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60 years of creativity in business organizations

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Abstract: This paper analyses the role of creativity in business organizations by examining the core ideas of an article published sixty years ago as a way to elucidate how relevant they are today in view of the research literature. The paper proposes the use of computational social simulations to support systematic reasoning about some of these longstanding issues around organizational creativity. An example of an agent-based simulation to study team ideation is presented to support systematic reasoning about the role of creativity in business organizations and to articulate future lines of inquiry.

Keywords: organizational culture; design thinking; computational simulations; creative teams

1. Introduction

The world has changed in fundamental ways in the last six decades, and yet the contemporary discourse on the role of design and creativity in business seems eerily reminiscent of the reasoning in influential management circles half a century ago. This paper re-presents and examines ideas published a full decade before the formation of the Design Research Society (Randall, 1955). That Harvard Business Review article functions here rhetorically as an archaic source in which the current literature can be projected. It opened with the unambiguous statement: "creativity is important in business" (p. 121) framing four core related arguments:

1. First, "almost every person is creative to some degree", yet according to the author, people who "display lesser talents in this area are trapped by a system which serves to suppress even the small degree of creativity which they may possess" (p. 121). In addition to supporting top outstanding individuals, "wise organizations" are advised to increase "the creativeness of 500 individuals each by, say, 1%" (p. 121). In that way, "those who are to do the work are likely to have valuable ideas as to how it might be done [and] there is no greater creative incentive for a person than to know that he is working on his own program and that its success or failure is dependent on him" (p. 125).

2. Second, a "right atmosphere" is necessary for creativity to "freely emerge and not be stifled" (p. 124). Whilst such atmosphere […] "is not easily defined and is extremely difficult to develop", it should give "free access to ideas" and it consists of groups that "bring together a variety of backgrounds and experiences" (p. 124). It also should help individuals "understand their function in correct relation to the work and objectives of the total group", and develop "a good balance between work and relief from work" (p. 125). In contrast, most organizations were characterised as prioritizing focused attention, specialization, systematization, and control, viewed as "stimulants for efficiency in the routine and mechanical activities" and "quite different from the stimulants for creativity" (p. 127).
3. Third, an initial step for creativity in the organization is to help people across areas to "sense a disturbing element or a problem", a process "affected by the amount and type of information to which he [sic] has access" (p. 124). Therefore, information should be "stored not as single units, but as a part of an associated body of ideas." In addition, people "should have access to the widest possible field of knowledge […] with an understanding of other areas which are somewhat associated with her own field of activity" (p. 122). To this end, ideas should be treated "with a maximum number of cross references" as this "affords a greater possibility of recall and association with other material to give birth to a new and different idea" (p. 122).
4. Lastly, in relation to how organizations handle failure, since new and unproven ideas are "different from those already known", a "wise policy" is "to encourage venturesome thinking, always recognizing that some new ideas will be successful and others will fail" (p. 126). Creative attempts across the organization hinge "on the concept of mutual confidence" in a culture that provides "reasonable understanding" should new ideas fail (p. 126). A consequence of this is "the big problem" or "the dilemma of management", i.e., that "great profits may result from increased efficiency, and equally great profits may result from creativity and inventiveness […] yet the means by which the two are stimulated are not necessarily compatible" (p. 128).

It is difficult to identify ways in which the world hasn't changed since 1955, with 90% of the large organizations that existed then, are gone today. Yet at first sight, the core ideas framed in that article remain relevant and arguably unresolved. Specific elements make it look archaic and obsolete, including its gender-biased writing and the explanation of creative thinking using a contested five-stage model that simply moves the riddle of idea generation to a vague *illumination* stage.

This paper analyses the role of creativity in business organizations by examining the four core ideas in that article to elucidate the extent to their prevalence. Computational simulation is used here as a lens through which to consider the modern literature on organisational creativity. Agent-based simulation enables researchers to define and implement models where the characteristics and behaviour of individual agents can be represented including agent heterogeneity, and where multiple scales of interaction can be analysed, including the emergence of macro or societal structures from aggregate decentralised action (Gilbert, 2008).

The paper examines each of the ideas summarised above in a dedicated section. A discussion section follows that examines the use of computational social simulations to support systematic reasoning about the role of creativity in business organizations. Concluding remarks and future work close the paper.

2. Increase the creativeness of 500 individuals

The first tenet made by Randall (1955) is that organizations should strengthen everyone's creativity rather than "suppress even the small degree of creativity which they may possess" (p. 121). Today many scholars share the conviction that creative capacity is universal, and there are numerous views of creativity as necessary for a fulfilled life in areas as diverse as social change (Freire, 2000), psychology (Runco, 2004), and citizenship (Burgess et al., 2006). In design, a leading recent work in co-creation opens with "an important disclaimer […] the key idea on which the book is based is that all people are creative" (Sanders & Stappers, 2012, p. 8). However, as acknowledged in the same paragraph, this "is a controversial hypothesis and we are well aware that not everyone believes it to be true".

Idea generation or 'ideation' has been practiced in organizations for six decades under two key assumptions: first, that all individuals have creative capacity; second, that specific techniques can transform that potential into action. The book *Applied Imagination*, written around the time of Randall's article (Osborn, 1953), marked the beginning of the corporate use of brainstorming claiming that "the average person can think up twice as many ideas" (p. 229). Today ideation techniques such as brainstorming remain commonly used tool in business (Kolko, 2015).

There are today different ways in which the premise of universal creativity is challenged. From a systems view, it is argued that organizations have limits as to the number and degree of creativity that its members can exercise. Csikszentmihalyi and Epstein (1999) debate the extent to which “reality puts boundaries on what is needed and what is useful", arguing that if an organization tries to make "their 25,000 engineers more creative, what happens? Nothing, because […] you get lots of new ideas, but no one knows which are good and which are bad" (para. 17). The recent filing for bankruptcy by the innovation platform Quirky (Lohr, 2015) may be cited to illustrate such view.

From a different viewpoint, creativity has been formulated in scales or levels, from an everyday process akin to learning and personal discovery, to inventions and innovations with long-term and large-scale impacts (Kaufman & Beghetto, 2009). Evidently, the lack of a common definition of creativity prevents consistency in this debate. However, it can be argued that sixty years after Randall argued against limiting creativity to "a very few in key decision-making posts" (p. 128), a bias in the attribution of creativity continues to be mainstream today, as evidenced by a prominent study inspecting the genetic roots of creativity and psychosis (Power et al., 2015). A simple but important assumption lies behind such studies, which most people seem to take at face value (Andiliou & Murphy, 2010), i.e., that a population can be divided into creative and non-creative individuals based on their occupation. Power et al. (2015) define creative people as "those belonging to the national artistic societies of actors, dancers, musicians, visual artists and writers" (p. 954).

What is often missing from contemporary design discussions is the regulation of knowledge. Randall refers to 'conditional thinking' such as 'promotion from within' that can block the creative process (1955). Kolko (2015) highlights the present importance of risk taking in organizations, and how the inhibition of knowledge can slow the formation of intellectual capital. While scholars have attempted to address ways to elicit and share tacit knowledge in the firm (Nonaka & Takeuchi 1995), design studies have often neglected research into how power and control can regulate creativity.

Lessig's model of intellectual property rights and his modes of regulation and control suggest possible heuristics to improve creativity (Lessig, 2004). In that model, four modes regulate knowledge flow: law, markets, architecture, and norms. The concentration of power and decision making based on a hierarchical management norm is based on the normative presumption that intellectual capital is the most valuable asset of the modern firm (Lev, 2001).

As a corollary, and to illustrate the unresolved discussion of the feasibility, merit, and strategies to increase "the creativeness of 500 individuals each by, say, 1%" (Randall, 1955, p. 121), some scholars studying creative groups argue that in regards to creative capacity "an organization would prefer 99 bad ideas and 1 outstanding idea to 100 merely good ideas [...] in the world of innovation, the extremes are what matter, not the average or the norm." (Girotra et al., 2013, p.1).

3. A right atmosphere

The second argument, derived logically from the previous one, addresses the influence of organizational culture on creativity, a topic that has received considerable attention by scholars in recent decades (Ekvall, 1996; Tesluk et al., 1997; Martins & Terblanche, 2003; Von Keogh et. al, 2000) –including from a design perspective (Chang & Chiang, 2008; Kumar, 2012; Panuwatwanich et al., 2008; Starostka, 2014). Today innovation capability is an active research area (Lawson and Samson, 2001), and design has been identified as a contributor to organizational climates that support innovation (Bertola & Teixeira, 2003; Verganti, 2008; Battistella et al., 2012). A recent meta-analysis on this topic confirms the hypothesis that a developmental organizational culture that emphasises an external and a flexibility orientation is supportive of innovation, yet "a fragmented concept of culture for innovation" persists in the literature and an inclusion of these findings "into management theory is still missing" (Büschgens et al., 2013, p. 763).

Frameworks today provide structure for managers to diagnose and change organizational culture (Cameron & Quinn, 2005). Managers may choose different strategies depending on the role of innovation in the long-term objectives of the firm, i.e., hierarchical structures emphasise "control and an internal orientation", considered apt for "efficiency-oriented rational cultures" (Büschgens et al., 2013). This tension between creativity and efficiency, epitomised by Taylor's theory of 'scientific management', is still an issue today. Randall wrote, "Another hazard to the free flow of information is the insistence that it flow only through the formal lines of authority as established by the organization chart" (p. 124). Hierarchical management structures continue to be singled out by a number of authors as a barrier to innovation while suggesting small autonomous teams to encourage knowledge creation (Hamel, 2007; Ismail et.al, 2014; Ries, 2011; Von Krogh et.al, 2000).

Studies on team diversity and creativity have proliferated (Horwitz and Horwitz 2007). The advantage of member heterogeneity for group tasks that demand creativity and innovation was captured in early experiments by Triandis, Hall and Ewen (1965) and it has been replicated in numerous studies since. However, negative effects have also been found, i.e., when diversity impedes communication or when knowledge or expertise is skewed in the group. While the findings are inconsistent, a rich picture of team diversity suggests that different types of heterogeneity demand careful planning as a function of the specific organizational strategies and task characteristics.

A key element of a creative atmosphere that is reiterated by Randall (1955) relates to "the correct type of emotional atmosphere [which is] made up of the thoughts and feelings affecting a groups' operation, is not easily defined and is extremely difficult to develop or change" (p. 127). Scholars have consistently found support for the hypothesis that positive affect relates not only to job satisfaction, but also to "how creatively people will think on the job" (Amabile et al., 2005, p. 368). A recent literature review confirms that positive mood enhances creativity and supports an interactionist perspective where emotions and situational factors interact to support creative activity (Davis, 2009). In regards to "relief from work" (Randall, 1955), vacations seem to at least partially support creativity by increasing cognitive flexibility, but not original thinking (de Bloom et al., 2014).

Beyond academic research, questions about creativity in organizational culture have received attention in recent years, as exemplified by the debates on corporate culture in companies regarded as innovative. This indicates several issues including differing perceptions of a shared environment, the challenges of shaping culture, and the open questions on how to support divergent and convergent processes to implement new initiatives.

4. Ideas with a maximum number of cross references

Randall (1955) alludes to epistemological factors of organizational creativity underlining the need to store and process information "with a maximum number of cross references" and to make information available "both horizontally and vertically, from superiors as well as from peers" (p. 122). Concept association has received ample attention in creativity research (Osborn, 1953), whilst influential standardised tests of creativity are based on associative reasoning (Mednick, 1962). Analogical reasoning, based on conceptual associations, is not only considered critical for creative cognition (Ward et al., 1997), but has been characterised as the core of cognition (Hofstadter & Sander, 2012).

The relation between knowledge, expertise, and creativity has been studied extensively. Some scholars find support for a linear relation between creativity and knowledge, suggesting that creative thinking can be explained "by determining the knowledge that the creative thinker brings to the situation he or she is facing" (Weisberg, 1999, p. 248). Others have challenged this parsimonious explanation based on experimental studies that show that the relationship between quantity and quality (originality) in creativity is rather complex (Rietzschelet al., 2007). How information is structured and what mechanisms are used to process and match to prior information including cross-indexing and analogy is considered critical for creative reasoning (Oxman, 1990).

In design, a "T-shaped profile" (able to combine breadth and depth of knowledge and experiences) is considered beneficial for creativity. However, with the increasing complexity of problems and the accelerated increase of information, the “burden of knowledge” perspective claims that further specialization is increasingly required for innovation (Jones, 2009) –as well as teamwork abilities. Randall's (1955) observations about information and knowledge are framed in relation to enabling people "sense a disturbing element or a problem" (p. 122). Whilst problem solving has been extensively studied, research on problem finding, posing, definition, discovery, or identification is more disperse and inconsistent (Runco, 1994). The ability of management to create the right atmosphere for knowledge sharing, and creative collaboration are inherent in the on-going discussion of intellectual capital (Stewart, 2001). A number of researchers have identified this as a knowledge management problem connecting social capital, pluralistic design, information technology, and communication within the global enterprise (Hamel, 2007; Von Krogh et al., 2000).

Overall, a review of 2,013 effect sizes from over one hundred studies shows that the variables with a large mean effect size on creativity do include workplace conditions, problem definition, and knowledge retrieval (Ma, 2009).

5. The big problem

The last point of Randall's article (1955) deals with how organizations manage the consequences of failure. Risk aversion, uncertainty avoidance, and openness to experience have been identified as advantageous for creative activity. Kolko (2015) applies the design process to corporate tolerance for failure in which “employees in every aspect of the business must realise that they can take social risks without losing face or experiencing punitive repercussions” (p. 69). Organizations face a range of factors that create uncertainty (Jalonen, 2011), most of which have arguably increased significantly since the mid-twentieth century.

The "investment theory" of creativity (Sternberg et al., 1997) recommends that creative organizations "buy low and sell high" in "six distinct but interrelated resources: individual knowledge, intellectual abilities, thinking styles, motivation, personality, and environment" (p. 9). In this context, "buying low" refers to the high-risk pursuit of new ideas knowing that "not every new idea is a good creativity investment". In contrast, "selling high" means finding buyers for new ideas, "convincing them of its worth, and moving on to new projects when it becomes valued and yields a significant return" (p. 10). Similar to this approach, studies of entrepreneurial failure recommend pursuing high-variance outcomes since high failure rates of new initiatives do not matter when "the cost of failing is contained and the businesses that do succeed enjoy substantial growth" (McGrath, 1999, p. 28).

Randall's "dilemma of management" (1955, p. 127) can be seen six decades later as a collection of dilemmas beyond the tension between incremental or disruptive growth. Rather, the management of creativity seems to require balancing a multiplicity of dimensions, interactions, and moderating conditions. To an extent, the currency of the ideas presented by Randall sixty years ago is rather high today. The research in these decades has validated those ideas in general, mainly by unravelling the myriad subtle conditions related to each of the theses. However, inconclusive findings abound in the research reviews, and to some extent, the results from research studies

have only reinforced the complexity of the issues and the difficulties to study them applying conventional research methods.

One way forward in the study of creativity in organizations is to reconsider first principles and examine key components and dynamics of the complex themes involved. The next section shows how computational simulations can systematically support reasoning about creativity in teams.

6. Pumping intuitions about organizational creativity

The previous sections of this paper have elucidated the four core ideas proposed by (Randall, 1955). The implications of these ideas in modern organizations in full is beyond the scope of this paper. Instead, the focus here is on just the first core idea of fostering creativity in all members of an organization. This can be modelled computationally as a means to understand the impact of encouraging individuals to be more creative.

The computational modelling approach presented here extends work on agent simulation (Axelrod, 1997), in particular computational models of creativity and innovation (Watts & Gilbert, 2014). In such systems, populations of agents consist of two-dimensional lattices where independent agents follow a shared set of behaviours interacting with adjacent agents and iteratively building shared outcomes. We apply the original rules in Axelrod's model of culture dissemination (1997), where agents are initially assigned a set of values and interact with adjacent neighbours passing one of those values at every turn. In the original configuration, every agent starts with a random unique set of values, and the population gradually converges to a consensus of a single shared (dominant) set of values. In this way Axelrod demonstrated the self-organizing capacity of a group of individuals to reach agreement without the need of centralised control.

We introduce three variations to the original model: first, when agents sense total convergence in their adjacent neighbours, they attempt to introduce a new random value (with very low probabilities of 0.01% akin the mutation rates of evolutionary systems). This change is based on an assumption that creative people are less accepting of the status quo. This assumption is borne out in the literature that shows that creative behaviour is associated with higher openness to new experiences (Silvia et al., 2009). The simulation model is therefore modified to introduce 'change agents', thus triggering waves of gradual convergence and punctuated divergence in the agent group (Sosa & Gero, 2005).

Second, we distinguish between types of agents in the local interaction: whilst in the original model all agents take a value from a random neighbour at each turn, inspired by recent studies of creative teams (Elsbach & Flynn, 2013), we experimentally study a range of ratios between "idea-taking" and "idea-giving" agents in team composition. This could be considered a challenge to the view that creativity should be universally stimulated. However, it is an acknowledgement that teams may include a number of “explorer-promoters” (McCann & Margerison, 1989) who excel both at generating ideas and getting people enthusiastic about them. In particular product designers collaborating in teams seem more inclined to "idea-giving" behaviours (offering and promoting their own new ideas) than "idea-taking" behaviours (soliciting, considering, and incorporating new ideas of others) (Elsbach and Flynn, 2013). To understand the implications of the number of creative people in a team, the range of parameters inspected goes from teams where all agents

take the values of neighbouring agents, to teams where all agents *pass* their values to their neighbouring agents.

Third, we manipulate the degree of divergence or dissent of change agents –from groups where agents can only introduce a marginal change (one value in their set of values), to those where agents are able to introduce radical changes (the entire value set). This can be linked back to Randall's idea by considering factors such as the extent to which people can be encouraged to be more creative, the type of information available to them, or how failure-tolerant is an organisation.

Some of the basic dynamics that we set to think about with such model include: the extent to which 'idea-taking' impacts the rate of change in an organization compared to the more common behaviour of 'idea-giving' that most designers favour (Elsbach & Flynn, 2013); the effects of accounting for divergent capacities in the composition of creative teams, and the potential impact of having more radical ideas during ideation in teams. A single dependent variable is used here, called "revolutions" (*rev*), which stands for the number of collective changes of dominant values in a population (Sosa and Connor 2015). When a change agent introduces a diverging value, and this is adopted by the entire group over time, a 'revolution' is registered.

We implement a model with nine agents, ranging from teams with eight idea-taking and one idea-giving members (i.e., *rev_8t1g*) to teams with nine idea-giving members (i.e., *rev_9g*). Agents have a set of ten traits, following the system description by Axelrod (1997). Degree of change is implemented by varying the number of traits that change agents can alter when introducing a diverging value, from only one trait (*rev_1trait*) to all traits (*rev_10traits*).

As shown in Figure 1, the results of sweeping the parameters of 'idea-giving' and 'idea-taking' agents and the degree of change in the group, show that increasing participation (*rev_9g*) has no effect (or may have a negative effect) when dissent is incremental (*rev_1trait*), but it has significant effects when dissent is more radical (*rev_10traits*). In other words, participation seems to only matter when team members are allowed/able to make big, bold contributions. It follows that if efforts are put on increasing participation that yields incremental ideas, not only the levels of group creativity may fail to increase, they may actually decrease.

This model also suggests diminishing returns for increased group participation, as adding more 'idea-giving' agents brings a significant increase in group revolutions only when participation is low, and it slows down thereafter. A corollary of this model is that groups with lower creative participation (i.e., fewer idea-giving agency) but that make bolder changes may be able to produce more creative outcomes than groups with higher but more conservative participation levels.

Group size effects have been analysed extensively in the literature (Stewart 2006). Von Krogh et. al (2000) argue that there is an optimal size for creative teams, in micro-communities of five to seven people. Opening the idea generation roles to more team members or simply enabling individuals to make 'bolder' decisions may not be the best strategies. Instead, our model opens the possibility that the management of creative collectives needs to create and continuously evaluate a strategy that optimises resources and achieves the desired outcomes.

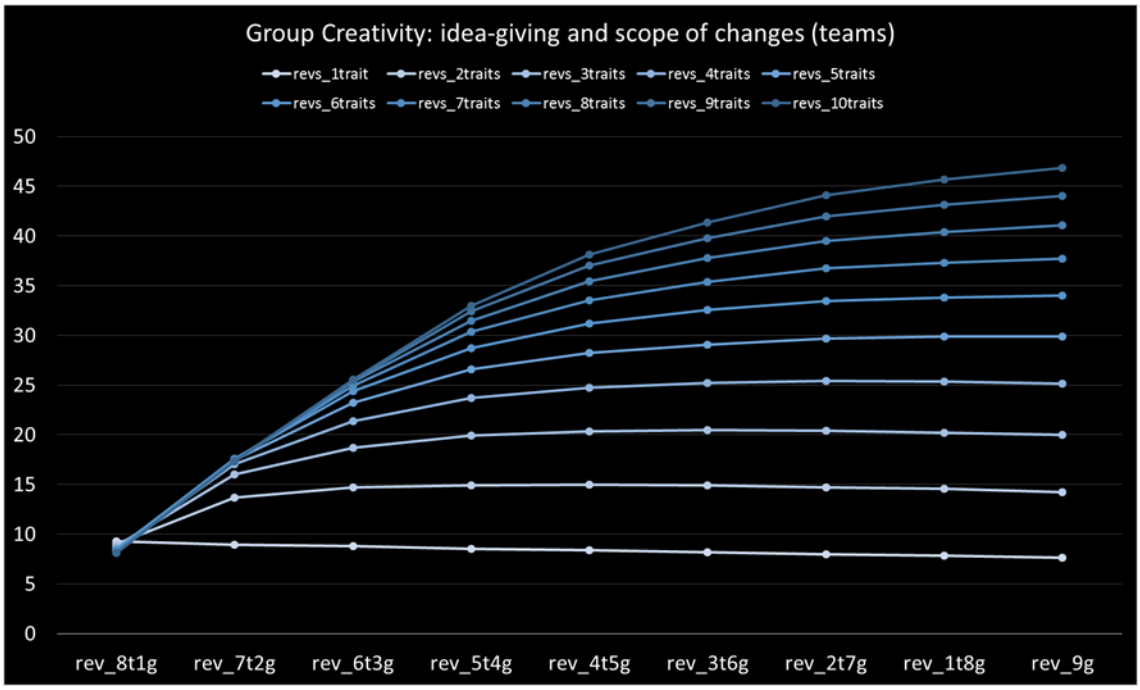

Figure 1. Increasing idea-giving behaviour is beneficial when changes are radical. The vertical axis plots number of 'revolutions' or group changes, and the horizontal axis shows an increasing proportion of 'idea-giving' team members. Darker lines indicate more radical or 'bolder' new ideas.

7. Conclusions

This paper has revisited an article from 1955 that framed a set of ideas about creativity in the organization, and which seem rather current six decades later. The four core tenets of that article are examined here, citing support from the literature. The parallels to contemporary discourses is uncanny (Kolko, 2015), although today it is understood that a myriad of subtleties lie beneath such arguments. The results from research studies reinforce the complexity of the issues at hand and the difficulties to study them applying conventional research methods.

This paper has proposed to reconsider first principles and to examine key components and dynamics of the complex themes involved in this topic. In relation to one of Randall's (1955) key ideas, it has shown how computational simulations can systematically support reasoning about creativity in teams by discussing an agent-based simulation of team creativity. In that study, participation in creative teams is characterised as having 'diminishing returns', suggesting that enabling some, but not necessarily all, individuals in an organization to generate more radically new ideas may be more critical than simply opening access to ideation. Further work will examine this in more depth as well as considering how agent-based simulations can be used to examine the remaining of Randall's (1955) key ideas.

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