Crowdsourcing collective intelligence through coopetition [1]

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1. INTRODUCTION

In recent years, the elaboration of creative solutions by the crowd (idea crowdsourcing) has been integrated seemingly everywhere. Many organizations, both public and private, have adopted the concept of idea crowdsourcing to develop platforms for open innovation. The Climate CoLab project from the MIT Center for Collective Intelligence is an example of such initiatives. Although many studies have been done about idea crowdsourcing, one of the main questions remains how to design their coordination mechanisms to enhance crowd performance [Majchrzak and Malhotra 2013]. Many crowdsourcing platforms are based on a competition model, which users are rewarded based on their relative performance (i.e., idea competitions [Leimeister et al. 2009]). Some organizations also create platforms based on a cooperation model which invites users to post, share and discuss new ideas through collaborative communities [Boudreau and Lakhani 2009].

In addition to these two trends, a third existing model has emerged, referred to in the literature as "coopetition" [Bengtsson and Kock 2014, Hutter et al. 2011, Füller et al. 2014]. Coopetition construct describes a simultaneous combination of competition and cooperation. This type of hybrid situation becomes familiar in idea crowdsourcing platforms, for example by implementing cooperation features in idea contest platforms [Adamcyk et al. 2011]. The coopetition model requires a closer look to its performance compared to the other two classical models. Indeed, coopetition is a new construct and needs further research [Bengtsson and Kock 2014, Füller et al. 2014]. This emerging model asks the question of the simultaneity between cooperation and competition [Majchrzak and Malhotra 2013], which are often presented as exclusive situations [e.g., Axelrod 1997]. Concerning its relevance for idea crowdsourcing, some studies state that certain competition or community features have a positive impact on idea quantity and quality [Adamczyk et al. 2012, Piller and Walcher 2006]. Other case studies suggest that the coopetition model has the potential to provide superior creative outcomes, in comparison with pure cooperation and competition settings [Blohm et al 2011, Füller et al. 2014]. However, to our knowledge, quantitative studies aiming to confirm or disprove the effect of different crowdsourcing models on creative performance have not been conducted. The goal of this study is therefore to examine how the coopetition model affects creative performance in comparison with the competition and cooperation models. To answer this question, we conducted an experiment with 177 students to test four models of crowdsourcing platforms (competition, cooperation, coopetition and pure idea submission) drawing on social interdependence theory framework [Deutsch 1949, Johnson and Johnson 1989] to conceptualize coopetition at the inter-individual level.

2. COOPETITION THEORY

Cooperation and competition are often considered contradictory phenomena. For many authors, they are conceived of as two extremes on a continuum [e.g. Bullinger et al. 2010]. However, in real life, few situations are "purely" cooperative or competitive but are rather a mix of the two with distinct intensities [Deutsch 2006]. Therefore, instead of two opposite constructs, cooperation and competition

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should be viewed as two points on a continuum since it is "possible to account both for the simultaneity of contradictory interactions and for the degree of cooperation and competition that variously can be low–low, low–high, balanced, high–low, or high–high" [Bengtsson and Kock 2014]. The concept of coopetition aims to capture those simultaneous situations. Initially considered in order to exist at the inter-organizational level, coopetition has been defined as a dyadic and paradoxical relationship in which two firms compete in some activities while cooperating in others. Nowadays, the concept of coopetition has evolved into a multi-level phenomenon rather than existing solely at the inter-organizational level [Bengtsson and Kock 2014, Chiambaretto and Dumez 2016]. Thus, coopetition can be more broadly defined as the simultaneous and paradoxical presence of cooperation and competition between two agents.

It is worth noting that at the individual level, studies are relatively rare, reflecting the recent nature of this subject. Recent literatures have brought coopetition construct to information sharing in professional contexts [Baruch and Lin 2012, Burström 2012, Enberg 2012], in workgroups [Bergendahl et al. 2015] or in idea crowdsourcing platforms [Hutter et al. 2011, Fuller et al. 2014]. However, this literature does not discuss the theoretical implications by clarifying the terms of competition and cooperation at the interpersonal level. Therefore the coopetition concept requires more conceptual and theoretical development considering this dimension [Bengtsson and Kock 2014]. In this study, we use the social interdependence theory framework [Deutsch 1949, Johnson and Johnson 1989] to conceptualize coopetition at the inter-individual level. This framework is useful to define coopetition at this level since it describes and articulates cooperation and competition constructs from a social-psychological point of view. This robust framework [Johnson and Johnson, 1989] allows us to list and design essential components corresponding to each model (cooperation, competition and coopetition).

3. EXPERIMENT: THE EFFECT OF COOPETITION ON CROWD CREATIVE PERFORMANCE

Participants and research design. To test if a coopetition platform relative creative performance is higher than pure cooperation or competition platforms, we conducted a 2 x 2 factorial design, crossing a cooperation (high vs. low) and a competition (high vs. low) environment. We designed four crowdsourcing platform interfaces (cooperation, competition, coopetition, neutral), each one containing specific functionalities derived social interdependence theory framework [Johnson and Johnson, 1989] (see Tab.1). 177 undergraduate students from a university were asked to generate innovative ideas about new iPad smart cases/covers, for thirty minutes. The instructions were given online with each specific tone (competition: "give the most creative ideas and win"; cooperation: "make part of the community and share your innovative ideas"; coopetition: both; neutral: only "give innovative ideas"), accompanied with stimulating images related to each situation.

Tab. 1 Experimental cells' features

Social Interdependance Theory	Features	Coopetition	Cooperation	Competition	Neutral (control)
Competition characteristics	**Competition Features**				
Forced social comparison	Leaderboard	X		X	
Conflicting goal	Rewards for a limited number of winners	X		X	
Cooperation characteristics	**Cooperation Features**				
Sharing of useful knowledge	Visible ideas	X	X		
Possibility to interact	Comments	X	X		
Common goal and support	Collective evaluation (like)	X	X		

Measures. Creative performance was measured in terms of idea quantity and idea quality [Wierenga and Van Bruggen 1998]. Idea quality was the number of creative ideas [Reinig et al. 2007] evaluated by two innovation experts among three dimensions: originality, feasibility and value [Poetz and Schreier 2012].

Manipulation check. The perception of competition ($\alpha = .87$) was measured with a bipolar three-item scale, e.g. "This platform offers a challenge to see who the best is". The perception of cooperation ($\alpha = .88$) was measured with a bipolar three-item scale, e.g. "Participants can help one another generate ideas". Items where adapted from Johnson and Norem-Hebeisen' scale [Johnson and Norem-Hebeisen, 1979]. The manipulation check revealed a significant difference between the platforms with high ($M = 4.72$) versus low ($M = 3.45$) cooperation elements ($F(1,176) = 26.90$, $p = 0.00$). The second manipulation check showed a significant difference between the platforms with high ($M = 5.15$) versus low ($M = 3.79$) competition elements ($F(1,176 = 30.92$, $p = 0.00$).

Results. To evaluate the effects on idea quantity and idea quality, an analysis of variance was conducted with the cooperation and competition models as discrete between-subject factors and interactions. The ANOVA indicated significant main effect of competition on idea quantity ($F(1,176) = 7.18$, $p = 0.00$) and idea quality ($F(1,176) = 3.69$, $p = 0.05$). In contrast, our results revealed no significant effect of cooperation on idea quantity (($F(1,176) = 0.60$, $p = 0.43$) and idea quality ($F(1,176) = 0.99$, $p = 0.32$). The interaction effect is significant for both idea quantity ($F(1,176) = 5.72$, $p = 0.01$) and idea quality $F(1,176) = 4.78$, $p = 0.03$). Planned contrasts revealed that a platform with a mix of cooperation and competition generated more ideas, than a competition (contrast estimate = 1.33; $p = 0.00$), or cooperation (contrast estimate = .83; $p = 0.02$) platform. Moreover, we noted that a coopetition platform generated more creative ideas than a platform with either pure competition (contrast estimate = 0.52; $p = 0.02$) or pure cooperation (contrast estimate = 0.67; $p = 0.00$) environment. The coopetition platform also outperformed the control group for both idea quantity (contrast estimate = 0.91; $p = 0.01$) and idea quality (contrast estimate = 0.48; $p = 0.04$) (see Fig. 1 and 2). Considering the results, our hypothesis that coopetition leads to a higher creative output is validated.

Fig. 1: Number of ideas (quantity)

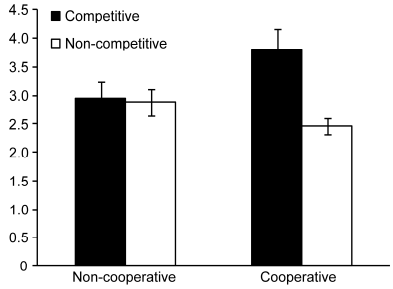
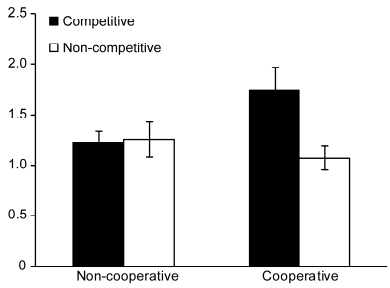


Fig. 2: Number of creative ideas (quality)



4. DISCUSSION AND FUTURE RESEARCH

This study shows that the coopetition model leads to a higher creative performance than pure cooperation and competition platforms. Therefore, it has several implications, for both theory and practice. The coopetition model for crowdsourcing platforms is confirmed to be a useful tool to drive collective intelligence of a crowd since it enhances the generation of creative ideas. Our findings are in line with a recent experimentation investigating coopetition in real-life workgroups [Bergendahl et al. 2015]. These findings acknowledge the theory that coopetition is beneficial for innovation [Bengtsson and Kock 2014], not only at the organizational level but also among individuals in idea crowdsourcing context. We shall note however a limitation to our study since it only focuses short-term sessions (30 minutes). It is still an important insight since the most users pass little time on the platform

[Majchrzak and Malhotra 2013]. However, we believe that an interesting way of research would be to compare the long-term effects of cooperation, competition and coopetition platforms and dynamics. Moreover, investigating the composition of crowds in terms of social roles might highlight our understanding of the long term effect of coopetition, a certainly complex phenomenon. Indeed, it seems that a variety of roles (cooperative, competitive, coopetitive, neutral) coexist in crowd-based coopetition with no "best profile" in terms of creative capability [Füller et al. 2014], but it is possible to find the best profiles combinations to maximize platform performance [Levine and Prietula 2015]. To conclude, the highlighted "coopetition effect" shows that collective intelligence can result from cooperation with competition. This can drive research agendas to go beyond the classical cooperation-competition dichotomy.

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