Nominal Groups? Ok Boomer! A future-oriented agenda for brainstorming studies

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Abstract: This paper critically examines brainstorming going back to the original sources to assess its origins and the origins of its systematic study. It identifies the "nominal groups" fallacy that is often used to discredit this ideation method and reviews evidence that supports the key principles behind group brainstorming. Lessons for a future design-led agenda of universal creative literacy are discussed. Brainstorming appeared eighty years ago, and it is abundantly clear that it works when properly conducted. The substantial challenges that we face in the next eighty years require the power of collective creativity. Properly conducted creative literacy is a strategic priority for the twenty-first century.

Keywords: creativity; ideation; research methods; primary sources; brainstorming

1. Introduction

To brainstorm refers colloquially to the action of generating new ideas by having a group discussion to solve a problem[1]. Canonical definitions depict brainstorming as a mode of problem-solving by means of "a group discussion of spontaneously arising ideas"[2]. Whilst widely used in design practice (Elsbach and Flynn, 2013; Shroyer, Lovins et al., 2018), some critics discredit brainstorming citing studies that claim that, compared to individuals generating ideas in isolation (called *nominal groups*), group brainstorming generates fewer ideas and of lower quality on average in the same length of time. Notwithstanding the conceptual and methodological complexities of defining and evaluating early ideas (Sosa, 2019a), we critically interrogate here the use of so-called nominal groups in studies of group ideation performance. In this paper we go back to the primary sources to critically examine the study of brainstorming and to sketch pedagogical and research paths for future work.

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[1] Merriam-Webster Dictionary definition https://www.merriam-webster.com/dictionary/brainstorm
[2] Oxford Dictionary definition: https://www.oed.com/view/Entry/304150

Although everyday definitions of brainstorming tend to characterise it as a spontaneous and impromptu activity, in a more rigorous sense the term refers to a well-structured technique for "idea finding" created in the 1930s (Osborn, 1963). Osborn drew on professional practices in advertising to formulate rules and guidelines to plan, prepare, and conduct "brainstorm sessions". A primary recommendation for this technique is to conduct a "triple attack of individual-group-individual ideation" (p. 191) given that both group and individual ideation "can be just as productive" (p. 191). By the 1950s brainstorming had become "too popular too fast" (p. 152), resulting in it being misused and often unable to meet inflated expectations (Osborn, 1963). Around that time the first experimental studies concluding that "group participation when using brainstorming inhibits creative thinking" (Taylor, Berry et al., 1958, p. 23) gained traction and influenced derivative studies over six decades giving brainstorming a bad name (McCaffrey, 2014).

This paper starts by revising the original formulation of brainstorming and the extent to which it has been empirically studied in valid ways. It then delves into brainstorming with three goals in mind: first, it seeks to demystify it and treat it more rigorously as a structured ideation method. It does this by returning to the primary sources to inform a critical review of the related literature. Second, the paper seeks to inform a program of inquiry that addresses open questions on how to aptly conduct brainstorming. These two goals address questions of *whether* group brainstorming works and questions of *how to* do, study, and teach it. In our experience, ideation methods such as brainstorming can enable participants to exercise their creative capacities. Therefore, our third goal here is to reflect that if/once people can become more creative aided by a competent use of methods, then *why, when*, and *what for* could this massive creative power be used in the twenty-first century as we face an existential threat fuelled by a planetary climate emergency and the entrenchment of fascist and patriarchal agendas.

2. The origins of an octogenarian

"Idea-producing conferences" originated in contrast to "conventional conferences" (meetings), and in 1938 participants named them after their value to use "the brain to *storm* a problem" (Osborn, 1963, p. 151). This octogenarian workplace technique has precedents in ancient traditional practices where groups discuss and collectively generate ideas to tackle difficult challenges. *Prai-Barshana* is mentioned as a centuries-old practice in India that explicitly separates generation and evaluation of ideas (p. 151). "Brainstorm sessions" were presented with the aim to formulate the "conscious ways" in which creative people establish a "working mood" to carry out "idea finding efforts" (p. 118). The following principles and rules for brainstorming were postulated (Osborn, 1963):

- Novelty needs to be subject to "the most impartial scrutiny" because new ideas tend to be "worthless or because we shall not know how to elicit their value" (p. 130). All new ideas need, therefore, to be "sceptically entertained… for the thousandth idea may be the one that will change the world" (p. 130).

- Brainstorm sessions are intended to *storm* a problem, i.e., to produce "a checklist of ideas" that can "serve as leads" to be "subsequently evaluated and *further processed*" (p. 152).
- Group ideation is "relatively fruitless" unless participants understand and "faithfully follow" these rules: rule out criticism; welcome "free-wheeling" (wild ideas); pursue quantity; seek to combine and improve ideas (p. 155). These have become known as the "four rules of brainstorming" (p. 155).
- Associative thinking is singled out as a key group mechanism to trigger a "chain reaction". The resulting ideas, or "*hitch-hikes*", can account for up to one-third of all ideas (p. 154). This process of "re-processing ideas by means of modification and combination" can transform "mediocre ideas into sterling ideas" (p. 158).

Four key guidelines are recommended to prepare creative sessions (Osborn, 1963):

- It is important to adequately formulate the problem to be *stormed* in a session. The problem needs to be specific and narrowed down to "a single target" (p. 158). A brainstorm session can be "successfully devoted solely to breaking down a broad problem" to make it more suitable for a creative session (p. 173).
- Participants are supplied a background memo "at least two days in advance of the session" (p. 175). This memo of "not more than one page in length" serves to orient participants and to let them "sleep on the problem thus allowing incubation to enhance the workings of association" (p. 174).
- The panel leader (facilitator) develops in advance their own list of ideas. If and when a session slows down or gets off the track "the leaders can prime the joint flow of ideas by contributing some of their own" (p. 175).
- Leaders use their own list of ideas to prepare leads that they can suggest during a session "by way of classifications or categories" (p. 172). They also prepare "idea-spurring questions" to move a session forward, such as "Put to Other Uses? Adapt? Magnify? Reverse? Combine?" (p. 175).

Five recommendations are offered to conduct creative sessions (Osborn, 1963):

- Participants only offer "one idea at a time" (p. 176). To achieve this, they are encouraged to "make notes of ideas they plan to offer when their turn comes" (p. 177).
- Turn-taking is expressly recommended to create opportunities for "hitch-hikes" by idea association, thus encouraging ideas that are "directly sparked by a previous idea" (p. 176).
- The leader monitors and incentivises the "spirit of a brainstorm session" (p. 157) for which both self and "mutual encouragement" are crucial (p. 157).
- A secretary captures all the ideas in ways that are "reportorially -not word for word" -brainstorms can also be audio recorded (p. 177).

- In closing, participants are thanked and directed "to keep the problem on their minds until the next day when they will be asked for their afterthoughts" (p. 178). A list of all the ideas is sent to participants asking them to reply with new ideas formed after the session (p. 179).

To conclude this recount of the primary source where brainstorming was presented (Osborn, 1963), the following key points are noted:

- The *purpose* of brainstorming is manifold: besides generating a check-list of early ideas, these sessions can be "tools for improving morale", they allow participants to discover "what people think about problems", they allow them to "gain a better understanding of each other", they can also produce enjoyment (p. 189), and they can supplement creative training (p. 192).
- Crucially, throughout the book Osborn explicitly indicates that "group brainstorming is recommended solely as a supplement to individual ideation" (pp. 141, 143, 191).
- When properly conducted, group brainstorming "can produce far more good ideas than a conventional conference -and in less time" (p. 152).
- Brainstorming can be directed to produce different types of ideas including "planks for plans", "check-lists to stimulate further thinking", and "approaches to solutions" (p. 192).
- To evaluate ideas from a brainstorm as initial leads for further processing, "the surest method of evaluation is to put our ideas to test. And the task of thinking up the best way to test is a creative challenge in itself" (p. 118).

From these steps and suggestions to plan and prepare, lead, and follow-up ideation sessions, it is clear that critical factors for success include participant training and leadership (facilitation) of a session. From its origins, the brainstorming method had a structure derived from practice.

As it became adopted in professional fields during the 1950s, scholars directed their attention to empirically evaluate the claims of brainstorming. Rather than studying the practices of brainstorming, early researchers decomposed and selectively studied some of the underlying mechanisms in isolation (Taylor, Berry et al., 1958; Meadow, Parnes et al., 1959; Parnes and Meadow, 1959; Cohen, Whitmyre et al., 1960; Parnes, 1961; Weisskopf-Joelson and Eliseo, 1961; Gurman Jr, 1962; Dunnette, Campbell et al., 1963). Most of these laboratory studies applied quasi-experimental methods studying undergraduate students randomly assigned to experimental conditions. Researchers instructed brainstormers to generate ideas in response to a brief, assigned them a time limit of five to fifteen minutes, and gave them a compensation. The ideas they produced were counted and judged by a panel for originality, uniqueness, appeal, feasibility, and/or value.

These research efforts misconstrued a brainstorm as an experimental session and selectively focused on some of the rules and guidelines to storm a problem. Specifically, they failed to

provide the brief to participants in advance, considered critical for priming and for individuals to prepare for a group session. They also failed to include the strategically important role of facilitation or leadership and instead simply instructed participants to ideate and left them to their own devices. Lastly, the ideation tasks in these studies are fun but inconsequential toy exercises that are either too general and open-ended like the *Tourist* and *Teacher* problems (Taylor, Berry et al., 1958), implausible imagination exercises like the *Thumbs* and *People* problems (Taylor, Berry et al., 1958), or aimless divergent reasoning tasks like the *Hanger* and *Broom* problems (Taylor, Berry et al., 1958). For the last four decades, researchers have pointed that the study of brainstorming has failed to acknowledge and apply the guidelines to properly conduct it (Jablin and Seibold, 1978; Kalargiros, 2014). As a result, these studies ended up testing "quasi-brainstorming procedures" (Jablin and Seibold, 1978, p. 350). Designed with questionable procedures, their findings and conclusions are problematic.

3. The origin of the "nominal group" straw man

The early studies of brainstorming were motivated by a range of goals including: a comparison of individual vs. group performance measured as idea productivity and various criteria of idea quality such as originality (Taylor, Berry et al., 1958); the effects of brainstorming vs. "non-brainstorming" ideation instructions (Meadow, Parnes et al., 1959; Parnes and Meadow, 1959); the effects of group cohesiveness and types of task (Cohen, Whitmyre et al., 1960); the effects of the "rule out criticism" rule (Weisskopf-Joelson and Eliseo, 1961); the effect of time limits (Parnes, 1961); and the effects of homogeneous vs. heterogeneous groups and self, interaction, and task orientation (Gurman Jr, 1962).

Of these, (Taylor, Berry et al., 1958) became by far the most highly cited. That study initially reports that "on each of the three problems the mean total number of ideas produced by the twelve groups was *considerably larger* than the mean number produced by the forty-eight individuals, the difference being highly significant... on all three problems *group performance is clearly superior to individual performance*" (p. 34). Taylor, however, decided to incorporate the construct "nominal groups" from previous work on problem solving (Taylor and McNemar, 1955). Nominal groups are formed after the experiment is completed by adding the responses from the same number of individuals as the size of the real groups. The researchers then score the performance of nominal groups "*by assuming* that if any one in the group solved a particular problem, the group solved it" (Taylor and McNemar, 1955, p. 476). With this setup to compare nominal vs. real groups brainstorming, the study found the performance of the real groups to be "markedly inferior to that of the nominal groups in terms of number of ideas produced" (p. 43). This finding was replicated a few years later (Dunnette, Campbell et al., 1963), and since then nominal groups spread like fire in creativity research (Lewis, Sadosky et al., 1975; Diehl and Stroebe, 1987; Nijstad and Stroebe, 2006).

Here we examine the validity of the assumptions behind the "nominal groups" construct in the context of creative ideation. First, comparing the ideation of groups vs. individuals

contradicts Osborn's recommendation for "a triple attack" using individual-group-individual brainstorming. Second, making recommendations based only on fluency and perceived wuality of sketchy ideas reduces brainstorming to "a machine theory view" (Sutton and Hargadon, 1996, p. 688). Third, comparing the outcomes of real vs. nominal groups rises methodological predicaments including time allocation as noted by (Gurman Jr, 1962), since individuals working in groups of size N have $1/N$ of the time available to share their ideas compared to those working in isolation. Whilst the artifact "nominal groups" is justified on the basis of number of people, their proponents ignore the significant difference in number of minutes between these conditions. Namely, the ideas generated by so-called nominal groups represent $N \times t$ where N is the number of brainstormers and t is session time limit, whilst the ideas generated by real groups represent only t time. Such direct comparison between parallel and serial ideation is conceptually weak.

Fourth, Osborn indicates that idea association in groups can be superior when the process is *adequately facilitated*. The rationale by Taylor for setting the time limit shows the critical disadvantage of not having adequate (or any) facilitation: "The time limit of twelve minutes for each problem was chosen, on the basis of considerable pretesting, as one which would permit group members to express all ideas occurring to them within the work period and at the same time not result in excessive periods of silence for individual subjects. In the actual experimental sessions, appreciable periods of silence appeared between responses near the end of the twelve minutes." (Taylor, Berry et al., 1958, p. 46). Precisely because ideation slows down, leaders are recommended to "prime the joint flow of ideas by contributing some of their own" and by suggesting "idea-spurring questions" (Osborn, 1963, p. 175).

For these reasons, studies of non-facilitated brainstorming using "nominal groups" engage in a logical fallacy and create an illusory refutation of group ideation. They also show a lack of creative facilitation experience by those studying ideation. The validity of studies that deviate in important ways from brainstorming procedures has been questioned, and studies that do not perform due diligence in implementing Osborn's recommendations are "a futile exercise" (Kalargiros, 2014, p. 15). In the end, scholars who discredit brainstorming on these bases show a "lack of understanding, lack of adherence to critical procedural guidelines, [and a] parochial research agenda" (Kalargiros, 2014, p. 15).

Although many studies of brainstorming cannot be trusted, the last four decades have provided evidence that confirms why it is widely used by professionals (Sutton and Hargadon, 1996; Shih, 2011; Shroyer, Lovins et al., 2018).

3.1 A health check-up of an octogenarian
Several phenomena associated with brainstorming have been studied over the last four decades, providing support for many (but not all, not yet) of the bases of this "idea-finding" method. Namely:

- Creativity is increasingly viewed as a human capacity (Arendt, 2013) which echoes its framing as a universally distributed imaginative faculty: "the fact that war

spurred many, many people to think up so many good ideas helps prove that nearly all of us are gifted with creative talent; and it helps prove the part that effort plays in activating this talent." (Osborn, 1963, p. 16).

- Evidence generally supports idea fluency correlates with higher originality and novelty (Adánez, 2005). This "quantity breeds quality" dictum is explained in probabilistic terms: "the more ideas you think up, the *more likely* you are to arrive at the potentially *best leads* to solution" (Osborn, 1963, p. 124). However, the central role of associative thinking in ideation suggests key combinatorial advantages. In a list of ideas, every new entry causes a significant growth of new connections, meanings, and paths for combining and modifying "leads to solution".

- The associative basis of creative thinking has been established and profusely studied (Mednick, 1962; Goldenberg and Wiley, 2019), giving support to the fourth rule of brainstorming and the observation that "most ideas are by way of combinations" (Osborn, 1963, p. 282). Unfortunately, the standard task for associative reasoning called the "Remote Associates Test (RAT)" employs questions with a single correct answer[3], ignoring the open-endedness of creativity.

- Hierarchy of authority has been shown to be detrimental to idea generation (Keum and See, 2017) confirming the guideline that "a panel should consist of people of substantially the same rank" and to avoid "superior officers" in a brainstorm (Osborn, 1963, p. 170).

- The value of creative sessions beyond producing ideas -as noted by Osborn- has been demonstrated in ethnographic studies of ideation "in the wild" (Sutton and Hargadon, 1996). Measuring ideation sessions solely by number and quality of ideas has been portrayed as a machine view of ideation (Sutton and Hargadon, 1996).

- The documented increased productivity of "hybrid ideation" (Girotra, Terwiesch et al., 2010) supports the "triple attack" strategy recommended to storm problems (Osborn, 1963, p. 191).

- The longitudinal study of creative teams in the workplace has found evidence of two types of contributions from team members: *giving* and *taking* behaviours (Elsbach and Flynn, 2013). This can explain why ideation sessions are appropriate throughout a project (Shroyer, Lovins et al., 2018) as they produce leads to solutions that require further development and imaginative testing (Osborn, 1963).

- Studies of ideation where participants work on design problems rather than toy problems show a comparable performance between individuals and teams, even when brainstorms are not facilitated (Linsey, Clauss et al., 2011). Design ideas that are product of combinations and development of other ideas tend to be of superior quality (Linsey, Clauss et al., 2011), which supports the role of combinatorial processes to transform "mediocre ideas into sterling ideas" (Osborn, 1963, p. 158).

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[3] Remote Associates Test sample questions: https://www.remote-associates-test.com/

- One of the few studies that compared established (worked together for 10 weeks) vs. non-established groups (only worked together once for the brainstorm session) found evidence that validates Osborn's claims (Levine, Heuett et al., 2017).
- Evidence suggests that "idea-spurring questions" of the type suggested by Osborn to prepare for a brainstorm do have positive effects in creative ideation (Torrance, 1961).
- Whilst many ideation studies draw conclusions based on average values of fluency and metrics of idea quality, design researchers note that "extremes are what matter, not the average or the norm" (Girotra, Terwiesch et al., 2010) and draw attention to maximum values and variances. This supports Osborn's emphasis on the "thousandth idea" that will pay off (p. 130).
- Studies of ideation that address the effects of how design briefs or tasks are framed are rare, although their likely influence has been mentioned over the years (Meadow, Parnes et al., 1959; Vasconcelos and Crilly, 2016). Osborn warned that failure to adequately frame a problem "can seriously mar the success of any brainstorm session" (Osborn, 1963, p. 173).
- Osborn's reference to the "spirit of brainstorm sessions" strongly resonates with current models for training and practising creative facilitation (Light and Akama, 2012).
- Evidence shows that late stages of ideation sessions tend to be more productive (Parnes, 1961) confirming that "almost always we have to think up a number of *unusable ideas* in order to arrive at one that may work" (Osborn, 1963, p. 126).
- Lastly, studies of design practice show that group ideation that applies many of Osborn's insights continues to be widely used by professionals eighty years later (Shih, 2011; Shroyer, Lovins et al., 2018). Whilst it is clear that *properly conducted* brainstorms work, more research is needed to better understand why and how they do, and how to make them more enjoyable, effective, widespread, and more inclusive.

4. The next eighty years of Brainstorming

The intricacies of group creativity call for research approaches that inform ideation methods in the twenty-first century. Here the following are explored:

- Creative facilitation and creative leadership require more and deeper examination to identify best practices, effective pedagogical approaches, and to identify principles that can be applied across situations, teams, domains, and organisations.
- Attention is required for the conditions originally recommended by Osborn that have been overlooked in the design of empirical studies. These include the effects of briefs given to participants, principles for the appropriate framing of problems, and the information provided to promote incubation and prime associative thinking.

- The contextual and stochastic aspects of ideation need to be considered in the ways brainstorming is studied and how findings are used to inform practitioners. Osborn explored "the element of luck in creative quests" (Osborn, 1963, p. 331), yet research questions that account for "creative accidents" (Osborn, 1963, p. 332) are largely missing. The choice of research methodologies can expand the current focus on average outcomes and representative samples in the pursuit of generalisation, to pay attention to exceptional conditions and extreme outcomes in the pursuit of qualitative insights and contextualised heuristics.

- The ways in which ideas are defined and evaluated deserve closer attention, especially since they tend to be implicitly and ad-hoc designated across ideation studies (Sosa, 2018; Sosa, 2019a). The effects of evaluation on the nature of findings deserve more careful scrutiny (Weisskopf-Joelson and Eliseo, 1961; Linsey, Clauss et al., 2011).

- Methods like brainstorming suit extroverted individuals and organisational cultures of flat hierarchies where vocal opinions are embraced. Other methods or variations would be valuable to include introverts and collectivist cultures where new ideas can be shared and recombined in less overt ways.

- Technological approaches have so far mainly sought to support or improve brainstorming. In the future, means to automate idea synthesis can be pursued, such as by substantially augmenting the associative basis of creative ideation.

- More studies are needed that target the functions of ideation practices beyond the mechanistic view of ideas as outputs, for example their value to nurture creative organisational cultures, team psychological safety, and individual capabilities.

- Closer attention needs to be put on the "harvesting of afterthoughts" (Osborn, 1963, p. 178) and in general to follow-up practices after an ideation session. The study of individual-group-individual "triple attack" strategies could reveal the ways in which ideation occurs before, between, and after sessions.

- Ideation studies need to differentiate the type of sessions under study. Moving beyond the treatment of all ideation events as one type, researchers could specify what type of problem is studied, what are the ideation goals, what types of ideas are being sought, and where the ideation event is located in the course of a creative project. This would help interpret and connect findings across studies.

- More ethnographic studies of ideation "in the wild" are desirable, as well as laboratory and classroom studies that more faithfully follow brainstorming guidelines (Cohen, Whitmyre et al., 1960; Shroyer, Lovins et al., 2018).

This illustrative list includes ideas aimed at building knowledge about how brainstorming can be better understood, better practised, and better learned. Equipped with more advanced procedural knowledge, designers need to better understand that creativity is needed to tackle the critical global challenges of the twenty-first century. After all, this method originated in advertising and gained popularity in the military and corporate worlds of the Cold War. Brainstorming has mostly been applied to enable a commercial agenda that

promotes values and ways of living based on never-ending consumerism that lead to an unsustainable future. How may brainstorming be used to deal with major global challenges in the next decades?

4.1 We can all be more creative! But, what for?

Creativity has traditionally been portrayed as positive and desirable, even having childlike and playful undertones as hinted by the tired dictum that "*creativity is intelligence having fun*". The "dark side" of creativity has been explored to some extent (Cropley, Cropley et al., 2010) ranging from unprecedented ideas for dishonest or criminal purposes, to the negative consequences and side effects of well-intended inventive ideas. The in-depth biographical analysis of creative figures has shown other negative aspects of creativity including the Faustian bargain that some prominent creators accept as the price of their relentless pursuits for originality and fame (Gardner, 2011). Eminent creators also often engage in abuse of power and other unethical behaviours and have suffered mental health problems and addictions (Gardner, 2011). In this context, very little research on brainstorming has included ethical dimensions (Mumford, Waples et al., 2010). To inform an ethical brainstorming practice, the following questions are of relevance:

- How may we foresee and assess the destructive effects of creativity (Schumpeter, 2002) including the loss of existing expertise, practices, and worldviews?
- What are the politics and the ethics of creativity? (Winner, 1980; Sosa, 2019b) Who gets to change things? Whose dreams and visions inform desirable futures? How is the mandate for creative agency adjudicated and asserted?
- How may ownership of new ideas and their effects be negotiated, shared, and transferred? (Ihde, 2006).
- How may creative agency break away from a market economy where large corporations capture most imaginative talent creating a class gap between the haves and have-nots of creativity?
- How may localities transcend the Western version of creativity that is used to colonise other regions through certification on their toolkits and methods? How may local creatives exercise their own version of creative action and constitute their own methods?
- How may creatives attend to the impeding emergencies (climate, social justice, migration) yet avoid tunnel vision that prevents them from imagining a desirable future beyond these crises?
- How may education systems transcend the current disciplinary divides between creatives and non-creatives?
- How may we suspend disbelief to support early ideas and protect their growth based on their potential, yet critically scrutinise them to prevent the high-jacking of innovative ideas by con-artists and fraudulent early investors?[4]

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[4] The Drop Out documentary about Elizabeth Holmes and Theranos: https://abcaudio.com/podcasts/the-dropout/

• How may entrepreneurial frameworks like effectuation (Sarasvathy, 2008) explicitly accommodate the type of ethical concerns that come with new ventures?

5. Discussion

This paper started by critically examining brainstorming going back to the original sources to assess its origins and the origins of its systematic study. It then identified the fallacy of using "nominal groups" used to discredit this ideation method and reviewed evidence that supports many of the group brainstorming principles. The paper then framed an agenda for the future study and practice of creative ideation focusing first on questions of "*How*", and questions of "*What for*" later. Brainstorming is turning eighty, and it clearly works when properly conducted to enable the creative capacities of all who make a serious effort. The substantial challenges that we face in the next eighty years can be creatively and collectively tackled to the extent that we support Hannah Arendt's principle of *natality*, i.e., the realisation that "every birth represents a new beginning and the introduction of novelty in the world" (Arendt, 2013, p. 9). Beyond reductive studies that compare group vs. individual ideation, it is time to approach the study and education of creative literacy as a strategic priority for the twenty-first century -a task that designers are well prepared to deliver.

The work presented here suggests a few key ideas that inform future research efforts. The first is that it is critical to return to primary sources. Google Scholar statistics in February 2020, show 7742 papers that cite (Osborn, 1963), of which 594 use the term "nominal groups" and only six include the term "triple attack" -denoting how Osborn's original recommendations remain ignored whilst Taylor's artifice created a big following. Whilst (Taylor, Berry et al., 1958) reports only 856 citations, a Web of Science report in January 2020 shows a total of 11,754 *secondary* citations of the study that introduced the use of "nominal groups". This indicates that the findings of Taylor have been amplified by researchers who may arguably not have even read that paper but learned of its conclusions through secondary sources. As such, one finds statements such as: "There is considerable evidence that group brainstorming is *less productive than individual* brainstorming" (Kohn and Smith, 2011, p. 359) which is precisely the opposite of what the original reports (Taylor, Berry et al., 1958).

Another lesson for designers, design scholars, and design educators is that the myth that group brainstorming does not work is based on research that follows "academic rigour" but ignores "practice rigour". Design research needs to acknowledge the double challenge of being scientifically *and* designerly relevant. Further, as creative methods are increasingly understood and improved, the ethical dimensions of their deployment must be recognised and integrated into our research questions and teaching practices.

The need for creative solutions to tackle the challenges of the twenty-first century seems timely to acknowledge that the creative orientation of design professions has made them instruments to advance corporate agendas that promote a lifestyle of endless consumption and waste. Methods and tools for creativity are urgently needed to address the current

global crises and to imagine desirable futures beyond these emergencies. The history of design and invention shows that the best intended innovations have often had disastrous consequences in the long run -this can be viewed as a failure of process and a failure of methods to generate and understand new ideas before it is too late. Innovation in new drug development considers possible consequences and side-effects -likewise, design innovation can and needs to be conducted in more responsible ways.

Lastly, creativity is not exclusive to design, and designers seem ideally positioned to open up *creativity for all* in inclusive ways that are respectful of individual and cultural differences. From a philosophy of natality that underpins rigorous universal creative literacy (Arendt, 2013), it is possible that by the year 2100 we will have resolved the planetary challenges of today and, more so, will have discovered new ways of being creative.

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