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PhD Thesis:

GROUP COGNITIVE COMPLEXITY AND CREATIVITY

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CHAPTER 1: INTRODUCTION

Do groups have their own minds? Can we say that groups develop emergent cognitive properties by themselves? These questions have arisen in science and philosophy since the late nineteenth and early twentieth centuries. As a result, the group mind thesis was developed, according to which groups function as collective agents who pursue specific goals, make decisions, solve problems and can have their own intentions. They are considered emergent entities who are subjects of mental states and processes, being more than the sum of their members (Theiner & O'Connor, 2010; Curseu, Schruijer & Boros, 2007; Curseu, 2006). Theiner and O'Connor (2010) proposed a „big tent" approach in order to describe the characteristic features of a cognitive system. In line with this approach, we can say that a system is cognitive when: 1) the system can adapt its behavior to a dynamic and continuous changing environment (adaptability); 2) has the ability to process information from the environment (information processing); 3) has the ability to select the information and pursue its own goals in its environment (heed); 4) has the ability to create internal representations of its environment (intentionality); 5) it can create artifacts through which to modify its environment (extension); 6) has the ability to become aware of himself as a cognitive entity (self - reflexion); 7) has the ability to have conscious experiences of himself as an agent, and the world (consciousness). These criteria are not mutually exclusive or jointly exhaustive (Theiner & O'Conner, 2010).

The development of new knowledge structures does not take place in the mind of one individual, in isolation, rather knowledge structures and processes are distributed across people and arising from their interpersonal interactions (Theiner & O'Conner, 2010; Curseu, 2006). Collective cognition transcends therefore individual cognition, it emerges from the interplay of individual cognition through interaction. Further, such collective cognitive structure become elements of the environment and cultural practices (Hutchins, 2000) and further impact on individuals. We can therefore conceptualize a dynamic interplay between the social context in which individual navigate and the cognitive processes (knowledge creation, creativity, problem solving, decision-making) unfolding in individuals and groups. According to Glăveanu (2013) creativity is a psychological, social and cultural process, the creative act taking place through the interaction of the actor and his environment, being evaluated by an

audience. He has built The Five A's Model which is composed by five elements: 1) the actor; 2) the action; 3) the artefacts; 4) the audience; and 5) the affordances. The actor is a person who is part of a social network which functions according to certain rules, norms and traditions. The mind of the individual shapes the socio-cultural system in which he lives, and, in turn, that socio-cultural system shapes his mind, and so on. We cannot separate the actor's mind from the environment (Glăveanu, 2013) in that the creative products of the individual are always embedded in the social context in which individuals navigate. The concept of collective action shapes the creative behavior of the social actors. Once the actor has an idea, in order t transform it into a finite product (i.e., artwork) he must take into account continuous feedback loops from the environment with its affordances and constraints (Mace & Ward, 2002). Artefacts are the creative products of a culture (Glăveanu, 2013). They can be material (i.e., artwork) or conceptual (i.e., ideas) (Cole, 1996). The audience is composed by the people who evaluate the product of creativity and decides its value. The audience can be part of the family, friends, collaborators, or opponents and contributes to the creative process by judging, criticizing, or using the artefact. Therefore, the creative process is socially construed in which the social actor adjusts his product as a function of audience feedback (Glăveanu, 2013). To conclude, literature on emergent cognitive phenomena has crystalized in two main directions. On the one hand research explored the way in which collective cognition emerges from the interplay of individual cognitive structures and process through interpersonal interactions and on the other hand explored the way in which individual cognitive processes are shaped by the social context. At the core of these two research directions is interpersonal communication as the key vehicle that generates collective cognition, and it shapes individual cognitive processes in social context.

In line with the first research direction on the emergence of collective cognitive structures, an important emergent property or characteristic of collective cognition, refers to group cognitive complexity (GCC). GCC describes the richness and sophistication of groups knowledge structures that are used for organizing and storing cognitive contents (Curșeu et al., 2007). GCC is a key component property of collective cognition because it affects information search and processing (Tuckman, 1964; Stager, 1967), task performance and organizational performance (Choi & Coen, 2009; Hendrick, 1979; McNamara et al., 2002; West, 2007) and the ability of planning (Stone et al., 1994). Recent studies show that emergence of GCC is influenced by factors such: gender diversity (Curșeu et al., 2007; Curseu et al., 2010; Curșeu & Pluut, 2013), cognitive disparity (Curșeu et al., 2007), contribution diversity and expertise

diversity (Curșeu et al., 2010), nationality diversity (Curșeu & Pluut, 2013), normative interventions (Curșeu & Schruijer, 2012), role balance (Meslec & Curșeu, 2015), group size, percentage of women and minority dissent (Curșeu et al., 2017). Thus, we can say that collective structures develop in a sociocultural context, as a result of the interaction among people. The first aim of this thesis is to explore the influence of communication processes on the emergence of collective cognitive structures.

In line with the second research direction, collective creativity reflects the way in which social influence processes impact on creative processes. In the 5A model of collective creativity, Glăveanu (2013) specifies the interdependence of individual creative processes with the social-cultural system in which the individual navigates. Interpersonal communication is a vehicle through which creative artifacts are generated and shaped. A second aim of our study is to explore the way in which humor in communication is related to the emergence of collective creativity. Moreover, the link between group creativity and GCC was not explored in the literature, although both emergent cognition and group creativity are related to knowledge differentiation and likely driven by the same processes that underline knowledge differentiation and integration in groups. The third aim of the study is to explore the association between group creativity and GCC. Because in modern organizations group-work is broadly used (Hollenbeck et al., 2012) especially in cognitive tasks, thus, our principal aim to investigate and understand the emergence of collective structures has important implication for team and organizational performance. Moreover, understanding the way in which communication shapes collective creativity has important implications for public (and political) communication. Finally, the processes that underline group creativity have important implications for group and organizational innovation.

Main Objectives and a Brief Summary of the Studies

The main objective of this thesis is to explore emergent collective knowledge structures in a social context. Our paper contains four studies: a conceptual review and three empirical studies. The conceptual review explores the antecedents and consequences of GCC. First, we provide a conceptual overview of the underpinnings of cognitive complexity at the individual level. Second, we shift the level of analysis at the group and organize the studies according to composition (i.e., team members' characteristics are similar and converge in order to outline a global property of the group that is the same as its constituent parts) vs. compilation (i.e., the group level phenomena originate from heterogeneous characteristics of group members and

manifest at a higher level) framework (Kozlowski & Klein, 2000). We contribute to the literature by pointing out the relevance of the metric used to evaluate GCC. Another contribution is that we write the first integrative review on GCC in which we integrate the main literature with respect to the emergence of GCC developed since 1955, until 2021.

The second study explores the relationship between communication and the emergence of collective cognition. First, we test the non-linear association between the frequency of communication and group cognitive complexity. Second, we test the extent to which team familiarity moderates the impact of communication frequency on group cognitive complexity. Third, we investigate the mediation role of the communication frequency in the non-linear association between group size and gender diversity on one hand and group cognitive complexity on the other hand. We contribute to the literature by identifying the role of group structure (group size and group diversity) and communication frequency in the emergence of collective cognition. In addition, the practical implications are very important for the managers/consultants that could design future interventions in order to enhance the benefits of communication frequency and to mitigate the negative effects of it. Although group creativity and group cognition are inherently connected, and research to date has recognized the key role of communication for the emergence of both, little empirical evidence exists to support these connection.

Thus, the third study explores group creativity in a collective brainstorming task and different indices of group cognitive complexity (GCC) in a cognitive mapping task performed by 85 student groups. The sequencing of brainstorming and cognitive mapping allows us to evaluate cognitive differentiation and cognitive integration processes as they unfold during group interactions. Our results show that the group creativity (estimated using the creativity quotient for the ideas generated during the brainstorming task) is positively related to absolute and negatively to relative GCC. This result supports the interpretation of relative GCC as an index of integrative cognitive complexity, while the absolute GCC is as an index in which differentiation dominates. Moreover, task related communication fosters both cognitive differentiation and integration processes in groups, while non-task related communication impairs cognitive integration processes. Finally, our results replicate the inverted U-shape association between the frequency of task-related communication and relative GCC, as well as the mediating role of the task-related group arguments in the relationship between gender diversity and relative GCC. These results have important implications for the evaluation of

GCC and they shed light on the relation between group creativity and emergent group cognition.

In the fourth study we analyse the relationship between humor and collective creativity in a political context. Specifically, we explore the relationship between the type of humor used in public communication messages and their perceived (collective) creativity. We set out to test the difference between perceived creativity in messages using affiliative and aggressive humor as well as the extent to which gender and need for cognition moderate the effect of humor on perceived message creativity. We contribute to the literature, this study being among the first attempts to explore the role of humor type on the perceived (collective) creativity of messages used to express public opinions.

CHAPTER 2: ANTECEDENTS AND CONSEQUENCES OF GROUP COGNITIVE COMPLEXITY: A CONCEPTUAL REVIEW

Introduction

The purpose of this paper is to examine the literature on the antecedents and consequences of group cognitive complexity (GCC) and integrate the empirical work by employing the composition/ compilation framework of emergence and the Input-Mediator-Output-Input model of team effectiveness. Through a systematic search in extant databases, the authors found 27 empirical studies exploring the antecedents and consequences of GCC. The extant literature is dominated by a compilational approach on GCC, experimental designs, and a focus on exploring the antecedents of GCC (group composition and processes mostly), thus providing useful insights for organizational interventions. The work on the implications of GCC for individual or organizational level outcomes is however scant. Future endeavors could rely more on a multilevel exploration of GCC, take a developmental rather than a one-shot approach and explore the impact of new ways of working on the emergence of GCC.

As organizational tasks become increasingly challenging and complex, groups are often deployed to perform them and, as such, their capacity to manage complexity is paramount. The input-mediator-output-input (I-M-O-I) model of team effectiveness (Ilgen *et al.*, 2005) stresses the role of adaptive group processes and emergent states as key factors that allow groups to navigate the volatile and varied task domain and, as such, to tackle complexity. Consistent with the I-M-O-I framework (Ilgen *et al.*, 2005), the emergent cognitive structures that teams

develop during interaction are key mediators between team inputs, on the one hand, and team adaptation, innovation, and performance, on the other (Burke *et al.*, 2006; Zajac *et al.*, 2014; Zhang *et al.*, 2007). The literature on group cognition proliferated in the last decades and meta-analytic evidence (DeChurch and Mesmer-Magnus, 2010) supports the beneficial effects of shared mental models and transactive memory systems for group outcomes. However, little integrative efforts were made to explore the antecedents and consequences of group cognitive complexity.

Studies to date explored the antecedents (e.g., Coman *et al.*, 2019; Curșeu and Pluut, 2018; Curșeu *et al.*, 2012 etc.), as well as the consequences of GCC (Cheng and Chang, 2009; Curșeu *et al.*, 2010) and we set out to review these implications. The paper is structured as follows: first, we provide a conceptual overview GCC. Second, we build on the composition *(i.e.*, team members' characteristics are similar and converge in order to outline a global property of the group that is the same as its constituent parts) vs. compilation (*i.e.*, the group level phenomena originate from heterogeneous characteristics of group members and manifest at a higher level) framework on emergent group phenomena (Kozlowski and Klein, 2000) and we integrate the extant empirical research on the antecedents and consequences of GCC. Third, we discuss theoretical and practical implications and identify future research directions.

Literature Search Method

We used two methods of data search. First, we used the following keywords and all possible combinations: *group cognitive complexity, integrative complexity, cognitive flexibility, collective cognition, group cognition, antecedents, outcomes* to perform searches in databases such as: PsycInfo, Sage, Google Scholar. Second, we used the reference list of the already identified articles in order to expand our search (the snowball technique). We included in our review only the studies that have conceptualized GCC in terms of differentiation and integration and that investigated empirically the relationship between GCC and other variables (*i.e.*, predictors, outcomes and moderators). We included only English written papers, without constraining the search to a specific time frame.

Twenty-seven papers were finally included in the review. As previously argued, the following section reviews this work by using the multilevel approach to emergence (Kozlowski and Klein, 2000) and the I-M-O-I framework (Ilgen *et al.*, 2005) and discusses issues of construct measurement, as well as antecedents and consequences of GCC and its contingencies.

Findings

The Conceptualization and Measurement of GCC

Emergent phenomena such as GCC are conceptualized by building on a composition and/or a compilation framework. The compositional perspective relies on the principle of isomorphism and describes how collective emergent phenomena such as GCC are rooted in individual level characteristics that are essentially the same (*i.e.,* they share the same content, meaning and construct validity across levels) as they converge and then emerge to a higher level as a property of the group (Kozlowski and Klein, 2000). Ten studies on GCC employed such a compositional approach (*e.g.*, Hendrick, 1979; Stager, 1967 etc.). In this view, GCC relies on the cognitive complexity of team members and, in terms of measurement of the construct, the authors adopt an additive or mean model and aggregate individual evaluations.

The compilation approach of emergent phenomena describes them as a combination of heterogeneous characteristics originating at the individual level that through interaction yield a higher-level property (*i.e.*, a configural unit property). Configural unit properties are similar to shared unit properties in that they originate at the individual level. However, unlike the shared unit properties that are isomorphic, configural unit properties are based on the assumption of discontinuity. Configural unit properties capture individual contributions that are distinctively different (*i.e.*, gender diversity, demographic characteristics, personality characteristics, performance in interdependent tasks, network density) (Kozlowski and Klein, 2000).

Research adopting a compilation perspective on GCC argues that GCC originates at the individual level of analysis in the way team members use concepts and connections to represent a certain knowledge domain and it emerges as a property of the group via team members' interaction and communication. As such, the method of measuring the construct strives to capture GCC as a configural property of the group and employs content analyzing the group products such as the essays written by groups (Gruenfeld and Hollingshead, 1993; Gruenfeld and Preston, 2000) or the letters to shareholders (Cheng and Chang, 2009), content analyzing qualitative data gathered from press or the company archival data by using the Q-sort technique (Wong *et al.*, 2011), , or employing the cognitive mapping technique (Curșeu *et al.*, 2010).

When researchers perform content analysis on group products one or more coders assess GCC by using a scale scored from 1 to 7, whereby 1 reflects a low level of GCC (i.e., low level of differentiation and integration) or the use of a unidimensional perspective on a

certain domain; a score of 3 indicates the use of multiple dimensions when representing a knowledge domain, but with reduced connectivity. Such a score reflects a moderate level of differentiation and a low level of integration. A score of 5 reflects differentiation and the use of a single integration rule in order to connect the dimensions; whereas a score of 7 reflects a high level of GCC, described by increased differentiation and increased integration (*i.e.*, the use of many complex rules in order to integrate the multiple dimensions identified) (Gruenfeld and Hollingshead, 1993; Gruenfeld and Preston, 2000).

The Q-sort methodology is another way to evaluate GCC. Wong et al. (2011), for instance, had external raters employ the Q-sort methodology in order to rate top management teams' integrative complexity, by starting from qualitative, archival data on these teams. They used the 13 items pertaining to the intellectual flexibility dimension in Group Dynamics Q-sort (Peterson *et al.*, 1998), which reflect the level of differentiation and conceptual integration displayed by a team. Each item contains two opposite statements that describe different levels of GCC as displayed by a top management team during decision-making processes (*i.e.*, the statement at the top of the card reflecting high GCC and the one at the bottom reflecting low GCC). The external raters are instructed to sort the cards into categories ranging from 1 "lower statement is very characteristic of the group," to 9, "upper statement is very characteristic of the group."

Cheng and Chang (2009), on the other hand, used computer-aided content analysis performed on the letters sent to shareholders by the companies' top management teams in order to assess GCC with respect to the teams' mental representations of the economic environment the firm is operating in. Such letters to shareholders are included in the Annual Reports issued by the companies and contain information about past actions, major events, current states and future strategies of development. Cluster analysis was used in order to categorize the dimensions of the strategic model (Cheng and Chang, 2009).

Another method of measuring GCC is the cognitive mapping technique (Curșeu *et al.*, 2010; Uitdewilligen *et al.*, 2021). The method requires for groups to either elicit and organize concepts pertaining to a certain domain, either to just organize a number of key concepts provided in advance by the researcher. Organizing these concepts entails drawing connections among them and further specifying the nature of these relations (*i.e.*, causal, association, equivalence, topological, structural, chronological, and hierarchical) (Gomez *et al.*, 2000). External coders finally rate the conceptual maps created by the team by using three indicators:

the total number of concepts used in the cognitive map, the total number of connections established between the concepts, and the number of distinct relations established between the concepts. Various composite scores reflecting the absolute GCC, or relative GCC are further computed (Curseu *et al.*, 2010).

The following tables summarize the main articles which were integrated in this review.

Table I. Outcomes of GCC in a compositional perspective

Authors	Type of design	Type of relationships	Outcomes
Tuckman (1964)	Experimental design	GCC positively predicts:	The type of group structure (Flexible vs hierarchical)
			Information search
			Leadership style (less autocratic vs. more autocratic)
			The amount of activity in the task
			Sensitivity to environmental cues and changes
			The ability to predict future events
Stager (1967)	Experimental design	GCC positively predicts:	The ability to handle uncertainty in the functional role structure (the amount of uncertainty in the group-processing information structure)
			Interpersonal conflict
			The extent to which generated conflict is utilized
			Novel information search
Hendrick (1979)	Experimental design	GCC positively predicts:	Time for task completion
			Behavioral differences (quickness in task-solving)
Stone, Sivitanides, & Magro, (1994)	Experimental design	GCC positively predicts:	The quality of assumptions formulated in order to solve an ill-structured task
McNamara, Luce, & Tompson (2002)	Correlational design	GCC negatively predicts:	Firm performance
West (2007)	Longitudinal design	Inverted U-shape association between GCC and:	Firm performance
Choi & Coen (2009)	Experimental design	GCC positively predicts:	Task performance in a firm simulation task

Table II. Moderators of the relation between GCC and outcome variables in a compositional perspective

Authors	Type of design	Moderators	Moderated relationship
Streufert, Suefeld, & Driver (1965)	Experimental design	Variation in information load	Moderates the relationship between GCC and information search, in such a way that, when information load increases, groups low in GCC still requesting for more information as compared to groups high in GCC. On the other hand, when the information load increases, the drop in self-initiated information search behaviors was stronger for groups low in GCC, than for groups high in GCC.

			Moderates the relationship between GCC and utilization of integrative information, in such a way that when the information load is moderate, groups high in GCC display an optimal utilization of integrative information, whereas for groups low in GCC, the integrative information processing capabilities are significantly lower and they collapsed when they were exposed to extremely suboptimal or super optimal levels of information load.
Tuckman (1967)	Experimental design	The type of task (abstract vs. concrete task)	Moderates the relationship between GCC and group performance in such a way that in groups in which individuals with a high level of cognitive complexity prevail, outperform groups composed of a majority of individuals with a lower level of cognitive complexity, when they are faced with an abstract and unstructured task.
Stone, Sivitanides & Magro (1994)	Experimental design	The type of dissent introduced in groups	Moderates the relationship between GCC and decision-making participation, in such a way that: groups composed of members with low cognitive complexity that employed „the devil advocate" (DA) method of introducing dissent made significantly worse recommendations as compared to DA groups with high cognitive complexity members and groups with low cognitive complexity members employing a "dialectic inquiry" method of introducing dissent. Moderates the relationship between GCC and task participation in such a way that the DA groups comprised of low complexity members had less equal task participation as compared to the other groups
Mayer & Dale, (2010)	Experimental design	The interaction between the type of task (i.e., complex vs simple task) and group structure (i.e. centralized vs. decentralized structure)	Moderates the relationship between GCC and group satisfaction in such a way that groups with a lower level of GCC reported higher satisfaction when the task was complex and when the group structure was decentralized, as compared to low GCC groups engaged in a less complex task and a decentralized structure.

Table III. Antecedents of GCC in a compilational perspective

Authors	Type of design	Antecedents	Type of relationship
Curșeu, Schruijer, & Boroș (2007)	Cross sectional design	Gender variety (heterogeneity vs. homogeneity)	Positively predicts GCC
		Cognitive disparity	Negatively predicts GCC
Curseu, Schalk & Schruijer (2010)	Cross sectional design	Gender diversity	Positively predicts GCC
		Group contribution diversity	Negatively predicts GCC
		Expertise diversity	Negatively predicts GCC

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Curșeu & Schruijer (2012)	Experimental design	Normative interventions	Have a positive impact on GCC
Coman, Curșeu, Fodor, Oțoiu, Rațiu, Fleștea & Bria (2019)	Cross sectional design	Task – related arguments Non-task – related arguments	Both variables have a reversed U-shaped association with GCC
Curșeu, Janssen, & Raab, (2012)	Cross sectional design	Task conflict Relationship conflict	Positively predicts GCC Negatively predicts GCC
Curșeu & Pluut (2013)	Experimental design?	Gender diversity Nationality diversity	Positively predicts GCC Positively predicts GCC
Meslec & Curșeu (2015)	Cross - lagged design	Role balance	Positively predicts GCC
Curșeu, Schruijer & Fodor (2017)	Cross sectional design?	Minority dissent Percentage of women Group size	Positively predicts GCC Positively predicts GCC Inverted U-shape with GCC
Curșeu & Pluut, (2018)	One field study and 2 experimental studies	External information search The absorptive capacity of the boundary spanner The cognitive distance between the boundary spanner and the rest of the group	Positively predicts GCC Positively predicts GCC Negatively predicts GCC
Brodbeck, Kugler, Fischer, Heinze & Fischer (2020)	Experimental design	The type of group (consent groups, dissent groups, dissent – stepwise – recap groups)	Dissent – stepwise - recap groups have a greater GCC than dissent groups, which have a greater GCC than consent groups
Hojbota, Rusu, Curșeu & Constantin (2020)	Experimental design	Normative interventions (presence vs. absence of norms)	Presence of norms (*i.e.* prescribed rules that encourage members' participation in task, stimulating debate) predict a higher level of GCC

Table IV. Mechanisms that explain the relationship between the antecedents of GCC and GCC in a compilational perspective

Authors	Type of design	Antecedents	Type of relationship	Mediators
Curșeu, Janssen, & Raab (2012)	Experimental design	Network fragmentation Network density	Positively predicts Negatively predicts	Task conflict Relationship conflict
Curșeu & Pluut (2013)	Experimental design	Diversity in teamwork – related to expertise	Negatively predicts	Teamwork quality

		Disparity in need for cognition	Positively predicts	
Coman, Curșeu, Fodor, Oțoiu, Rațiu, Fleștea & Bria (2019)	Experimental design	Group size	Is a positive predictor when increases from low to average levels	Task – related arguments
		Gender diversity	Is a positive predictor when increases from low to average levels	

Table V. Outcomes of GCC in a compilational perspective

Authors	Type of design	Type of relationship	Outcomes
Curseu, Schalk, & Schruijer (2010)	Experimental design	GCC positively predicts:	Performance Viability Satisfaction
Uitdewilligen, Waller, Roe, & Bollen, 2021	Longitudinal, experimental design	GCC positively predicts	Performance growth over time Information search over time
Cheng & Chang (2009)	Mixed design	GCC positively predicts	Firm performance

Table VI. Moderators of the relationship between antecedents and GCC and GCC and outcome variables in a compilational perspective

Authors	Type of design	Moderators	Moderated relationship
Gruenfeld & Hollingshead (1993)	Experimental design	The amount of time that groups worked together	Moderates the relationship between individual cognitive complexity and GCC, such that during the late period, GCC became significantly higher than average individual levels and were not significantly lower that the highest individual levels.
Curșeu, Schruijer & Boroș (2007)	Experimental design	The quality of interactions	Moderates the relationship between average individual complexity and GCC, by turning it from a non-significant positive relationship in a significantly positive relationship.

Wong, Ormiston, Tetlock (2011)	Mixed design	Level of firm's centralization	Moderates the relationship between GCC and corporate social performance in such a way that companies lead by teams with low GCC have higher levels of corporate social performance (*i.e.*, satisfying the needs of multiple stakeholders) when a decentralized decision-making system is put in place, whereas for firms lead by management teams with high GCC the degree of decentralization is not influential.
Curșeu, Schruijer & Boroș (2012)	Experimental design	Membership change	Moderates the relationship between the presence/absence of deviants and GCC, in such a way that, groups that experience minority dissent have a higher GCC when the dissenter leaves the group as compared to the groups whereby the dissenter continues to stay
Curșeu & Schruijer (2012)	Experimental design	Established vs ad hoc groups	Moderates the relationship between normative interventions and GCC in such a way that GCC increases in groups that worked than in ad hoc groups.
Curșeu & Sari (2015)	Experimental design	Gender variety	Moderates the relationship between power disparity and GCC, in such a way that the relationship between power disparity and GCC increases, when the group is heterogeneous with respect to gender, while in gender homogenous groups power disparity is a negative predictor of GCC
Gruenfeld & Preston, (2000)	Qualitative design	The type of majority/minority (offensive/deffensive)	Moderates the relation between minority/majority and the cognitive complexity of the decision taken by them in such a way that the majority members who argued to uphold the precedent had a higher significant level of GCC, comparing to the offensive majority (*i.e.*, majorities who overturn the status-quo) or defensive minority members
Curșeu, Schruijer & Fodor (2017)	Experimental design	Social acceptance	Moderates the relationship between minority dissent and GCCin such a way that minority members are more likely to express their incongruent views, eliciting a greater GCC, when the group climate is an open one.
Curșeu & Pluut, (2018)	Experimental design	Prior knowledge base	Moderates the relationship between external information search and GCC in such a way that the benefits of information search are stronger in groups that have a richer prior- knowledge base
Hojbota et al. (2020)	Experimental design	Normative interventions (presence vs. absence of normative prescriptions)	Moderates the relationship between membership change and GCC in such a way that groups in which the most active member was excluded, but received normative interventions, had a cognitive gain during the second task compared to groups with the same membership condition, but that did not received normative interventions, which had a cognitive declaine during the second task.

We contribute to the literature by writing the first integrative review on GCC in which we integrate the relevant literature that was developed over time. The element of originality of this paper is that we analyzed GCC by using two different frameworks. First, we have used the I-M-O-I model (Ilgen *et al.*, 2005) in order to bring a clear image about the antecedents and consequences of GCC which were investigated until now. Second, we used the emergence approach (Kozlowski and Klein, 2000; Kozlowski and Chao, 2013), specifically, the composition/compilation framework to further clarify the conceptual underpinning of GCC. In particular, we have organized the papers considering these two different approaches on the emergence of GCC: GCC was conceptualized either as a similar or shared characteristic within group members (composition), either, as a combination of heterogeneous characteristics which comprise to yield a group-level property (compilation). Depending on the approach used by researchers (composition/compilation) on emergence we made a brief summary for the different type of measurers for every framework.

Our paper brings a clearly structure and broad image regarding how GCC can be influenced and the impact of GCC on group outcomes, especially group performance. Thus, through our conceptual review, we offer an easy and faster way for HR personnel or managers to implement programs which foster the development of GCC and to modify environments, group composition, members' roles and other antecedents and moderators which can impair or enhance GCC and then, other relevant group outcomes.

We could further investigate antecedents and consequences of GCC that were not explored until now, or the impact of moderators of the relation between antecedents that were already explored in relation to GCC. Also, we could investigate the impact of certain moderators of the relation between GCC and its outcomes. Furthermore, research could explore diverse mechanisms that explain the relation between GCC and outcomes, or between antecedents and GCC.

In addition, our review points out the relevance of the metric used to evaluate GCC. For instance, in the case of using cognitive mapping as a tool to extract a metric of GCC, authors should not only capture the complexity of a cognitive structure, but we should add to the measure of GCC, the level of accuracy of the content. Such an approach was used in previous studies (Curseu *et al.*, 2010) and the correlation between GCC and accuracy is positive and significant, yet the two dimensions should be considered separately when discussing the characteristics of the emergent group-level cognitive structures.

CHAPTER 3: COMMUNICATION AND GROUP COGNITIVE COMPLEXITY

This chapter explores the effects of group size, group composition, and group argument frequency on group cognitive complexity (GCC). We evaluated a sample of 509 students organized into 106 groups who participated in a group cognitive mapping activity. As hypothesized, we found that group argumentation has an inverted U-shaped association with GCC. Group member familiarity did not moderate this relationship. We also found that task-related arguments mediate the relationships between group size and gender diversity on one hand, and GCC, on the other. Moreover, we found that optimal group-level cognitive benefits were observed in group discussions in which the ratio between task-related and nontask-related group arguments was 3 to 1. The discussion focuses on the practical and theoretical implications of these findings.

In this study, we argued that the relationship between the number of group arguments used during group debates and GCC has an inverted U shape (H1), and it is moderated by team familiarity in such a way that familiar teams will achieve an optimum level of both differentiation and integration faster than unfamiliar teams (H2). Moreover, we expected that the number of group arguments used during debates mediates the curvilinear association between group size and GCC (H3) and between gender diversity and GCC (H4).

Our results are in line with previous studies (e.g., Curşeu et al., 2012; Curşeu et al., 2007; Grand et al., 2016; Meslec & Curşeu, 2015) emphasizing the critical role of communication for the emergence of group cognition. However, we also answer the call for more research into the TMGT effect in psychology (Grant & Schwartz, 2011) and management (Busse et al., 2016; Pierce & Aguinis, 2013), as ways to extend our understanding of various elements of group dynamics. Specifically, we found that GCC increases as the number of exchanged group arguments increases from low to average, whereas a further increase of the number of TRGAs, from average to high, leads to a decline in GCC. Therefore, the benefits of task-related group communication exceed its costs as the values increase from low to a moderate level (i.e., up to an inflection point), but at higher levels of task-related group communication, the costs exceed the benefits. In a similar fashion, frequency of NTRGAs has a nonlinear association with GCC, in such a way that the negative association between NTRGA and GCC becomes stronger for higher levels of NTRGA.

Communication is, therefore, a key process for the emergence of grouplevel cognitive structures; yet, too many group arguments decrease the integrative complexity of collaborative learning groups. According to our results, the inflection point for the number of TRGAs is around 120 group arguments. Therefore, we can state that at around 120 group arguments per group debate, the relationship between TRGAs and GCC is positive, whereas after 120 group arguments, the relationship becomes negative. This observation is in line with the growing body of empirical evidence suggesting that an optima level of debate is most conducive for team

performance and innovation (Chang, 2017; De Dreu, 2006). We add to these insights, and we show that the emergence of group cognition is one plausible mechanism that explains the nonlinear association between the frequency of group communication and group performance. Further research could directly explore these claims in field studies.

The second hypothesis stating that interpersonal familiarity moderates the inverted U-shaped relationship between TRGAs and GCC was not supported. A plausible explanation for these results could be the way in which we have evaluated familiarity. Our measure was based on self-reports regarding the average time that the groups had spent together in meetings for project completion and, thus, it could be subjected to recollection biases. As a future research direction, we recommend using a more objective measure of interpersonal familiarity. However, previous studies that investigated the impact of familiarity on team performance showed mixed results. Familiarity influences team performance positively (e.g., Gruenfeld et al., 1996; Huckman, Staats, & Upton, 2009), negatively (e.g., Barker et al., 1996), or in a curvilinear way (e.g., Katz, 1982; Sieweke & Zhao, 2015). Further studies could onsider other factors or mechanisms that can explain the role of familiarity in the relationship between task-related group communication and GCC (i.e., the nature of task). Finally, a potential explanation for not finding a moderation effect of familiarity could be the gender-skewed distribution withinb groups. As mentioned earlier, the majority of our respondents are women and 40 groups were composed exclusively of women, whereas the majority of the gender heterogeneous groups had a women majority. As illustrated in previous research, the percentage of women in groups is positively associated with collective intelligence (Woolley, Chabris, Pentland, Hashmi, & Malone, 2010) and with collective emotional intelligence of groups (Curşeu, Pluut, Boroş, & Meslec, 2015). Women's higher social sensitivity explains the positive effect of the percentage of women in groups on their cognitive and affective dynamics. We could, therefore, argue that the high percentage of women in our sample could have shadowed the potential moderation of familiarity. High social sensitivity may, in principle, overrule the potential moderating role of interpersonal familiarity. Future research could disentangle these differential effects.

In addition, the results of the mediation analyses partially confirm the third and fourth hypotheses, indicating that the number of TRGAs shared during group debates mediates the impact of group size (at low and moderate values of group size) and gender diversity (at low and moderate values of gender diversity) on GCC. At high values of both group size and gender diversity, the mediation through TRGAs was not significant. The results suggest that both relationships (between group size and GCC, and between gender diversity and GCC) could be explained by other mechanisms besides the frequency of TRGAs. As a further research direction, one could investigate what other mechanism can mediate the relationship between

group size and GCC. The literature to date (Curşeu & Pluut, 2013; Curşeu et al., 2007) has shown that gender diversity (conceptualized as gender variety) has a small positive impact on GCC. We contribute to the literature by showing that the relationship between gender diversity and GCC is mediated by the number of group arguments shared during debates. Considering that the curvilinear relationship between gender diversity and GCC was only partially mediated by the number of TRGAs, we can conclude that, besides TRGAs, there are other mechanisms that could explain the relationship. Therefore, another research direction could be to investigate those mechanisms. A limitation of the current study is the sample used (sample of students); therefore, the results should be generalized with caution, especially because the gender distribution is strongly skewed toward women. A second limitation of our study is the index used to measure familiarity that was self-report and also prone to memory biases because we asked members to recall the average time spent together in a meeting for the project achievement task. Also, the same measure excluded online group meetings, and this could have biased our evaluation of team familiarity. A third limitation refers to the cognitive mapping task and the formula used to compute GCC, as these are boundary conditions of our study. For example, while coding the types of relations, we have assigned equal weights to all observed relations, as based on the initial taxonomy (Gómez et al., 2000), no such weights were discussed and introducing it in our coding procedure would have been rather arbitrary. Then, we have used an integrative score for GCC that reflects the relative differentiation and integration per concept used in the cognitive map; therefore, it is a global indicator of integrative complexity. Future research could explore using different tasks and different coding procedures for the differentiation and integration and separate these collective cognitive processes in time. One could imagine a design in which groups first engage in collective brainstorming and in the coding of ideas, different idea generation categories receive different weights depending on their sample frequency (Lucas, van der Wijst, Curşeu, & Looman, 2013), and then, the groups engage in integration as a separate task. Such a task separation could disentangle the differentiation and integration processes and shed more light on the role of communication processes in shaping cognitive differentiation and integration in groups. Finally, another limitation of the current study was the use of single coders to capture the frequency of communication events. Ideally, we should have used two coders for each group, blinded to the hypotheses of the study and we should have videotaped the cognitive mapping sessions for further reference and analysis. The fact that we have carried out this study as part of the regular curricular activities made these ideal choices rather impractical.

The present findings have important practical implications for designing effective collaborative learning groups. Being aware of the relevance of group communication processes, educators using collaborative learning groups and consultants can explore and implement

interventions that have the potential to prevent the negative effects of TRGAs and to increase the beneficial ones. As our results show, an optimal level of task-related group communication during the cognitive mapping task has between 100 and 120 group arguments that can be effectively integrated. In the sample used in our research, cognitive convergence (Ervin et al., 2017; Staggs et al., 2018) seems to be optimal at this number of group arguments. Student groups could be trained to optimize their group discussions by striving for a number of group arguments that fits this range. Moreover, our additional exploratory analyses have identified that the optimal balance between TRGA and NTRGA in groups is when TRGAs account for 75% of the group arguments. Therefore, the optimal ratio of TRGAs and NTRGAs identified in our analyses is 3 to 1, in other words, for each non-task related argument, groups have to share and discuss 3 TRGAs. As we have argued in our theoretical framework, NTRGA is important for socialization and securing a pleasant work atmosphere in groups, yet the incidence of NTRGA should not exceed 25% of the arguments discussed during the debates. Group trainings could emphasize the important role of NTRGAs as well as the fact that student groups should strive for an optimal balance between TRGA and NTRGA.

Our study answers the recent call for more exploration of the non-linear association between communication frequency and group outcomes (Marlow et al., 2018) and provides support for a TMGT effect of TRGAs on the complexity of emergent group cognition. Our results reveal the need to explore distinct mechanisms that explain the link between group communication, on the one hand, and integrative cognitive complexity (Driver & Streufert, 1969; Gruenfeld & Hollingshead, 1993; Gruenfeld et al., 1996) and cognitive convergence (Ervin et al., 2017; Staggs et al., 2018). In line with the emergent view on group cognition (Curşeu, 2006; Kozlowski et al., 2016), cognitive emergence requires differentiation in both, cognitive terms (Curşeu et al., 2007; Grand et al., 2016), as well as well as in the structure of social interactions (Curşeu et al., 2012). In other words, group members have to actively share diversified information to generate a significant group knowledge pool (Grand et al., 2016) that will ultimately generate group level knowledge structures through cognitive convergence. When the number of group arguments shared during debates is too high, groups may experience significant cognitive load (Kirschner et al., 2009) that prevents them from effectively integrating the knowledge pooled via group discussions (Grand et al., 2016). Our results therefore point to the relevance of exploring group communication using a toomuch- of-a-good thing framework. Field and experimental studies could tackle the mechanisms that explain the role of communication for cognitive differentiation and integration, treated as separate cognitive processes. Moreover, as already indicated by Grand and collaborators (2016), computational studies could further explore the interplay between differentiation and

integration in groups and shed more light on how differential mechanisms associated with too little or too much communication impact on emergent group cognition.

CHAPTER 4: GROUP CREATIVITY AND GROUP COGNITIVE COMPLEXITY: AN EXPLLORATORY ANALYSIS USING IDEATION FLUENCY AND A COGNITIVE MAPPING TASK

As research on group cognition flourished during the last decades, various issues emerged with respect to the evaluation of emergent cognition in groups. First, various tasks were used to evaluate emergent group-level cognitive structures including Q-sort methodology (Wong et al., 2011), discourse or text analysis (Gruenfeld & Hollingshead, 1993; Gruenfeld, 1995) as well as group cognitive mapping (Curseu et al., 2007). All these different procedures use global indicators of integrative complexity that include, explicitly or implicitly indices of knowledge differentiation and knowledge integration (Suedfeld & Tetlock, 2014). As the two dimensions are essential for evaluating emergent group-level cognitive structures, more clarity is needed as to which one is more prevalent in the various indices used in group cognition research.

Second, literature on emergent cognition lacks integration with other streams of research that explores group level cognitive constructs, like group creativity for example. Group creativity is defined as the originality, novelty and usefulness of the ideas collectively generated by group members in the group processing space (Nijstad et al., 2006). Therefore, group creativity reflects group-level information processing that can be described mostly in terms of knowledge differentiation as the typical creativity indices focus on fluency (number of different ideas generated by the group) and flexibility (the diversity of conceptual categories in which the ideas generated by groups fit in) (Runco & Chand, 1995). We can therefore use the group creativity quotient as a knowledge differentiation benchmark for various indices of group cognitive complexity.

Third, various measures of emergent group level cognitive structures lack clear grounding as true indicators of emergent group level phenomena, rather than simple aggregations of individual cognitions. Previous literature on emergent group cognition has stated that the emergent group-level cognitive structures should reflect: (1) the group as a whole, (2) agreement reached through communication, (3) discriminant validity of the construct and (4) group interaction processes (Curseu et al., 2007; Bar-Tal, 1990). In other words, although various measures are supposed to capture group-level phenomena that emerge from the combination of individual cognition through social interactions, it is unclear whether they truly reflect such emergent phenomena, whether they are the result of aggregation (nominal group

technique) or they are simply the result of a single individual member of the group producing the evaluated output (for example a text representing a group statement or report).

We build on previous research that used cognitive maps to capture the emergent cognitive complexity in groups and explore the association between group creativity (cognitive differentiation) and various indices of cognitive complexity. Building on previous research (Coman et al., 2019) we set out to predict different indicators of GCC by using a creativity index computed by using Schnider's formula for a group idea generation task. Moreover, we set out to replicate the results reported in previous research concerning the relation between group communication and group cognitive complexity. In a recent study, Coman et al (2019) showed that the frequency of task-related group arguments has a non-linear association (as inverted U shape) with relative group cognitive complexity. We therefore attempt to replicate this particular result in our study, while accounting for group creativity as an indicator of knowledge differentiation in emergent group cognition.

Our study has several contributions to the literature on emergent group cognition. First we aim to explore the interdependencies between group creativity and group cognitive complexity in subsequent tasks in an attempt to disentangle the dominance of knowledge differentiation and integration processes in different indicators of group cognitive complexity. Such an attempt would contribute to the literature on emergent group cognition by showing that groups as socio-cognitive systems (Curseu, 2006; Hinsz, 2015; Hinsz et al., 1997) exhibit stable information processing tendencies underlying cognitive performance in different tasks. Second, we aim to provide further empirical evidence for the validity of group cognitive mapping as a method for evaluating emergent, group level cognition. Our study directly explores the role of interpersonal communication processes in groups (frequency of task and non-task related group arguments) on various measures of group cognitive complexity.

One of the methods of measuring GCC is the cognitive mapping technique (Curșeu et al., 2010) in which group members are asked to collectively organize either a number of key concepts provided by the researcher or elicited by the group members themselves and to specify the nature of the relations among these concepts (i.e., causal, association, equivalence, topological, structural, chronological and hierarchical) (Gomez et al., 2000). The final maps are then assessed by using three indicators: the total number of connections established between the concepts, the number of distinct relations established between the concepts and the total number of concepts used in the map.

Cognitive differentiation and integration are often combined in various measures of GCC and, as such, GCC is an index of integrative complexity (Gruenfeld & Hollingshead, 1993). It is important however to understand the interplay of cognitive differentiation and

integration in the various measures of GCC as, for example, cognitive differentiation was argued to be more influential for the absolute rather than for the relative GCC. We should also note that there is a partial overlap between GCC and creativity, when creativity is operationalized as ideational fluency and flexibility. Fluency refers to the number of ideas or solutions produced by an individual or a group, while flexibility reflects the number of distinct categories in which the ideas or solutions fall (Runco & Chand, 1995). At the same time, the more arguments a group brings in a discussion, the greater the fluency index will be. Thus, there is an overlap between fluency and the index of differentiation of GCC (*i. e.*, the number of ideas or concepts that are used in the cognitive map).

Modern organizations heavily rely on teams for creative tasks that often require successful integration of various ideas, viewpoints, and individual opinions in complex collective knowledge structures (or group cognition). Although the link between group creativity and group cognition is (Aggarwal & Woolley, 2019), literature to date did not extensively explore the association between team creativity and the structure of the emergent group level cognitive structures (as captured, for example, in the cognitive maps). Our study presents an initial empirical investigation of the association between different structural indicators of collective cognition and team creativity. More specifically, our paper explored the relationship between the quotient of creativity and various indices of GCC, reflecting cognitive differentiation and integration. Our results supported our initial expectations that group creativity negatively predicts relative complexity, an index of integrative complexity(H1), that it positively predicts absolute cognitive complexity, an index in which cognitive differentiation dominates (H2), and it negatively predicts both indices of cognitive density reflecting cognitive integration (H3). Our results show therefore that group creativity as an index of cognitive differentiation is indeed positively related to indices that reflect cognitive differentiation in cognitive maps and negatively related to indices that reflect cognitive integration in cognitive maps. By obtaining significant results between different indices that measure differentiation (i.e., creativity and various indices of GCC) we point out that groups have similar performances at measures that underlie the process of cognitive differentiation. At the same time, our results show that the cognitive mapping technique is a valid instrument for measuring the cognitive differentiation and integration in emergent collective cognitive structures.

Moreover, we have explored the relationship between frequency of communication and the different measures of GCC. In line with previous research (Coman et al., 2019), we found a significant inverted U shape association between task – related group arguments and relative GCC. When the level of task- related arguments increases from low to moderate , relative GCC increases too, but when the level of task – related group arguments

increases further from average to a higher level, relative GCC decreases. Thus, the frequency of communication has its benefits from low up to average levels, while the communication costs exceed its benefits at higher levels of group arguments . This pattern of results is in line with signal detection explanation for the association between group creativity and group cognition put forward by Aggarwal and Woolley (2019), namely that diversity in the ideas expressed signals for integration, yet when the number of group arguments is too high, cognitive integration is not efficient anymore.

In addition, and in line with the signal detection framework (Aggarwal & Wolley, 2019) we show that task – related group arguments positively predict absolute GCC, which is an index of group cognitive complexity in which differentiation is more prevalent ($\beta = .48$, $p < .001$) , and it positively predicts the first index of cognitive map density ($\beta = .30$, $p < .01$), which is an index of integration. A first conclusion concerning the frequency of group arguments is that the number of arguments may simply reflect both cognitive differentiation and integration processes . T herefore, researchers using the frequency of group arguments should embark on a thematic analysis in order to clearly disentangle whether the interpersonal communication in groups generates cognitive differentiation or integration.

Finally, the first index of cognitive map density is negatively and marginally predicted by non-task related group arguments ($\beta = -.20$, $p = .09$), while in the second model the effect becomes significant ($\beta = -.40$, $p = .02$). Therefore, non-task related communication is detrimental for cognitive integration in groups and this negative effect is likely to illustrate the distracting effect of non-task related communication. Cognitive integration requires that group members explore all possible relations established among various concepts included in the map and engaging i n non-task related communication will reduce the attention the group members devote to the task at hand. Ultimately, this is reflected in the lower density of the conceptual maps they elaborate . Non-task related group arguments also have a negative impact on the second index of cognitive map density ($\beta = -.36$, $p = .03$), while the non-linear association is positive and significant ($\beta = .33$ $p = .02$) and illustrates an attenuating negative association between the non-related group arguments and cognitive integration. Such a relationship shows that as the number of non-task related group arguments increase from low to average, the cognitive integration is drastically impaired, while as the frequency of non-task related arguments further increases from average to high, the decrease in cognitive integration is less accentuated. Our results point to the fact that the non-task related communication impairs cognitive integration rather than differentiation in groups.

Our study has important implications as it embarked in an attempt to replicate extant findings. In psychology, replication is an important, yet a very painstaking process (Meslec et al., 2020). In short, the study partially replicates the results of Coman et al. (2019)

regarding the relationship between the frequency of task-related group arguments and relative GCC. On the other hand, it failed to replicate the non-linear association between non-task related group arguments and relative GCC, as well as the mediating role of task-related communication in the relation between group size and relative GCC. This failure to replicate the results reported in Coman et al (2019) may be due to the different cognitive mapping task used in the current study. Coman et al (2019) fixed the number of concepts to be used in the map to 20, while in the current study the number of concepts used varied (depending on the concepts generated in the brainstorming task) between 5 and 49 with an average of 13 (SD=6.84), therefore this could be a boundary condition of the current study. This difference in the task was necessary to capture the cognitive differentiation and integration processes in the creative and cognitive mapping tasks .

In addition, we explored the relationship between communication frequency and other indices of GCC, such as absolute cognitive GCC and map density. Furthermore, we contribute to the emergent cognitive literature by pointing out that groups as socio-cognitive systems (Curseu, 2006) exhibit stable information processing tendencies underlying cognitive performance in different tasks which involve the processes of cognitive differentiation and integration as key elements. As a practical implication we illustrate the validity of cognitive mapping technique in measuring the emergence of GCC. Further it could be used in other studies which aim to capture group emergent differentiation and integration.

CHAPTER 5: COLLECTIVE CREATIVITY IN A POLITICAL COMMUNICATION CONTEXT

Group collaboration is an important means of creating new ideas or products. Research and development groups in various industries develop new technological solutions to current societal problems, entrepreneurial groups create new products or services (i.e., robots that replace people in routine tasks, digital devices for helping people with disabilities or people with different disorders, such as Alzheimer's), and many of the most impressive artistic acts are also the product of groups. For instance, there are groups of actors who improvise a theatre scene based on a proverb suggested by the audience (Sawyer & DeZutter, 2009), or groups of jazz improvisers (Sawyer, 1992). Thus, creativity is a dynamic sociocultural process, that requires the combination and integration of inputs from multiple individuals. In order to create meaningful ideas or products, the individuals use specific cues available in the environment and take into account the feedback of a specific audience (Glăveanu, 2013). In other words, the perception of audience plays a key role in deciding whether an idea or product has a creative value.

Information perception depends on different factors, such as: the way in which a message is formulated, personal factors (i.e., need for cognition), environment, the popularity or expertise of the person who conveys the information (Cacioppo et al., 1984). In our paper we investigate the relationship between the type of humorous messages used in public communication (aggressive vs. affiliative humor) and perceived collective creativity in a political context. In extension, we also analyse the role of specific moderators (i.e. gender, need for cognition) in the relationship between the type of humorous messages and perceived collective creativity. This study is among the first attempts to explore the role of humor types on the perceived (collective) creativity of messages used to express public opinions.

In this study we argued that messages containing affiliative humor are perceived as more creative than messages containing aggressive humor(H1) and that this relationship is moderated by gender (H2) and NFC (H3).

The results provide empirical support for all three hypotheses. Specifically, we found that messages that contain affiliative humor were perceived as more creative than messages that contain aggressive humor. Our results are in line with previous research which shows that affiliative humor has a positive impact on the affective state comparing to aggressive humor (Samson & Gross, 2012; Cann, et al., 2016). Moreover, people tend to prefer strangers that use an affiliative humor (Cann et. al., 2016) and the individuals with a good sense of humor are considered as being more creative (O'Quin & Derks, 1997).

The second hypothesis stating that gender moderates the effect of humor on perceived creativity in such a way that aggressive-affiliative creativity gap is higher for women than for men, was also confirmed. this is in line with previous studies which show that men tend to use more aggressive humor than women (Martin et al., 2003) and use communication with different purposes (Mason, 1994; Wood, 1996).

The third hypothesis stated that NFC moderates the effect of humor on perceived creativity in such a way that the aggressive-affiliative creativity gap difference is higher for people scoring high rather than low in NFC and it was also supported. Our result is congruent with the ELM model (Petty & Cacciopo,1984) which states that a subtler content (i.e. such as messages that contain affiliative humor) needs a greater degree of elaboration comparing with a less subtle and basic content (i.e. such as messages that contain aggressive humor).

As an additional result we found that age also moderates the relationship between the type of humor contained in the messages and the perceived collective creativity. Thus, older people evaluate message creativity significantly lower than younger participants. A possible explanation could be that the older generation has more collectivistic values than the younger

generation. They appreciate more social acceptance and normative conformity (Brewer & Chen, 2007), while younger generation, has more individualistic values and encourages more the novelty, uniqueness and self-initiative (Jones & Davis, 2000).

A limitation of the current study is that we didn't consider that humor could be influenced by cultural factors (*i.e.* the degree of individualism/collectivism, therefore a *future research direction* could be to explore the relationship between humor and perceived collective creativity in different cultures.

This study is among the first attempts to explore the role of humor types on the perceived (collective) creativity of messages used to express public opinions.

CHAPTER 6: CONCLUSIONS

We live in an information age in which groups must perform more and more cognitive tasks. Therefore, we can say that groups are key cognitive agents in today's society. In order to shed a new light on group cognition, our aim was to investigate the emergence of collective knowledge in a social context. Specifically, in the first place, we have organized the relevant literature on GCC in a conceptual review showing the evolution of research on GCC since 1955 till now. The review also explores the antecedent and consequences of GCC that are grouped according to composition/compilation framework (Mathiew et al., 2000). This is one important contribution of our thesis, considering that the in the literature were no reviews on GCC. Our review helps researchers to build an idea about the key studies on GCC and integrate them in a meaningful way.

Since, groups are socio-cognitive systems (Gruenfeld & Hollingshead, 1993) in which information processing depends on the interplay among group members' cognition and on the social interactions between them (Curşeu, Schalk &Schruijer, 2010), our second aim was to investigate the relationship between communication frequency and GCC. We found that task related arguments are beneficial when they increase from low to moderate level, but, when they increase to a higher level GCC, decreases (the inflection point is 120 task related arguments). A similar invested U-shaped relationship was found between non-task related arguments and GCC. Task related arguments partially mediate the non-linear relationship between gender diversity and GCC and between group size and GCC. The number of task related arguments mediets the impact of gender diversity, at low and moderate values of gender diversity on GCC, and mediates the impact of group size, at low and moderate values of group size on GCC. We contribute to the literature by exploring the nonlinear relation between communication

frequency and group outcomes. Our results can be used to create collaborative learning groups and to implement interventions that mitigate the negative effects of task related arguments. The present findings also reveal that we need to explore other mechanisms which could explain the nonlinear association between group size and GCC and the nonlinear association between gender diversity and GCC.

Our third aim was to explore the association between group creativity (seen as differentiation) and various indices of GCC. Our study has important theoretical implications because it partially replicates the results of Coman et al. (2019) regarding the relationship between the frequency of task-related group arguments and relative GCC. Also, our results supported out initial expectations that group creativity negatively predicts relative complexity, an index of integrative complexity, positively predicts absolute cognitive complexity, an index in which cognitive differentiation dominates, and negatively predicts both indices of cognitive density, both reflecting cognitive integrations. We also found that task – related group arguments positively predict absolute GCC that is an index of group cognitive complexity in which differentiation is more prevalent and positively predicts the first index of cognitive map density, which is an index of integration. An important practical implication of our study is that we illustrate the validity of cognitive mapping technique in evaluating the emergence of GCC. Further it could be used in other studies in order to capture group emergent differentiation and integration.

Moreover, our fourth aim was to explore perceived (collective) creativity in a political context. Specifically, we have investigated the relationship between the type of humorous messages employed in a political protest and perceived creativity of that messages. Our hypotheses were supported. Thus, we found that messages that contain affiliative humor were perceived as more creative than messages that contain aggressive humor. The results also show that gender moderates the effect of humor on perceived creativity in such a way that aggressive-affiliative creativity gap is higher for women than for men. Another moderator in the relationship between the type of humor and perceived creativity is need for cognition. Need for cognition moderates the effect of humor on perceived creativity in such a way that the aggressive-affiliative creativity gap difference is higher for people scoring high rather than low in need for cognition and it was also supported. As an additional result we found that age also moderates the relationship between the type of humor contained in the messages and the perceived collective creativity. Thus, older people evaluate message creativity significantly lower than younger participants. Our study ads an important value to the literature by among

the first attempts to explore the role of humor types on the perceived (collective) creativity of messages used to express public opinions.

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