The potential of design-driven foresight to support strategy articulation through experiential learning

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Abstract

The turn of the 21st century has seen the burst of research on how design can support strategy formation and execution; however, little attention has been placed on the emerging field of design-driven foresight, that is the combined adoption of design and foresight methods to generate more immersive, experiential, and engaging representations of the future and inform strategy-making. This paper further unpacks this domain by examining the mechanisms that connect design-driven foresight with strategy articulation through relying on experiential learning. By drawing on a three-year research and innovation project, we illustrate how the relevant stakeholders make use of design-driven foresight processes while co-creating some interactive technologies needed to support crowdsourced curatorial processes in cultural heritage. The empirical evidence suggests how design-driven foresight, through co-creation workshops, can support experiential learning in the form of three distinct processes: favouring knowledge translation mechanisms, creating a safe space for learning-by-doing, and facilitating a multi-stakeholder conversation anchored to material and tangible work embedded in design artefacts. In turn, experiential learning can support processes of strategy articulation that emerge while stakeholders tinker with multiple exploitation pathways and progress through alternating phases of convergent and divergent thinking. Finally, it is argued that the plasticity and openness of design artefacts adopted in the context of foresight support forms of learning that will eventually foster processes of strategy articulation.

Keywords: Strategy articulation; Design; Foresight; Experiential learning.

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1.   Introduction

This paper takes a design perspective to explore how foresight processes can trigger organisational learning and, in turn, support strategy articulation. Organisations increasingly find themselves having to adapt to environments that are volatile, uncertain, complex, and ambiguous (Bennet and Lemoine, 2014). Constant support to learning processes, a commitment to knowledge, a certain openness to the outside world, and renewal mechanisms emerge as essential ingredients for survival (Senge, 1990), providing organisations with the needed flexibility and responsiveness (Hax and Majluf, 1988; Harris and Lenox, 2013). Given this uncertainty, organisations have handled interdisciplinary stakeholder conversations through problem-solving approaches that have enhanced the ability of the collective to align and learn and, as a result, change together (Peler et al., 1989; Serrat, 2017). The 21st century has seen a burst of research on how design can support strategy formation and execution, evidencing increasing integration into the practice of strategic management (Knight et al., 2020). The collaborative dimension of learning across organisational departments and functions has supported the alignment of how resources are used vis-à-vis how capabilities are deployed for the achievement of a common goal (Örtenblad, 2001; Freedman, 2013). The learning emerging from this process has been defined as experiential because it stems from a broad range of experiences that occur across the organisation (Kolb, 2015).

This experiential learning constitutes an important component of processes of strategy articulation, that is, those processes that enable strategy to be explicitly identified and described in terms of ideas, directions to follow, goals, and expected results (Love et al., 2002; Elsbach and Stigliani, 2018). We conceive strategy articulation as an iterative process, or practice (Jarzabkowski et al., 2016), whereby a series of actions are continuously re-evaluated and re-adjusted in accordance with the influence generated by internal or external factors. These strategy-making

processes are effective when they draw on actions that originate from new learning (Stacey, 1992), implying that strategic thinkers are 'learners' rather than 'knowers' (Liedtka, 1998).

We contend that foresight – "the ability, the skill and art of describing, explaining, exploring, predicting and/or interpreting future developments, as well as assessing their consequences for decisions and other actions in the present" (Berkhout et al., 2007, p. 74) – can support learning processes connected with strategy (Bühring and Liedtka, 2018). Future scenarios (Lindgren and Bandhold, 2003) or trends emerging from foresight promote forms of learning that encourage individuals and organisations to question what they know and their own frames of reference (Ayas, 1996). On the one hand, foresight can provide educational tools for decision-makers (e.g., future scenarios); on the other, it can mobilise actors at all organisational levels, encouraging them to reflect upon future issues (Godet, 2007; Bootz, 2010).

In the past decades, a good number of authors examined how design – i.e., a set of processes and practices undertaken to identify, frame, and address problems by significantly relying on modelling and other visual and physical representations (Schön, 1987; Martin, 2009) – can feed into (1) strategy formation or execution and, more specifically, (2) the definition of foresight methods or techniques. With regard to the first aspect, researchers identified a number of ways whereby design processes and artefacts, such as intensive use of visualisations, can broadly support strategy (Lojacono and Zaccai, 2004; Dalpiaz et al., 2016), strategy-related ideation sessions and other meaning-making processes (Ewenstein and Whyte, 2009; Kaplan, 2010; Knight et al., 2018), often fostering the emergence of multiple, productive divergent perspectives (Eppler and Platts, 2009). As far as foresight approaches are concerned, extant research has focused on the emergence of the *practice* of design-driven foresight, consisting in creating more immersive, multi-sensorial, experiential, and engaging representations of the future, which, in turn, support strategic planning (Bühring and Liedtka, 2018). Fewer studies particularly looked into the *learning processes* that can

be elicited by design-driven foresight in the context of strategy articulation, yet an important dimension of firms' growth and strategy making (Maitlis, 2005; Elsbach and Stigliani, 2018).

By engaging with the above aspects of foresight, this paper adopts a case study approach to examine how experiential forms of learning that are fostered by design-driven foresight can support processes of strategy articulation. The analysis is focused on PLUGGY, a three-year European research and innovation project that had the scope of (i) creating interactive technologies to foster crowdsourced curatorial processes related to cultural heritage and (ii) defining long-term exploitation strategies connected to these technologies. Although an innovation project, PLUGGY can be intended as an 'ad-hoc' organisation (Mintzberg, 1979) set up on a temporarily basis (Hobday, 2000); as such, decisions taken within its context qualify as strategic decisions in a similar vein to decisions taken by more conventional organisation types, yielding relevant implications for strategic management. The empirical evidence suggests how design-driven foresight, through the running of co-creation workshops, can support experiential learning in the form of three distinct processes: favouring knowledge translation mechanisms, creating a safe space for learning-by-doing, and facilitating a multi-stakeholder conversation anchored to material and tangible work such as design artefacts. In particular, the physicality of design artefacts (including their plasticity and openness) triggers experiential learning that feeds directly into foresight actions, supporting processes of strategy articulation that emerge while stakeholders tinker with multiple exploitation pathways.

The paper is organised as follows. Section 2 reviews the literature, looking more closely into the key constructs of strategy articulation, design-driven foresight, and experiential learning. Section 3 describes the research approach and the research context. Section 4 presents the findings of the study, while Section 5 discusses the results and the theoretical and practical implications of the research, suggesting avenues for future research.

2.   Literature review

2.1   The potential of design to support strategy articulation

In the past decades, a number of authors (Heskett, 2017; e.g. Brown, 2019; Knight et al., 2020) have explored how design can support strategy formation and execution or, following the term we use in this paper, strategy articulation, i.e., those practices in which representations of what the organisation "has been, is, and will be doing" in a repetitive way are formulated and circulated among stakeholders and subjected to their various interpretations (Mirabeau and Maguire, 2014, p. 1219). Within the scope of this paper, design is conceived as a practice that tends to harness cycles of divergent and convergent thinking (Cross, 1985; Brown, 2009) through a series of tools, methods, and activities, such as: early, rapid, and frequent prototyping (Bogers and Horst, 2014), user participation and co-creation processes (Avram et al., 2019), and user testing (Buchanan, 2004). Furthermore, design enables to frame problems, to create and evaluate multiple alternatives, and to widen solution spaces (Conley, 2010; Binder et al., 2011; Ehn et al., 2014).

Various researchers have explored the interplay between strategy and design. Already more than 30 years ago, Mintzberg connected strategy with design by arguing that 'crafting' strategy is a better word than 'planning' strategy and creating an analogy between the strategist and the potter, whose work is not guided only by rational and analytical thinking, but also by material "skill, dedication, perfection through the mastery of detail", and whose thinking and learning emerge while "her hands are working the clay" (Mintzberg, 1987, p. 66). More recent research looked into how a design approach (e.g., an intensive use of visualisations) can support strategy definition and development (Liedtka, 2002; Eppler and Platts, 2009; Boztepe, 2018), including a granular analysis of how design outputs such as visuals or other material items (e.g., mock-ups, prototypes, physical

representations) are used by strategists to support collaborative forms of meaning-making activities. Liedtka and Kaplan (2019) examined how companies can use design to support key moments of strategy development, mostly with regard to assessing and further developing their current products and services portfolio through a human-centred problem-solving approach. Design artefacts such as drawings or prototypes at various degrees of refinement can support brainstorming sessions (Sutton and Hargadon, 1996) and, broadly, ideation processes (Ewenstein and Whyte, 2009). For instance, PowerPoint slides help negotiate meaning in uncertain environments by creating spaces for discussion and allowing for adjustments of ideas (Kaplan, 2010). The ways in which PowerPoint slides are crafted (e.g., the use of pictorial representations or juxtapositions) prompt strategists to engage with their content and collaborate with other participants, to recognise and discuss aspects of strategy, and to further their understanding of what the particular strategy is (Knight et al., 2018).

Drawing on an action research approach, Eppler and Platts (2009) evidenced how the systematic use of visualisation can benefit the quality of strategic planning processes; in particular, the authors argued that: visualisations can support an ongoing and continuous strategy refinement process; the concurrent use of different forms of visualisation enables to gather and switch perspectives; and visualisations can act as bridging devices to help transform strategic insights into actions. When stakeholders, with different background, agendas, and knowledge specialisations, have to interact, design outputs such as artefacts, sketches, visual representations, or prototypes, can be used to translate ideas, theoretical and technical requirements, documents, and outputs into formats that can be more easily understood and appreciated by various stakeholders (Simeone et al., 2017; Secundo et al., 2020). These studies support the broader perspective whereby human activity is always mediated by the physical and cultural artefacts that surround us. Nicolini et al. (2012) examined how material objects not only act as translation devices across different thought worlds,

but how they also hold together different types of knowledge, fuelling cooperation while generating contradictions.

In spite of these studies, the use of design in foresight in relation to strategy has been mostly overlooked. In the section that follows, we review existing research that has explored the implications of adopting design methods (e.g., visualisations, prototypes, human-centred co-creation) jointly with foresight methods.

2.2   Strategy articulation and the experiential aspects of design-driven foresight

Design has for long been used to support foresight processes (Römgens, 2016), mostly as a way to (1) help non-expert audiences familiarise with foresight – e.g., by using vivid and engaging prototypes, videos, or visualisations (Hartman, 2016; Simeone et al., 2017), (2) to analyse and frame large amount of materials through cluster visualisations or affinity mapping (Bol, 2016), and (3) to facilitate the engagement with stakeholders – e.g., through workshops and participatory design (Kelliher and Byrne, 2015; Ojasalo et al., 2015). Extant research emphasised how design adds an experiential dimension to traditional foresight methods through the creation of 'provocative' prototypes (Dunne, 2005), immersive future simulations (Candy and Dunagan, 2017), or fine-grained design fiction representations (Sterling, 2009). This experiential dimension can be embodied in the creation of physical prototypes that can be manipulated, representing utopic, dystopic, or 'provocative' objects from a near or distant future (Dunne and Raby, 2013). Some other design researchers and foresight professionals work under the rubric of design fiction, producing storyworlds in narrative formats such as movies or other media, with the intent of eliciting imaginary experiences from the audience (Sturdee et al., 2016; McVeigh-Schultz et al., 2018).

Existing literature has also evidenced how the process of connecting futures thinking (including the thinking fueled by design-driven foresight) with actionable strategy remains complex and delicate. For example, scholars have argued that scenario building, widely used to deploy a range of coherent futures (Lindgren and Bandhold, 2003), is often detached from the actual process of building strategic visions (Curry and Hodgson, 2008, p. 1). A widely recognised challenge relates to how the outcome of foresight processes can inform strategy articulation or execution (Godet, 2012; Ramos, 2017): because of the unpredictable nature of the future, planning ahead for success through committing resources or developing specific capabilities may increase rather than mitigate chances for failure. Other researchers argued that the practices of design-driven foresight and futures thinking discussed above are recognised as an important driver underpinning organisational learning (Rohrbeck et al., 2015; Selin et al., 2015). However, *how* such learning is connected to strategy remains still vague (Bootz, 2010).

2.3 Design-driven foresight: a route to actionable strategy via experiential learning

Learning is a key component of organisational growth; behavioural theory scholars conceive learning as a relational concept that encompasses reinforcement of attention rules and search paths that prove successful in generating solutions (Cyert and March, 1963). Exploring this learning in further depth brings scholars from a learning perspective closer to strategy scholars (Knott, 2001; Szulanski and Jensen, 2006), creating a more explicit connection between strategy and organisational development (Argote, 2015).

Within the reflective tradition of design research, it is argued that the very act of designing triggers meaningful and experiential learning for the organisation; learning underpins the actions of designers, who try out certain options (throughout sketches, models, or prototypes), share the related artefacts with other stakeholders to get their feedback, and then reflect on the possible next

moves (Schön, 1987). Thinking like a designer, as opposed to conventional management thinking, helps organisations adopt a future-oriented perspective; in other words, they are not hurried into decision making or asked to commit to a specific path of action early on (Owen, 2007). Along similar lines, Darsø argued how learning is linked to an exploratory approach, tied into bifurcation points; these can be dilemmas, problems, and situations against which the learner (or learning organisation) do not know how to proceed, yet the process seems to lead to productive frustration and favour reflectivity (Darsø, 2001). Collaboratively addressing bifurcation points provides participants with the opportunity to discuss, reflect on, and gain awareness about their choices (Levinsen and Nielsen, 2011).

The understanding of design-related learning as experiential directly links with extant research that has analysed the experiential nature of learning within organisations (e.g. in Argyris, 2002; Kolb, 2015) and, in particular, how strategy-making as a process can stem from experiential practices. Constructivism theorists have argued that experiential learning happens when the individual is "consciously engaged in constructing an […] entity" (Papert, 1991, p. 1). Bürgi and colleagues (2005) observed how individuals were using Lego bricks in a workshop context, for instance by building physical models, to represent their view of the organisational identity, and how this helped them engage with strategy discussions. Similarly, Heracleous and Jacobs (2008) presented an approach to strategising through a process of crafting embodied metaphors, that is, physical constructions that can be touched, moved, and examined by individuals in a collaborative context. The authors pointed out how the process of physically engaging with such constructions – moving them around and moving around them – helped workshop participants making sense of the world and "debate specific strategic challenges in a generative fashion" (p. 309). While the use of experiential learning in schools and formal educational contexts has been criticised because of its lacking enough direct instructional guidance (Kirschner et al., 2006), more recent scholarly efforts

have reiterated how, within the context of organisational learning, experiential learning can effectively support collaborative sense-making and unfold as a result of the use of design thinking (Elsbach and Stigliani, 2018). This use of design thinking may in turn "produce a balanced form of strategic thinking" (Elsbach and Stigliani, 2018, p. 2299), urging further research on this connection.

The current manuscript contributes to the above debate by analysing how experiential learning as triggered by design-driven foresight can support strategy articulation. Despite the existence of scholarly work on how design can support learning processes throughout the formation of possible and preferable futures (Hancock and Bezold, 1994; Bühring and Liedtka, 2018), the specific connection between design-driven foresight, experiential learning, and strategy articulation remains underexplored. As such, we pose the following research question: *How can the use of design in foresight support experiential forms of learning and thus processes of strategy articulation?*

3.   Research methods

This paper draws on a single case study, PLUGGY, a design-driven research and innovation project funded by the European Commission for the period 2016-2019. Case studies allow the identification of critical insights through a fine-grained examination of one or more examples (Pettigrew, 1990). Theory building processes (Eisenhardt and Graebner, 2007) emerge from the investigation of real-life contexts (Glaser and Strauss, 1967; Yin, 2009) in situations where 'how' or 'why' questions are being posed. In our research, we investigated 'how' design-driven foresight can support learning processes in strategy articulation, in line with the exploratory nature of this research.

Case studies are a consolidated research method in organisation and management studies (Berg, 1968; Breslin and Buchanan, 2008; Buchanan, 2012) allowing to gather useful and

intermittent feedback, to adapt the research design to the availability of different types of evidence and data, to assess outcomes and test rival theories, and to develop key learning points in relation to major themes within a field (Yin, 2009). Selecting PLUGGY as the single case study allowed us to achieve an in-depth understanding of how the multi-faceted nature of design-driven foresight can shape strategy articulation and theorise about this relationship accordingly (Eisenhardt and Graebner, 2007). Furthermore, due to the possibility for one of the researchers to be present and observe the project all throughout, the case provided the research team with access to a research field of timely relevance, difficult to examine otherwise (Yin, 2009). In spite of the ability of the single-case study method to provide a rich description of a phenomenon (Siggelkow, 2007), it is still highly criticised as a method because of the difficulty to solidly build new theory upon it (Dasgupta, 2015). Whilst we remain aware of this limitation, we found the method as best suited to narrate, in a transparent manner (Eisenhardt, 1989), the unfolding of a phenomenon that not only required in-depth understanding, but also a close connection between empirical evidence and emergent theory (Hargadon and Douglas, 2001).

3.1   The research context: PLUGGY and its exploitation strategy

PLUGGY saw the collaboration of nine core consortium Partners (in the rest of the paper, named Partners): 4 research centres active in the fields of computer sciences and engineering design, 3 companies operating in the areas of tourism, video gaming, and interaction design, a museum, and a cultural foundation. The main idea behind the project was that technologies such as augmented reality, immersive 3D sound environments, geolocation, and videogames could support a new generation of curatorial processes – i.e., the processes behind selecting, annotating, and exhibiting artworks (Burdick et al., 2012) – which would be more open and collaborative. Thanks to a set of free-to-use software applications developed within PLUGGY, end-users could explore, analyse, and

make arguments not only about artworks that were in museums, art collections, and other established cultural archives, but also about aspects of cultural heritage that were not routinely covered by professional art curators. End-users adopted PLUGGY's software applications to curate cultural heritage and create digital and interactive exhibitions ranging from Peloponnesian silk wedding dresses to industrial chimneys in Malaga and old coins from Slovakia.

One of the core aspects of PLUGGY consisted of defining a plan to exploit the results of the project. The PLUGGY project is here seen as an 'ad-hoc' organisation (Mintzberg, 1979) to the extent that it was set up to accomplish a well-defined task on a temporarily basis (Hobday, 2000). According to the guidelines of the European Commission, exploitation consists in "the use of the results [from a research and innovation project] for commercial purposes or in public policymaking" (from the section "Funding and tender opportunities" within the website of the European Commission); in other words, exploitation of results coming from this kind of research and innovation projects is an integral component of an organisation's strategy. It follows that the "exploitation plan" of PLUGGY acquires relevance in organisational terms and enables us to draw insights for business strategy. It is also worthy to note that all Partners were asked to develop their respective exploitation plan to identify how technologies and the knowledge emerging from the project would contribute to their core business model and offering. These plans were articulated as formal documents highlighting critical aspects of the exploitation strategy, such as, among others, the following: (a) vision on how to use PLUGGY's key exploitable results, that is, "the main result that has been selected and prioritised due to its high potential to be exploited" (from the above-mentioned website of the Europe Commission); (b) critical actions, resources, and capabilities to be deployed to reach this vision; (c) a plan on how these actions could be executed in time; and (d) key performance indicators. One Partner – an interaction design agency referred to as IDAgency in the remaining of the manuscript – coordinated the process whereby the exploitation plans of individual

Partners were being articulated. The remit of IDAgency was less about defining the exploitation strategy for PLUGGY and more about facilitating a discussion among all consortium Partners and supporting their efforts to identify their own exploitation strategy as well as a possible cross-organisational joint exploitation strategy. Based on some of its previous experiences with co-design, IDAgency decided to use design-driven foresight to facilitate co-creation processes, which could inform the articulation of the consortium's exploitation strategy. An interview with IDAgency revealed that the process was deliberately structured in two phases: during Phase 1, organisations have been trained on how to use design-driven foresight in strategy articulation; in Phase 2, organisations have been encouraged to adopt design-driven foresight in support of strategy articulation processes.

3.2   Data collection and analysis

One of the authors was part of the PLUGGY consortium and had the chance to gather data during the entire duration of the project and beyond. His role in the project was to contribute, as part of a wider team of interaction and service design experts, to the exploitation activities tied to the software applications developed in PLUGGY. Foresight processes were an integral part of such an undertaking.

With one of the authors being internal to the project, the research team was in the position of gathering data through various methods, including participant observation (Czarniawska, 2012), two focus groups (Kitzinger, 1995; Frey, 2019), and interviews with key informants (Kumar et al., 1993) from PLUGGY. Figure 1 presents a timeline of the research process vis-à-vis the phasing of PLUGGY.
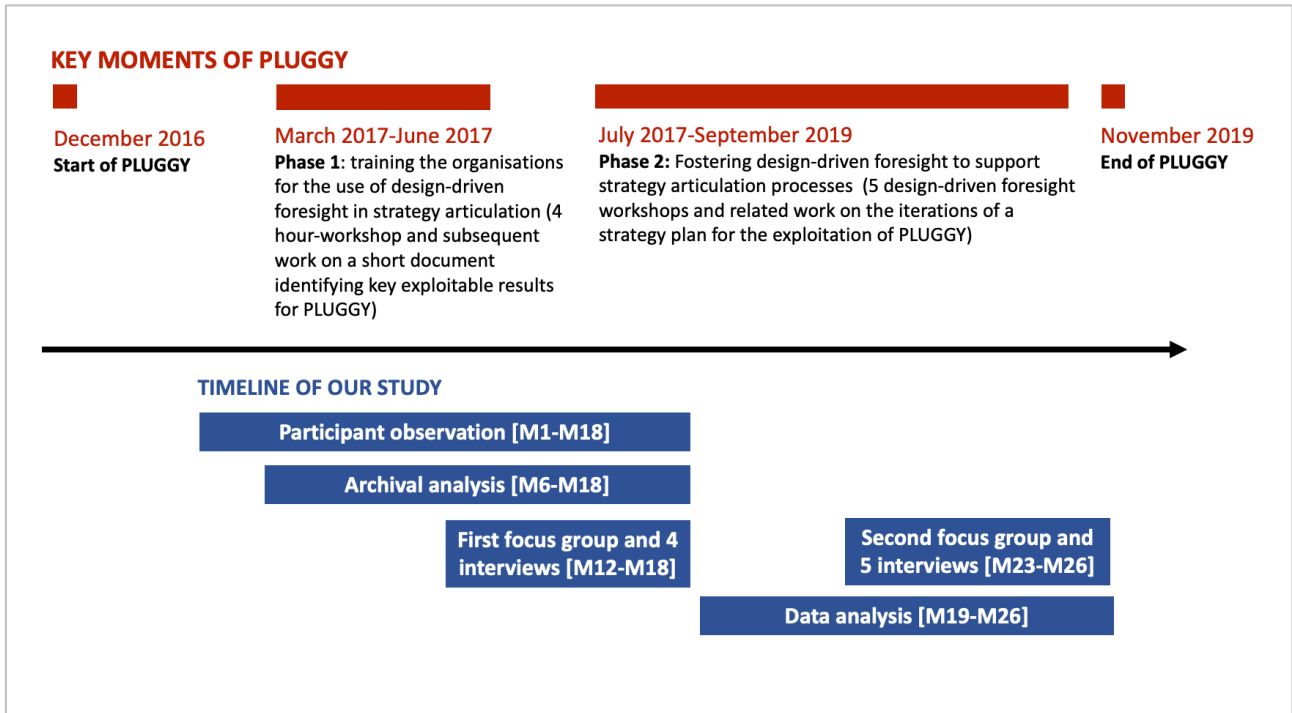
Figure 1 Timeline of the research

The questions for the focus groups and interviews were based on flexible and semi-structured protocols that enabled the research team to gather informants' perspectives on the following aspects: the elements of the design-driven approach that characterise the project; the foresight practices undertaken by the actors involved; and the influence of this approach on strategy articulation. Material from the focus groups and interviews helped researchers back up some of the initial insights they had on the case (Myers, 2013). Additional data was collected by the research team through the examination of PLUGGY reports, deliverables, prototypes, products, and communication materials. The analysis of this set of data was geared towards elaborating an interpretive framework to better link design-driven foresight and strategy articulation. The overall aim was to triangulate data deriving from various sources, reducing single-observation biases to the bare minimum (Tarrow, 1995).

Iterative processes of data reduction, analysis, formulation of working hypotheses, and verification were carried out (Corbin and Strauss, 2008; Miles et al., 2014). First, data was edited into a single profile document in which key outcomes of various phases of PLUGGY were documented (e.g., pictures and descriptions of design artefacts such as sketches, wireframes, demonstration videos, and prototypes). Data was subsequently examined through various iterations in which the authors of the paper were at first working independently and then sharing and integrating their analyses, seeking for the highest degree of reliability (Gilmore and Coviello, 1999). The textual analysis of the deliverables related to the exploitation strategy of each Partner confirmed that the combination of design and foresight methods had played an important role in the articulation of their strategy. To follow, the analysis of the interview transcripts revealed how learning was supporting informants while they were adopting foresight methods for strategy articulation. With the aim of inductively grounding preliminary results, the authors kept going back to key constructs emerged from past and current literature (Eisenhardt, 1989). The process led to the identification of three critical constructs – i.e., design-driven foresight, experiential learning, and strategy articulation – that brought to the fore the ability of design-driven foresight to support a more granular interaction among participants and, as a result, the fostering of experiential learning that would then feed into PLUGGY's exploitation strategy and related plans (a detailed illustration of the findings follows in Section 4 below). To enhance the transparency of both data collection and analysis (Cloutier and Ravasi, 2021), Table 1 illustrates how data was collected at different points in time and how the subsequent analysis contributed to the identification of the constructs and the development of the case study narrative.

Phase of the research process: data source and description	Contribution of the data to the case-study building	Key findings underpinning the definition of the constructs
Participant observation [M1-M18]		
As a member of the team in charge of coordinating the project exploitation plan, one of the authors was in the position of leading design-driven foresight processes and observing the impact of these processes in relation to strategy articulation. Observations were carried out during the researcher's visit at the office site of the Partners and attendance of various meetings and workshops. A series of 30 design artefacts (images, mock-ups, software prototypes, etc.) were collected. For each design artefact, additional notes on how the artefact had been supporting strategy making were taken.	• Preliminary characterisation of the design-driven foresight processes. • Understanding of how design-driven foresight processes were used in PLUGGY.	Combining design and foresight leads to different forms of collaboration among the consortium's Partners *Examples of supporting evidence* Notes taken while observing participants during the workshops indicated repeated instances of combination of design and foresight methods (e.g., co-creation of visual and immersive scenarios). These workshops allowed participants: • to interact effectively through relying on the design artefact; • to better understand their different disciplinary backgrounds and point of view; • to work together in a playful way, smoothing possible tensions.
Archival analysis [M6-M18]		
Additional information in relation to the core design-driven foresight and strategy articulation processes were gathered from sources such as the project website, deliverables, outcomes, and communication materials.	• Further specifications on how PLUGGY's design-driven foresight affected strategy articulation (official project deliverables written by the Partners). • Understanding Partners' exploitation strategy in terms of vision, critical actions, resources and capabilities needed to reach this vision, action plan, and key performance indicators. • Illustration of the design-driven process supporting strategy articulation.	Textual analysis of the deliverables related to each Partner's exploitation strategy confirmed that the combination of design and foresight methods had played an important role in strategy articulation. *Examples of supporting evidence* In the official deliverables detailing the individual exploitation strategies for each Partner, there were texts describing the process that led each Partner to articulate their strategy. These texts were co-written by each Partner. An analysis of such texts shows repeated occurrences in which partners recognise the importance of the co-creative design process, like in this text excerpt: *"We did not have much previous experience with design methods. We were surprised to see how the PLUGGY workshops helped us look at our strategic options in a broader and deeper way. These playful design processes supported brainstorming sessions in which we explored several strategic pathways, also unusual for us. For example, we are now considering servitisation as the best way to distribute PLUGGY technologies to museums"*.
First focus group and four semi-structured interviews [M12-M18]		
The focus group and the initial round of interviews with PLUGGY's Partners aimed at exploring learning	• In-depth exploration of how the design component of foresight influenced	An inductive analysis of the interview transcripts revealed that the learning dimension is critical for the informants; in particular, the empirical evidence draws attention to how combining design with foresight supports specific

processes connected to design-driven foresight and its relation to strategy articulation.	learning processes and strategy articulation.	learning processes that helped those involved articulate their strategy. *Examples of supporting evidence* Our analysis of the transcripts found repeated occurrences in which Partners voiced how the workshops elicited learning processes; two examples are reported: • *"We are good at programming, but we don't know much about legal stuff. The design workshops guided us through the complicated legal issues related to open-source licensing. We understand it a bit better now and this will help us decide how to exploit the software components that we are developing in PLUGGY".* • *"It was nice to position ourselves in the distant future through foresight. We came up with some crazy ideas but after all, these crazy ideas made us understand better the PLUGGY technologies".*
Data analysis, reduction, display, and identification of interpretation patterns [M19-M26]		
Data was put into tables and analysed, also in light of the theoretical constructs deriving from the literature review. Data analysis took place on an iterative manner: the two members of the research team worked independently and would regularly meet to share results, to discuss their robustness, and/or go back to the data were disagreement was present to further validate the analysis.	Identification of key analytical concepts in relation to two key phases of strategy articulation: (1) training the organisations to use design-driven foresight when articulating their strategy; (2) fostering design-driven foresight to support strategy articulation processes (illustration of these follow in Section 4).	A fine-grained analysis of the data collected led to the identification of three critical constructs: design-driven foresight, experiential learning, and strategy articulation. In particular, we observed how design-driven foresight (1) supported a more granular interaction among the participants, drawing also on knowledge translation dynamics that were triggered by the interaction and (2) created a safe space for experimentation. All this supported learning processes that were collaborative and experiential and that, in turn, helped strategy articulation. We discuss key connections among these constructs in Section 4.3 and provide a graphical illustration in Figure 4. *Examples of supporting evidence* Data showed how participants confirmed that they considered the workshops as moments in which they learnt about the technological and legal aspects of PLUGGY. In particular, the following insights could be drawn: • learning elicited by these workshops was of different nature compared to "*normal conversations*" or to "*reading emails or deliverables written by other Partners*"; • learning was immediate: "*learning was more immediate*", "*it was easier to understand what the other Partners have in mind*"; • appreciation of the hands-on aspects of learning by doing, which was qualified as "*fun*", "*playful*", and "*disruptive*"; • workshops as source of multi-faceted learning: "*PLUGGY workshops opened my mind to so many exploitation opportunities… even too many to process*"; • workshops supporting the elaboration of strategy: "*we now have a clearer vision of many possible exploitation possibilities*"; "*the hands-on work on the prototype during the workshops made us understand that, even if we are not programmers, our company*

		could offer services based on PLUGGY, for example, we can install and configure it for our clients".
Second focus group and 5 additional semi-structured interviews [M23-M26]		
A second focus group and 5 additional interviews with the Partners enabled us to confirm preliminary findings as well as collect further empirical evidence.	Fine-tuning of the analytical constructs used to examine the case and elaboration of critical findings.	Data emerging from the focus group and the additional interviews were analysed with the aim of validating how the three constructs related one another. *Examples of supporting evidence* Interviewees agreed that design-driven foresight made them understand the project better *("We got a clearer and broader picture of not only the project, but also the exploitation strategies adopted by other participants")* and this helped them articulate their strategy *("This wider picture allowed us also to establish a strategic partnership with another Partner since we better understood each other and realised that our exploitation strategies were complementary")*.

Table 1 Data collection and data analysis

As mentioned earlier, one of the authors was a member of the IDAgency team. This dual position – that is, collecting data from a field, which he was at the same time aiming to shape as an active member of IDAgency – may have put the researcher in an ambiguous situation. A wide range of research methods literature points out how these situations should be thoroughly handled (Atkinson, 1992; Clifford, 2003; O'Reilly, 2005), particularly in relation to how the researcher's understanding of the case may be influenced by the specific position held in the context of the project (Blomberg and Karasti, 2013). In order to offset any potential effect deriving from such ambiguity, three measures were implemented by the research team. First, the author holding the dual position disclosed his intention to conduct an academic research investigation to the other members of the IDAgency team as well as other Partners of PLUGGY, keeping them in the loop of how the research was unfolding (Rabinow et al., 2008); the research can therefore be considered overt. Second, it is important to clarify that within IDAgency, there was a team of five people working on the exploitation strategy of PLUGGY, including the CEO of the company and a dedicated project leader. Therefore, although the first author contributed to defining the exploitation strategy for

PLUGGY, he did not hold the most influential position. Last but not least, to mitigate any likely interpretive biases in the data analysis tied to the researcher's dual position (Maanen, 1979; Hammersley, 2006), both authors carried out the data analysis independently, undertaking a series of iterations in which the second author often played the role of the "devil's advocate" and challenged the first author's interpretations if/where appropriate (Locke, 2003).

4.   Empirical evidence

Among the longer-term objectives of PLUGGY, there was the provision of the necessary architecture and the technologies for the creation of pluggable software applications, allowing for beyond-the-project, not yet imagined, ways of fostering collaborative and crowdsourcing curation of cultural heritage. Most institutions currently operating in the art and culture fields favour a more centralised curation and stricter control on how to use and monetise artworks; besides the exception of a few research and commercial projects (Oomen and Aroyo, 2011; Ridge, 2014), crowdsourcing is not the obvious choice. The lack of an extensive number of comparative examples on crowdsourced curation and the continuous evolution of interactive technologies made it difficult to envision how PLUGGY and derivative applications could be exploited, even more so in the medium- to long-term horizon. To tackle this challenge, IDAgency – the team in charge of elaborating the exploitation strategy for PLUGGY– decided to set up and coordinate a design-driven foresight action through co-creation workshops attended by Partners along with some external stakeholders (i.e., professional art curators, end-users).

As we will see in the next two subsections, this work on design-driven foresight spurred some learning processes that helped PLUGGY articulate a deliberate, comprehensive, and future-proof exploitation strategy. Our analysis is articulated by drawing on the two phases envisioned by

IDAgency: (1) training the organisations to use of design-driven foresight in strategy articulation and (2) fostering design-driven foresight to support strategy articulation processes.

4.1 Training the organisations to use design-driven foresight in strategy articulation

Short description of the phase: A few months into the project, IDAgency organised a 4-hour workshop open to Partners and external stakeholders and geared toward the co-creation of future exploitation scenarios (Van der Heijden, 1996; Lindgren and Bandhold, 2003) for PLUGGY. The workshop started with IDAgency presenting a design fiction story (Sterling, 2009) that depicted some possible (distant) future uses of PLUGGY (e.g., an interactive art installation in which some dynamically created real-time holographic projections enrich a physical, tangible artefact exhibited in a museum). This initial presentation signalled to the participants that the workshop was geared towards an exploratory and visionary co-creation journey rather than the definition of realistic exploitation scenarios. The participants were invited to co-create not only a textual description of future exploitation scenarios and related business models, but also some additional visual material. By tinkering with coloured markers, scissors, and glue, the participants created some paper mock-ups showing examples of future PLUGGY applications. Most participants were not professional designers and did not have any formal training in design; despite so, they managed to sit down together and contribute to the creation of these design-enriched future scenarios (Figure 2).

Figure 2 Hands-on and design-driven workshop in Italy to envision future exploitation scenarios for PLUGGY (photo courtesy of XTeam, 2017)

Design-driven foresight methods used*: design fiction story, visually-enriched future scenarios.*

The role of design-driven foresight: Our focus groups and interviews showed how the interaction among participants was riddled with underlying tensions. Some participants, such as universities and cultural organisations, were in favour of open source and access; some others, such as some of the companies of the consortium, wanted to keep a stricter control of intellectual property seen as a source of strategic differentiation and competitive advantage. Some university researchers centred their agenda mainly on producing a source code that could showcase their advancements in computer science. Some of the companies, conversely, were not interested in the more exploratory aspects of research and rather pushed for PLUGGY to invest more resources into producing less experimental, more solid, and ready-to-market software components. In the interviews we carried out, company representatives repeatedly voiced their discontent for a project that – in their eyes – risked becoming *"too theoretical and abstract"*. Academic researchers, instead, saw the

contribution of private companies as not *"enough thorough"* and not *"anchored to research advancements in computer science"*.

These tensions were eased by the design-driven foresight activities, particularly in relation to three aspects. First, the co-creation workshop facilitated knowledge translation processes among participants with different backgrounds, languages, and agendas. In the focus group that we facilitated after the workshop, participants frequently expressed appreciation for the co-creation process itself *("it supported an open-minded and experimental approach that brought participants together")* and for the visual outputs of it (which, as voiced by a museum curator, *"for the first time in the project, allowed me to see more clearly the potential of the complex technological engines developed in PLUGGY"*). Second, participants were not asked to define a single and unified exploitation scenario but rather to develop an array of simultaneously possible scenarios, which was also possible because of the co-creation technique specifically deployed throughout the workshop. All the participants (also the non-professional designers) were at ease with building low-fidelity and paper-based mock-ups and, therefore, could quickly produce a good number of scenarios. These paper-based mock-ups had a good degree of plasticity (i.e., they could be easily shaped and re-shaped during co-creation) and openness (i.e., they were 'sketchy', incomplete, and open to the co-creation dynamics occurring in the workshops). The plasticity and openness of these scenarios could accommodate diverse views and, by that stage, were not requiring the selection of one single way ahead; as such, participants felt they had found a safe space within which they could express their own views and learn. As voiced by one participant from a cultural institution: *"Even though I don't know much about commercial exploitation, I felt ok with sharing my ideas during the workshop"*. In addition, the scenarios were set in a not-so-near future, pointing participants towards a range of possible future exploitation strategies rather than the one that may most likely happen. Third, the activity of practically tinkering with design moves on how to visualise PLUGGY

applications forced the participants to have a conversation that was linked to their material design moves (e.g., one participant would point to a paper mock-up and wonder: *"Should we add this functionality here in the main menu of this PLUGGY application?"* and another participant would draw something on that paper mock-up and say: *"I'm not sure. How about we add a button right here on the main page?"*). Materially-grounded conversations of this kind enabled participants to study each other's moves and define exploitation scenarios through a series of reflective and collaborative steps. As one company executive expressed, this workshop *"gave me the chance to have a good grip on what the other companies were thinking without having to expose myself too much"*.

How these processes supported learning and strategy articulation: Each Partner used the knowledge emerged during the co-creation workshop to craft a first piece of their exploitation plan, i.e., a short document identifying critical aspects of their exploitation strategy, including the key exploitable results for PLUGGY. Importantly, this document, by providing examples of how PLUGGY could be exploited in the future, would also give vital indications of the envisioned software components to the Partners in charge of developing the technical functionalities. Due to the financial and temporal resources of PLUGGY being strictly predefined, only a limited number of technical functionalities of the software components could be developed within the scope of the project; thus, it was critical to align these developments with each Partner's expectations. Because the workshop was focusing on advancements in computer science, attempting to reach this alignment was not an easy task for those Partners without a deep understanding of artificial intelligence, ontologies, machine learning, augmented reality, and binaural spatialisation. Design-driven foresight provided opportunities for knowledge translation processes, in which participants specialised in different disciplines converged on a common vocabulary and learnt from each other. The co-creation workshop offered a safe space within which participants could experiment and

tinker with the various functionalities enabled by PLUGGY technologies, a setting that provided ground for a granular and materially-grounded interaction among the Partners and for experiential learning. Knowledge was developed throughout the workshop when participants were being exposed to two types of bifurcation points: (a) the different future exploitation scenarios created during the workshop and (b) the multi-directional design moves that were occurring during the workshop, which were highlighting the diverse thinking across the participants. The whole process started off with participants exploring different exploitation scenarios through divergent thinking; at a later stage, the same individuals came together, converging towards the writing of a joint short document that would identify key exploitable results for PLUGGY.

4.2 Fostering design-driven foresight to support strategy articulation processes

Short description of the phase: In the second phase of the project, the project officer of the European Commission assigned to PLUGGY asked IDAgency to push the other Partners in defining a more realistic exploitation strategy, which would highlight precise objectives, key exploitable results, and a detailed plan on how to exploit these results. This was not an unusual request, since most projects funded by the European Commission need to develop an 'exploitation strategy' document; this requirement is spelled out in the official contract signed between the consortium Partners and the European Commission. Furthermore, the project officers designated to the project regularly remind the consortia to assign the adequate degree of priority to the various activities so that the needed exploitation strategies could be adequately formulated. IDAgency kept using design-driven foresight by organising and facilitating workshops in which participants were asked to use the key exploitable results identified in Phase 1 for the co-creation of future-oriented visual stories and prototypes. The difference with the workshop organised in the first phase was that in this second set of workshops, participants were now tinkering with design materials such as

snippets of software code, visual elements presenting user interface components and, in general, more advanced prototyping processes (Figure 3).

Figure 3 Augmented-reality design props to facilitate multi-stakeholder interaction and co-creation at a workshop in Spain (photo courtesy of University of Malaga, 2019)

Design-driven foresight methods used*:* co-creation of immersive prototypes and visual stories.

The role of design-driven foresight: Workshops were open to professional designers, programmers and other stakeholders such as museum curators; IDAgency used a hackathons format in which participants with very different levels of technical competence were teamed together to address a challenge of common interest. The challenge consisted of having to develop experiential (Candy, 2014) and immersive (McVeigh-Schultz et al., 2018) prototypes showing the functioning of the interaction model. To do so, participants needed to agree on the final key exploitable results of

PLUGGY, those software components that would allow third-party organisations to develop their own PLUGGY applications. Here, again, the main problem was the diversity of participants, who had different needs, interests, backgrounds, technical, and design skills. Their collaboration was challenged by such diversity. As an example, one of the themes elaborated in the workshops was the type of license to be attached to the software components developed in PLUGGY. Rather than only examining and discussing the pros and cons of each open-source license, participants were asked to collaboratively produce some fictional visual stories anchored to the prototypes developed during the workshops. These fictional stories showed possible future uses of the prototypes according to different licensing strategies. Participants were invited to consider more specifically creative and unusual future uses of PLUGGY, to think outside the box, and then to collaboratively craft some stories. Like in the case of the first workshop, these fictional visual stories were plastic and open to being co-created also by those participants without strong design skills.

Interviews showed how participants thought that this creative exercise made it easier to understand each other and to comprehend the more technical aspects of PLUGGY. A researcher stated that, after the workshop, she finally *"understood better how a software license works"* and that the co-creative work helped her *"get closer to a [legal] language I don't understand".* Since design-driven foresight pushed each team to collaboratively craft a visual story, team members had to translate their specialised knowledge (e.g., in computer science or in legal aspects of exploitation) into bits (e.g., simplified descriptions or examples) that could be used by non-specialist fellow team members. The translation of knowledge into creative bits that could be collaboratively manipulated was occurring within the hackathon, a *"safe enough space"* in which participants were immersing themselves into unfamiliar territories (e.g., legal aspects of software licensing) and learning about new things (e.g., differences among core licenses). The open-ended nature of this co-creation process engaged participants in a journey that brought them to closely

interact with other participants and jointly explore divergent creative possibilities. These stories suggested multiple exploitation pathways for PLUGGY, which were rich in bifurcation points. Participants ended up suggesting very different licensing strategies, ranging from the most viral open-source licenses to licenses that would leverage a stricter control on all intellectual property. The hands-on co-creative work on visual stories and prototypes facilitated a granular interaction among participants; in a subsequent focus group, the same participants mentioned how pleasantly surprised they were for feeling at ease throughout the process of jointly ideating the exploitation strategy, despite being unfamiliar with such advanced technologies or related legal aspects. They particularly appreciated that the design artefacts emerging from the co-creation work were *"open"* and *"sketchy"* and, as one participant said, this helped him *"feel more at ease in contributing, even though I am not a professional designer"*.

While the first workshop aimed at producing a joint short strategy document identifying key exploitable results for PLUGGY, these other workshops were geared towards helping each Partner in creating their own specific exploitation strategy. To support this process, IDAgency organised five workshops, in different geographic locations. Together with all the Partners, a diverse set of local external participants attended each workshop. This diversity in participants (from different geographic locations) fuelled the creative process and allowed Partners to be exposed to a great variety of viewpoints and ideas on PLUGGY, meaningfully enhancing their divergent thinking. However, our interviews also showed that, while some participants embraced and appreciated the multiplicity of possibilities offered by these co-creation workshops, some other were quite disoriented because the storytelling process was depicting the PLUGGY exploitation in an ambiguous and open-ended fashion – for instance, after the second workshop, a manager of a company that was a key Partner in the project expressed some frustration, *"these events change the*

cards on the table", arguing that it was difficult to keep track on how the functionalities of PLUGGY would evolve from one workshop to the following one.

How these processes supported learning and strategy articulation: This variety of perspectives elicited during the workshops worked as bifurcation points, which allowed workshop participants to embark onto learning and strategy articulation processes that were multi-directional and open to different views. In the interval between the workshops, IDAgency continuously integrated the emerging key insights into a series of iterations of a strategy plan for PLUGGY exploitation. For example, insights on suitable software licenses that emerged from the workshops fed into the exploitation strategy of those Partners who wanted to develop new market propositions based on the PLUGGY technology. In the official PLUGGY deliverable, IDAgency helped these Partners to select and codify exploitation pathways that were considered more closely compatible with the discussions held during the workshops. Various iterations of this written document were shared with the participants, who had the opportunity to consult it both prior and after the workshops. This created a sort of continuous oscillation between the divergent and exploratory thinking favoured by the design-driven foresight workshops and the more analytical strategy document, which pushed for a more convergent thinking. As a result, the articulation of strategy was constantly changed and progressively fine-tuned. The whole process was multi-directional rather than linear and evolved in accordance with participants' collaborative and experiential learning. Table 2 summarises the unfolding of the process over the two phases in a narrative fashion.
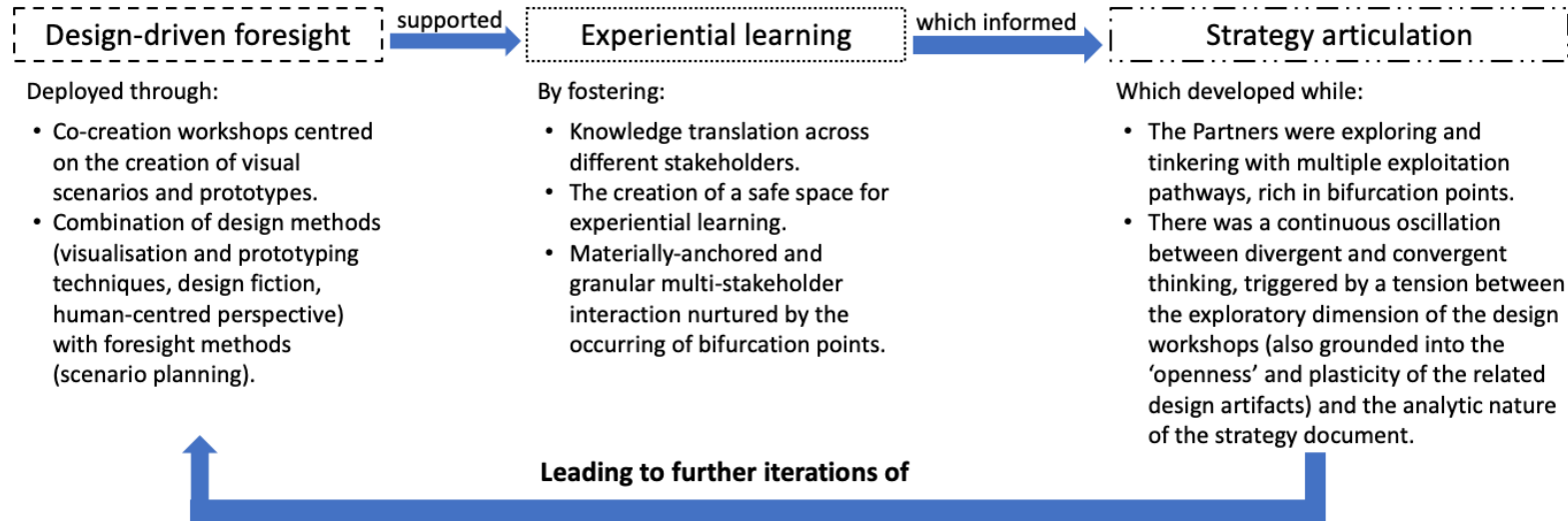
Period	Description of the strategy-making process	Design-driven foresight methods adopted	Emergence of experiential learning	Implications of convergent and divergent thinking for strategy articulation
Phase 1 (March - June 2017)	Running of a 4-hour workshop open to Partners and external stakeholders, geared towards the co-creation of future exploitation scenarios.	Design fiction story and visually-enriched future scenarios.	*Learning through material interaction.* Experiential learning was supported by knowledge translation, the creation of a safe space for learning, and granular and materially-anchored multi-stakeholder interaction. *Learning through diversity and multi-directionality.* Experiential learning occurred during the workshop through two bifurcation points: (a) different future exploitation scenarios and (b) multi-directional design moves.	*Engagement with convergent and divergent thinking.* Design-driven foresight encouraged workshop participants to engage with convergent thinking (e.g., building a shared vocabulary and understanding of the project) and divergent thinking (e.g., exploring a multiplicity of diverse exploitation scenarios). *Collective effort towards the fulfilment of shared exploitation objectives.* Ultimately, the Partners converged towards a single joint short strategy document with the objective of outlining the key exploitable results for PLUGGY.
Phase 2 (July 2017 - September 2019)	Running of five workshops, open to Partners and external stakeholders, with the aim of identifying specific exploitation pathways for each Partner.	Co-creation of immersive prototypes and visual stories.	*Learning through material interaction.* Like in the previous phase, experiential learning was supported by knowledge translation, the creation of a safe space for learning, and granular and materially-anchored multi-stakeholder interaction. *Learning across space.* Building on the experiential learning occurred in Phase 1, here multiple bifurcation points are further triggered by the interaction of different stakeholders across geographic locations.	*Persistent tensions between convergent and divergent thinking.* There was a continuous tension between divergent and convergent thinking, triggered by a tension between the exploratory dimension of the design workshops (also grounded into the 'openness' and plasticity of the related design artefacts) and the analytic nature of the strategy document. Iterative processes of participating in co-creation workshops and subsequent writing (and re-writing) of the exploitation strategy document led to a continuous oscillation between divergent and convergent thinking. *Fostering multiple and diverse strategic visions.* Partners were encouraged towards envisioning their own specific individual exploitation strategy, stemming from the unified strategic vision developed during Phase 1.

Table 2 A narrative summary of how design-driven foresight supports strategy articulation

4.3 Connecting design-driven foresight, experiential learning, and strategy articulation

Within PLUGGY, design-driven foresight was conceived as a combination of (a) design methods, that is, visualisation and prototyping techniques, design fiction, and a human-centred perspective, and (b) foresight, that is, scenario planning. This hybrid set of methods was deployed through co-creation workshops open to Partners and external stakeholders. In Figure 4 below, we provide a graphic illustration of how the three constructs – design-driven foresight, experiential learning, and strategy articulation – connect one another in the context of our case study.

ILLUSTRATION OF HOW THE CORE CONSTRUCTS RELATE ONE ANOTHER

Design-driven foresight → *supported* → **Experiential learning** → *which informed* → **Strategy articulation**

Deployed through:
- Co-creation workshops centred on the creation of visual scenarios and prototypes.
- Combination of design methods (visualisation and prototyping techniques, design fiction, human-centred perspective) with foresight methods (scenario planning).

By fostering:
- Knowledge translation across different stakeholders.
- The creation of a safe space for experiential learning.
- Materially-anchored and granular multi-stakeholder interaction nurtured by the occurring of bifurcation points.

Which developed while:
- The Partners were exploring and tinkering with multiple exploitation pathways, rich in bifurcation points.
- There was a continuous oscillation between divergent and convergent thinking, triggered by a tension between the exploratory dimension of the design workshops (also grounded into the 'openness' and plasticity of the related design artifacts) and the analytic nature of the strategy document.

Leading to further iterations of

ILLUSTRATION OF ADDITIONAL INTERACTIONS BETWEEN THE CORE CONSTRUCTS

The blue arrows represent the cycle already described above, whereas the black arrows provides evidence of the underpinning bi-directional process.
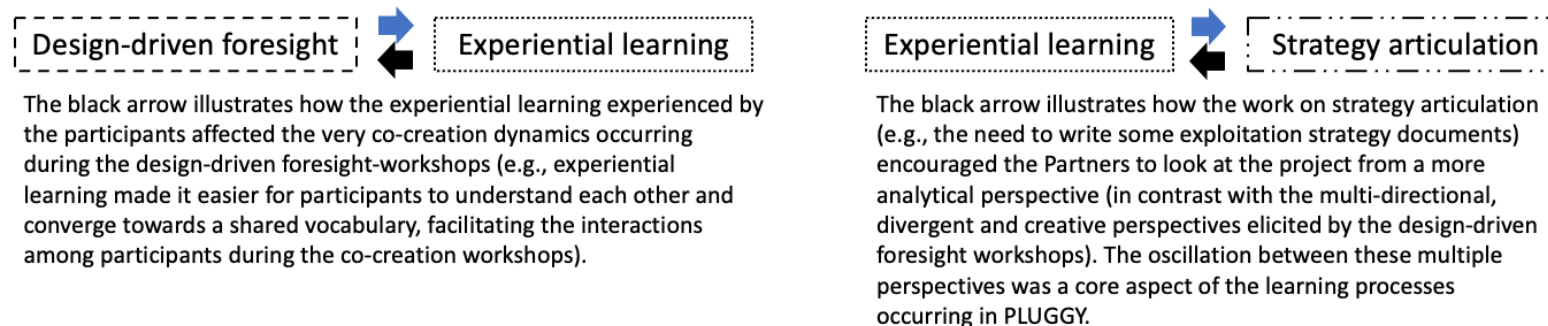
Design-driven foresight ⇄ **Experiential learning**

The black arrow illustrates how the experiential learning experienced by the participants affected the very co-creation dynamics occurring during the design-driven foresight-workshops (e.g., experiential learning made it easier for participants to understand each other and converge towards a shared vocabulary, facilitating the interactions among participants during the co-creation workshops).

Experiential learning ⇄ **Strategy articulation**

The black arrow illustrates how the work on strategy articulation (e.g., the need to write some exploitation strategy documents) encouraged the Partners to look at the project from a more analytical perspective (in contrast with the multi-directional, divergent and creative perspectives elicited by the design-driven foresight workshops). The oscillation between these multiple perspectives was a core aspect of the learning processes occurring in PLUGGY.

Figure 4 The role of design-driven foresight in supporting strategy articulation

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Design-driven foresight supported experiential learning by fostering three processes. First, the format of the workshops forced participants to translate their own specialised knowledge into simplified descriptions and examples that could be used by other participants to understand and collaborate in the co-creation activities. At times, this specialised knowledge was translated in visual formats, easier to understand and circulate. This was the case, for example, of the prototype shown in Figure 3, an iPad application that clearly illustrated the functioning of a PLUGGY augmented reality engine: by simply looking at this application, workshop participants would immediately understand the potential of augmented reality for curatorial processes. Some other times, the translational representations were much more ambiguous and prone to multiple interpretations. For example, Figure 2 shows some participants interacting with and co-creating a visually-enriched future scenario (specifically, preliminary ideas for a geolocated and augmented-reality-based art journey in an Italian city), which was plastic and open-ended and that allowed participants to propose very different ideas on how to use and distribute PLUGGY technologies. As such, participants in the workshops were invited to participate to co-creation processes that simultaneously (1) clarified matters and brought participants on the same page and (2) accommodated uncertainty, fostered conflictual perspectives, embraced ambiguity and, eventually, elaborated complexity. This sort of paradoxical translational aspects of design-driven foresight acted as a management practice, which coordinated the work and learning processes of a variety of different stakeholders.

Second, design-driven foresight required participants to develop multiple PLUGGY functioning prototypes that were anchored to the future. This boundary condition forced them to come up with exploitation possibilities that were linked to real life and yet embedding a projection towards the future. Rather than focusing on a single, unified technological outcome, PLUGGY ended up working on a set of software components that could be (1) used by a third party either

simultaneously or independently and (2) easily recombined in a modular fashion, thanks to a pliable licensing strategy that, on the one hand, favoured openness and, on the other, allowed external commercial developers to retain some control. This sort of open-ended environment would allow short-term exploitation possibilities for those interested in just recombining already released PLUGGY components, but it would also support longer-term exploitation pathways for those third-party developers who wanted to use PLUGGY components as a springboard for their own development projects. This environment was fostering multiple and exploratory interpretative directions, widening possibilities for use and learning. In combination with the translational processes described above, this orientation towards a multiplicity of diverse perspectives created a sort of 'safe space' within which participants were more open to appreciate rather than reject other (potentially different) viewpoints.

Third, design allowed for a more fine-grained interaction compared to verbal conversations. By taking part into a series of workshops, the Partners and some external stakeholders had the chance to reflect on their exploitation strategies while contributing to the creation of design artefacts. Participants' materially-grounded collaborative work on early and unfinished design artefacts provided insight on the moves of other participants; as a result, participants could tinker with their moves and explore different directions in which the exploitation of PLUGGY technologies could evolve by getting real-time feedback from 'peers'. This multi-directionality was nurtured by the occurring of a series of bifurcation points, i.e., moments throughout the design-driven foresight process whereby the stakeholders could visualise, interpret, and operate with PLUGGY and its software components, bearing loyalty to their respective needs, interests, agendas, or views of the future. While journeying through these bifurcation points and participating to the materially-anchored and granular multi-stakeholder interaction, participants would gather and elaborate insights on PLUGGY through processes of experiential learning. Note

that participants were not only harmoniously cooperating, but also playing a power relation game that would direct the project towards their interest, maximising their exploitation possibilities.

The work on strategy articulation that led to the final iteration of the exploitation plan was linked to how IDAgency facilitated the interaction of such numerous and diverse stakeholders and to what and how the stakeholders learned about PLUGGY. Ambiguity (e.g., the idea that the exploitation of PLUGGY could simultaneously follow two directions conflicting between themselves) was a core aspect of the strategy articulation process and, as such, leveraged by IDAgency. On the one hand, IDAgency deliberately used design-driven foresight to foster multi-directionality, tensions, differences, and ambiguity, thus widening participants' perspectives and divergent thinking. On the other, IDAgency had to push the Partners to formalise written strategy documents, which would contain clear and accurate exploitation pathways and converge towards a coherent and integrated exploitation strategy. The underlying and continuous tension between ambiguity and the need for accuracy and clarity was one of the key aspects of the whole process; in the understanding of IDAgency, this tension was critical to support a more open-ended strategy articulation process. Through the iterative workshops, participants were forced to meet and confront these tensions; learning occurred through the overlapping, conflicting, and competing design moves that underpinned the strategy articulation process.

The dynamics illustrated in the top-end of Figure 4 happened on an iterative basis. The elements of strategy articulation that emerged during Phase 1 (as described in Section 4.1) informed the functioning of the design-driven foresight workshops, leading to a new cycle of experiential learning in Phase 2 (as described in Section 4.2). Although the figure depicts a somewhat linear process and does not capture the temporal dimension, it is important to note that the presence of bifurcation points along with the co-creative nature of the interaction among the Partners may trigger asynchronous learning, which will enable the fine-tuning of the articulated strategy over

time. The bottom-end of Figure 4 visualises additional relations among the core constructs, drawing attention to the underpinning bi-directional processes. Experiential learning experienced by the participants affected the very co-creation dynamics occurring during the design-driven foresight-workshops (e.g., experiential learning made it easier for participants to understand each other and converge towards a shared vocabulary). The work on strategy articulation (e.g., the need to compile exploitation strategy documents) encouraged the Partners to think through the project with a more analytical eye, as a contrast to the multi-directional, divergent, and creative perspectives elicited by the design-driven foresight workshops.

5. Discussion

5.1 Theoretical implications

This paper takes a design perspective to explore how foresight processes can trigger organisational learning and, in turn, support strategy articulation. More specifically, it evidences how, through the combination of design and foresight methods, the involved stakeholders articulate their strategy by engaging in co-creation activities and embracing the experiential learning that is anchored to the physicality of design. This process also draws attention to how individuals alternate their focus between unleashing their creativity and thinking through their strategy document in analytic terms. This resonates with previous research that highlighted how thinking like a designer may delay firms' decision-making process: by avoiding to commit to a specific path of action earlier in the exploration process, firms can maximise learning and reduce uncertainty (Owen, 2007).

Our work engages with ongoing scholarly debates that examine the extent to which strategists use visuals and material items to support collaborative forms of meaning-making activities (Eppler and Platts, 2009; Ewenstein and Whyte, 2009; Kaplan, 2010; Simeone et al., 2017; Knight et al.,

2018; Secundo et al., 2020). Our research contributes to this stream in three ways. First, our case study points to the importance of qualities such as 'openness' and plasticity of design artefacts. The work of Ewenstein and White (2009) already unveiled how various stakeholders, while looking into an architectural design project, could refer, point to, or touch visual representations of architectural features. The authors argued that the openness and incompleteness of such design artefacts enabled different stakeholders to put forward their own interpretations, needs, and wants. This paper provides an integrative view by examining how the 'openness' and plasticity of design artefacts can be leveraged in a process that deliberately fosters multiple pathways and ambiguity. This process sits on the alternating dynamics of divergent and convergent thinking and, at some point, shifts from being open, as per the design artefacts, to being more structured and codified, as per the strategy documents and plans. This multi-directionality can be deliberately promoted to navigate uncertainty and tackle the wicked problems tied to the design and development of cutting-edge technologies while enabling stakeholders to engage with their own needs, interests, and languages. In other words, through tuning, monitoring, and balancing different viewpoints, multi-directionality makes sure that diversity represents a resource for, rather than a barrier to, strategic decision making. Second, our findings highlighted how the design-driven foresight workshops constituted a safe space for interaction and learning. The work of Kaplan (2010) indicated how the use of PowerPoint slides in strategy meetings could help create spaces for discussion and adjustment of ideas. Our work extends this study by showing how employing a specific kind of design artefacts and processes – the ones connected to foresight – encourages participants to interact around a yet-to-be-defined future that would accommodate different perspectives, with no predetermined right or wrong ways of designing things or envisioning exploitation strategies. Not only pictorial representations help individuals develop a better understanding of strategy, as suggested by Knight and colleagues (2018), but the translation processes triggered by design engenders a space where

participants feel safe to co-create. As such, this research complements extant research that argues how design artefacts act as the translator among stakeholders with divergent needs and interests (Simeone et al., 2017; Secundo et al., 2020) by shedding light on the broader mechanisms that support strategy articulation (Section 4.3 and Figure 4). Third, the case of PLUGGY provides strong empirical evidence of how design artefacts yield a type of interaction that rests on different (design) moves. Like in a chess game, these moves can be exploratory and foster a constructing dialogue, but they can also be of a more assertive nature and aimed at steering the strategic process towards specific outcomes. Observing design processes through the lens of design moves enables to take into consideration the role of physical objects in supporting multistakeholder collaboration not only by acting as translation devices across different thought worlds (see previous point), but also by embodying and holding together different types of knowledge, fostering collaboration without completely eliminating tensions and contradictions (Nicolini et al., 2012). As such, this research also extends Eppler and Platts's (2009) work by providing a granular analysis of how visualisations and prototypes help gather and switch perspectives throughout the strategic planning process, nurturing a design-driven foresight process.

The current manuscript engages with a second important scholarly debate, which relates to how the material aspects of design – such as visualisations, stories, or prototypes that offer vivid and engaging representations of possible, plausible or, rather, 'provocative' and utopic futures – can support foresight practices (Alvarez and Barney, 2007; Sterling, 2009; Dunne and Raby, 2013; Kolko, 2015; Candy and Dunagan, 2017). As a result, stakeholders are able to imagine a portfolio of desirable futures and actively experiment, with the aim of gathering new knowledge and learning (Bühring and Liedtka, 2018). Our work integrates these studies by illustrating specific mechanisms whereby design-driven foresight along with the physicality of the design artefacts (including their openness and plasticity) encourages various stakeholders to co-create and learn through direct

experience. Experiential learning is recognised as an understudied topic and researchers are calling for additional evidence on how "design thinking tools (and the experiential learning processes they initiate) facilitate, hinder, or change managerial cognitive processes, such as strategy making" (Elsbach and Stigliani, 2018, p. 2298). Bürgi and colleagues examined workshops in which participants were using Lego bricks to build physical models of some aspects of their work situation (e.g., models representing their view on the identity of their organisation) while engaging in strategy discussions (Bürgi et al., 2005). Their analysis praised the potential of a constructionist approach, according to which learning can be very effective if learners are immersed in hands-on building activities. Similarly, Heracleous and Jacobs (2008) studied how the use of physical constructions that can be touched, moved, and examined by the participants of a management workshop can help participants make sense of the world and debate on strategy-related challenges. In this body of work, strategy is conceived as a crafting practice; therefore, the work on physical construction can lead to generative and productive strategising. Our research integrates these theorisations of constructionism and experiential learning by examining how such learning is fuelled by design-driven foresight. We claim that this learning can unfold through the three distinct, yet interrelated processes discussed so far: knowledge translation across different stakeholders, creation of a safe space for experiential learning, and materially-anchored and granular multi-stakeholder interaction supported by bifurcation points (Darsø, 2001; Levinsen and Nielsen, 2011). In particular, the case study illustrated how such bifurcation points positioned participants along trajectories of multiple temporalities and ramified exploitation pathways, which made them feeling as if they were free to choose their own trajectory and/or to voice their opinions and disagreement. This attitude towards a collaborative interaction enabled PLUGGY to preserve and manage differences among stakeholders instead of obsessively seeking for unanimous consensus. By so doing, this research joins recent academic efforts within the innovation literature that look into how

idea contradictions, rather than only similarities, can support people in developing a collaborative conversation about an innovation vision (Magnanini et al., 2021), leveraging on the ability of conflict and dissent to stimulate divergent thinking (De Dreu and Beersma, 2005).

5.2 Managerial implications

The three mechanisms whereby design-driven foresight can help ignite and facilitate experiential learning processes and strategy articulation discussed above characterise a management practice that could support those strategists working with multiple different stakeholders and in relation to not-so-near temporal horizons. When anchored to the materiality of design moves, the processes of managing and coordinating the interaction among stakeholders become a matter of tuning, monitoring, and balancing divergent and convergent needs, interests, and ways of thinking to a greater level of precision. Although our case refers to a relatively small organisational context, the findings can be extended to address strategy articulation within larger organisations, where the diversity of opinion may emerge across organisational units, divisions, or projects, hardening the decision-making process (Samba et al., 2018).

Our research provides a meaningful headlight to management education. Scholarly effort has already explored how design-driven approaches can help organisations solve complex problems (Dunne and Martin, 2006; Glen et al., 2014); at the same time, it has been argued that, although designers may have the potential to work at higher strategic levels, their training may not fully support them in doing so (Borja de Mozota, 2010). By integrating extant management education literature on design thinking and emerging technologies (Earle and Leyva-de la Hiz, 2020), the findings of this research may inform curricula development through the acknowledgement of a role of design not only as supportive of strategic thinking, but also as enabling managers to embrace the experiential learning that design methods such as design-driven foresight may lead to.

An interesting insight in this regard is provided by Figure 4 (Section 4.3), which illustrates in a simple way how elements of strategy can be articulated through the adoption of design-driven foresight by sustaining experiential learning. By so doing, the current research not only acknowledges the role of organisational learning for strategy-making, but it also provides decision-makers with an understanding of how they can articulate their strategy by embarking on an exploratory and visionary co-creation journey rather than being forced to solely define realistic exploitation scenarios. Elements of emergence and adaptability were found throughout the analysis: whilst not of a systematic nature and therefore not sufficient to feed into the case-study building, these are deemed relevant avenues for future research.

5.3 Limitations and future research

Single case studies are often criticised for the unique focus on one individual unit of analysis and, therefore, their potential for further applicability. In the context of our research, we have accomplished a series of steps aimed at reducing the bias deriving from the one case while acknowledging its boundaries condition (Busse et al., 2017). First, by collecting data over a timeframe of more than 2 years, we made sure that the evidence and the subsequent interpretation was shedding light on some of the nitty-gritty aspects of design, which often remain overlooked in management literature. Second, the use of different data collection techniques along with the provision of a detailed illustration of how strategy was forming over time (through the design workshops) are a testimony of how the contribution of design-driven foresight to strategy articulation we hinted to in the discussion of our findings is aligned with recent conceptualisations of what 'strategic' may mean, that is, interdependence *across contemporaneous decisions* and *across time* (Leiblein et al., 2018).

Another limitation of our study was that PLUGGY remained anchored to a specific part of the world as it almost exclusively saw the collaboration of European organisations and individuals. Despite we made sure that the design-driven foresight at work was capturing cultural diversity, the very process of projecting the future was affected by the specific cultural factors at play during the workshops (e.g., differences and similarities in languages, ways of thinking, ways of collaborating, group dynamics, etc.). We thus contend that the findings earlier discussed would benefit by a comparative analysis of different geographic and cultural contexts.

In order to contribute to theory building and empirical testing, we envision two research avenues as particularly promising. First, a closer scrutiny of single design artefacts produced within projects like PLUGGY might provide a more detailed view of how specific features of each artefact can contribute to strategy articulation. Scholars have already started exploring this aspect; for instance, Azad and Zablith (2020) examined how specific affordances of visualisation tools (affectivity, relationality, and interactivity) shape strategy work. Adopting a closer level of zoom, as they did, would further enrich the analysis of the design artefacts and processes leveraged in the PLUGGY case. Second, our investigation may benefit from a fine-drawn characterisation of the core elements of strategy. Strategy can be characterised as considering the resources and capabilities in hand (or that can be achieved and developed), defining goals that can be realistically met, and mobilising these resources and capabilities in specific manners, with an eye on the risks involved (Freedman, 2013; Echevarria, 2017; Simeone, 2020). Further studies could look at how design-driven foresight and experiential learning would support organisations and individuals to think more creatively and strategically about their goals, their resources and capabilities, and the ways in which these can be deployed in relation to multi-faceted representations of the future.

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