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Design thinking for entrepreneurship: An explorative inquiry into its practical contributions

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ABSTRACT
Design thinking (DT) is expanding its horizons across a variety of different domains. One of the early and debated contributions regarding DT addressed its relationship with the entrepreneurial field. Today, there are numerous contributions that design thinking can offer in the creation of new ventures. However, there are few examples in the literature that discuss the concrete impacts and benefits of adopting DT in this field, demonstrating it through entrepreneurial projects. This paper aims to explore practitioners' experiences with the application of theories from design thinking inside an entrepreneurial context. The impacts of the learning and the relative application of the main design thinking principles are evaluated via a sample of 50 participants in an international summer academy that offered education on DT concepts and practices. Through this research, a deep understanding of how design thinking can contribute to entrepreneurship is provided, highlighting which specific DT abilities enable the development of entrepreneurial activity.

KEYWORDS
Design thinking; entrepreneurship; start up; business innovation; cross-disciplinary

Introduction

Design thinking (DT) has been recognized as a driver of innovation and change by different scholars and practitioners (Brown 2008; Forrester 2018; Liedtka 2015; Martin 2009; Sheppard et al. 2018). DT has undergone constant change; from being used for activities aimed at creating new products to being implemented as a solution in managerial practices that face strategic challenges (Martin 2009; Kelley and Kelley 2013; Dell'Era et al. 2020). A series of studies have defined DT as a powerful practice (Brown 2008, 2009; Carlgren, Rauth, and Elmquist 2016): a set of techniques, methods and tools

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that can support managers to face and overcome difficult and multifaceted challenges. Among the different contributions that DT can give, one of the most established is as a creative problem-solving method that fosters innovation (Brown 2009; Liedtka, King, and Bennett 2013; Martin 2009; Dell'Era et al. 2020). It can be seen as an iterative process made of different phases, such as providing insights on end-users, generating ideas, testing and implementing.

These aspects have allowed DT to expand into other domains, such as organizational change, agile development, and strategic and market innovation (Dell'Era et al. 2020). One of the recent connections has consisted of juxtaposing design thinking with entrepreneurship. The entrepreneurial world represents a fertile context for the exploitation of DT principles and practices; DT is considered a promising approach, specifically during the early stages of the creation and development of entrepreneurial initiatives (Sarooghi et al. 2019; García, Deserti, and Teixeira 2017). There has been an increasing number of contributions discussing the relation between design thinking and entrepreneurship that aim to investigate how the design process, methods and tools can be useful for entrepreneurship (García, Deserti, and Teixeira 2017; Val et al. 2019; Chou 2018). A number of scholars have highlighted the importance of fully incorporating the mindset, principles, methods and tools of DT into entrepreneurial organizations and how DT practices can generate profit from its advantages. Garbuio et al. (2018) outlined the importance of adopting the knowledge that underlies DT's methodologies, processes and tools to add entirely new perspectives to entrepreneurship.

There has also been a specific focus on discussing DT's contributions to specific phases of an entrepreneurial process, underlining how design thinking improve both the understanding, and the related embedding of an entrepreneurial mindset, that flourishing initiatives. (Val et al. 2019)

However, there is insufficient evidence about the concrete benefits and impacts of adopting DT during the initial stages of entrepreneurial initiatives. This paper aims to explore the practical outcomes of the application of DT principles to an entrepreneurial context by investigating the related benefits of recipients. More precisely, the paper addresses the following research question: what benefits design thinking principles bring in the creation of a successful entrepreneurial initiative?

Empirically, we rely on the case of the CREA Summer Academy, a design thinking educational programme directly related to entrepreneurship. During the programme, participants had the opportunity to receive specific education on DT concepts and to directly apply them to the development of new venture ideas. The study engaged 50 participants from the summer academy who, after the conclusion of the programme, applied their DT knowledge to

their own entrepreneurial careers. The aim of the analysis – leveraging the key DT principles – was to understand what practical design abilities they developed within the programme through their adoption of design thinking and how these skills contributed to the development of their entrepreneurial activities.

The article is structured as follows: the subsequent section summarizes the main design thinking principles and their implications that are utilized in this research, followed by an overview of the main relations and links between design thinking and entrepreneurship. In the following sections, an overview of the research methodology is presented to describe the empirical results, which are subsequently discussed, after which conclusions are drawn and future research avenues are identified.

Theoretical background

Design thinking

The value of design thinking (DT) has been well established in recent years by scholars from the design and business and management disciplines: most of the contemporary literature consolidates the positive implications of design thinking for innovation, strategic option generation and management education (Beckman and Barry 2007; Glen, Suciu, and Baughn 2014; Garbuio et al., 2018). One of the most important contributions of design thinking to the business field is its capacity to empower and facilitate radical innovation for companies and businesses (Dell'Era et al. 2020; Martin 2009; Brown 2008; Verganti 2009).

Indeed, design thinking is recognized as an innovative approach to support managerial practices facing strategic challenges (Martin 2009). In this sense, the practical implications of DT have been codified as DT for *creative problem solving*, where the innovation process starts with user involvement and a deep diving into the human-related problems.

The creative problem solving (CPS) approach evolved in recent years and has been codified according to an iterative process that aims at addressing complex challenges in a creative manner (Brown 2008, 2009). CPS is recognized as one of the most crucial approach of design thinking (Dell'Era et al. 2020), representing the effective expression of its original constructs.

Indeed, a vibrant dialogue between academics and practitioners is occurring and is focused on how DT is defined; this has stimulated various scholars to identify what, specifically, characterizes DT through different systematic studies: according to recent reviews, we can talk about specific features (Dunne 2018), themes (Carlgren, Rauth, and Elmquist 2016) attributes (Micheli et al. 2019) or practices (Dell'Era et al. 2020) in DT. An

adaptation of these theoretical perspectives is implemented in this study to delineate the core design principles on which DT has been built.

The main six principles identified in depicting DT for creative problem solving are: *human centeredness, creative reframing, learning by doing, visualization, holistic approach, divergence and convergence.*

Human centeredness is the essential principle of DT: users and stakeholders, the human factors, are the starting point and the centre of the whole DT process. The means to actuate this principle consists of empathizing with users: empathy refers to considering others' viewpoints, to understanding their perceptions, physical and emotional desires and wishes, and to recognizing what they deem important (Connell et al., 2015). Empathy is 'the core value of human-centeredness' (Carlgren, Rauth, and Elmquist 2016): design thinkers can envision solutions by taking a 'people first approach' and by doing so they can shift their point of view to address expressed and unexpressed challenges (Micheli et al. 2019).

The DT approach is built on an alternative and nonlinear path to problem solving: *Creative reframing* of the problem means challenging and reframing the existing problem and the related practices and assumptions. It implies the expansion of space for both the problem and solution, focusing on what the solution might become in the future rather than analysing its current state (Dorst and Cross 2001).

DT is characterized by the *learning-by-doing* and *trial-and-error* studies that have tested a variety of potential solutions involving end-users and other project stakeholders (Beverland, Wilner, and Micheli 2015). These principles are actuated by working iteratively, experimenting and prototyping quickly and often to 'learn about the strengths and weaknesses of an idea' (Brown 2008). Iteration is used to better define the issues being addressed (Beckman and Barry 2007) and to activate a loop cycle of problem framing and experimental solution ideation. Together with empathy, this guarantees a user-centred approach to innovation.

Another crucial focus of DT is the process of passing from abstract imagination to visualized concepts and then thinking beyond those visual representations (Boni, Weingart, and Evenson 2009). This happens, first, to make ideas and insights visual and tangible, to externalize knowledge and to communicate new ideas; second, to provide experiences that enable understanding: as Micheli has expressed, *visualization* does not always include physical artefacts (sketches, visual representations); storytelling, indeed, is a way to imagine alternatives or experiences that can be used to make abstract ideas seem vivid and realistic (Carlgren, Rauth, and Elmquist 2016; Micheli et al. 2019).

Design thinking also entails *holistic thinking*: the importance of not only examining the specific problem or issue in consideration but also how it

relates to its surrounding environment or the system in which it exists (Beverland, Wilner, and Micheli 2015). It is about analysing problems in their entirety, zooming in and out of the context of the problem's application to fully understand its complexity and boundaries. This integrative approach permits both the development of a real understanding of the problem's context and a definition for the relevant findings that need to be considered when redefining the challenge (Dorst and Cross 2001; Dorst 2011).

Furthermore, DT aims to blend analytical thinking with intuitive thinking (Martin 2010); the design thinking process includes a divergent stage of discovering unconventional ideas, followed by a convergent stage in which the most promising ideas are chosen and developed (Brown 2008). DT application distinguishes itself by dynamically balancing intuition and rationality to combine knowledge patterns that are identified through an intentional evaluation of the relevance of those patterns (Stephens and Boland 2015). Design thinkers continuously and actively mediate the tension between possibilities and constraints to generate alternative and innovative solutions to valuable challenges (Liedtka 2015).

Design thinking and entrepreneurship

Entrepreneurial initiatives are different from established companies, mainly due to their lack of structure and routines, different dynamics and overall elevated complexity, which are related to the simultaneous development of both the business itself and the purpose of its sales (Daniel 2016). Barringer and Gresock (2008) have referred to the importance of delivering a comprehensive process with well-structured activities before launching new businesses, such as sensing a space of opportunity, creating a business idea, testing the idea and conducting a feasibility analysis. All these activities in the entrepreneurial process call for a flexible, adaptable and innovative approach and have attracted the interest and attention of scholars and practitioners, who have connected and integrated design thinking and entrepreneurship (Chou 2018; Daniel 2016; Garbuio et al. 2018; García, Deserti, and Teixeira 2017; Glen, Suciu, and Baughn 2014; Laferriere, Engeler, and Rixon 2019; Sarooghi et al. 2019; Val et al. 2019). The most relevant studies and discussions connecting these areas, useful for the objective of this research, are detailed in the next paragraph.

In recent years, several papers have demonstrated that the principles of DT should necessarily be included and adopted in entrepreneurial studies and practices for a variety of reasons to fulfil very specific needs (Laferriere, Engeler, and Rixon 2019; García, Deserti, and Teixeira 2017; Sarooghi et al. 2019; Val et al. 2019). On the one hand, it has been stated that the application of specific design tools could support the application of processes to

shape a specific mindset (Sarooghi et al. 2019), especially in the early stages of opportunity identification and exploitation. Being forced to confront ill-defined problems and overarching uncertainty can compel entrepreneurs towards the adoption of DT to identify opportunities that balance viability, desirability and feasibility (Sarooghi et al. 2019) to address complex societal problems and address multiple actors and stakeholders (Laferriere, Engeler, and Rixon 2019; Val et al. 2019).

DT's mindset, methods and tools have been shown by García, Deserti, and Teixeira (2017) to identify promising contributions for systematically searching for, framing, developing and accessing opportunities to entrepreneurs, especially in the front-end phase of an entrepreneurial process. The study identified the cognitive traits of design and DT, such as the conception and realization of new things, the capacity to deal with ill-defined problems and to be alerted by 'weak signals' to make sense of the surrounding context, that are essential for entrepreneurs to discover or create business opportunities. Moreover, another strand of literature has shared how the cognitive thinking traits of designers can contribute to the creation of entrepreneurial ventures. First, designers' capacity to deal with wicked problems (Buchanan 1992; Cross 2006; Weick 1995; García, Deserti, and Teixeira 2017) and identify hidden patterns and weak signals (Baron 2006; Kolko 2010; García, Deserti, and Teixeira 2017) could enable entrepreneurs to discover opportunities before their competitors (Barringer and Gresock 2008; García, Deserti, and Teixeira 2017). In addition, the divergent and convergent thinking process and the ability to better imagine possible new products and services that do not yet exist (the ability to visualize) could generate innovative and creative ideas that entrepreneurs could rely on to develop new businesses (Val et al. 2019; Sarooghi et al. 2019). Trial-and-error attitudes provide a new perspective to look at 'failure', which is a natural condition of innovation, and could help to reduce risk. The most important is the capability to apply different attitudes to different stages of DT.

The importance of these underlying cognitive concepts for entrepreneurs has also been stressed by Garbuio et al. (2018). They stated that the part of DT relevant for entrepreneurship is related to the cognitive skills that distinguish DT from alternative approaches and methodologies, such as the 'lean startup' method or the 'business model canvas' (Garbuio et al. 2018). DT's cognitive skills can not only support entrepreneurs to face uncertainty or anticipate unexpected problems but also shape the entire initiative from the beginning, offering the possibility to not only identify existing opportunities for entrepreneurship but also to eventually create entirely new opportunities (Garbuio et al. 2018).

Comparisons between DT and entrepreneurship have also shown certain common features of both. An in-depth analysis was performed by Mueller

and Thoring (2012), who compared the two strategies of DT and lean startup (Ries 2011) and presented their similarities and differences. They both aim to create innovative businesses that are based on a user-centred mindset, and both strategies mention the importance of testing and following the 'fail early to succeed sooner' concept. Both processes share certain common steps to be followed, naming them in different ways but with similar underlying ideas. However, these differences enable them to learn from each other. DT is strongly rooted in performing qualitative research on users to identify actual needs and wants. The synthesis methods, ideation techniques and qualitative feedback/data are the essential tacit elements of DT that could improve the lean startup approach. On the other hand, lean startup, derived from the field of manufacturing, could strengthen DT through lean startup's earlier implementation of feedback and its application of metric-based evaluation techniques. Finally, a model of lean design thinking has emerged that integrates advantages from both strategies (Mueller and Thoring 2012).

Despite showing great promise in theoretical analysis and discussions, there is still a lack of evidence of the impacts and benefits of the application of DT to entrepreneurial practices (García, Deserti, and Teixeira 2017; Sarooghi et al. 2019). How do entrepreneurs perceive and practise these characteristics and methods of design thinking in real experiences? This lack of knowledge regarding DT's empirical benefits and the vastness of the field of design thinking demonstrate the need to define the precise elements and approaches of design thinking that are applicable to and relevant for entrepreneurship.

Research methodology

The aim of this study is to investigate how DT principles can support entrepreneurs in developing a new entrepreneurial idea and what long-term benefits it can create. For this reason, an exploratory case study methodology is appropriate (Eisenhardt 1989; Yin, 2009), due to its usefulness in answering 'how' questions and supporting the investigations of complex phenomena (Easton 1995).

Empirical setting

From an empirical perspective, the investigation was conducted by analysing 50 international participants, who constituted the case studies of the analysis and participated in a design thinking programme related to entrepreneurship named the CREA[1] Summer Academy between 2015 and 2017. The CREA Summer Academy was a European project conducted among seven countries (Italy, Germany, Slovenia, the United Kingdom, the Netherlands, Estonia

and Greece) for the development of innovative business ideas. During the programme, participants were able to acquire education regarding DT concepts and to directly apply them to the development of new venture ideas. Participants were supported, from both an academic and business standpoint, through the diversification of a partnership composed of European universities, incubators, regional development agencies and business support initiatives. The 50 respondents, 58% of whom were men and 42% women, were aged between 23 and 34, with different backgrounds, mainly in engineering, economics, computer science and sociology.

A questionnaire was conducted to explore how DT principles supported participants during the creation of their ideas and the long-term benefits they obtained. Descriptive statistic was used to calculate survey averages followed by seven in-depth interviews to better explore some of the findings of the questionnaire. The following criteria were adopted to select the interviewed:

- Identification of participants who continued to develop their idea after the programme;
- Identification of participants who continued to use the abilities acquired from the acquisition of design thinking principles during the programme in their daily job.

Data collection

The first part of the analysis was conducted through a questionnaire. The questionnaire was submitted by email over a period of 15 days to CREA participants, excluding those with a background in design to avoid biases. It was composed of 2 main parts exploring:

1. *General information and background of the respondent*. Requested data were age, background, current role in their job, sector of work and if she or he was/is able to apply design thinking's benefits to their daily work.
2. *The importance and impact of the six design thinking principles*. The aim was to understand the utility of each principle and the related abilities each unlocked through their acquisition, both during and after the summer academy. Each principle constituted an area of inquiry in the questionnaire. Each area of inquiry was structured with three closed questions, investigating the following:
   - How relevant every single principle was in the development of the respondent's idea during the CREA Summer Academy;
   - How relevant each principle remained, to date, for the respondent in relation to her or his current job;

- Which specific abilities resulted from the application of each principle.

The first two elements were investigated and evaluated using a Likert scale, ranging from 1 to 5, stating the relevance of each principle (1: not at all – 5: to great extent). The third element was explored with multiple choice answers, where participants were able to select one or more options among five proposed. The complete protocol of the questionnaire is provided in Appendix 1.

All the answers were collected in a Microsoft Excel file to create a descriptive statistics graph for each area of inquiry (Hays 1973).

The second part of the study was conducted through interviews. Seven people who participated in the questionnaire were selected to be interviewed. The interviews focused on the three most useful design thinking principles that emerged from the questionnaire. The questions sought to explore the 'how' of applying design thinking principles and how these principles had been useful in entrepreneurial development (see Appendix 2 for the detailed list of interviewees). Each interview was conducted by two researchers and lasted approximately 1 hour. All the interviews were taped and transcribed. The protocol was structured into three main sections:

- General information: The first section aimed to collect information on a company, how the idea was born, and the main steps to develop it.
- Explanation of principles: The second section included an explanation of the design thinking principles that would be covered in the interview.
- The value of principles: The third section was the core of the interview, with a series of questions investigating 'how' the design thinking principles were used and DT's benefits for the company.

The complete protocol of the interviews is provided in Appendix 3.

Data analysis

All the results of the questionnaire were elaborated on and then discussed by a group composed of two professors and four researchers. After a first-hand discussion, the research team invited two external researchers to consolidate the insights and enrich the statistical results with further comments.

Additional interviews were analysed by two researchers. Based on the interview transcripts, it was possible to find some common application methods and benefits among the participants. As suggested by Miles and Huberman (1994), the involved researchers separately analysed the transcripts.

The following two sections present and discuss the results in detail, relating them to the previously conducted literature review.

Research results

Insights from questionnaires

Regarding the first area of inquiry, which was aimed at understanding how useful the six design thinking principles were both during CREA and in the daily jobs of respondents, we found that some principles needed more time to be absorbed (Table 1). All six parameters were identified as useful in the context of entrepreneurship, obtaining a score equal to or higher than 3.51 out of 5. Those considered most useful, given a fairly long-term goal, were the principles of 'Diverging and converging' (4.05), 'Visualization' (4.21) and 'Creative reframing' (4.10). The parameter that appeared to require more time to be understood and used in an entrepreneurial activity is 'Learning by doing', evaluated with an average of 3.51 during CREA, increasing to 4.00 in the long-term perspective.

The most relevant ability unlocked by the DT principle 'diverging and converging' (Table 2) was identified as 'a way to generate and select ideas' by 68.4% of respondents. On the other hand, 'support in adopting a technology that was not previously considered' was only selected by 26.3% of respondents, and it was therefore not among the advantages from this principle.

Concerning the abilities unlocked by the DT principle 'human-centred design', the most relevant result was 'a way to discern the real problem', which was recognized by 68.4% of respondents. In contrast, 'a new way to understand hidden needs' was not considered an important ability in relation to this principle, being recognized by 16.3% of respondents.

The most relevant acquired ability associated with the DT principle 'Creative reframing' was 'an alternative way to manage problems', recognized by 83.3% of respondents. On the other hand, 'an alternative way to look at the big problem' was only selected by 25% of respondents, resulting not an advantage from this principle.

Concerning the capacities deriving from the DT principle 'learning-by-doing approach', the most relevant result, recognized by 63.2% of respondents, was 'a way to improve critical thinking'. On the other hand, 'A way to

Table 1. Importance of the six DT principles.

	Diverging and converging	Human centred design	Creative reframing	Learning by doing approach	Visualization	Holistic approach
Relevant during CREA	4,13	3,77	3,77	3,51	4,29	3,51
Still supporting your job	4,05	4	4,10	4	4,21	3,76

Table 2. Abilities unlocked from the DT principles.

Diverging and converging	It supported me in better developing the idea	It supported me in adopting a technology that I had not previously considered	A way to generate and select ideas	Increase the odds of solving the problem	None of the above
	34,2%	26,3%	68,4%	55,3%	2,6%
Human centred design	An alternative starting point to develop my entrepreneurial idea	A new way to understand hidden needs	A way to discern the real problem	An effective way to present the project, leveraging on the real user's needs	None of the above
	26,3%	16,3%	78,9%	57,9%	0%
Creative reframing	An alternative way to look at the big problem	An alternative way to manage problems	A way to come up with fresh and compelling solutions	A way to describing, explaining and inquiring the context	None of the above
	25%	85,3%	41,7%	41,7%	5,3%
Learning by doing approach	A way to understand criticalities of the idea in the market	A way to encourage risk taking	A way to increase engagement	A way to improve critical thinking	None of the above
	39,5%	28,9%	55,3%	63,2%	5,3%
Visualization	A faster way to process information	A way to create new discussions	A way to reduce the needed time to be aligned inside the team	A way to reduce time to let users understand the idea	None of the above
	60,5%	26,3%	50%	65,8%	0%
Holistic approach	An alternative way to tackle multiple parts of a project	An alternative way to think to the entire system of actors	An alternative way to think to the entire system of factors that are needed to make the idea work	An approach to divide tasks among team members	None of the above
	23,7%	52,6%	52,6%	31,6%	2,6%

encourage risk taking' was not considered to be an important ability, being recognized by only 28.9% of respondents.

The most relevant ability unlocked by the DT principle 'visualization' was 'a way to reduce time to let users understand the idea', which was recognized by 65.8% of respondents. On the other hand, 'a way to create new discussions' was only selected by 26.3% of respondents, resulting not an advantage from this principle. The two most relevant abilities unlocked by the DT principle 'holistic approach' were 'an alternative way to think to the entire system of actors' and 'an alternative way to think to the entire system of factors that are needed to make the idea work' (Table 1), both of which were recognized by 52.6% of respondents. On the other hand, 'an alternative way to tackle multiple parts of a project' was only selected by 23.7% of respondents, resulting not an advantage from this principle.

Insights from interviews

The analysis of the questionnaires identified three principles that emerge as more impactful in the development of an entrepreneurial path. Interviews was conducted to further explore these three principles.

Maintaining divergence and convergence throughout the entrepreneurial process

As mentioned above, the most significant unlocked ability related to how the 'Diverging and Converging' DT principle is *the way to generate ideas*. Therefore, the idea generation techniques adopted correspond to the main criteria theorized for the creative divergent stage: to discover unconventional business ideas, the interviewees confirmed that they directed their attitudes towards being open to listening to and observing different points of view from the beginning of their entrepreneurial paths to avoid excluding any useful possibilities.

> *Design thinking implementation helps us keep our mind open as much as possible; not having prejudices that could impede falling in love with our own perspective towards an entrepreneurial idea.*

The data show that this process starts with an activity learned from DT practices: collecting data and related insights through the involvement of the final user. Focus groups, codesigns, and preliminary testing sessions represent the most recurrent practices adopted to gather meaningful data to generate and develop entrepreneurial ideas. These activities facilitate verifying preliminary assumptions, refining business strategies, and developing user/customer experiences. These kinds of practices are the dominant ones in the idea generation/diverging phase.

In some cases, the interviewees also stated that these activities are implemented more experimentally during a very early stage of the ideation process to foster inspiration even before they have and defined entrepreneurial idea or direction.

> *It is surprising how effective it can be to gather opinions from people, potential final users, before starting a design phase: thus, somehow, designing through and during research activities instead of a more linear process of research to design solutions.*

In addition, during the data collection phase, a specific way to challenge the subjective perspective embedded in converging and validating the robustness of an idea emerges: through the engagement of external stakeholder experts in the field of interest. In some cases, these experts are selected from those who have an opposite and conflicting perspective.

> *When it is time to stress the strength of our idea, I usually push myself to go outside my comfort zone and talk with people with opposite opinions of the idea's purpose. Usually, triggering these conversations helps me to make a decision when it is time to pick a strategic direction.*

Visualization matters to create alignment

The principle of *visualization* was often related by the participants to the facilitation of communications with a variety of internal and external actors. Visualization was identified as a technique to make ideas tangible, and using the output as an object for discussion reduced the time for comprehension and mutual understanding.

The first dimension identified describes the use of visualization as a means to communicate solutions directly to users and stakeholders, which was done by the interviewees through renderings or drawings of products to make ideas comprehensible. As a way to communicate and process information, visualization has been pointed out as a key asset to test and discuss solutions with users and to present concrete ideas to investors.

> *It's mostly about representation: The only way to clearly communicate to potential clients is to show them what you do. Investing in visual representation and design can significantly empower the credibility of a start-up.*

Furthermore, *visualization* was identified as a fundamental skill to align a working team. The sketching of ideas, concepts and processes was mentioned as a crucial support in creating common ground as a starting point for discussion and identifying the current state of a visualization.

> *People think they are aligned after a meeting, but often they are not. If we have a meeting talking about, let's say, cows, now and afterwards I would ask five people here to draw a cow, they'd all draw a different one. This visualization may help to identify misunderstandings and discuss them directly.*

The support of collaborative tools and visuals facilitated visualization, and the discussion that followed turned it into a dynamic and collaborative activity among team members.

Finally, some interviewees pointed to the visual conception of ideas practised by a single person as an opportunity to reflect on the entrepreneurial solution itself and its aspects. Especially during longer processes of autonomous work, visualizations in the form of drawings and sketches were identified as concrete supports to track tasks and their rationales without the possibility of confrontations.

> *… visually connect the dots that I have in mind; it's like brainstorming with yourself and helps to get things from my head into my hands.*

Creative reframing to break down clichés

Starting from the survey results, it was investigated how respondents carried out this alternative way to manage problems by reframing them. The interviewees mainly pointed out two actions that enabled them to benefit from the DT approach.

First, the attitude and activity of *continuous questioning* compelled interviewees to transform their personal perceptions, understandings and imaginations of a problem. To do this, the DT approach provided the entrepreneurs with the methods and tools needed to include other possible perspectives to evaluate problems and then to rethink and reflect on what could work better or differently.

> *Thanks to these DT workshops, we realized that what we had in mind was maybe completely wrong and wouldn't work out.*

As mentioned above, one interviewee considered a totally opposite opinion to see what could happen and why this perspective could work. Another reformulated his or her initial problems by challenging the targets he or she already had in mind and exploring other new and unconventional possibilities.

> *Who even is my target audience? Maybe the target I have in mind might be interesting but also a little bit clichéd.*

The second important point highlighted by the interviewees is that the DT method and tools help entrepreneurs test and obtain feedback on their assumptions of business ideas to refine an addressed problem, as well as the way to solve it. It is a process of *continuous refinement of the problem and solution in parallel*. The data collected present an *experimental and hands-on way* to perform these creative reframing activities: creative reframing implementation, in this scope, is an evolving process in which interviewees have

made iterative prototypes and experiments to reshape entrepreneurial challenges and create potential business ideas pragmatically.

> … *a kind of constant feedback loop through which you understand what the clients' needs are and you understand what works and you improve - you put everything in question again.*

In this process of reframing, entrepreneurs often involved diverse actors who were experts in a sector or were not familiar with specific topics to participate in a *feedback loop* and showed how they think, react and respond to the entrepreneurial challenges. Entrepreneurs could then, eventually, include received opinions and feedback to develop their entrepreneurial ideas more successfully.

> *We have done workshops with both parents and children, who are not only needed for a better understanding of their problems but also provide us with very valuable feedback on the design of potential solutions, e.g., BM.*

Discussion and conclusions

The paper contributes to the understanding of how design thinking principles enable and unlock some abilities that entrepreneurs perceive as relevant in creating a new venture.

Its first contribution relates to the relevance that design thinking principles play in building a new company. Specifically, while abduction and reframing have (Dorst 2011; Cross 2006; Kolko 2010) always been considered the main characteristics of design thinking principles, here, the results show how entrepreneurs are more sensitive to the 'diverging and converging' dynamics and to the 'visualization' ability.

That evidence captures two basic entrepreneurial needs: on the one hand, entrepreneurs see in DT an exploratory power that may be lacking in an alternative or more analytical approach; on the other hand, entrepreneurs recognize the usefulness of design thinking capabilities not just related to the early phases of the new venture development but even later with the building of a specific design mindset.

Specifically, the article highlights how entrepreneurs value for the project of their startup and for their own cultural growth more the skills of converging/diverging, visualization and creative reframing.

Several reasons may underlie the results of the analysis. First, entrepreneurs can see in the diverging and converging thinking dynamics for one hand the opportunity to search for diversity and differentiation (diverging), for the other, the intrinsic need to provide a whole sense to the novel business idea (converging). Specifically that idea goes beyond one of the basic postulate at the base of the entrepreneurial study where the concept of 'opportunity recognition' is driven by the search of recurrent patterns (even

if facts and events at a first (Baron 2006) while 'diverging', in particular, pushes for a radical and breakthrough signals that could inspire new business streams.

The second beneficial principles by entrepreneurs deals with the visualization activity. Here the visual power of design thinking can be connected to the concept of 'boundary objects' that are largely diffused in organization and new product development studies (Carlile 2002; Fox 2011). Specifically, the visualization benefit deals – in particular in the early development phase of a startup – with the consensus creation among the founders when the business concept tends to be still immature; and later on, with the rest of stakeholders as investors, users, potential industrial partners. The visualization emphasized in the study tends to be indeed strictly connected with the entrepreneurial decision making where decisions usually tend to be quickly assumed, with sudden changes and an openness to embrace continuous improvements.

The concept of creative reframing here plays the relevant role to put entrepreneurs in front the idea to continuously explore the problem statement with novel perspectives in order to search for creative solutions. A specific emphasis has been dedicated to the sub-concept of 'continuous reframing' as a phase where the entrepreneurs tend to maintain the business idea open to external sources of creativity and/or to emerging insights deriving by new data and observations. That reframing perspective seems to be particularly promising not only in the early development phase but even later, when the startup piloting project needs to scale-up searching for a whole product/service portfolio perspective and the search for a stable business model (Normann 2001; Maurya 2016).

To conclude, if the paper aims to freeze key concepts in DT beneficial for entrepreneurship, new research avenues by addressing the relationship between design thinking and entrepreneurship can be opened.

A new road could be paved by additional studies that explore how design thinking entrepreneurial ventures perform – better or worse – with respect to new ventures conceived in accordance with more traditional entrepreneurial practices.

Here, a clear theoretical conceptualization of the 'design-driven' startup could be useful to introduce new taxonomies (specifically in contrast with the 'new-tech ventures') so identifying intrinsic specific traits and evolutionary behaviours of that peculiar entrepreneurial species.

Secondly, an extensive analysis should consider – on the basis of the extension of design thinking – how emerging practices hybridize principles

from other territories – such as agile thinking, digital transformation, or DevOps – with design thinking to foster new ventures.

Notes

1. CREA. Network of summer academies for the improvement of entrepreneurship in innovative sectors. HORIZON 2020 project - https://cordis.europa.eu/project/id/644988

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Data availability statement

Data available on request from the authors.

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Appendix 1. Protocol of the questionnaire

Section 1: Information about you

1. Age
2. Background
3. Your current role in your job
4. Sector in which you are working
5. Did you have the chance to really develop the entrepreneurial idea created during CREA?
   - Yes
   - No
   - I developed it for a period of time after the summer academy but then I abandoned it
   - Other
6. Did you have the chance to develop another entrepreneurial idea?
   - Yes
   - No
   - Other
7. Did you have the opportunity to work in sectors where you were able to apply the design concepts transferred during CREA?
   - Yes
   - No
   - Other

Section 2: 6 key activities

Below we will introduce you 6 key activities connected to the design world that you have experienced during CREA. We would like to understand how much these

a. have been used in the development of your idea during the two weeks of CREA
b. are still useful to you in your daily work

We would like to understand what kind of learning the use of the 6 activities previously presented have brought, during both your participation at CREA and your daily work (if you are still using them).

1. How much relevant were the following activities in the development of your idea during the CREA summer academy?

	1	2	3	4	5
Being pushed to produce a lot of ideas to solve the given problem, and then select the most promising ones (Diverging and converging)					
Put the user at the center of the whole process (Human-centered design)					
Understand and prioritise complex problems (Framing and reframing)					
Test ideas with real users and/or in their real context of use (Learning by doing approach)					
Use visual communication to share ideas and communicate them in order to set all the team on the same page (Visualisation)					
Analysing problems in their entirety and considering the whole context of application to fully understand their complexity (Holistic approach)					

2. How much the following activities are still supporting you in your job?

	1	2	3	4	5
Being pushed to produce a lot of ideas to solve the given problem, and then select the most promising ones (Diverging and converging)					
Put the user at the center of the whole process (Human-centered design)					
Understand and prioritise complex problems (Framing and reframing)					
Test ideas with real users and/or in their real context of use (Learning by doing approach)					
Use visual communication to share ideas and communicate them in order to set all the team on the same page (Visualisation)					
Analysing problems in their entirety and considering the whole context of application to fully understand their complexity (Holistic approach)					

3. What kind of learnings did you take away from the adoption of "**Diverging and converging**"?
   [Being pushed to produce a lot of ideas to solve the given problem, and then select the most promising ones]
   - It supported me in better developing the idea
   - It supported me in adopting a technology that I had not previously considered
   - A way to generate and select ideas
   - Increase the odds of solving the problem
   - None of the above
   - Others

4. What kind of learnings did you take away from the adoption of "**Human-centered design**"?
   [Put the user at the center of the whole process]
   - An alternative starting point to develop my entrepreneurial idea

- A new way to understand hidden needs
- A way to discern the real problem
- An effective way to present the project, leveraging on the real user's needs
- None of the above
- Others

5. What kind of learnings did you take away coming from the adoption of "**Framing and reframing**"?
   [Ability to understand and prioritise complex problems]
   - An alternative way to look at the big problem
   - An alternative way to manage problems
   - A way to come up with fresh and compelling solutions
   - A way to describing, explaining and inquiring the context
   - None of the above
   - Others

6. What kind of learnings did you take away coming from the adoption of "**Learning by doing approach**"?
   [Test ideas with real users and/or in their real context of use]
   - A way to understand criticalities of the idea in the market
   - A way to encourage risk taking
   - A way to increase engagement
   - A way to improve critical thinking
   - None of the above
   - Others

7. What kind of learnings did you take away coming from the adoption of "**Visualisation**"?
   [Use visual communication to share ideas in order to set the different stakeholders on the same page]
   - A faster way to process information
   - A way to create new discussions
   - A way to reduce the needed time to be aligned inside the team
   - A way to reduce time to let users understand the idea
   - None of the above
   - Others

8. What kind of learnings did you take away coming from the adoption of "**Holistic approach**"?
   [Analysing problems in their entirety and considering the whole context of application to fully understand their complexity]
   - An alternative way to tackle multiple parts of a project
   - An alternative way to think to the entire system of actors
   - An alternative way to think to the entire system of factors that are needed to make the idea work
   - An approach to divide tasks among team members
   - None of the above
   - Others

Appendix 2. List of interviewees

Field of the company	*Job title*	*Date*	*Duration*
Goods distribution	Head of Design	18/06	1.40 h
Platforms development	Partner and Managing Director	19/06	1.15 h
Educational games for kids	Chairman & Founder	20/06	1.30 h
Experiential travel agency	Business and innovation strategist	21/06	1.30 h
Transport	Chief marketing officer	21/06	1.20 h
Healthcare	CTO and Co-founder	22/06	1.40 h
Sustainability	Chairman & Founder	22/06	1.25 h

Appendix 3. Protocol of interviews

Section 1: General information

1. What is the field in which your company operates?
2. How did the idea of founding your company come about?
3. What were the main steps in setting up the company?
4. What were the main difficulties encountered in setting up the company?

Section 2: Explanation of principles

During the interview we will refer to the following principles, already explored in the questionnaire:

- **Diverging and converging:** Being pushed to produce a lot of ideas to solve the given problem, and then select the most promising ones.
- **Creative Reframing:** Creative reframing of the problem means to challenge and reframe the existing problems to transform them into opportunities to find creative solutions to these problems.
- **Visualization:** Use visual communication to share ideas or concepts in order to set everyone, team and/or stakeholders, on the same page.

Section 3: the value of principles

Diverging and converging

5. How did you approach the problem you wanted to solve in your business idea? Did you use any alternative ways to the 'traditional' ones? (use of metaphors, external sources, use of tools that made you better understand how to develop the idea, etc.)
6. What methodologies did you use to generate the ideas? And which ones to select the most promising ideas?
7. What role did the user's perspective play in the generation of your idea? What kind of observation or analysis did you do to take your perspective into account?

Cretive reframing

8. How was the initial problem reformulated? Why was it reformulated in that way? What were the methods and data that supported you in reformulating the initial problem?
9. How did the data collected and the users' observations contribute to the process of reformulating the initial problem?

10. How did you manage to think out of the box to imagine something that does not yet exist but that could be a better alternative to more obvious solutions? What was the idea/inspiration that made you think to proceed in this way?

Visualization

11. Did you frequently use visualization to display your thoughts?
12. How does this action support you in processing and synthesizing information?
13. Which aspects of your entrepreneurial idea particularly benefit from "visualization"? (communication with the customer, explanation of the operating system, development of user experience, etc.). Can you please provide an/some example/s?
14. Which are the situations where visualization supported you in processing and synthesising information to be communicated with external/other stakeholders?

    Do you remember a specific case when this kind of situation took place?

15. What role did the user's perspective play in the generation of your idea? What kind of observation or analysis did you do to take your perspective into account?
16. How did visualization support you in simplifying the idea in order to communicate it with external/other stakeholders?
17. Are there other times when visualisation has proved to be a particularly useful tool?