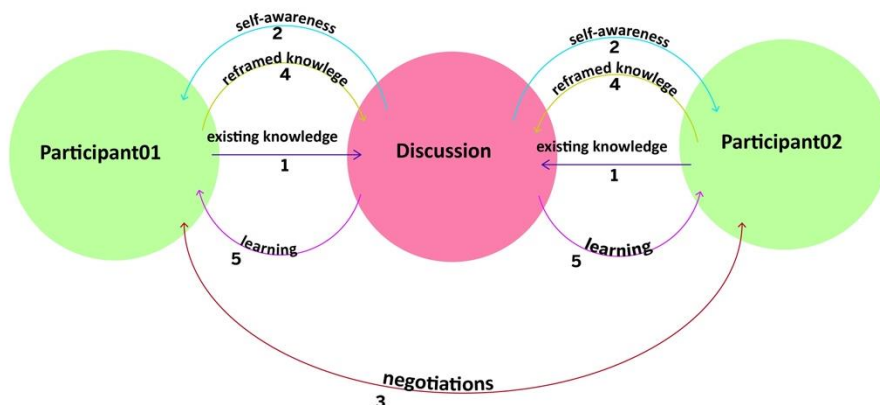


Figure 1. Self-awareness developed through conversations

This approach is the foundation of the MRes, where discussion between students of different disciplines is key to generating heuristic and inclusive boundary learnings, and this became even more important when the Covid-19 pandemic hit the UK. Lockdown forced the programme to re-think collaboration and the “Make it Public” unit became an online festival. Respecting its objective of generating new methodologies of engagement in art and design, besides the more traditional formats of papers and exhibitions, the unit adapted. The MRes students gave the online festival the subtitle of “How to be out of the box when you are stuck in one”. The seven online activities reflected common research interests but also ways of engaging and collaborating from isolation.

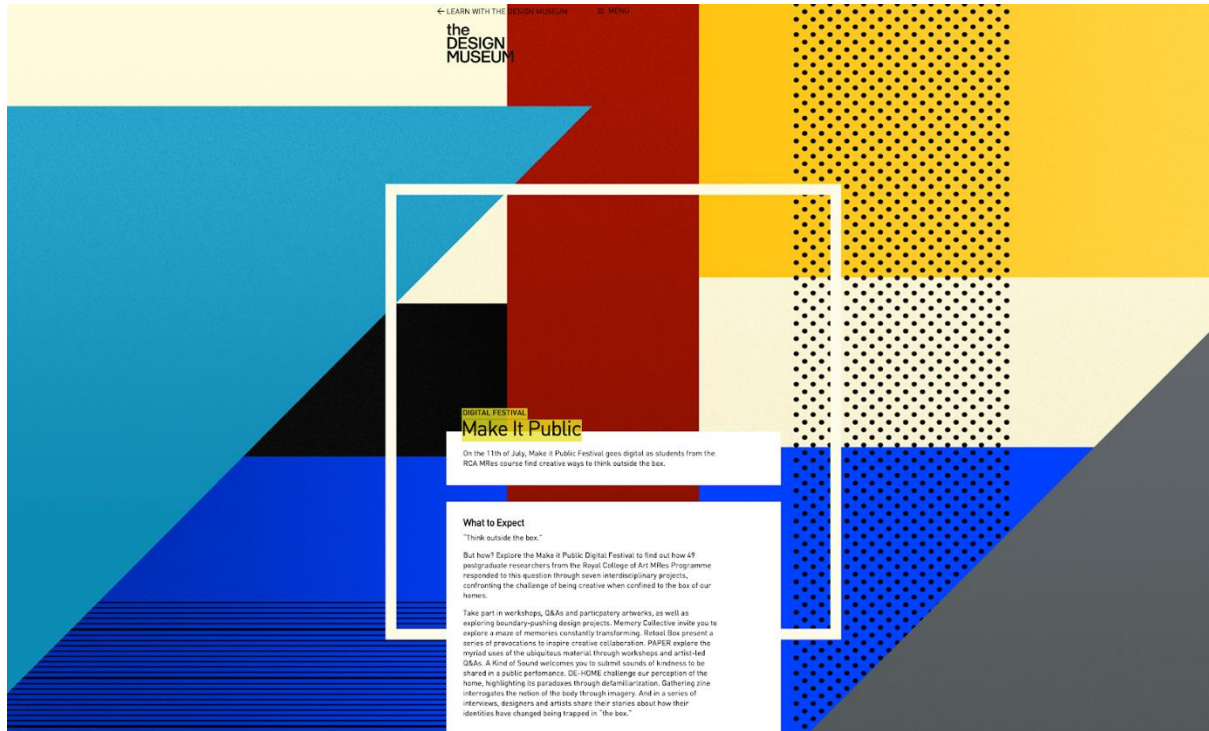


Figure 2. The Make it Public Festival on the Design Museum web page

The seven topics - Balance, Body, Identity, Memory, Paper, Participation, Position - generated the following online activities:

- a zine developed upon the topic of the body (Body);
- a collection of interviews of artists and graphic designers on the topic of identity (Identity);
- a magazine illustrating the alienated experience of one’s home during lockdown (Balance);
- a series of digital cards collected on an Instagram account supporting interdisciplinary collaboration (Position);
- an interactive digital maze collecting some of the authors’ memories of spaces (Memory);
- Innovation
- a reflection on the lockdown isolation visualised through the technique of papier-mache (Paper);
- a soundtrack played by a piano with no player performing the collection of sounds people around the world shared on the topic of kindness (Participation).

These experiences were hosted and publicised through the Design Museum webpage (Figure 02. Figure 3).

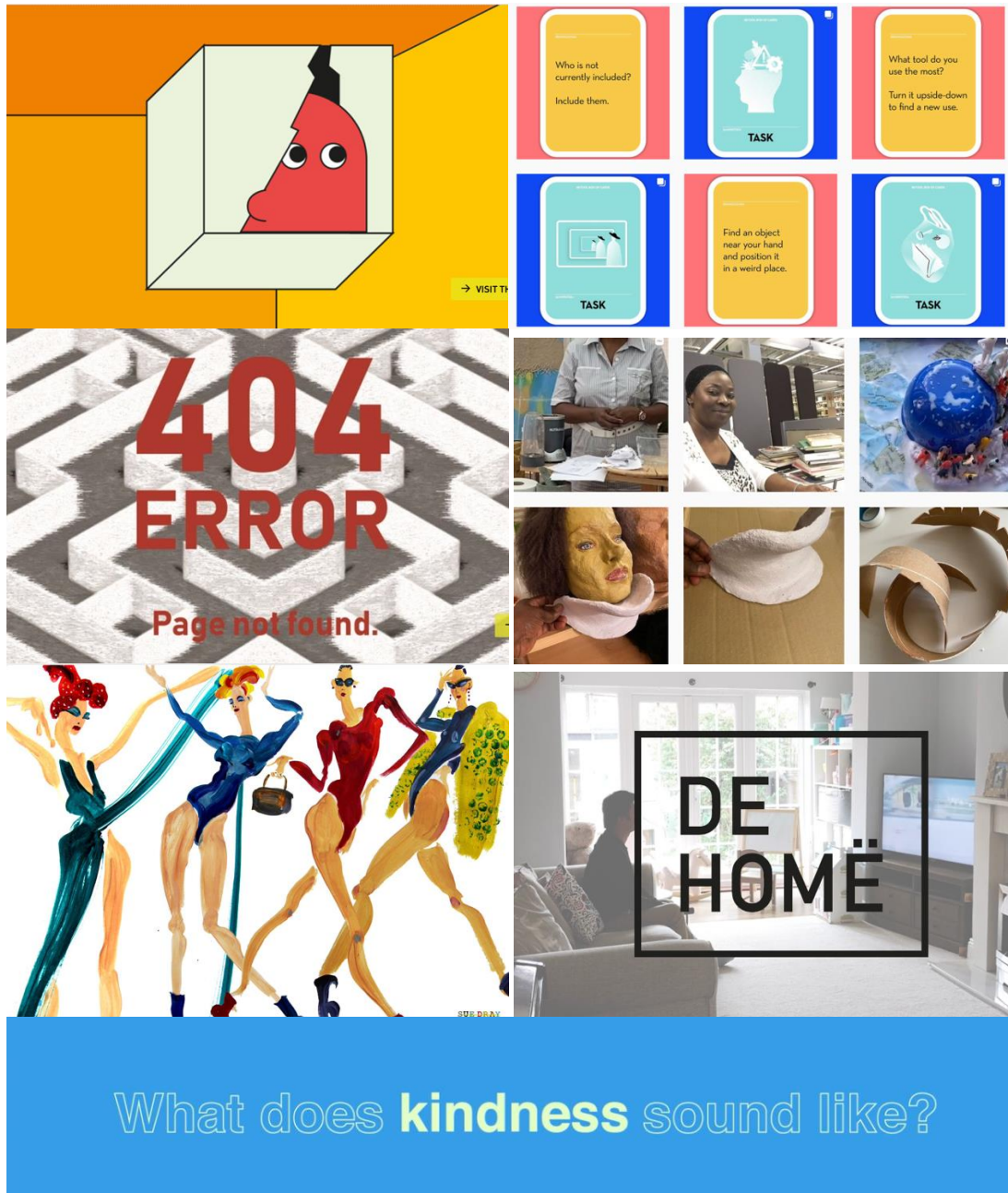


Figure 3. The seven activities. From Left - Identity, Position, Memory, Paper, Body, Balance, Participation

To develop and create these activities we developed a detailed schedule of tutorials, group reviews and technical surgeries that supported the students' learning and creative process in line with the programme's learning outcomes of engaging and developing discussion, all related to interdisciplinary thinking. To achieve so it was important that the "Make it Public" should not be approached as a brief comprised of tasks but as a collection of conversations stimulating heuristic learning and new knowledge generated from the students' lenses. This is not a process or pedagogy in which meaning is literally transferred from one participant to another, but it is constructed from a shared, negotiated and converged understanding of a given concept, which is acknowledged, implemented, or approximated, through the process of discussing with peers. Conversations reframe meanings by approximating the delta of knowledge resulting from the different understandings participants bring to the discussion (Sweeting, 2015). Using an open ended approach allows the different disciplines to assimilate, interpolate and integrate the respective boundaries (Jones, 2010), which produces an interdisciplinary approach to knowledge. As the "Make it Public" topics were open and applicable to the different disciplines, the risk of polarisation was reduced and curiosity was encouraged through building capacity to reflect and listen. These topics offered the groups agency, generated by a sense of ownership

(Kazansky, B. (2021), which informed the process leading to the development of the final outcomes. The debates supported participants in negotiating the decision making and evaluation process (Dubberly, & Pangaro, 2019); conversations, as a self aware process, shifted the attention away from a solution-making approach for generating mindsets able to debate any assumptions of any kind of knowledge brought to the group; in the “Make it Public” conversation has induced a kind of reflection that both negotiates and implements knowledge through the process of reaching an agreement, even if that agreement is to retain different viewpoints. This is not a reductionist approach, nor would that be a desired outcome of an interdisciplinary conversational pedagogy; in interdisciplinary contexts conversation leverages the agency of each participant as a negotiated process within a defined goal; it distributes responsibilities across team members, encourages proactivity and increases participation and motivation. The topics informing the online festival activities fostered conversations that constructed positive interdependence, motivated team members in engaging proactively and generated a boundary form of learning through the integration of different kinds of disciplines. The seven topics forced each team member to reflect, speak and debate, therefore develop a range of interpersonal skills (Berasategi, N., et al, 2020) able to express the complexity of dialoguing across disciplines. By promoting an awareness of knowing (Scott, 2011) these conversations helped the groups become comfortable with ambiguity and work through the conflicts generated by conversations (Dubberly, & Pangaro, 2019). Some of the groups managed to ‘tame’ or harness the cycle of conversations: for instance the activity developed by the Position group emerged from the struggles the team faced in aligning its members along a common position on methods of engagement; to respond to this a set of cards - Re.Tool Box - was created to facilitate processes of negotiations which emerged from the struggles of reaching agreements in interdisciplinary groups (Figure 4).

The Position group is an example where conversations develop a model of working and planning based on an argumentative process that gradually manages agreement from conflict (Dubberly, & Pangaro, 2019). Reflecting on the activities, one of the groups commented that the project “helped to observe, listen to people from different areas”.

Conflict is part of an interdisciplinary context where participants need to be equally engaged to mitigate this negative aspect, as outlined by another group: “Any group environment comes with challenges, but these are easily overcome by practicing patience, empathy and listening skills. I particularly enjoyed the ways in which my team members’ views could be vastly different from my own and led to insightful reflections”. The interdisciplinary space of the “Make it Public” opened up alternative ways of thinking and approaching research as a creative dialogic space. Another group commented: “The more we interacted with each other the more our ideas and values aligned” which reflects how the online festival activities created an engagement that reflected the combination of different attitudes and cultures, but also the methods used to develop this.

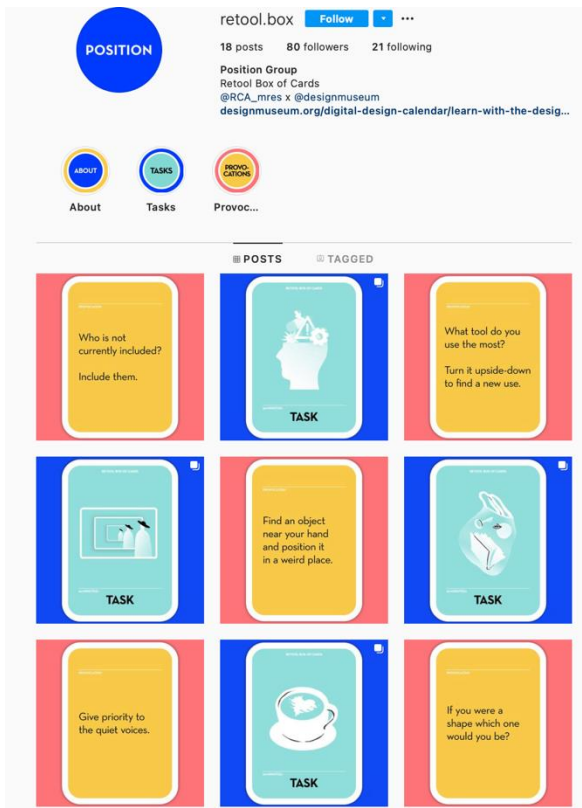


Figure 4. Retool box of cards on Instagram

The “Make it Public” activities visualise the complexity of the process of learning at the boundaries of the disciplines. For this reason, these activities can be framed in terms of boundary objects: objects that enhance the capacity of an idea to translate across cultural defined boundaries (Fox, N. J., 2011) or objects that represent a set of working arrangements (Star, S. L., 2010). Like boundary objects, these activities acted as ‘boundary experiences’ for the property of demarcating knowledge (Fox, N. J., 2011), i.e. of making clear what are the differences, definitions and diversities of a particular subject of studies. Where boundary objects have different kinds of meanings assigned by different kinds of actors, they also outline different kinds of understanding different people have of the same subject, which leads to processes of negotiation (Balint, T. S., & Pangaro, P. 2017). The boundary role was played at two different levels; the topics informing the online festival enabled communication ABOUT boundary experiences (Balint, T. S., & Pangaro, P. 2017); they were forms of repositories of knowledge as they offered multiple access to different kinds of disciplines, but also relate objects whose boundaries are the same for different communities, although the content that is bounded differs (Fox, N. J. 2011). The online activities were boundary objects FOR communication, i.e. they engaged different kinds of audiences (team members, peers, tutors and the general public) in dialogues which feedback loops, defined by the conversations between the students and the members of the public, increased the capacity to harness different kinds of languages and knowledge (Balint, T. S., & Pangaro, P. 2017). Following Balint's definition of boundary objects the festival generated two levels of boundary experiences of learning stimulated by the very interdisciplinary context in which different groups of people communicate across the boundaries of their knowledge (Fox, N. J. 2011). Collecting the response from the public one of the groups commented that:

The work really extended far beyond our small team and showcased just how many different views and practices there are and it brought about such diverse conversations. By the time we collected the submissions, it felt like the work was less to do with us as individuals but became an entirely collective experience. What started as simple teamwork turned into a curative process.

Through dialogue and exchange of knowledge the seven festival activities instantiated the groups’ capacity to communicate art and design research through the integration of different practices and theories; they expressed a “convergent experience” of thinking where multiple disciplines merge into hybrid experiences (Jones, 2010) and also they offered the general public the means to creatively discuss and reflect on the

condition of the lockdown. The festival activities made debate and communication boundary objects because they acted as an infrastructure that locally has different meanings without changing its universal understanding (Star, S., L., 2010) and engaged in reflective practices (Balint, T. S., & Pangaro, P. 2017). The festival activities are boundary objects FOR communication for the capacity of integrating and cross-pollinating knowledge across disciplines (Balint, T. S., & Pangaro, P. 2017); they allowed researchers to communicate with different people and elicited new ideas emerged from the performance of communicating with different kinds of audiences. Such condition enabled inclusivity which is crucial in helping create experiences that stimulate convergence. Even the highly solution-focused experiences, like the zine or the papier-mache workshop, were capable of stimulating conversations about freedom of expression and empowerment with activities created upon clear instructions.

For the role they played the initial topics can be defined as measures of the “distance” between the disciplines, as they visualise diversity but also the strategy to harness this diversity; the topics leveraged this polarity through their boundary object condition (FOR and ABOUT) which, in its turn, stimulated and developed conversations, hence boundary learning experiences. However, this was not a smooth journey as some of the groups demonstrated the capability to harness this polarity (Position), others used the topics to formulate clear divisions by keeping disciplinary boundaries (Memory) or to prevail against other disciplines (Paper); in other groups the topic acted as a means to bond and foster shareable but diverse experiences (Identity, Body and Balance). Overall the “Make it Public” festival collectively has developed a range of different attitudes and means for working and integrating different practices and disciplines. This is important and a vital element in such a pedagogical and research approach, born from within boundary learning experiences and in conjunction with boundary objects.

Discussion

In the “Make it Public” project interdisciplinary was a product of a process for developing conversations across different kinds of knowledge but also a necessary step to develop boundary learning, which is an extended form of deep interdisciplinarity.

The “Make it Public” festival gave us the opportunity for leveraging collaboration to converge different learning experiences able to integrate different kinds of knowledge. The reflections and discussions generated by the initial topics demonstrated a rich diversity of positions contrasting with individuated boundaries of knowledge. It needs to be specified here the context in which the “Make it Public” was developed, which was within academic research, i.e. a context driven by research questions. This process would almost certainly follow different dynamics in a professional context where the outcome is a more intrinsic element. But it does offer, through this lens, a way of rethinking and reframing the ways in which we work as disciplinary specialists and the potency of cross-disciplinary boundary experiences for stimulating fresh thinking and producing more innovative and creative solutions.

What contributed to stimulating dialogue and discussion across disciplines in the “Make it Public” was what constitutes a sense of ownership of the process and how the students developed this as they became confident with experimentation and challenging their own boundaries of working and understanding (Tobi, H., & Kampen, J. K., 2018).

In the “Make it Public” activities the relationship between interdisciplinarity and boundary learning is interrelated: they are both necessary and sufficient factors needed to elicit the convergence and integration of knowledge; deep interdisciplinarity is generated by the experience of communicating and dialoguing across disciplines; boundary learning is elicited through cross-discipline conversations at the boundaries of the disciplines. Hosted online, the students needed to take personal and collective journeys which highlighted and developed skills related to communication, negotiation and dialogue. One of the group’s feedback reflects this double experience:

*It [Make it public] enabled the group to explore more methods and avenues than you believe we would have if we had been a single discipline;
It was inspirational to confronting questions in my research project that would not have ordinarily occurred to me.
The more we interacted with each other the more our ideas and values aligned. Leading to a cohesive final concept*

It needs to be noted that disciplinary cultures of research influenced this process, as reported by one of the groups: “It helped me understand how different creative minds can approach the same question through different ways” . Some of them used the experience of conversation to iterate and learn new ways of working,

others remained within the disciplinary context and used the different skill sets available across the team to generate a multidisciplinary activity that recognised boundaries without necessarily crossing or blurring them.

Another factor that had an impact on the development of interdisciplinary thinking was the multicultural context and with students located across Asia, Middle East, Europe and Americas. This influenced ways in which social interactions privilege and undermine certain personality types. This particular factor was highlighted by the modalities of online collaborating, using platforms like Zoom, and the practicalities of working across different time zones, potentially disadvantaged some students. Some of the groups found it easier to split tasks, while others prioritised discussion and negotiation. The outcomes generated were markedly different in terms of interdisciplinarity. Here we are defining interdisciplinarity in terms of a more interdisciplinary outcome/approach being one where specific disciplinary practices and approaches are not readily identifiable in the outcome.

Two key knowledge formation processes sit within this way of thinking about learning: assimilation and integration. Assimilation reflects the complex process of bringing new ideas into an existing system of ideas. Bakan (1995) suggests that this process requires active participation from both sides: the assimilating and the assimilated ideas. In terms of learning, this requires the knowledge framework to adjust and make spaces for the new element or elements to be added to it. This might entail a wholesale restructure, aligning the new ideas with something closely related that already exists in the system or indeed creating an appendix to existing system that does not structurally change it. In contrast integration or an integrated pedagogy is multi-layer and multi-scalar, where all elements, new and existing, are considered simultaneously. Boundary learning experiences potentially include elements of both, and it is through this combination of multi-scalar knowledge systems giving way to assimilation that innovations and boundary objects can become realised. This method was tested within a unit which however resonated across the student's learning experience as noted by one of them: "It was inspirational to confronting questions in my research project that would not have ordinarily occurred to me"; this point is reflected in the external examiner's reports which confirms how the MRes students managed to adapt the project to the pandemic through the methods the programme offered to them.

The "Make it Public" festival has been an opportunity for implementing the experience of working through and for an interdisciplinary objective and thus for generating methodologies of interdisciplinary boundary learning. The experience of boundary learning has been key to more fully understanding the value of communication associated with the capacity to discuss, reflect and generate convergence and entanglement (Fitzgerald, D., & Callard, F. 2016). In certain cases this reinforced the distances between cultures and approaches to research; in others it helped redefine and expand boundaries for communication. As reported by the students some of the groups found a balance in aligning, negotiating and dialoguing, which had a positive impact on the experience developed for the festival, others struggled with establishing working ethos, practices, technical limitations and group dynamics. As a pedagogical reflection, this boundary learning experience also highlights some of the ways in which prevailing teaching methods serve to privilege particular groups and approaches within each discipline. This can mean that students and researchers become drawn into a discipline on these grounds rather than on a certain set of skills and knowledge. To think and learn through boundary learning experiences, such as those deployed here, offers a space of innovation and open thinking, and a methodology for generating interdisciplinary methodologies.

As reported the impact of the "Make it Public" on the final stages of the programme reflects the type of learning the students experienced. We noted that those who demonstrated highly integrated interdisciplinarity and learning experienced the greatest impact. This is not surprising, but offers a pedagogical reflection. Those groups that did produce interdisciplinary outcomes demonstrated a stronger capacity for listening and negotiating ideas overall. For these groups the respective personal projects didn't necessarily deliver interdisciplinary projects but capabilities of working in interdisciplinary contexts and expanded modes of individuated thinking, which in the majority of cases translated into more confident communication, increased capability for listening and an ability to harness different opinions in different ways. One solo research project shifted the focus on the concept of female agency expressed as a form of dialogue to design the space for women's voices to be heard. Another leveraged the concept of creativity in UK curricula to develop a system of conversations able to engage policy makers, teachers and parents in assessing what creativity means and how it is applied.

A factor that had to be constantly mitigated was the students' fear of failure, which created a barrier for experimentation; this was particularly evident at the beginning of the project. Despite the fact that failure is an intrinsic factor in research and given their research is built upon working towards uncharted maps, it is rarely harnessed by students in taught programmes for its negative connotations. Nonetheless learning how to fail is

vital in a research context. It enables iteration between search, discovery, test and prototype, in which failed outcomes are necessary. This is exacerbated or accelerated in an interdisciplinary context where there is the extra factor of collaborating with different kinds of attitudes, embedded cultures and preconceptions (Jones, 2010). In this context failure was a necessary step to foster a culture of shared reflection; it closes the gap between performance cultures and learning cultures, and provides the first step in the creation of an organization that can successfully initiate and sustain interdisciplinarity (Jones, 2010). Failure increases the capacity to discuss, builds resilience and the capacity to balance a response to negative conditions, and also to harness and learn from errors and failures.

Conclusion

This paper has considered interdisciplinarity as a form of enhanced communication able to intersect, integrate and interweave different kinds of disciplines for developing new knowledge. Through the MRes and Design Museum “Make it Public” online festival this paper has articulated the learning experience of the 2020 MRes students due to Covid 19 restrictions. We had already been developing a critical interdisciplinarity into the curriculum, but the pandemic accelerated this. With isolation and multi-locatedness of the students, we became interested in understanding how the process of dialoguing and conversing with peers of different disciplines can be used to enhance the interdisciplinary framework of learning. What was its capacity to promote a culture of self-reflection, awareness and the ability to negotiate ideas. The seven “Make it Public” activities gave these conversations a shape, which was represented by (1) the learning journey guiding the students’ dialogues with their peers across different disciplines and (2) by the engagement the students developed with the general public that extended those conversations outside the academic sphere. For this capacity to engage and empower different backgrounds the “Make it Public” activities can be defined as boundary objects FOR and ABOUT conversation (Balint, T. S., & Pangaro, P., 2017) and, more specifically, boundary learning experiences; they were repositories of different kinds of knowledge (Fox, N. J. 2011) but also they offered people of different disciplines the opportunity and space to express ideas, concerns and ways of working. Through this particular condition the “Make it Public” festival has generated a number of interdisciplinary spaces through which the students were able to learn how to embrace and harness the feedback from discussion and the collective knowledge the group was able to generate through negotiation and debate. It then follows that interdisciplinarity was the objective but also the roadmap for designing boundary experiences of learning. Under these terms interdisciplinarity is a meta strategy offering space for discussion and reflection visualised and expressed by the activities and experiences the groups of students developed for the festival. With the “Make it Public” online activities interdisciplinarity has been translated in attitudes and behaviours implementing the creative (and learning) process the groups pursued as a collective but also as reflective individuals. In the context of this paper interdisciplinarity has been described as a process and experience of integration able to combine different contributions and forms of knowledge at and between disciplinary boundaries. This festival was motivated by the necessity to respond to the disruption of Covid-19, whose associated challenges needed multilateral and cross-disciplinary solutions. This has enabled us to articulate a pedagogy of boundary learning in which researchers from multiple disciplines, sectors and backgrounds design a communication and research project that fosters and champions the convergence of thinking, built upon integration and assimilation of knowledge shared. In this pedagogical turn, deep interdisciplinarity as a research method becomes extended and expanded as a pedagogical tool for training researchers.

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