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From cognition to action: A psychological investigation of action regulation in complex and uncertain social systems

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Résumé

Cette thèse présente une revue des réflexions récentes et plus traditionnelles provenant de la théorie des systèmes, de la créativité en emploi, des théories d'organisation du travail et de la motivation afin de proposer une perspective psychologique de la régulation des actions des individus au sein d'environnements de travail complexes et incertains. Des composantes de la Théorie de la Régulation de l'Action (Frese & Zapf, 1994) ainsi que de la Théorie de l'Auto-Détermination (Deci & Ryan, 2000) sont mises en relation afin d'évaluer un modèle définissant certains schémas cognitifs clés associés aux tâches individuelles et collectives en emploi. Nous proposons que ces schémas cognitifs, organisés de manière hiérarchique, jouent un rôle central dans la régulation d'une action efficace au sein d'un système social adaptatif. Nos mesures de ces schémas cognitifs sont basées sur des échelles de mesure proposées dans le cadre des recherches sur l'ambiguïté de rôle (eg. Sawyer, 1992; Breaugh & Colihan, 1994) et sont mis en relation avec des mesures de satisfaction des besoins psychologiques (Van den Broeck, Vansteenkiste, De Witte, Soenens & Lens, 2009) et du bien-être psychologique (Goldberg, 1972). Des données provenant de 153 employés à temps plein d'une compagnie de jeu vidéo ont été récoltées à travers deux temps de mesure. Les résultats révèlent que différents types de schémas cognitifs associés aux tâches individuelles et collectives sont liés à la satisfaction de différents types de besoin psychologiques et que ces derniers sont eux-mêmes liés au bien-être psychologique. Les résultats supportent également l'hypothèse d'une organisation hiérarchique des schémas cognitifs sur la base de leur niveau d'abstraction et de leur proximité avec l'exécution concrète de l'action. Ces résultats permettent de fournir une explication initiale au processus par lequel les différents types de schémas cognitifs développés en emplois et influencé par l'environnement de travail sont associés à l'attitude des employés et à leur

bien-être psychologique. Les implications pratiques et théoriques pour la motivation, l'apprentissage, l'habilitation, le bien-être psychologique et l'organisation du travail dans les environnements de travail complexes et incertains sont discutés.

Mots-clés : Régulation de l'action, besoins psychologiques, ambiguïté de rôle, théorie de l'autodétermination, bien-être psychologique, créativité en emploi, incertitude, motivation, organisation du travail.

Abstract

This thesis review recent and more traditional thinking of the system theory, creativity in the workplace, job design and motivation theories to propose a psychological perspective to the regulation of individual action in complex and uncertain work environments. Components from the Action Regulation Theory (Frese & Zapf, 1994) and the Self-Determination Theory (Deci & Ryan, 2000) are put in relation in order to test a model of key cognitive schemas related to the accomplishment of collective and individual tasks in the workplace. We propose that these hierarchically organized cognitive schemas are central to efficient action regulation in adaptive social systems. Our measures of these cognitive schemas are based on scales proposed in literature on role ambiguity (eg. Sawyer, 1992; Breaugh & Colihan, 1994) and are put in relation with measures of satisfaction of psychological needs (Van den Broeck, Vansteenkiste, De Witte, Soenens & Lens, 2009) and psychological well-being (Goldberg, 1972). Data from 153 full-time employees from a video game company were collected across 2 time periods. Results indicate that different types of cognitive schemas associated with the individual and collective goals are related to different types of psychological need satisfaction and that psychological need satisfaction is related to psychological well-being. Our results also support the hypothesis of a hierarchical organization of these cognitive schemas based on their level of abstractness or proximity with concrete action. These results begin to explain the process through which different types of cognitive schemas developed in, and influenced by, the working environment relate to employee attitudes and well-being. Theoretical and practical implications for motivation, learning, empowerment, psychological well-being and job design in complex and uncertain work environment are discussed.

Keywords: Action regulation, psychological needs, role ambiguity, self-determination theory, psychological well-being, workplace creativity, uncertainty, motivation, job design.

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List of abbreviations

$\chi 2$ M	Model chi-square
ANOVA	Analysis of variance
AS	Autonomy Support
ART	Action Regulation Theory
CAS	Complex Adaptative Systems
CFI	Comparative fit index
NC	Normed chi-square
NFI	Normed fit index
NNFI	Non-normed fit index
RMSEA	Root mean square error of approximation
SD	Standard deviation
SDT	Self-Determination Theory
SRMR	Standardized root mean square residual

Foreword

"The most important, and indeed the truly unique, contribution of management in the 20th century was the fifty-fold increase in the productivity of the manual worker in manufacturing.

The most important contribution management needs to make in the 21st century is similarly to increase the productivity of knowledge work and knowledge workers.

The most valuable asset of a 20th-century company was its production equipment.

The most valuable asset of a 21st-century institution (whether business or nonbusiness) will be its knowledge workers and their productivity."

- Drucker, 1999, p.79

"We're in a knowledge economy, but our managerial and governance systems are stuck in the Industrial Era. It's time for a whole new model."

- Manville & Ober, 2003, Jan., p. 48

Introduction

I. The work context in the 21st century

August 2005, Businessweek announces the coming of the creative economy. A new economy where the competitive advantage tied to knowledge would be less and less important on the global market. This new dynamic would mark the beginning of a creative era where innovation would become the new competitive ground upon which occidental companies can differentiate themselves. « Better recipe, not just more cooking », a key formula proposed by the economist Paul Romer, synthesizes the new opportunities and challenges companies currently face. Romer (Romer, 1990) proposes that the competitive advantage will rely more on the capacity to differentiate on the market than on productivity. Subsequently, Richard Florida (Florida, 2005) announces the reign of a new class of creative workers able to formulate and solve new and complex problems and whose place in today's organizations is expected to become more and more central. Thereby, organizations that desire to take on innovation and creativity have to manage the tension between exploitation and exploration. This requires that they put in place working environments that promote the exploration of new business avenues as well as the ability to deploy, through efficient structures and processes, growth across time (March, 1991).

The entry into the knowledge era and its emphasis on innovation and adaptation to a fast paced environment brought to organizational studies a whole new set of questions(Barkema, Baum, & Mannix, 2002). The impact of these changes has been important on a variety of research domains from organizational leadership (Boal & Schultz, 2007; Mumford, Zaccaro, Harding, Jacobs, & Fleishman, 2000; Schneider & Somers, 2006; Uhl Bien & Marion, 2009) to job design (Drach-Zahavy & Freund, 2007; Winfried Hacker, 2003; Oldham & Hackman, 2010; Sinha & Van de Ven, 2005) and organizational theories (Adler, Goldoftas, & Levine, 1999; Anderson, 1999; Anderson, Meyer, Eisenhardt,

Carley, & Pettigrew, 1999; Brown & Eisenhardt, 1997; Drazin & Sandelands, 1992; Levinthal & Warglien, 1999; Morgeson & Hofmann, 1999). In most of these cases, authors recognize that to survive in a fast paced and changing environment, organizations require creativity and flexibility to face a growingly uncertain environment. As a result, a rising pressure seems to be applied to change the way organizational leaders structure the work environments to coordinate the employee's efforts around interdependent and collective tasks in a flexible way in order to answer the new requirements of knowledge work (Drucker, 1999; Senge, 1990; Xu & Rickards, 2007).

These changes are manifested in the growing conception of process oriented leadership (Uhl Bien, Marion, & McKelvey, 2007) and the pragmatic managerial recognition that empowerment is essential for knowledge work (Wall, Cordery, & Clegg, 2002; Wilkinson, 1998). These changes are also manifested in the job design propositions that work is becoming much more social and requires flexibility encompassed in concepts such as job crafting (Berg, Wrzesniewski, & Dutton, 2010; Wrzesniewski & Dutton, 2001) and self-management(Rousseau & Aubé, 2010; Tata & Prasad, 2004). The major idea resulting from this requestionning of some of the most traditional ways of thinking about the organization seems to be that it is less and less sufficient to explain the relation between the employee and the organization in the formal tradition of the rational and mechanistic conceptualisation of the organization. The forming of an alternative paradigm, taking roots in the organic representation of the organization, is taking form around the new concepts of improvisation, emergence and self-organizing processes. These concepts capture an underlying representation of the organization as adaptive, social, constructivist and multilevel.

Parallel to this requestionning of the way we organize work in the new economy, “the revolutionary changes occurring in today’s workplace have far outpaced our understanding of their implications for work life quality and safety and health on the job” (Sauter et al., 2002, p.vi). These changes require complementing our traditional conception of workplace health factors (physical, chemical, injuries, etc.) with modern challenges pertaining to psychosocial factors (Benach, Muntaner, Benavides, Amable, & Jodar, 2002). Indeed, psychological health issues are becoming one of the most prevalent work-related health problems faced by modern organizations (Bond, Galinsky, & Swanberg, 1997; Merllié & Paoli, 2001). The high prevalence of stress in modern workplace is associated with an increase of mental work and emerging working conditions impacting the psychological load of employees, such as information-intensive work, quick learning, high time pressure or continuous change in the organization of work (Rantanen, 1999). Also, numerous researches have demonstrated the consequences a negative work environment can have on psychological health of the employees (Foucher, Savoie, & Brunet, 2003). As such, stress issues in the workplace do not only have an economic impact, but should also be examined with a systemic perspective by investigating their outcome at the psychological, physical, behavioural and organizational levels (Kelloway & Day, 2005). We thus concur with Kalimo (Kalimo, 1999), that in the knowledge era, “the critical factor of success in work is shifting from machines to the human mind” and we propose that the organizational design challenges faced by organizations of the knowledge economy can’t be understood in isolation to a conception of psychological health at work for these particular work environments.

II. The research question

For every complex problem there is an answer that is clear, simple, and wrong.

—H. L. Mencken

The challenge associated with describing the inner functioning of an organic conception of the organization lies in the identification and description of the social mechanisms regulating and orienting employees' behaviours in these organizational systems. Our objective will be, first, to position our research question by reviewing organizational theories that propose channels through which the organizational environment can maintain a structured coordination of workers while also preserving high levels of adaptive capacities and flexibility. Our second objective will be to propose a model, at the cognitive level, of the action regulation of workers in uncertain work environments by taking into consideration job designs, psychological health and work motivation literature.

Thus our research question will be: **In a work context that requires collective efforts on complex and uncertain tasks, are there fundamental mental schemas, associated to the working environment, that can facilitate the regulation of workers' actions and how would they relate to the basic psychological needs and psychological well-being of the employees?**

To better position this research question, some important indications need to be addressed. First of all, our research question specifies that we are interested in work contexts that are collectively oriented and that focus on complex and uncertain tasks. This does not imply that the central component of our discussions would not be applicable in other work contexts, but we find that these specific work environments offer unique opportunities to study psychological and organizational questions that have the potential to extend the reach of some of the

theories that we will review. The concepts of creativity and innovation are often referred to as an explanation of the psychological processes at play when employees face complexity and uncertainty in their work context. This is not the avenue we will take in the present research. One way to define creativity and innovation is useful to explain situations in which "individuals attempt to orient themselves to, and take creative action in, situations or events that are complex, ambiguous, and ill defined" (Drazin et al., 1999, p.287). However, throughout the text, creativity and innovation will refer to a specific characteristic of the work context rather than a psychological construct or phenomenon.

The core ideas of this thesis pertain to the mental schemas associated to the action regulation of individuals. As such, the model empirically tested herein focuses exclusively on the individual level. Morgeson and Hofmann (1999) asserted that individual behavioural acts do not occur in a vacuum but rather are limited by the surrounding context and influenced by situational factors. Thus, considering this point of view requires us to spend an appreciable portion of our theoretical review to position the concept of organizational structure and explain how it can impact one's cognitive schemas. As such, organizational structure will not be conceptualized as a physical element residing outside the individual, but rather as residing in the mental schemas of the agents composing a system (Morgeson and Hofmann, 1999). This fundamental theoretical assumption will play an essential role in positioning the epistemological roots of our approach as well as the rational through which we will position our individual level empirical investigation within the larger macro-level scope of the organization.

More specifically, the first part of our theoretical review focuses primarily on the macro level of the organization. We, first of all, address the question of the organization of work for uncertain and complex tasks. In order to do so, we define the characteristics of unstable and complex work environments and their impacts on the functioning of organizational systems. We will then review different classic and more recent organizational theories in order to come up with a general

understanding of the functioning of organizational systems in these conditions. In doing so, we will focus on the processes by which organizational systems can flexibly impact the behavior of the individuals composing them. In the second part of this theoretical review, we will build upon the principles derived from these systems designed to organize work for uncertain and complex tasks, to deploy a targeted investigation of the psychological processes at the individual level taking place in complex and collective work environments. We will conclude this theoretical review by proposing a model conceptualizing the way people regulate their behaviour in complex and unstable work systems.

Literature review

I. Organizational systems in unstable and complex environments: investigating the social processes orienting and regulating the behaviour of individuals

1. Characteristics of complex and unstable work environments and their impact on organizational systems

Creativity is often presented as a meaningful construct to explain organizational change and innovation at different levels of analysis, from the individual to the collective and from the actual creative behavior to the context in which it is enacted (Ford, 1996; Woodman, Sawyer, & Griffin, 1993). As such, the description of very actual organizational challenges, like fast paced changes, complexity, ambiguity or uncertainty of the work environment, and the proposition that creativity, innovation and adaptation can be an answer to these challenges are highly present in organizational literature (Burke, Stagl, Salas, Pierce, & Kendall, 2006; Hoegl & Parboteeah, 2003; Kazanjian, Drazin, & Glynn, 2000; Kozlowski & Ilgen, 2006; Woodman et al., 1993; Xu & Rickards, 2007). Such an approach takes roots in the perspective that creative and habitual action are competing behavioural options and may hold the key to explain both conformity and flexibility in the work context (Ford, 1996). Researches on creativity in organizational settings have typically adopted a definition of creativity as an outcome that is both novel and appropriate in terms of value and utility (T. M. Amabile, 1988; Ford, 1996; Hennessey & Amabile, 2010; Oldham & Cummings, 1996; Runco, 2004). These researches have made possible the identification of

different individual and contextual levers from which it is possible to influence the level of creativity of individual and collective outputs in work contexts (Amabile, Barsade, Mueller, & Staw, 2005; Amabile, 1996; Camison Zornoza, Lapiedra Alcami, Segarra Cipres, & Boronat Navarro, 2004; Damanpour, 1991; Hulsheger, Anderson, & Salgado, 2009; Shalley, Zhou, & Oldham, 2004; Singh, 1986). However, the main perspective present in organizational literature in regards to conceptualizing creativity in the workplace focuses primarily on creative outcomes (Robert Drazin, Glynn, & Kazanjian, 1999). As such, a focus is put on organizational factors and their direct link to the creative level of the outcome, asking "How do you increase creative outputs in organizations?" (Robert Drazin et al., 1999). Although this outcome perspective of creativity is acknowledging that a creative process is present, this process is often taken for granted and is seldom the focus of research or described. Such a unitary approach to creativity hinders our ability to distinguish between the origins of creative behaviours (as initiated proactively by the individual or required by the situation) and between the different types of problems faced by individuals (Unsworth, 2001). As proposed by Drazin and colleagues (1999, p.287), we will focus our inquiry on "how individuals attempt to orient themselves to, and take creative action in, situations or events that are complex, ambiguous, and ill defined". First of all, such an approach implies that engaging in creative actions may not always lead to an outcome that is novel, useful or creative. Second of all, this approach gives a lot of importance to the characteristics of the situation in which individuals are engaged. Thus, we will not only present creativity literature but we will also review the particularities of situations leading to a creative process and their impact on the organization of work.

Factors influencing the creativity and innovation levels of work teams' outputs can be divided into two categories: Team processes (for ex. Task orientation, vision) as well as input variables in terms of structure (tasks interdependencies) and context (team size and composition diversity) (Hulsheger et al., 2009). In their meta-analysis these authors demonstrated that factors associated with team processes displayed substantial and generalizable relationships with creativity and innovation (ps between 0.4 and 0.5), whereas input variables only showed weak relationships (ps between 0.1 and 0.2). As such, different variables associated with social interactions, such as support for innovation, task orientation, cohesion, and communications (internal and external to the team) have an important impact on creativity and innovation (Hulsheger et al., 2009). Also, the commitment to a clear collective vision encompassing superordinate team goals could influence the way individuals cooperate and, in turn, also influence the level of creativity and innovation (Hulsheger et al., 2009). As such, several studies suggest that in the context of a collective endeavour requiring new modalities of action and novel outcomes, two broad categories of variables are central to team innovation and adaptation: 1) the team processes described as the quality and the particular forms of social interaction and communications amongst the members of the team, and 2) the development of shared mental models taking the form of collective and emergent norms and visionary goals and their resulting impact on the climate of the team and the motivation of its members (Burke et al., 2006; Hulsheger et al., 2009; Marks, Mathieu, & Zaccaro, 2001). Such a motivational perspective to team creativity and adaptation is also central to the psycho-social perspective of creativity. Indeed, numerous researches illustrated the complex dynamic existing between the motivational type developed (intrinsic vs extrinsic) and creativity, as well as the importance of the social environment on the motivational type developed by the

individuals (Amabile, 1996; Hennessey, 2003). More precisely, the motivational dynamics associated with creativity in the work place demonstrated that a) informative feedback, b) promotion of workers' autonomy, and c) the presence of clear overall goals had a positive impact on creativity in the workplace (Hennessey & Amabile, 2010). Together, these researches on creativity and team adaptation give a brief but clear picture of the importance of social processes resulting from the work context, as well as the attitudes and mental models developed at the individual level.

Problems underpinning creative processes are considered qualitatively different from more straight-forward problems for which a predetermined solution exists (Lubart & Mouchiroud, 2003). Those creative problems require that greater variety of cognitive and conative capacities be deployed at the different stages of problem resolution (Lubart & Mouchiroud, 2003). The central characteristic of creative problems is their high level of complexity and the fact that they are ill-defined (Baughman & Mumford, 1995; Mumford, Mobley, Reiter-Palmon, Uhlman, & Doares, 1991; Mumford, Scott, Gaddis, & Strange, 2002; Runco & Dow, 1999). The creative process thus consists in reorganizing and recombining the structure of information (Mumford et al., 1991). It is principally distinguishable by the capacity to build the problem based on new combination of information, as well as the capacity to think outside habitual mindsets (Ford, 1996; Runco, 2004). For this reason, situations requiring a creative process are described as ill-defined and uncertain (Robert Drazin et al., 1999) and as requiring the development of new modalities of action. Creativity is thus associated with a form of flexibility, proactivity and reactive adaptation in the face of environmental change, opportunities, uncertainty and complexity (Runco, 2004).

As mentioned at the entry of this section, a process perspective to creativity put a lot of emphasis on the characteristics of a situation leading to the enactment of creative processes rather than the factors influencing the creativity of the outcome. As such, we then proposed that the central particularity of situations that require creative problem solving is that the underlying task is initially ill-defined, uncertain and requires the objective of the task to be constructed before being solved. As Drucker (1999) states for knowledge work, "the task does not program the worker" and defining what is the task is a challenge in and of itself as compared to the more traditional manual work. This difference is of central importance. As some authors argue, in an uncertain and fast paced environment, individuals cannot rely on the traditional temporal mindset in which individual actions can be controlled by past experience (Bluedorn, 2002; Petranker, 2005; R. Purser & Petranker, 2005; Purser, Bluedorn, & Petranker, 2005). As such, in these situations, the structuration of individual action cannot follow a pre-established action plan operating under Lewin's (1951) conceptualization of learning – unfreeze, change, freeze. An alternative model of learning – freeze, rebalance, unfreeze - (Weick & Quinn, 1999) rather proposes that in highly uncertain context, we should get from a conceptualization of behavioural structure as formally predetermined to a concept of structure as a process that should take place during the course of action (Purser & Petranker, 2005; Purser et al., 2005). Indeed, these authors propose that uncertain contexts, because of their specific characteristics, can lead to a change in the way we model the regulation of individual action and learning. Also, this new perspective of human functioning in uncertain contexts raises questions about the way we model the evolution and change of organizational action at the systemic level. Let's now turn to bodies of literature addressing the way systems can coordinate actions

amongst numerous individuals, particularly in the context of fast paced change in which it is difficult to forecast the future state of the system.

The way organizations face ill-defined, uncertain and complex problems has been the object of research in a wide array of research areas such as project management (Kazanjian et al., 2000), complexity theories applied to organization (Morel & Ramanujam, 1999) and work teams (Burke et al., 2006; Hulsheger et al., 2009). Charles Lindblom's (1959) work on incrementalism consists of an early investigation of the way individuals and systems face uncertain situations. Lindblom proposed that few situations are characterized by clear objectives allowing for a systematic analysis of the various factors underlying decision making. For this reason, Lindblom suggests that decisions should be taken gradually, as new advances are made along the way of execution. Quinn (1978) identifies this process that allows navigating through uncertain and complex situations as logical incrementalism. Logical incrementalism allows the agent to gradually get from a general definition of expectations to a specific operationalization of the required components of execution, as new information and constraints emerge during the course of action. Such a notion of gradual adjustment is a fundamental characteristic of the creative process for which there is a necessity to establish a flexible and adaptable structure that could not be determined *a priori* (Amabile, 1996; Lubart, 2001; Wallas, 1926). However, such an approach makes it impossible to decompose tasks in a top-down logic. As such, the collective mode of action regulation tends to transform from a sequential and hierarchic model to a model exploiting opportunities during the course of action (Hacker, 2003). This systemic strategy consists of an opportunistic research for an action sequence that takes roots in the various emerging constraints instead of pursuing a rigid, predefined and stable goal

(Morel & Ramanujam, 1999; Visser, 1994). This constant realignment of goals and action plans during the course of action is the result of various adaptation and learning processes defined in terms of feedback loops. As such, the presence of feedback at the core of the regulation processes of collective entities allows for the emergence of a bottom-up influence of individual actions that has an impact on the contextual analysis undertaken by the group, the definition of its goals and the planning of its tasks (Frese & Zapf, 1994). In sum, collective action, in complex and uncertain contexts, is considered to be fundamentally dependent on the experience in the course of action in order to adapt the core hierarchy of collective goals and subsequently, the following action sequence of the group.

Project management has been and remains largely applied to the organization of creative and innovation tasks within organizational contexts (Demaio, Verganti, & Corso, 1994; Hobday, 2000; Hoegl & Parboteeah, 2006; Kazanjian et al., 2000). Indeed, the project environment constitutes a privileged way to integrate a variety of knowledge (Hobday, 2000; Nonaka & Konno, 1998) and it is characterized by a high level of flexibility to create and recreate its own structure based on the fluctuating needs emerging during the course of the project (Hobday, 2000). Gilles Garel (2003), in his historical perspective on project management, defines the identity of the project structure as the unicity of the conceptualization and realization of the organizational task. However, project management faces two important challenges: a) the project team must translate the initial intention and situational analysis into a strategy of action that is concrete and efficient; b) the project team must manage the unstable and numerous representations that the various actors develop on the strategy to adopt and its constant adaptation to the changing practical reality in which it takes place (Boutinet, 2001). This

departure between the representation of the project's vision and its practical realization constitutes an even greater challenge in conditions where innovation and creativity are required. Projects giving prime importance to innovation and creativity, also called soft projects, are characterized by ill-defined initial objectives and a high level of uncertainty affecting the capability of the project team to initiate prospective planning (Atkinson, Crawford, & Ward, 2006). For these soft projects, applying traditional project management tools and techniques is considered as less appropriate and less applicable to the reality of the project (Winter, Smith, Morris, & Cicmil, 2006). Instead, a better tolerance of uncertainty within the project would be necessary and the focus of management interventions should be oriented toward the interactions of project members and the human factor of the project (Atkinson et al., 2006). As such, it is the very determinist perspective of project management, with its tools and techniques allowing for the planning and control of time, specifications and budget of the project, that is questioned extensively because of its incapacity to take into consideration the full complexity of the new environments of projects (Söderlund, 2004; Winter et al., 2006). In this perspective, some researchers propose to study the actuality of the project by investigating complex social processes present at different levels of the projects and that affect the working experiences of individuals taking part in the project (Cicmil, Williams, Thomas, & Hodgson, 2006).

This section has been oriented toward defining the nature of creative collective tasks and how the uncertainty associated with these tasks could impact the functioning of organizational systems. In more details, we have seen that unstable and complex environments raised organizational problems requiring the enactment of creative problem-solving. By reviewing the literature on creativity in organizational settings we have seen that structural

inputs had a weak effect on creativity and that it was rather the motivational and social processes variables that were the most critical in situations requiring flexibility from organizational system. We have seen that the enactment of creative problem solving required flexible organizational structures and a capacity to react in the action instead of the more traditional plan and control paradigm in organizational theory. From a top-down perspective, based on a hierarchical and sequential model of collective action, we get to a model that includes bottom-up learning loops which have the possibility to change the collective objectives and the whole structure of enactment of the collective task. Finally, when reviewing literature on project management, the most widely used organizational form to face creative and complex organizational problems, we found more questions than answers ... This research field is currently questioning its most traditional paradigms of planning and control in the face of new kinds of projects. The coming of soft projects and the impossibility to structure this particular kind of project with traditional project management tools raise important questions on how to manage high level of uncertainty and complexity in organizational systems. In this sense, the project management area of research is looking for ways to identify the complex social mechanisms affecting the organizational system in contexts of high uncertainty. It is the question that we will work on in the next section.

2. Review of some classical perspectives of organizational theories on the structuration of complex and unstable organizational environments

A. The classic models of organization

Minztberg (1982) suggests that the function of structure is to divide the collective task in different distinct tasks and then to assure the coordination required between these tasks. Different formal and informal mechanisms are thus deployed to enable the differentiation/integration of the collective task where the enactment of the collective effort becomes the center of what is the organization structure. These mechanisms are supervision, standardization and mutual adjustment (Mintzberg, 1982). Mintzberg's mechanisms of coordination contribute to better grasp the function of structure at the organizational level, which is to divide and integrate the collective tasks. Structure then becomes the phenomenon that can explain how a collective endeavour becomes the sum of numerous individuals in action.

Ouchi (Ouchi, 1980), in a heavily cited article on organizational structures, raises the question of transaction costs attached to different ways of structuring collective efforts. The problem faced by organizations is that in dividing and integrating collective tasks, an organization faces the problem that, in the first place, individuals have different interests that won't lead them to follow a collective goal in a coordinated manner. Ouchi's article (1979) focuses primarily on the mediation of individual's interests that are not the same. According to Ouchi, control is enacted through standardization of workers' behaviors, which represent a first way to mediate interaction between workers. However, often, this is not enough, due to the fact that job ambiguity requires more flexibility from the organizational structure.

Supervision is a second way to mediate working interactions which bring more flexibility to the organizational structure but it can rapidly be overwhelmed in some uncertain environments. Finally, as a third way to mediate working relations, Ouchi brings in the concept of minimizing goal incongruence between employees and organizations. These three means of mediating working relations are pretty much like Mintzberg's mechanisms, but put on a sort of continuum where we go from regulation of specific behaviors to the influence of the goals pursued by the individuals. Ouchi (1980) further proposes that regulating goals remains the only option for organizations in situations of uncertainty and complexity. This mean of regulation would take place in team organizational forms that would be able to reduce the distance between organizational and individual goals (Ouchi, 1980). Goal convergence would then reduce the need for formal rules and give rise to the emergence of an informal system of authority much more flexible than formal mechanisms. Ouchi (Ouchi, 1980) however insists that for such an informal system to take place, an implicit culture defining how work must be accomplished must be present, shared by all members and enforced by an efficient socialization system. In sum, we see with Ouchi's (1979, 1980) work that structure can transpose organizational objectives in a coordinated action at the individual level in two ways: by influencing the behaviors themselves or by acting on the goals followed by the individuals. Overall, the different forms of organizations and mechanisms of behavioral control give rise to social systems with structural characteristics radically different from one another, by influencing the interaction types promoted and allowed in the collective (Morgeson & Hofmann, 1999).

B. A classic model of social structures

As presented, classical theories of organizations position clearly the role of structure in the transformation of organizational objectives in individual actions. We have seen with Ouchi (Ouchi, 1979, 1980) that formal means can be deployed within the organizational environment in order to regulate the behaviors of employees toward organizational objectives. However, these regulation mechanisms seem insufficient when facing high levels of uncertainty and ambiguity that require to pass from a formal to an informal mechanism of regulation and that act on the objectives pursued by the employees instead of controlling their behaviors. However, the actual essence of informal organizational structures seems elusive. Fortunately, different theorist proposed models of social mechanisms that take place in such social environments as organizations. Allport in his 1962's article proposed an answer to what he called the master problem of social psychology: "If we point to, or try to touch the group, we are doing nothing that can be distinguished from pointing the individual" (Allport, 1962). This problem calls for a social mechanism that could explain how groups of individuals can lead to the emergence of a collective phenomenon. For Allport (1924, 1962), each individual, when entering in interaction with other people, becomes a stimulus that will end up influencing the behavior of those around him. Those very people will then subsequently influence back the behavior of the initial individual. These social retroactions will thus be at the origin of a reciprocal chain of events that will structure the behaviors of the whole group (Allport, 1962). These retroaction loops emerging from individual actions and becoming a structuring phenomenon of action at the individual level are a central concept in the socio-constructivist theories.

In his structuration theory, Giddens (1993) uses this very concept to describe the emergence of a group phenomenon. In Giddens' work, structure is no longer an externalized artifact having a unidirectional influence on individuals. Rather, structure resides at the cognitive level and represents "the medium and the outcome of the practice which constitutes social systems" (Giddens, 1984), because structure comes from the regularization of these practices and their institutionalization within signification schemes, norms and power relations (Giddens, 1993). In this perspective, structure "… must not be conceptualized as simply placing constraints on human agency, but as enabling" (Giddens, 1993), what Giddens will define as the duality of structure. Such a conception of structure can be found in organizational theories (Drazin & Sandelands, 1992; Ranson, Hinings, & Royston, 1980). In this mindset, social interaction is very important in explaining the emergence of social structures and the interdependence of social structure and individual action. The study of social structures presented by Gidden represents an epistemological positioning of social processes where structure, understood as the reproduction of social practice, is used to explain how human action is constituted. Such a conception of structure is very important in order to position structure's function as a mean to constrain and enable individual action by relying on a cognitive and collective construct. The structuration theory also represents a key concept aiming to explain how structures are created and how they evolve, and thus represents an efficient conceptual tool aiming to describe how a collective and non-predetermined structure can emerge in a context of uncertainty and complexity.

Ranson, Hinings and Greenwood (1980) proposed, in line with the works of Giddens (1976) and Bourdieu (1977), a theory of the structuring process that joins together the formal and informal structure. Following their

conceptual framework, the organizational structure would link the formal codification and application of rules, norms and procedures with the informal framework of social interactions (Ranson et al., 1980). The organizational structure becomes a complex mean of control of individual interactions, but remains at the same time issued and recreated by these same interactions. The structure would then take form within interpretative schemes regulating individual actions. This notion of structure, created and recreated through interactions between individuals to explain the underlying functioning of informal organizational structure and mutual adjustment in the workplace, leads to a more flexible conceptualization of the organizational structure. Coming up with a concrete and understandable integration of all these perspectives into an organizational and social structure represents an important challenge. This challenge pertains principally to the definition of the structuration process of organizations as an interdependent process linking the cognitive structures at the individual level and the concrete interactions between the numerous agents forming the system. In such a conceptualization of organizational structure, there is no place that represents the beginning or the end of the phenomenon examined.

Based on the literature presented so far, here are some key characteristics of social structures in organizational environments. At the organizational level, the structure concept is used to define means by which organizations divide and integrate the collective tasks among numerous and different individuals. Structure is situated at the cognitive level of the individuals composing the system. Structure both constrains and enables individual behaviors through norms, rules, signification (interpretation) schemes and culture. Structure can be either formal or informal, however in either ways, it remains cognitive and originates from patterns of individual

interactions. However, informal and formal structures distinguish themselves clearly on their level of flexibility. The flexibility of the informal structure seems to be associated with an open mode of interaction that raises the opportunity of interactions between actors and the focus on the development of structure of meanings. This gives rise to a content of structure in terms of culture and interpretation structures that are acting on goal definition and on sensemaking processes. This informal perspective contrasts with the more traditional and rigid notion of structure in the form of organizational rules and procedures that act on a more proximal level on the behaviors of employees.

C. Summary of organizational and social perspectives of structure

We have seen that organizations struggle through the development of their structure to find ways to divide the collective tasks into different separated tasks, and then, to be able to coordinate people so they reach the collective objectives of the system. We have seen that from the formal mechanisms to the more informal ones, in uncertain times, organizations have to rely on a more flexible way of orienting the actions of their employees. We have seen that in order to do that, organizations have to move from more formal procedures to more abstract orientations at the symbolic and motivational levels. The structuration theory of Giddens gave us a modelization of how structures of meanings can emerge from individuals' interactions and then act upon each individual's behavior by enabling or constraining specific sets of action. Giddens theories, although depicting the way structure may emerge from individual actions, do not allow for a complete explanation of the different social mechanisms allowing the coordination of many individuals and the emergence of a coordinated and adapted collective action. In the following section we will see how the

theories of complexity can help us to model such mechanisms and give us a way to structure an investigation of these complex social mechanisms in a psychological perspective.

3. A recent model of organization coming from the theories of complexity: Complex Adaptive Systems and the proposition of an agent-based perspective of systems

The theories of complexity have often been applied to the organizational contexts in order to explain the new trends in management tied to the knowledge industry, the acceleration of change within organizations and the complexification of the organizational environment (see the special editions « Application of complexity theories to Organization science » of Organization Science (1999) and « Leadership and complexity » of Leadership quarterly (2007)). The management community is very interested in complexity theories, because, among other reasons, these theories go much further than highlighting the importance of learning and knowledge creation for modern organizational systems. This set of theories also describe in what way these leaning processes unfold in organizations by highlighting the central role of the agent's cognitions within organizational systems (Burnes, 2004; Holland, 2006; Holland & Miller, 1991; McElroy, 2000). Indeed, as we will see, the theories of complexity integrate in large part the organizational theories literature presented up to now but articulate it in a multilevel perspective of organizational systems functioning.

Developed in the middle of the 1980's at the Santa Fe Institute (Pascale, 1999), the theories of complexities applied to organizational systems

propose a modelization of the organization as a Complex Adaptive System (CAS). This modelization can be considered as an extension of organizational systems described as open systems in the general theory systems theory (Katz & Kahn, 1978). Indeed, a CAS, just like open systems, interacts with the environment within a process of transformation of the inputs into new outputs. However, the models of CAS do not seek to explain in what way systems progress toward a structuration that will lead to a homeostatic equilibrium. Rather, models underlying the functioning of CAS seek to describe the underlying mechanisms within these systems that make possible the emergence of complex structures that are both non-linear and constantly evolving, and that allow CAS to adapt even in highly uncertain and changing environments (Schneider & Somers, 2006).

To come up with an accurate description of the functioning of these systems, a fundamental change must be made to the way we study the emergence of collective phenomenons. As such, instead of explaining a collective action through a global and holistic investigation of all the parts of a complex system, as proposed in the open system study, CAS models propose to understand the perspective of the agents comprising the system and to study the environmental cues guiding their actions (Anderson, 1999; Burnes, 2004; Levinthal & Warglien, 1999). The perspective proposed through CAS models is thus fundamentally multilevel by explaining how regularities at the collective level can originate from the structuration and the evolution of the interactions of the individuals that compose the collective (Anderson, 1999; Holland & Miller, 1991). CAS are thus generally defined as systems composed of autonomous agents whose interactions allow for the emergence, through phenomenons of self-organization, of stable structures at different

levels of the system (Anderson, 1999; Holland & Miller, 1991; Vidgen & Wang, 2009).

CAS models rely on an agent based perspective in order to explain the emergent phenomenons taking place within the system. A central principle pertaining to the functioning of CAS posits that complex and non-linear outcomes can result from the parallel action of interdependent agents respecting a limited set of very simple rules (Anderson, 1999; Holland, 2006; Holland & Miller, 1991). As such, CAS revolve around numerous agents whose behavior is dictated by a set of schemas, or cognitive structures, that determine which action the agent will undertake based on his perception of his own localized environment (Anderson, 1999). Schemas can be as simple as behavioural rules or recipes, but also as complex as detailed representations of the realities that encode and formalize the regularities of the environment (Anderson, 1999; Gellmann, 1994). The knowledge structures underlying these schemas can then compete within the system in order to define what shared interpretation will be prominent within the system (Anderson, 1999; Greenwood & Hinings, 1996). Also, when an important number of agents interact with each other in the presence of positive feedback loops, the behaviours associated with a favourable result and the underlying schemas that led to these behaviours will be reinforced and will structure themselves to form a stable and predictable collective action pattern (Anderson, 1999). It is thus on the basis of specific rules, whose application across the system become shared, that structures and regularities can emerge within a group without the necessity of a centralized control mechanism (Drazin & Sandelands, 1992).

This being said, localized adaptation is also central to the functioning of CAS. Indeed, each agent does not interact with all the agents of the system

and, thus, can act only on the basis of the information available to him in its proximal environment and to the collaborators with whom he is interacting (Anderson, 1999). As such, the collective learning and the adaptation of the CAS are the results of the individual efforts of each agent trying to adapt and improve his own personal adjustment (Schneider & Somers, 2006). This localized adaptation results from the impossibility for an agent to predict the global impact of his actions at the level of the system, leading each one of them to maximize their own adaptation (at the condition that they can assess the proximal adjustment of their action) instead of the adaptation of the system as a whole (Burnes, 2004). However, since every agent in the system is constantly interacting with other agents, the value of his actions, and consequently his level of adjustment will always be dynamically dependent on the choices and actions of other agents. In these conditions of localized adaptation, the agents will never be able to define a stable and optimal individual behavioural frame within such a system (Morel & Ramanujam, 1999). This will lead them to co-evolve with one another without ever reaching a homeostatic equilibrium (Anderson, 1999).

So far, we have discussed the fundamental nature of the agents forming a CAS, their interactions as well as the presence of localized feedback loops. All these elements are the basis for self-organization phenomenons that can explain the emergence of temporarily stable structure within the system that will maintain its dynamical and flexible nature (Holland, 2006; Holland & Miller, 1991; Vidgen & Wang, 2009). This systemic state, which the complexity theorists position as being “at the edge of chaos”, allows a system to survive in an unstable and complex environment by reaching a second order optimal equilibrium point between flexibility and stability (Morel & Ramanujam, 1999; Stacey, 1996). As such, CAS’s high

adaptability is based on self-organization phenomenon in which a large part of the decisions are dispatched to the individuals comprised in the system (Kauffman, 1995). However, the theories of complexity do not exclude issues of leadership and structure, even though emergence is a central mechanism of the system these theories describe (Uhl Bien et al., 2007). Indeed, complexity theories, as applied to organizational systems, do not propose new models of organization but rather extensions of the traditional models (Schneider & Somers, 2006). As such, when applied in practical and concrete contexts, these theories ask the question of what should be structured and what should not be structured in complex systems (Choi, Dooley, & Rungtusanatham, 2001; Vidgen & Wang, 2009). But, because the models these theories propose are fundamentally agent-based, their approach is fundamentally cognitive. This is to say that a collective action can self-organize and emerge at the condition that agents' interactions allow them to get the information and the feedback necessary to orient and adjust their own actions locally. By proposing models that are fundamentally multi-level, complexity theories propose a psychological explanation at the individual level of the social/collective phenomenons underlying CAS functioning.

4. Synthesis of the key elements reviewed

In this first part of our theoretical review, we made a concise review of different modelizations of organizational structure and social processes within organizational systems. We have seen that in a creative context, traditional plan and control perspectives of the organization were not sufficient to explain what is going on in the social system and that a better understanding of the underlying social processes was necessary to fully understand human functioning in these work environments. We continued our review by

highlighting the fundamental multilevel nature of the organizational structure concept, a phenomenon explaining how a collective endeavour is integrated to become the sum of numerous and differentiated individuals in action. Numerous mechanisms can be proposed to explain how a complex and collective endeavour can be accomplished by a group of individuals. Our objective was not to describe the different types of differentiation / integration strategies deployed by organizations neither to explain how each one impact the structure of interaction promoted in the system. We reviewed Giddens' work and its description of the process by which structures emerge and, more importantly, some key assumptions of his theory that propose a model of individual and social cognition. The CAS theories that propose a fundamentally cognitive perspective of structure has also been reviewed. These two perspectives, focussing on the agents composing the organizational system, describe the psycho-social nature of evolving organizational environment and the structure of the interactions that take place within these systems. We have seen that unless we are in a very stable work environment, such a perspective is essential to describe what actually happens in an unstable work environment but also to explain episodes of change in stable environments.

Numerous social mechanisms are described to explain how structure emerges and how the system adapts and self-organizes. Complexity theories propose that the adaptability of organizational systems can be described through decision making functions conceptualized at the level of the agents acting in the system instead of an overarching centralized control mechanism. These theories thus support the proposition of a psychological perspective of the agents' cognitions and of its interactions within the psycho-social environment of the system. It is these interactions and their underlying

feedback loops processes that make it possible to link one's actions and his or her mental representations. Ultimately, we argue that complexity theories constitute an explanation of the learning and adaptation processes both at the individual and the systemic level.

These theories thus allow the description of learning processes that emerge from action instead of being planned and centralized within the system. The description of these bottom-up dynamics are coherent with the foundations of empowerment theories (Cunha & Rego, 2010; Levinthal & Warglien, 1999) and imply an understanding of the complex relation between the individual's behavior and his work environments, as modelled by theories of job design and motivation (eg.: Deci & Ryan, 2000; Frese & Zapf,1994). This vision suggests that in a complex and changing environment, good systemic adaptability and learning require that we conceptualize the organisational system through mechanisms emerging at the individual level, thus leading to a psychological perspective of the system's functioning. By proposing that emergence and learning occurs from information treatment of individuals aiming at maximizing their own personal adjustment, those theories raise the question of what types of information do people need to operate in these contexts.

As we have seen previously, the focus of the CAS model is not on structuring every components of a system. Rather, it aims at structuring just enough aspects of the inner workplace environment to allow efficiency, but at the same time avoid inertia and loss of flexibility, which would be problematic in a context where change is prevalent. This raises the question of what should be structured in order to raise the efficiency of the system and what should not be structured because of the inertia it involves? This question carries an underlying idea generally promoted by the literature on creative

work environment that should also be of interest when addressing the question of the regulation of individual action in a creative work environment namely, the existence of different work environments cues essential for individual action that could be structured either flexibly or rigidly, depending on the requirement of the task. This position leads to both, a more balanced perspective of the proper level of structure (more structure is better as a wrong universal approach to organizational functioning) and a multifaceted perspective of structure, where more than one type of environmental cues may impact individual actions and be the focus of organizational design and leadership actions in complex and unstable work environments.

5. Presentation of theoretical propositions supporting our empirical approach

Where does this leave us? It leaves us with the bases of a methodology for studying what happens in unstable work environments. The CAS theories are fundamentally cognitive theories modelizing how individuals perceive and interact with their work environment. As such, our theoretical investigation of organizational systems leads us pointing at some key elements that will guide us in modelizing our empirical investigation. In light of this first part of our literature review, we now present some key theoretical elements that put into context the approach that we take in the remainder of this thesis.

Our review of Allport's and Gidden's work gave us the opportunity to describe how retroaction loops between an individual and its social environment can stabilize structured patterns of behaviours both at the

individual and collective level. This perspective of structure leads us to position the following propositions:

- Social structure reside within the cognitions of individuals as opposed to being external to individuals
- Social structures emerge and are maintained through patterns of interactions that stabilize through time and in between the members of the collective.
    - It is these patterns of actions that make structure apparent.
- Individual action is both constrained but also enabled by its interdependency with social structure
    - Social structure cannot be separated from individual action

When reviewing the work of Mintzberg (1982), Ouchi (1979, 1980) and Ranson and colleagues (1980), we have seen that different means or strategies could be applied to ensure the proper differentiation of individual efforts and their integration within the scope of the collective goals. From more formal mechanisms to more informal ones, structure still resides at the cognitive level of the people composing the system. However, formal and informal mechanisms differ in how they control individuals' actions to integrate them in a cohesive manner in the pursuit of a collective goal. As such, integration can be achieved by controlling individual actions, by controlling individual goals or by fostering individual goal convergence with the organizational goal. This perspective of structure leads us to position these additional propositions:

- Structure does not only pertain to cohesive and integrated interactions but also consist in enabling differentiated actions at the individual level.
- As such, structures emerge in the broader context of organizational and individual goal pursuit
- Structural flexibility and adaptability can be better achieved by distally influencing goal convergence with the organizational objectives rather than proximally controlling individual behaviour.

The concept of convergence is central to multilevel theories. A common multilevel methodological approach consist in the study of emerging collective constructs by analyzing the degree of sharedness of psychological individual construct and then raising these construct at the collective level as a characteristic proper to the system if enough sharedness is demonstrated. This approach will not be the one we adopt in this thesis. Indeed, numerous aspects of the complex adaptive systems (CAS) will lead us to focus our attention on another phenomenon than the stable and shared collective construct. CAS are explained through the perspective of the agents himself. These agents guide their action based on their perception of their own immediate environment. This localized adaptation based on the limited knowledge of the agents will lead the community of agents to co-evolve over time without necessarily reaching any form of stability. The self-organization of stable structure is thus temporary and will lead to the development of an optimal balance between stability and flexibility within the system. This perspective of structure leads us to position these additional propositions:

- The localized nature of agents and their limited knowledge of the whole system make it unlikely that complex structured patterns of

behaviours within the system are the results of mental schemas that are similar and shared across all the agents of the system.

  - Not every member of a collective may be affected by a particular pattern of structured behaviour
  - Not all members affected by a particular pattern of behaviour may develop the same mental schemas at the same intensity
  - Thus, not every agent should share exactly the same perception and understanding of a specific collective construct

- CAS models question what balance should be made between better structure to promote efficiency and less structure to maintain adaptability. This raises the question of "what should be structured" and thus re-questions the notion that more structure/control is necessarily better.
- Also, in a system that is adaptive and constantly self-organizing, the identification and measurement of a temporary, collective and emerging construct may not be the key element to investigate.
- Rather, the capacity of the system to <u>consistently</u> support the emergence of temporary but strong collective structure that support the enactment of individual action in the system could prove to be central to understanding the social processes at play.
- As such, instead of measuring whether a specific mental schema is shared across the system (for example, "do the members of the team share the same collective goal?"), we propose to focus our investigation on the capacity of the system to promote the constant emergence of temporary patterns of behaviour (for example, "to what extent do members of the team feel at different point in time that there is a clear and shared collective goal"?).

- By proposing that emergence and learning in CAS occurs from individual's information treatment aiming to maximize their own adjustment, those theories raise the question of what types of information do people need to operate effectively in these contexts?
- Finally, the establishment of structured pattern of behaviours does not only explain the process through which shared mental schemas can emerge and generalize across the full system of agents. The structuration process can also explain the emergence of mental schemas that are locally differentiated for sub-categories of agents within the system. These differentiated and localized mental schemas should however support the accomplishment of a common collective objective to become an integrated part of the social structure over time.

In the light of these theoretical elements we will now position our approach of the study of the psycho-social phenomenon taking place in complex and uncertain organizational systems. The emergence of structured patterns of behaviours, what we consider collective structures, does happen through time. As such, it is important for us to highlight that we focussed our review on uncertain work contexts, articulated our discussion of structure around Giddens's theory t that gives prime importance on how structure develop and concluded by presenting the functioning of systems that are always evolving. As much as we are aware that collective construct emerge and can stabilize in a social system, it will not be the target of our analysis and investigation. First of all, the qualitative nature of collective constructs will vary from one situation to another (for example, the emergence of a collective goal is qualitatively specific to a team in its specific context). Secondly, in highly unstable environments, these collective constructs are subject to rapid change and evolution (for example, the collective goal of a social system could

change through time as a result of collective learning or change in the external environment). Thirdly, even when a collective structure emerges and starts to be shared, not everyone should be expected to share it in the same extent (for example, as a collective goal starts to emerge, the members of the collective may not understand it with the same level of clarity). In fact, as proposed by the CAS literature, it may not be the emergence of a specific construct, but rather the capacity of the system to consistently allow the emergence of temporary but strong collective structure that will be of interest. As such, we concur with Morgeson and Hofmann's (1999) proposition that structure can take different forms of behavioural patterns and we consider that in CAS, the identification of these temporary patterns does not represent the phenomenon we intend to investigate. We rather propose to follow the functional approach proposed by Morgeson and Hoffmann (1999) that suggest investigating structures in the light of their functional contribution in supporting the enactment of collective and individual goals. To do so, we propose to review the literature on motivation and action regulation in work contexts to develop a model of different functional areas where social structure supports the enactment of individual and collective goals. As such, our approach will consist in asking ourselves: in what way does collective structures can affect individual and collective goal striving by contributing to efficient self-regulation processes at the individual level? Said differently, a collective does not develop random structures, or pattern of behaviours. Instead it should develop structures that successfully orient the individuals toward the attainment of individual and collective goals (Morgeson& Hoffman, 1999). In this perspective we will turn our investigation toward self-regulation and motivational theories to build a model of key categories of mental schemas that are likely to be influenced by information conveyed by the social environment. Our objective will thus be to identify, from individual self-

regulation processes, in what way the collective structure can support goal directed actions. As such, we believe that more than one type of environmental cues may impact individual and collective actions and be the focus of design and structuration processes. The scope of this thesis will however focus exclusively on the self-regulation processes at the individual level. We however acknowledge that team-regulation processes should also be included to develop a complete model that cover the full extent of the psycho-social processes at play in uncertain and complex social systems.

II. A model of the regulation of individuals in organizational systems facing complex and unstable environments

1. Self-determination theory

A. A quick overview.

The Self-Determination Theory (SDT) (Deci et al., 2001; Ryan & Deci, 2000) is a motivational meta-theory that can prove to be very useful in modeling the interaction between environmental factors and individual outcomes (Deci & Ryan, 2002). SDT proposes a conception of motivation where the quality of the motivation developed is the center of attention, rather than considering motivation as a unitary construct where only the intensity of the motivation varies (Deci et al., 2001; Gagné & Forest, 2008; Ryan & Deci, 2000). The theory proposes the existence of a continuum of motivation describing different types of motivation, such as "amotivation or unwillingness, passive compliance or active personal commitment" (Deci et al., 2001; Ryan & Deci, 2000). The most highly developed motivational orientation, a self-determined one, is associated with an optimal functioning of the individual (Deci & Ryan, 2002). In the work context, a work environment facilitating such a self-determined motivational orientation is tied to different organizational outcomes, such as creativity, work satisfaction, performance, psychological well-being and health at work (Gagné & Deci, 2005).

B. An integrative and dialectical perspective of human functioning

"SDT begins by embracing the assumption that all individuals have natural, innate, and constructive tendencies to develop an ever more elaborated and unified sense of self" (Deci & Ryan, 2002). SDT further proposes that people actively engage into integrative processes on two levels: intrapersonal integration of inner self, as well as interpersonal integration of self with larger social structures (Deci & Ryan, 2002). However, although this integrative inclination toward personal and interpersonal coherence (that SDT also describes as an internalization process) is assumed to be a natural developmental tendency;

"the degree to which people are able to actively synthesize cultural demands, values, and regulations and to incorporate them into the self is in large part a function of the degree to which fulfillment of the basic psychological needs is supported as they engage in the relevant behavior (Ryan & Deci, 2000).

More specifically, a dialectical interface is proposed to be taking place between the individual and its environment. The internalization process proposed by SDT is an attempt by the individual to transform an external regulation into a personally endorsed self-regulation (Ryan & Deci, 2000). This organismic tendency consists of a natural individual inclination to seek actualization of one's own potentialities, as well as to master new situations. On the other end of this dialectical interface there is the social environment that can both support or thwart this internalization process. In order to organize the complex interrelation between the social environment and the individual motivational processes, SDT has proposed a set of basic psychological needs. These needs have been used to explain the complex

relation between the social environment characteristics and the individual motivational processes (Deci et al., 2001; Deci & Ryan, 2002; Ryan & Deci, 2000).

C. The basic psychological needs and psychological well-being

The construct of needs in SDT has been fundamental in understanding the content of goals and the process by which they are pursued. SDT defines basic psychological needs as "innate psychological nutriments that are essential for ongoing psychological growth, integrity and well-being" (Ryan & Deci, 2000). As such, the concept of needs is used to define the necessary condition for psychological integration, self actualization and well-being. These needs are specified as innate tendencies underlying deep structure of the human psyche. They are conceptualized as universal and are meaningful in relation to the extent to which people can satisfy them, rather than in relation to the strength of these needs for each individual (Ryan & Deci, 2000). Different studies support empirically SDT's perspective of basic psychological needs as being innate and universal across cultures (Chirkov, Ryan, Kim, & Kaplan, 2003; Chirkov, Ryan, & Willness, 2005; Deci et al., 2001). The three needs proposed by SDT are described as follows: "(a) to engage optimal challenges and experience mastery or effectance in the physical and social worlds; (b) to seek attachment and experience feelings of security, belongingness, and intimacy with others; and (c) to self-organize and regulate one's own behavior (and avoid heteronomous control), which includes tendency to work toward inner coherence and integration among regulatory demands and goals." These needs are thus respectively referred to as the need for competence, which represent the desire to act in an effective manner with his environment in order to attain desired goals (Deci, 1975;

White, 1959). The need for relatedness refers to the desire to have a sense of belongingness with other individuals and its own community (Baumeister, Heatherton, & Tice, 1994; Ryan, 1995). The need for autonomy reflects the desire to perceive ourselves as the origin of our own behavior and experience the feeling that we act based on our interest and values (Decharms, 1968; Ryan & Connell, 1989).

This definition of needs that are both universal and innate will be a central component of our epistemological stance toward the study of a job design. Our perspective is that within such a conception of psychological needs, we can identify components in the work environment that, by satisfying basic psychological needs, have a high likeliness to be essential dimensions of a job design theory. This is a job design perspective centered on the universal characteristics of the design end-user. Said differently, by identifying the universal psychological needs human beings require to function optimally, and by linking these needs to clear job dimension areas, we consider that we have a better potential to identify meaningful job design components than by studying the task in isolation to human inner psychological functioning.

The concept of basic psychological needs is a central concept in SDT in order to define the dialectic relation between individual functioning and the characteristics of the social environment. As such, characteristics of the social environment can be examined in relation to their support to the satisfaction of the three needs, and thus, as having the potential to promote optimal functioning and well-being (Deci & Ryan, 2002). Such a perspective leads to a study of different factors of the social context, like types of goals, types of motivation, personal differences in causality orientation, etc., in regards to

their capacity to satisfy basic psychological needs or not. It also leads to the study of the empirical link between needs satisfaction and well-being.

Within the SDT perspective, well-being is considered as more than simple happiness and positive affect, and is rather defined as a state that includes presence of vitality, psychological flexibility and a deep inner sense of wellness (Ryan & Frederick, 1997; Ryan, Deci, & Grolnick, 1995). Many studies guided by SDT have provided empirical support to the link between the satisfaction of needs and well-being (see Deci & Ryan, 2000, for a review). For example, studies measuring daily fluctuation in the satisfaction of needs have found that, both at the within person (daily-fluctuation) and between person (individual differences) levels, the general satisfaction of basic psychological needs is associated with well-being (Gagne, Ryan, & Bargmann, 2003; Reis, Sheldon, Gable, Roscoe, & Ryan, 2000; Sheldon, Ryan, & Reis, 1996).

Within SDT, the process proposed to explain how basic psychological needs lead to positive consequences in an organizational context passes through an interactive relation between those needs and the development of different types of motivation categorized according to their level of self-determination (Gagné & Forest, 2008). More specifically, the human tendency to either do a behavior because it is interesting (intrinsic motivation) or because he finds it important (well-internalized extrinsic motivation) is influenced by experiences of prior satisfaction of needs during the enactment of the activity (Ryan & Deci, 2000). The motivation that is then displayed is labelled self-determined motivation or autonomous motivation. By opposition, engaging in an activity because we are pressured by an external force (ex.: reward) or an internal pressure (ex.: culpability) are considered controlled

motivation. Thus, the concept of autonomous motivation represents the level at which the individual enjoys or has been able to integrate to his self-concept the objectives he is pursuing (Deci et al., 2001; Ryan & Deci, 2000). In the work context, Gagné and Deci (2005) proposed that satisfaction of basic psychological needs in the organizational context would lead to autonomous motivation, which will in turn yield the following outcomes : "(1) persistence and maintained behavior change; (2) effective performance, particularly on task requiring creativity, cognitive flexibility, and conceptual understanding; (3) job satisfaction; (4) positive work-related attitudes; (5) organizational citizenship behaviours; and (6) psychological adjustment and well-being" (Gagné & Deci, 2005).

D. The Cognitive evaluation theory and the concept of structure

Different researchers applying SDT to the domains of education (Reeve, Deci, & Ryan, 2004; Taylor & Ntoumanis, 2007), sport (Mageau & Vallerand, 2003) and organizations (Gagné & Deci, 2005) suggest that structure and autonomy support are key environmental factors leading to a self-determined motivational regulation. The cognitive evaluation theory (CET) (Deci & Ryan, 1980), a component of SDT, specifies the impact of different social environment factors on the form of motivation developed by an individual. According to the CET, an aspect of the social context will have a different impact on the motivation developed, depending on the actor's perception of the environmental cue as controlling his behaviour or simply as providing important information supporting the attainment of his goals (Deci & Ryan, 2002). In line with these notions of control and informational cue, the concepts of structure refer to the informational support present in the organizational context. Structure would thus have an impact on motivation,

particularly by satisfying the need of competence of the individual (Taylor & Ntoumanis, 2007). It would do so by allowing the individual to identify a clear link between the behaviour to enact and the attainment of the desired results (Ryan & Deci, 2000). The level of structure would then be linked to the quantity and quality of the information at the disposal of the individual regarding the expectations for him and the means to reach his objectives (Connell & Wellborn, 1991). As for a context supporting the autonomy, it must not be confounded with *laissez-faire* that would be opposed to a context that is structured. The two dimensions of autonomy and structure would have an independent and unique impact on motivation. In fact, permissiveness (i.e., lack of structure) and neglect (i.e., lack of involvement) are radically different from the concept of autonomy support that concerns the way structure and involvement is provided (Joussemet, Landry, & Koestner, 2008). Then, in an environment that would be structured and autonomy supporting, the structure would facilitate the development of an efficient action intention, while autonomy support would allow the individual to integrate this intention to his self-concept, thus leading to autonomous action (Reeve et al., 2004).

In sum, SDT proposes 2 key characteristics of the social environment, the level of structure and the possibility to make meaningful choices. SDT further proposes a motivational process based on three fundamental psychological needs that describe the impact of the environment on the individual. However, the SDT models have not been developed specifically for the work environment and are associated with an underspecification of the concept of structure in the workplace. To the knowledge of the author, no empirical study has yet been done to assess the impact of the structure on the motivational process of the workers. We will now turn our attention to job design and cognitive theories. These theories will help us develop the basis of

a conceptualization of the cognitive structure underlying action in the workplace.

2. Action Regulation Theory and self-regulation of work behaviors

"To establish a general theory of work behavior, one must begin with the concept of action."

- *Frese and Zapf, 1994*

The ART (Frese & Zapf, 1994; Hacker, 2003) is a job design theory describing the cognitive process underlying the realization of an activity in the work context. It is thus both cognitive and behavioural. Within ART, the core of what constitutes work rests upon the concept of action (Hacker, 2003). Actions are goal-oriented behaviors that are directed towards external conditions of the environment (Frese & Zapf, 1994; Oesterreich & Volpert, 1986). As for the concept of action regulation, it "denotes the mental processes by which action is adjusted to external conditions" (Oesterreich & Volpert, 1986). As such, this theory interests itself in the cognitive processing of the environmental information by the actor and how this processing regulates the behavior of individuals. This theory is thus neither solely behavioural nor cognitive in nature. It rather aims at integrating both the cognitive and behavioural dimensions of individual actions or, said differently, at linking together "thought and action, planning and execution" (Oesterreich & Volpert, 1986). To do so, the ART suggests different key descriptive models of the regulatory function that cognitions have on workers' behaviours; a description built around the concept of goals, execution and

feedback loops. The key ART models reviewed in this thesis are the sequential model of the accomplishment of activities and the hierarchical nature of action regulation in the work environment.

The challenges of using a theory like the ART are twofold. First of all, there is the language barrier. Since this theory has been developed by German researchers, a limited portion of the research underlying this theory has been presented in English. A second challenge lies in the breadth and large span of this theory. The ART takes the form of a "Grand theory" (Frese & Zapf, 1994) that proposes a unified framework of work psychology. A very large array of topics and propositions are presented and integrated together (stress, errors, personality, performance, skill development, work design), making it highly difficult to derive a specific models in isolation of the others. This makes the task of integrating key element of this theory within our model difficult, a task we undertake in the following section.

A. The action process during the realization of an activity

In the ART, the concept of action process consists of a sequence of actions that describes the different phases through which an activity unfolds into a series of actions. The process leading to the accomplishment of an activity is composed of cycles of actions that proceed from goal definition to the generation of a plan, followed by the execution and the reception of feedback. More precisely, Frese and Zapf (1994) as well as Hacker (1994) propose the following sequence:

1- Definition of a goal
2- Orientation by taking into account the environmental context

3- Generation of action plans
4- Selection of a particular action sequence from those available
5- Execution
6- Monitoring of the execution compared to the initial plan
7- Cognitive treatment of the feedback

This sequence, which is deployed as a recurring cycle that unfolds until the goal is reached, is divided into three global phases: a mental preparation phase prior to action, an execution phase and finally a monitoring and feedback evaluation phase (Tschan, 2002). Although presented in a very orderly fashion, this sequence may be altered greatly based on the continual feedback individuals get during the regulation sequence (Frese & Zapf, 1994). For example, during the preparation of the course of action, problems in defining a realistic plan of execution may lead an employee to redefine the goal he is pursuing. As such, even though later steps of the action process can change earlier ones, this model proposes a good description of the sequence of actions allowing the regulation of an activity. Empirical evidences suggest that ideal cycles of action regulation can be defined for an activity both at the individual and at the group level (Tschan, 1995, 2002). These results illustrate, first, the importance of the quality of action regulation cycles (as both defined in terms of presence of the key phases of action regulation and the proper order in which they are enacted) to explain performance at the group and at the individual level. They also support the assumption that both group and individual regulative processes may share structural similarities. These similarities, at different system levels, may be explained by two propositions: first, cycle quality may be related to the performance of an agent (an individual or a group) regardless of its systemic level, because this relation remains true across the different levels of tasks (more on task hierarchies

below); and second, individual cognition is proposed to be functionally analogous to group communication (McGrath & Tschan, 2004; Tschan, 2002; von Cranach, 1996). Numerous implications are derived from the sequential nature of action regulation and the contextualization of individual action within the frame of a group task structure. For the need of this thesis, in the following paragraph, we will more specifically focus on a particular phase of the action sequence, the mental preparation phase prior to action. And later in this section, we will discuss the definition of complex tasks within an organization as a set of hierarchically nested subtasks and the consequences of this perspective for individual action regulation within a group.

The mental preparation phases taking place prior to action comprise goal development, as well as the orientation and planning functions. These functions are anticipatory and should be done before the action (Tschan, 2002). Goals are mental structures that are central in this process and absolutely necessary for action to take place (Frese & Zapf, 1994). Goals as cognitive structures guide the action process by becoming "an anticipation of the results that one intends to achieve" (Hacker, 2003). As such, any activity starts with an initial wish or intention, leading to the generation of a purpose, a project or the acceptation of an external goal (Frese & Zapf, 1994; Tschan, 2002). In the work context, people are given tasks that they must redefine and interpret in order to extract their underlying goals (Frese & Zapf, 1994). The redefinition process that this proposition implies is of central importance, because it raises questions pertaining to the clarity of the task definition and of its underlying goals, the personal resources available to the individual in order to redefine the task into a goal and a set of sub-goals, as well as to the access of the employee to appropriate environmental information to correctly develop goals that are proper to the organizational objectives. A more

systematic review of the literature pertaining to goal setting will be done later. The goal development function is highly difficult and is often carried while the task is executed, instead of being done primarily during the preparation phase (Frese & Zapf, 1994). Of importance is the concept conveyed by the Action Theory, a theory that influenced highly the ART (Bedny & Karwowski, 2004), that a goal is paired and exists only in relation to a motive. Together, these two paired elements define respectively the cognitive and informational component, as well as the motivational and energetic push associated to an activity (Bedny, Karwowski, & Bedny, 2001). We see that goal development occupies a central role in the regulation of an activity by conveying an anticipative projection of a desired result. We have seen however, that, in the work context, goals are derived from task assignment, and that the development of goals is subject to an effortful redefinition process based on prior knowledge that highlights the dense informational processing underlying the development of goals.

The goal development function is then followed by the orientation and planning functions. The orientation function consists of an analysis of the current situation conditions and of the activity's objects, as well as the prognosis of their future state. This function is thus a search for information, and its collection and interpretation within/using abstract schemata and mental models (Frese & Zapf, 1994) that workers have developed about work processes. These internal representations are captured within the concept of *operative image system* as the knowledge base enabling action regulation and planning (Frese & Zapf, 1994). Different issues are of importance during the orientation phase: "(a) realism of mental model, (b) broad signal inventory, including opportunity recognition and the function of quick detection of complex signals (chunking), (c) developing a map of the environment that has

operative value, and (d) the right level of decomposition to understand an environment." (Frese, 2007). Expertise would play an important role in these different issues associated to the orientation phase. As such, higher level of expertise would result in faster interpretation of the environment, better understanding of a broader range of signals as well as the capacity to operate at different levels of decomposition (Frese, 2007). Following the orientation function, the plan generation function consists of linking the higher level goals to lower level operative plans that will make action possible (Frese, 2007). Plans vary on their degree of details and can range from a list of sub-goals to an elaborated action program defining how to proceed to reach the goal associated with the plan (Frese & Zapf, 1994). In essence, this final function of the cognitive preparatory phase of action regulation implies that people, prior to entering execution, proceed either to the generation of a plan or the retrieving of action plans already learnt.

B. Task hierarchies

ART proposes an elaborated description of processes by which the global goals of the organization deploy in a hierarchy of sub-goals orienting the actions of the employees (Frese & Zapf, 1994). As presented previously, the action process follows a definite sequence of phases that are organized based on an initial intention, which is then defined into a conscious goal. In the work context, action starts primarily with a task that is given to the employee (Frese & Zapf, 1994). The task is considered the intersection of the individual and the organization. It is through interpretation and redefinition of the task that an individual or a work unit will take over a portion of the overall organizational goal (Frese & Zapf, 1994). As such, at the organizational level, ART describes the mechanism through which the organizational goals are

divided into sub-goals that make possible the coordination and the sequential division of collective tasks into individual tasks. Different tasks and sub-tasks are defined and communicated to the workers, and adjustment mechanisms are implemented to make the adaptation of the action possible through feedback loops (Frese & Zapf, 1994; Hacker, 1994). As such, the definition of a global goal, into sub-goals and sub-sub-goals, down to a sequence of visible actions, becomes a mean, in the ART, to describe how workers can go from "the intellectual level that control and monitor the action process to lower levels directly linked to muscular activities (the sensorimotor level)" (Frese & Zapf, 1994). The flexibility required of an employee to be able to interpret a task defined at the collective level and redefine it at the individual level into a set of personal goals make it necessary for the structure of action to be organized hierarchically (Frese & Zapf, 1994). Indeed, the infinite number of potential concrete behavioral operations at work calls for an understanding of the "deep structure of action" [(Hacker, 1982) cited in Frese et Zapf, 1994] and the generative potential of higher level intentions in an organized hierarchy of goals (Frese & Zapf, 1994).

The notion that goals are organized in a hierarchic structure is not at all specific to ART and is rather the dominant conceptualization of the structure of goals (Austin & Vancouver, 1996). Using the particular terminology of control theories, Lord and Levy (1994) summarize the interactive relationship between the different levels of goals hierarchies by saying: "moving up one level explains why an action is done (to reduce discrepancies in higher-level systems), and moving down a level explains how discrepancies are reduced (by the operation of lower-level systems)." This is to say that goals are defined as creating discrepancies between our perception of the reality and an anticipated future state that is desired. As such, at any level of a hierarchy of

goals and sub-goals, moving one level in the hierarchy explains "why" a particular goal is undertaken, while moving down one level in the hierarchy explains "how" this goal can be reached. Importantly, underlying a hierarchical conception of goals is that goals vary on their level of abstraction (Carver & Scheier, 1998). As such, higher level and more abstract goals are translated down the hierarchy into more concrete standards, a process describing how an individual moves from abstractedness to specificity, or otherwise, from "cognition to action" (Lord & Levy, 1994). This is to say that higher level goals are symbolic in nature and require the conscious application and processing of rules to abstract symbols (Lord & Levy, 1994). On the other hand, lower level goals at the cognitive or biological levels entail sub-symbolic and preconscious processes that are automatic and much faster to carry out (Lord & Levy, 1994). However, the self-regulation of behavior never encompasses the totality of goal structure at one single moment. Rather, only a portion of the goal structure will be activated and the center of attention at one single moment, and as such the symbolic processing capacities, will be focused on a narrow but moveable segment of the hierarchy (Lord & Levy, 1994). Each level of the human cognitive goal architecture functions as a "stable subassembly" with its own regulation processes and its own response time (Lord & Levy, 1994). Also, depending on the obstacles encountered, the focus of attention will shift to lower levels of regulation to resolve these obstacles, and shift back to higher level of regulation once they are resolved (Lord & Levy, 1994). Globally, this implies that depending on the hierarchical level at which a goal is regulated, the nature of the goal pursued and of the feedback systems regulating the behavior will be very different. It also implies that we should be concerned by the level at which a goal is set and by the flexibility of the employee to shift his attention from one level to the other along the continuum while executing the action. Based on this model, ART

then positions how the design of work and of the different coordination processes can help with the regulation of workers' activities in a cognitive information processing model encompassing the collective and more abstract goals as well as the individual and more specific tasks (Oesterreich & Volpert, 1986; Tschan, 2002). Of importance, with the hierarchical structure of action and its impact on the design of work, is the notion that individuals do not always regulate their actions at the same level of hierarchy. We turn next to this notion of levels of regulation.

C. The hierarchical Levels of regulation – Modes of control

As we just mentioned, activities, aside from their sequential nature, can be described in terms of hierarchical levels of tasks and sub-tasks. This hierarchy does not only consist of an organization of goals and sub-goals, but also reflects the organization of the psychological processes regulating those goals. As such, the hierarchical nature of action regulation for ART represents much more than a hierarchical task analysis, including, and more importantly, a description of the levels of cognitive regulation, or modes of control, of actions at work (Hacker, 2003). The higher levels of the hierarchy of action regulation are conscious, thought-oriented, intellectual and general, while the lower levels consist more of unconscious automated routines that are specific and that imply sensorimotor programs (Frese, 2007; Hacker, 2003).

At the lowest level of regulation, the skill level, workers rely on procedural knowledge and tasks are handled routinely. As such, at the skill level, actions become routinized, situationally specific, automatic and less effortful (Frese, 2007; Frese & Zapf, 1994). Practice in a redundant environment leads individuals to regulate behavior at this skill level, which

requires no conscious decisions and a low level of feedback from the environment (Frese, 2007; Frese & Zapf, 1994). However, to come up with a substantial modification of these automatized behaviors, the regulation must be lifted to a higher, more conscious level (Frese, 2007). The second level of regulation implies processing of flexible action schemes (Hacker, 2003). These well trained action patterns are ready-made action programs that must be activated and integrated more or less consciously into a chain of action flexibly adapted for a specific situation (Frese, 2007; Frese & Zapf, 1994). Finally, the intellectual level of action regulation consists of the complex analysis of the situation and the development of strategies and plans to solve the problems encountered by the individual (Hacker, 2003). Execution at this level is based on conscious processing and while it allows for developing new action programs, it is working in a serial mode and is constrained by the limited resources of the conscious processing capabilities of the human brain (Frese, 2007; Frese & Zapf, 1994). Overall, this hierarchy is considered a weak hierarchy, because, while the highest levels of regulation include and determine the lower ones, the lower levels have also some level of autonomy and have a bottoms-up impact on the higher levels of the hierarchy (Frese, 2007; Hacker, 2003).

Finally, ART discussions about the levels of regulation and the sequences of action propose a basis for a job design model linking psychological well-being and performance. ART posits that action regulation problems result in stress (Frese & Zapf, 1994). Whether these regulation problems originate from regulation obstacles, regulation uncertainty or overtaxing of regulation resources, only the development of control over a task can overcome such difficulties (Frese & Zapf, 1994). As such, control can be developed when an action is complete hierarchically and sequentially

(Hacker, 2003). An action is complete hierarchically and sequentially when it allows an individual to get through all the phases of task regulation. A complete action, by allowing the individual to regulate his actions based not only on execution but also on abstract levels of the mental preparation of the action enable him to display autonomy in his actions and encounter learning opportunities (Hacker, 2003). The notion of complete versus partial work activities is considered to have a positive impact at the individual and organizational levels and can be achieved through the allocation of decision latitude (autonomy), the development of an intrinsic motivation and a deeper understanding of the requirements of a task (Hacker, 2003). We will now turn to the literature on goals and their impact on individual behavior in theoretical models outside ART.

3. Employee-related outcomes of goals in the workplace

A. The role theory

The impact of goals on individuals in the workplace has been well documented in various theoretical frameworks. Within the framework of the role theory (Kahn, Wolfe, Quinn, Snoek, & Rosenthal, 1964), the concept of role ambiguity has been generally referred to as "employees' perception of uncertainty concerning various aspects of their jobs" (Breaugh & Colihan, 1994). Role ambiguity has been initially defined in terms of predictability of behavioural outcomes and clarity of behavioural requirements (Rizzo, House, & Lirtzman, 1970). Researches demonstrated a solid relation between job or role ambiguity and variables of tension, anxiety or stress (Jackson & Schuler, 1985). In fact, as Jackson and Schuler (1985, p.40) state it, "The correlations of role ambiguity and role conflict with tension, and presumably other physiological reactions, seem to be the major reason that research on role

conflict and ambiguity is categorized as "stress" research". Two complementary explanations of the link between role ambiguity and negative outcomes at the individual level has been proposed: (1) Ambiguity consists of a noxious state leading individuals to be stressful (Kahn et al., 1964). (2) Ambiguity disrupts goal accomplishment (Sawyer, 1992). The literature on job ambiguity has not however proposed further details on the underlying modelization linking job ambiguity to symptoms of stress at the individual level (Schmidt & Neubach, 2007).

Over the years, however, the main scale of role ambiguity and conflict developed by Rizzo and colleagues (Rizzo et al., 1970) has been criticized on the basis of its psychometric deficiencies and the global validity of its construct (Breaugh & Colihan, 1994; King & King, 1990; Sawyer, 1992). At the center of the construct validity, criticism was the necessity to depart from the global measurement model of the overall job ambiguity to develop measure of the different, more specific, facets of role ambiguity (Jackson & Schuler, 1985; King & King, 1990). Returning to the work of Kahn and colleagues (Kahn et al., 1964) and their theory of role dynamics, researchers on job ambiguity proposed to measure key job-related information that had to be communicated in the work environment to ensure that employees can adequately perform their role. The resulting facets of the role ambiguity construct proposed distinguishing between goal clarity and process clarity (Sawyer, 1992) and between work method ambiguity, scheduling ambiguity and performance criteria ambiguity (Breaugh & Colihan, 1994). Although not proposing a clear modelization of the interrelation of these different types of information and of their distinctive impact on individuals, these researches demonstrated the validity of a distinction in the more specific facets of job ambiguity (Breaugh & Colihan, 1994; Sawyer, 1992).

B. The goal setting theory

Researches on the impact of goals on individuals in the workplace have also been done within the framework of the goal setting theory. The goal setting theory has demonstrated across numerous studies that a goal that is set as both difficult and specific will lead to a higher level of performance and satisfaction (Locke & Latham, 1990). A first major proposition of this theory is that difficult goals lead to the highest performance. The second major proposition is that goal specificity, by reducing the ambiguity of what is to be attained, and thus by clarifying the expectations, reduces the variation of the performance. However, many prerequisites seem attached to these conclusions, of which: performance must be fully controllable, the difficulty must not overcome the ability limit of the individual or more precisely, the individual must have the necessary knowledge and resources to perform the task (Locke & Latham, 2006). These prerequisites can prove to be difficult to attain in complex and uncertain environments, and this is the reason why the goal setting theory positions specific conditions in uncertain and complex environments (Latham & Locke, 2006; Locke & Latham, 2006). As presented by these authors, when facing complex tasks, people don't always have all the knowledge required to reach high levels of performance, which lead to weaker relations between the difficulty and specificity of the goal and the performance in empirical studies. In fact, in these circumstances, setting performance goals would disrupt learning and focus individuals on sheer effort and persistence instead of the development of new and adapted behavioural strategies. It has thus been found that in these circumstances asking individuals to do their best would lead to better strategies (Earley, Connolly, & Ekegren, 1989). Later, Winters and Latham (1996) proposed that

assigning specific and difficult learning goals instead of performance goals would lead to the best performance in these situations.

Central to this discussion is the notion of accuracy and quality of the goal setting process extensively discussed by Latham and Locke (Locke & Latham, 2006) and, when the environment is uncertain, the necessity to add to the distal goal, more proximal sub-goals, in order to have quick feedback and make learning from error possible (Locke & Latham, 2006). In a controversial article, Ordonez and colleagues (Ordonez, Schweitzer, Galinsky, & Bazerman, 2009a; Ordonez, Schweitzer, Galinsky, & Bazerman, 2009b) suggest that in many circumstances, goals may have various systematically detrimental effects and point out to specific areas of research that could more carefully bound the practice of goal setting in organizations. These authors propose that when managers define specific goals that go beyond their capacity to predict the end result of their goal setting practices on the behavior of individuals, many negative outcomes may appear. As mentioned, a particular strength of a goal at the behavioral level is to focus the attention of the employee. But, if goals become too specific, managers may not always realize the negative impact this can have at the individual and organizational levels, such as degrading employee performance, shift focus away from important but non-specified goals, harm interpersonal relationships, disrupt intrinsic motivation, corrode organizational culture, and motivate risky and unethical behaviors (Ordonez et al., 2009a; Ordonez et al., 2009b). In line with our previous discussion on ART, a hierarchically and sequentially complete task regulation process could prove to be a good way to protect individuals and organizations from the negative effects of a too narrow goal setting in complex and uncertain environment, as well as maintaining the

positive outcomes of specific and well defined goals, as proposed by the goal setting theory.

4. The demand-control model of occupational stress: linking control at work and psychological well-being.

The demand-control model of occupational stress (Karasek, 1979) positions that perceived decision-making latitude acts as a buffer toward workload-induced stress. Later on, the concept of job latitude has been broadened to include a more behavioural control orientation, including, for example, control over tasks, methods, or scheduling (Ganster & Fusilier, 1989; Jackson, Wall, Martin, & Davids, 1993; Karasek & Theorell, 1990). The demand-control model presents two major propositions: high job demand and low job control has the most detrimental implications on employee strain; high job control in the presence of high job demand can have a stress-alleviating effect on strain (Van der Doef & Maes, 1998, 1999). Early on, in a meta-analysis of the effect of perceived control and its impact at the individual level, Spector (1986) observed a large heterogeneity of results in the effect of autonomy on stress and other organizational outcomes and proposed that moderators of the positive effect of autonomy be identified. Mentioning the researches of Karasek (1979) on the demand-control model, Spector (1986) suggested that a potential moderation of workload should be considered as well as the possibility of individual differences in benefitting from autonomy like high growth need strength (Hackman & Oldham, 1976). Suggesting that not all individuals may respond positively to personal control, Spector (1986) observed that the provision of control in the work context was also accompanied by responsibility and increased workload. Thus, when an individual does not possess the required abilities and skills to exercise control

appropriately, the negative outcomes of control could be predominant over the positive outcomes. Over the years, the inconsistencies in research results on the demand-control model has led researchers to search for potential moderators by investigating various types of dispositional and situational characteristics (Daniels & Guppy, 1994; Day & Jreige, 2002; Jimmieson, 2000; Meier, Semmer, Elfering, & Jacobshagen, 2008; Parker & Sprigg, 1999; Parkes, 1991; Totterdell, Wood, & Wall, 2006).

The level of self-efficacy has been considered as a potential moderator variable explaining the context in which a high level of autonomy can become a buffer for a high workload level. As observed by Schaubroeck and Merritt (1997), the proposition of job control as a buffer against a high workload has a hidden premise about self-efficacy. Effectively, as proposed by Spector (1986) the provision of decision latitude over the task must be accompanied by a self-efficacy perception to lead individual to display coping behaviours (Schaubroeck & Merritt, 1997). Different studies on interaction between self-efficacy and control (Jimmieson, 2000; Meier et al., 2008; Schaubroeck, Jones, & Xie, 2001; Schaubroeck & Merritt, 1997) have demonstrated that the provision of control opportunities constituted a buffer over a high workload only in situations where the individual had the conviction he had the resources to exert the provided latitude. The latter results suggest that a personal disposition to consider that one can demonstrate competency, and efficaciously face the challenges encountered at work, is necessary to benefit the buffering effect on strain from autonomy at work.

Since self-efficacy beliefs are situationally specific (Wang & Richarde, 1988), they are thus more prone to be influenced by organizational variables. It is in this perspective that Chen and Bliese (Chen & Bliese, 2002) proposed

that variables such as job ambiguity and work experience could have proximal effects on the self-efficacy beliefs of employees. The authors argue that, even though the social cognitive theory did not specifically discuss the relation between role clarity and self-efficacy, the clear understanding of work expectations would be "congruent with the cognitive representation processes" (Chen & Bliese, 2002) proposed by Bandura (1997). In testing this relation, their results supported role clarity as a proximal antecedent of self-efficacy.

Taken as a whole, these results and theoretical propositions suggest that for an organizational context to confer control and thus to lead to the protective effect proposed by the job demand-control theory, the organizational context must support both the decision latitude/autonomy of individuals and the self-efficacy/competence. Also, some preliminary results proposed by Chen and Bliese (2002) suggest that job ambiguity could be an antecedent of the feeling of self-efficacy, and thus, the feeling of competence.

Hypothesized model

I. An overview

In the current study, we build upon a job design theory, the Action Regulation Theory (ART) and a motivational theory, the Self Determination Theory (SDT). Our objective is to propose a new modelization of the interaction between the work environment and the workers by inspiring ourselves of some core elements of these two theories. Central to our approach is the concept of a hierarchy of goals as reviewed in our section on the ART and the relevance of measuring the clarity of goals positioned at distinctive levels of this hierarchic structure. As such, we propose a model in which psychological need fulfillment, as defined by the SDT, mediates the relations between perceived clarity of three goal levels pertaining to an employee's job (i.e., collective goal clarity, individual goals clarity, individual action sequence clarity) and the employee's psychological well-being. We further propose that distinctive levels of a goal will satisfy different psychological needs. Also, we propose that the satisfaction of the psychological needs of the employee will fully mediate the impact of these different levels of goals on his psychological well-being. Thus, in the current study we aim at contributing to the job design literature by identifying and operationalizing a measure of three hierarchic levels of the goal structure developed in a workplace environment, as well as investigating the relation of these goal levels to individual psychological well-being. In this study, we also aim at contributing to the SDT literature by proposing that our approach to goal structure consists of an initial and partial operationalization of the SDT overarching construct of structure at the workplace. As such, a key contribution of our study is to investigate empirically the differential support that the clarity of distinct hierarchic levels of goals may have on motivational constructs, such as the satisfaction of psychological needs. Finally, another key contribution of this study will be to test the mediator role of psychological

needs in the modelization and conceptualization of the relation between the clarity of distinctive goal levels and employees' psychological well-being.

II. A measurement model of the goal structure

The hypothesized model is presented in Figure 1. Our operationalization of the goal structure has been designed based upon the steps of the mental preparation phase of the action in ART (Frese & Zapf, 1994; Rousseau, Aube, & Savoie, 2006). Our conceptualization of the goal structure is based on ART's conception of the mental preparation of the action, because of this model's relevance in operationalizing key hierarchic cognitive structure and describing sequential processes facilitating the regulation of action. Our proposition of three distinctive goal levels is inspired by the integrative teamwork behavior framework of Rousseau and colleagues (Rousseau et al., 2006), a model of team behavior largely inspired by ART. As proposed by these authors, the phase of team preparation of work accomplishment requires: 1st to grasp the overall organizational goal; 2nd orient oneself in the work environment and proceed to personal goal setting; 3rd make plans by deciding on the measures to be taken to reach the pursued goal. These three behavioural dimensions are formulated as follows: team mission analysis, goal specification and planning (Rousseau et al., 2006).

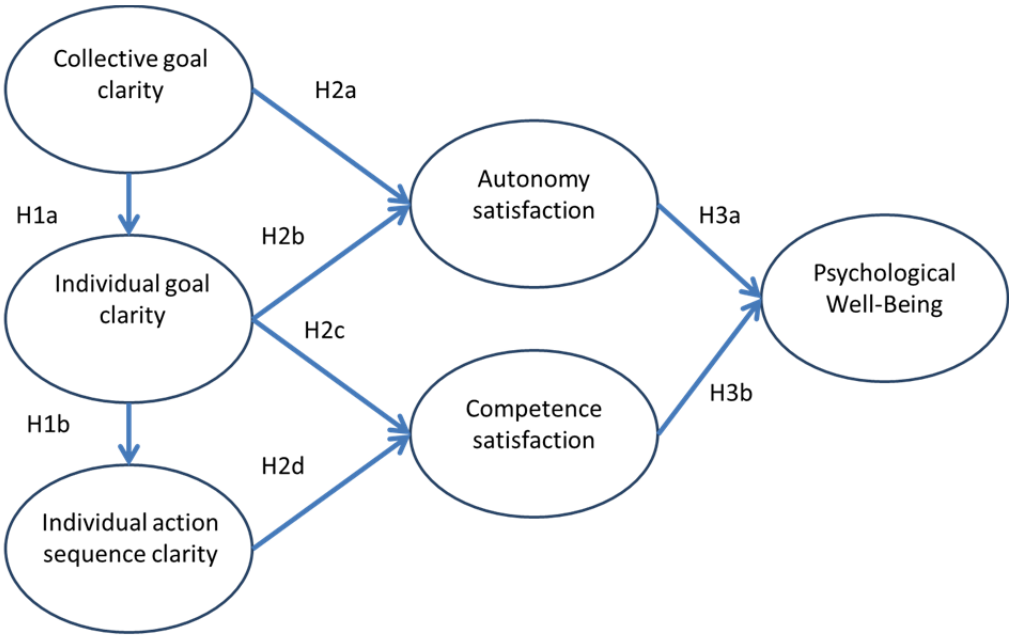

Figure 1- Hypothesized model

Our operationalization of this model in terms of mental structures goes as follows: by striving to understand the overall organizational goal of the organization, an individual develops a clear understanding of the collective goal he is contributing to; by orienting himself in the work environment and setting himself personal goals, an individual develops a clear understanding of his individual goals; and finally, by making plans and deciding on the measures to be taken to reach his goals, an individual develops a clear understanding of the sequence of action, or sub-goals, that will allow him to reach his goals. Our approach thus consists in proposing three broad hierarchical levels of goals and measuring their respective clarity. These levels of goals are the collective goal level, the individual goal level and the individual action sequence level. We propose that these different goal levels can be organized hierarchically from the abstract formulation of a team

mission and purpose, to the more specific formulation of individual goals, and finally to the concrete formulation of action plans and sub-goals. We further propose that these goal levels could represent fundamental mental structures at play in the motivational regulation of behavior in a complex and multilevel work environment. Finally, we propose that, by measuring the clarity of mental structures representing fundamental goal levels at play in the workplace, we offer a model that allows the analysis of the prevalence of effective communication processes for key information types in the work environment.

As such, it is not the particular organizational practices or processes present in the work environment that we will measure. Rather, it is the resulting perceived clarity of the mental structures that are experienced as a result of these organizational practices and processes. Indeed, the concept of structure could be conceptualized in two different ways: a) in terms of concrete practices and processes, that are external to the individual, that are present in the work environment, and that communicate specific information and goals to the employees; or b) in terms of mental structures, internal to the individual, that represent what types of information employees need from its environment to develop an efficient action intention and feel self-determined. We position these two perspectives because we consider both of them as being legitimate approaches to investigating what should be designed in the workplace and determine how a particular job characteristic can facilitate the motivational regulation of work behavior. Two reasons explain our choice to design our research question in the perspective of the mental structures approach. First of all, our contention is that it is the perceived clarity of these mental structures that will have a proximal impact on the need satisfaction of the employees and ultimately their psychological well-being. Indeed, rather than approaching the question of structure by asking what should be designed

in terms of specific managerial practices and artifacts in the workplace environment, we decided to approach this question in terms of what mental structures employees require to regulate work behaviors. Second of all, our objective was to develop a measurement model that would grasp the universal cognitive structures associated with action regulation in the workplace, rather than develop a measure that would be situational and specific to the particular practices developed in a specific organization or industry. Such an approach, while reducing direct and practical applicability of our results should however yield higher generalizability of the results across different work environments.

According to the hierarchic and sequential nature of the regulating process in ART (Frese & Zapf, 1994), we hypothesize that the three cognitive structures identified previously will relate to each other in a hierarchic way:

H1a: Collective goal clarity positively relates to individual goal clarity.

H1b: Individual goal clarity positively relates to individual action sequence clarity.

H1c: Individual goal clarity fully mediates the relation between collective goal clarity and individual action sequence clarity.

III. Linking the goal structure to needs satisfaction

The operationalization of the goal structure we just proposed has theoretical affinity with the concept of structure presented by SDT. Indeed, SDT proposes that the structure of a social environment provides an informational support that helps individuals identify a clear link between an intention and the actions that will make possible its enactment (Ryan & Deci, 2000). According to Ryan and Deci (2000, p.68), "research on the conditions that foster versus undermine positive human potentials has both theoretical import and practical significance because it can contribute not only to formal knowledge of the causes of human behavior but also to the design of social environments that optimize people's development, performance, and well-being.". Indeed, several studies link SDT needs with job characteristics (Greguras & Diefendorff, 2009; Anja Van den Broeck, Vansteenkiste, De Witte, Soenens, & Lens, 2010) on the basis that this theory can provide relevant conceptual tools to explain how different characteristics of the social environment can impact the motivational regulation of individual actions. In these researches, the psychological needs are often studied separately in order to show the differential impact of varied work context components on distinct psychological constructs. Indeed, several studies have demonstrated that the three needs proposed by SDT are differentially related to distinctive organizational variables (Richer, Blanchard, & Vallerand, 2002; Van den Broeck, Vansteenkiste, De Witte, & Lens, 2008).

Also, the cognitive evaluation theory (CET), the initial conceptual framework through which SDT investigated the relation between social contexts characteristics and the development of qualitatively different motivational regulation, focuses strictly on the need for autonomy and

competence (Van den Broeck et al., 2008). The need for relatedness is not integrated into this model because relatedness is not a necessary condition to experience intrinsic motivation (e.g. reading or computer programming) and is considered as more distal than the needs for competence and autonomy in its influence on the motivational regulation process (Ryan & Deci, 2000). To us, it is absolutely relevant to integrate a social perspective to the motivational regulation in collective and complex work contexts requiring a high level of interpersonal interactions, because of the interdependence of the tasks prevalent in these environments. The investigation of the relational nature of work and its impact on job design has been done previously in other researches, both within and outside the SDT framework. The impact of relational aspect of work with motivational dimension proposed by SDT is currently the center of a growing interest (Grant, 2008; Grant & Berry, 2011) and new models of the relational perspective of job design are proposed (Grant & Parker, 2009). However, the modelization put forward in this thesis bases itself strongly on CET to model the relation between goals structures and psychological needs. As such, we are much less focused on the mental structure pertaining to the social work context, but rather more oriented toward the task structure. In this perspective, our modelization, although positioned in the tradition of SDT, will focus exclusively on the need for autonomy and the need for competence.

SDT proposes that structure, in a social context, facilitates the development of a clear action intention and the identification of the means to reach precise objectives, which in turn will directly impact the satisfaction of the need for competence (Ryan & Deci, 2000; Taylor & Ntoumanis, 2007). As mentioned by Connell and Wellborn, the level of structure, in an SDT perspective, can be related to the quantity and quality of the information at the disposal of the individual as to the expectations set for him and the means to

reach these objectives (Connell & Wellborn, 1991). ART proposes that these types of information are integrated into the operative image systems individual have about their work environment (Frese & Zapf, 1994). The content of the operative image systems is varied but can be divided into three broad categories: a) action sequencing and timeframes; b) content of actions which include work approaches; and c) strategies of action. The operative image system thus has a guiding function in terms of goal orientation and action plan definition. When applied to the context of our research, these principles will be associated with the hypothesis that cognitive structures pertaining to action sequences and individual goals, by facilitating the development of clear action paths toward objectives, will facilitate the satisfaction of the need for competence.

Moreover, SDT also proposes that environmental factors can have an impact on the satisfaction of the need for autonomy of individuals by facilitating the integration of the intention to their self-concept (Reeve et al., 2004). As such, many factors have been identified as efficient means to support the autonomy of individuals, one of which is of particular interest to our operationalization of the regulating structure: the provision of a rationale for demands. Several studies (Deci, Eghrari, Patrick, & Leone, 1994; Reeve, Jang, Hardre, & Omura, 2002) demonstrated a significant positive effect between the provision of a rationale for action and the satisfaction of the need for autonomy. As such, our contention is that the clarity of the collective task will support the understanding of the context in which the individual task has to be enacted, and thus facilitate the understanding of the rationale behind one's individual goals. Such a conceptualization of the link between contextual information and autonomy is also proposed in the ART literature and discussed within the concept of "complete action" (Frese & Zapf, 1994; Hacker, 2003). As mentioned in our review of ART, a complete action, by

allowing an individual to get through the complete mental preparation phases of action regulation, enables him to learn actively in the action and to gain control over a particular task. Control in ART implies a high level of autonomy described both in terms of decision latitude and in terms of access to higher level goals and metagoals (Frese & Zapf, 1994). When applied to the context of our research, these principles will be associated with the hypothesis that when information about team level tasks and individual objectives is available, individuals have more opportunities to initiate a complete regulation of the work they have to do. As such, employees will be in a position to develop both a better understanding of the reason why they have to perform a particular task and a better integration of the global objectives of the organization. It is thus in such a context that they will be more likely to experience a greater satisfaction of their need for autonomy. More specifically, we propose the following hypothesis regarding the relation between the clarity of the goal structure and psychological needs satisfaction:

H2a: Collective goal clarity positively relates to autonomy satisfaction.

H2b: Individual goal clarity positively relates to autonomy satisfaction.

H2c: Individual goal clarity positively relates to competence satisfaction.

H2d: Individual action sequence clarity positively relates to competence satisfaction.

IV. Linking needs satisfaction to psychological well-being

The organismic tendency of individuals to seek an actualization and integration of the self is a central pillar of the SDT models (Ryan & Deci, 2000). A strong root of the empirical investigation of the SDT perspective has always been the study of the internal mechanisms leading to psychological growth, integrity and well-being (Ryan & Deci, 2000). This innate and natural tendency is also positioned within a dialectical interface where the social environment is closely interrelated with the motivational processes of individuals (Deci & Ryan, 2002). The three basic psychological needs, the need for autonomy, competence and relatedness proposed within the SDT have been used extensively to study empirically this interface (Deci & Ryan, 2002; Ryan & Deci, 2000). First, these needs have been used in several studies in order to demonstrate their reliable explicative power of individual well-being in various life domains (Gagne et al., 2003; Reis et al., 2000; Sheldon et al., 1996). Second, several studies have also used the basic psychological needs as constructs representing meaningful innate psychological structures essential for optimal psychological functioning (Ryan & Deci, 2000). They have thus proved to be useful constructs to identify characteristics of the social environment as promoting optimal functioning and well-being of the individual (Deci & Ryan, 2002; Ryan & Deci, 2000). For example, the study by Ilardi, Leone, Kasser and Ryan (1993) in a factory context showed that workers experiencing greater overall satisfaction of their basic psychological needs experienced more positive work attitude, higher self-esteem and better well-being as indexed by the General Health Questionnaire (Goldberg & Hillier, 1979). In another study, Baard, Deci & Ryan (2004) demonstrated that basic psychological needs in a work context

could prove to be an efficient way to link organizational factors to individual variables, such as performance and psychological adjustment.

Furthermore, in predicting stress in the workplace, the demand-control model of occupational stress of Karasek (Karasek, 1979) makes an interesting contextualisation of control at work and its role as a buffer toward workload-induced stress. As mentioned, the demand-control model presents two major propositions: high job demands and low job control have the most detrimental implications on employee strain; high job control in the presence of high job demands can have a stress-alleviating effect on strain (Van der Doef & Maes, 1998, 1999). Within our review of the demand-control model of occupational stress, we however proposed that within the concept of control proposed by this model lies a hidden assumption about self-efficacy. More specifically, it is suggested that giving opportunity for control (or decision latitude) must also be accompanied with perceptions of self-efficacy by the individual in order to face and cope with the increased responsibilities and workload that comes with greater decision latitude. Thus, this model proposes that when an individual does not possess the required abilities and skills to exercise the decision latitude he is granted, the negative outcomes of the control he is granted could be predominant over the positive outcomes (Spector, 1986). Taken as a whole, this suggests that for an organizational context to confer control and provide the protective effect proposed by the job demand-control theory, the organizational context should both support the decision latitude or autonomy of individuals as well as the self-efficacy or competence of the workers.

On the basis of these two theories, we expect the basic psychological needs of autonomy and competence to be positively related to the psychological well-being. Furthermore, we expect the basic psychological

needs to be a meaningful mediator of the relationship between the clarity of the different goal levels and psychological well-being.

H3a: Autonomy satisfaction positively relates to psychological well-being.

H3b: Competence satisfaction positively relates to psychological well-being.

H3c: Autonomy and competence satisfaction mediate the relation between the job clarity facets and psychological well-being.

Method

I. Participants

As part of a research-action partnership with a video game development organization, the employees of a studio developing video games have been solicited to participate in this study. The organizational environment of video game development studios suit well the characteristics of the work context that we wanted to investigate with our research question, this is to say, "work context that requires collective efforts on complex and uncertain tasks". Indeed, the characteristics of video game development work contexts has been studied and described in depth by other researchers (Cohendet & Simon, 2007; Simon, 2006; Walfisz, Zackariasson, & Wilson, 2006; Zackariasson, Styhre, & Wilson, 2006) and its characteristics correspond closely to those of soft projects as presented by Atkinson and colleagues (2006): goals that are highly ambiguously defined and abstract, success measures that are qualitative in nature, projects highly subject to external influence and exploration of many alternative solutions. To face the numerous challenges of the video game development work environment, new ways of modelizing the functioning of the project environment are proposed in the literature and base themselves on the characteristics of Complex Adaptive Systems (eg. Vidgen & Wang, 2009) and capture the essence of our analysis of complex and unstable work environments mentioned in the first section of this thesis.

Data from 153 full-time video game developers were analyzed in the current study. The mean age of the sample was 31.6 years (SD 4.70) and 90.3% of the sample was male, a proportion that is representative of the video game development industry. Participants were part of three different game development projects ranging from 40 to more than 100 persons. Each project was divided in a number of sub-teams whose number and composition was

dynamically changing based on the evolving needs of the projects. Overall, a variety of job families (37.4% programmers; 40.8% artists; 13.1% designers; 7.8% managers) were present in these projects. Participants could answer the survey either in French (51.6%) or in English (48.4%).

II. Procedures

The surveys were delivered through an internet platform independent from the organization and managed by the research team. The survey was available both in French and in English and a professional translation firm has been solicited to produce the French version of the survey. The measurement process has been divided into two phases. In phase 1, we measured variables pertaining to the different facets of job ambiguity. Two to three weeks later, surveys of the second phase were sent to the members of the projects and included a measure of psychological well-being and the psychological need satisfaction/frustration scales. This delay has been included in the research design in order to mitigate the effect of the common-method variance on the results. Two to three weeks have been judged sufficient to meet this objective.

Confidentiality of the individual responses of the participants has been guaranteed. Thus, only aggregated data by job families have been presented to project managers and executives of the studio. All the members of the projects targeted by our study (201) were solicited to participate in the study. The different job families covered the following specialities: game design, artists, software engineering and management. The participation rate in the study is high, 77% (153) of the participants answered both phases of data collection and 5% (10) of the sample answered only the first phase of the study.

III. Measures

1. The different facets of job clarity within the team

Clarity of the collective goal. A scale adapted from the team mission scale of the Campbell & Hallam (1994) Team Development Survey has been used to measure the clarity of the collective goal. The scale consists of 4 items rated on a 5-point scale ranging from 1 (Disagree strongly) through 5 (Agree strongly). A sample item includes "The overall purpose of this team is clear to me." For this scale Campbell and Hallam (1994) report Cronbach's coefficient of 0.81. The Cronbach's coefficient for our version of this scale is 0.90.

Clarity of individual Goals. We used the goal clarity scale developed by Sawyer (Sawyer, 1992) as one of the facets of the more general role ambiguity constructs. The questionnaire asks to indicate "how certain" the respondents are about different aspects of their job on a 6-point scale ranging from 1 (very uncertain) to 6 (very certain). A sample item includes "The goals and objectives for my job". For this scale, Sawyer (1992) reports Cronbach's coefficient of 0.92.

Clarity of action Sequence. We used two complementary scales developed by Breaugh & Colihan (Breaugh & Colihan, 1994), work method and scheduling ambiguities that were developed to measure two additional facets of the construct of role ambiguity. The items were rated on a 7-point scale ranging from 1(disagree strongly) to 7(agree strongly). A sample item for each of these two scales includes "I know what is the best way (approach) to go about getting my work done" and "I am certain about the sequencing of my work activities (when to do what)". For these two scales, the internal

consistency (alphas) reported by Breaugh and Colihan (1994) are 0.88 for the work method ambiguity scale and 0.88 for the scheduling ambiguity scale.

2. The mediating and dependent variables

Basic need satisfaction. We measured need satisfaction with a preliminary version of the Work-related Basic Need Satisfaction scale (Van den Broeck et al., 2010) obtained before the publication of the final version of the instrument. This instrument consists of 18 items used to assess the extent to which individuals experience satisfaction with the three basic psychological needs at work (i.e., competence, autonomy and relatedness). Sample items include "I really master my tasks at my job" (competence), "I feel free to do my job the way I think it could best be done" (autonomy), and "At work, I feel part of a group" (relatedness). The items were rated on a 5-point scale ranging from 1 (totally disagree) to 5 (totally agree). For these scales, the internal consistency (alphas) reported by Van den Broeck and colleagues (2010) are 0.81 for the autonomy scale, 0.85 for the competence scale and 0.82 for the relatedness scale. The alpha coefficients for our version of these scales are 0.82 for the autonomy scale, 0.82 for the competence scale and 0.84 for the relatedness scale.

Psychological well-being. We used Goldberg (1972) GHQ-12 instrument to measure psychological well-being. A sample item includes "Have you recently been feeling unhappy and depressed?" and responses were given on a 4-point scale ranging from 1 (more than usual) to 4 (much less than usual). For this scale, the internal consistency (alpha) generally reported in several studies is between 0.82 and 0.86 (Goldberg et al., 1997).

Results

I. Preliminary analysis

Missing values for each item have been replaced by the mean of the sample on this item (less than 0.01% of the responses). Univariate outliers have been examined and replaced by values at 3.29 standard deviation of the mean of the sample for the item on which such scores have been identified (0.02% of the responses) and 2 participants have been identified as multivariate outliers and excluded from the analysis (Tabachnick & Fidell, 2007). Also, items have been analyzed in terms of the normality of their distribution and all variables respected the norms set by Curran and colleagues (Curran, West, & Finch, 1996) as well as Kline (1998), in terms of Skewness and Kurtosis indices. Multiple regressions were conducted to examine if demographic variables (age, sex, language in which the survey has been completed) affected the dependent and mediating variables. Demographic variables were non-significantly associated with the dependent and mediating variables ($p \geq 0.05$). Finally, linearity between all possible pairs of the variables measured in this study has been assessed by inspection of bivariate scatterplots (Tabachnick & Fidell, 2007). No pairs of variable have been identified as departing from linearity.

II. Exploratory and confirmatory factorial analysis of the scales measuring the different dimensions of job clarity

In this study, four scales measuring three sub-dimensions of job ambiguity have been selected from three different and already validated instruments. Theoretically, a basic three-factor solution was expected, representing the collective goal clarity, the individual goal clarity and the

individual action sequence clarity. The possibility of a four-factor solution was also considered, where the individual action sequence dimensions would split into two highly correlated factors representing the work method ambiguity and the scheduling ambiguity scales. Exploratory factorial analyses using the Principal axis factoring method of estimation have been used to analyze the factorial structure of the scales of job ambiguities. Because a high correlation between these different scales measuring sub-dimensions of the global construct of job ambiguity was expected, Oblimin rotation methods have been selected.

The factorial solution with four factors has been retained because of the high proportion of variance explained by this factorial structure (69%) and its theoretically sound interpretation. Table 1 presents this factorial solution. The structure of these factors represents: a first factor including the four items of the Campbell and Hallam (1994) team mission scale; a second factor including the five items of the Sawyer (1992) goal clarity scale; and a third and fourth factor including the respective three items of the Breaugh & Colihan (1994) work method ambiguity and scheduling ambiguity scale. The intercorrelations (table 2) between these factors respect the theoretical expectations of a proximal link between individual goal clarity and both the collective goals and the sub dimension of individual action sequence clarity, as well as a more distal relation between collective goal clarity and the two sub-dimensions of action sequence clarity. Finally, a high correlation can be observed between the two sub-scales used to assess the clarity of individual action sequence.

The soundness of our measurement of the three sub-dimensions of job clarity has then been tested using the Confirmatory Factor Analysis. Confirmatory Factor Analysis allowing the modelization of complex factorial

structures, we opted to test additional assumptions underlying the organization of our job ambiguity construct. The factorial structure tested is displayed in figure 2. This structure reflects the basic 4-factor structure obtained with our exploratory factor analysis. We however grouped together the work method and scheduling ambiguity into a second order factor representing individual action sequence clarity. Finally, a global job ambiguity factor regrouping the three sub-dimensions of the collective goal clarity, individual goals clarity and individual action sequence clarity has been proposed. The structure tested fit the data well (Robust CFI ≥ 0.95; SRMR ≤ 0.06; Robust RMSEA ≤ 0.06) and all indicators loaded significantly on their corresponding latent construct ($p < 0.05$).

Table I - Factorial solution of an exploratory factorial analysis of the scales used to measure the sub-dimensions of job ambiguity

Items	Factors			
	F1	F2	F3	F4
TMS-1	.86			
TMS-2	.86			
TMS-3	.54			
TMS-4	.73			
GCS-1		.86		
GCS-2		.80		
GCS-3		.68		
GCS-4		.74		
GCS-5		.50		
WMA-1			.57	
WMA-2			.96	
WMA-3			.82	
SAS-1				.84
SAS-2				.73
SAS-3				.73

Notes: Saturation < .35 not displayed; TMS = Team mission scale (Campbell & Hallam, 1994), GCS = Goal clarity scale (Sawyer, 1992), WMA = Work method ambiguity and SAS = Scheduling ambiguity scales (Breaugh & Colihan, 1994).

Table II - Factor intercorrelations

	F1	F2	F3	F4
Team mission scale	**(.85)**			
Goal clarity scale	.55	**(.90)**		
Work method ambiguity scale	.49	.35	**(.89)**	
Scheduling ambiguity scale	.58	.34	.61	**(.87)**

Note : On the diagonal and in parentheses, the Cronbach alphas of each scales are presented.

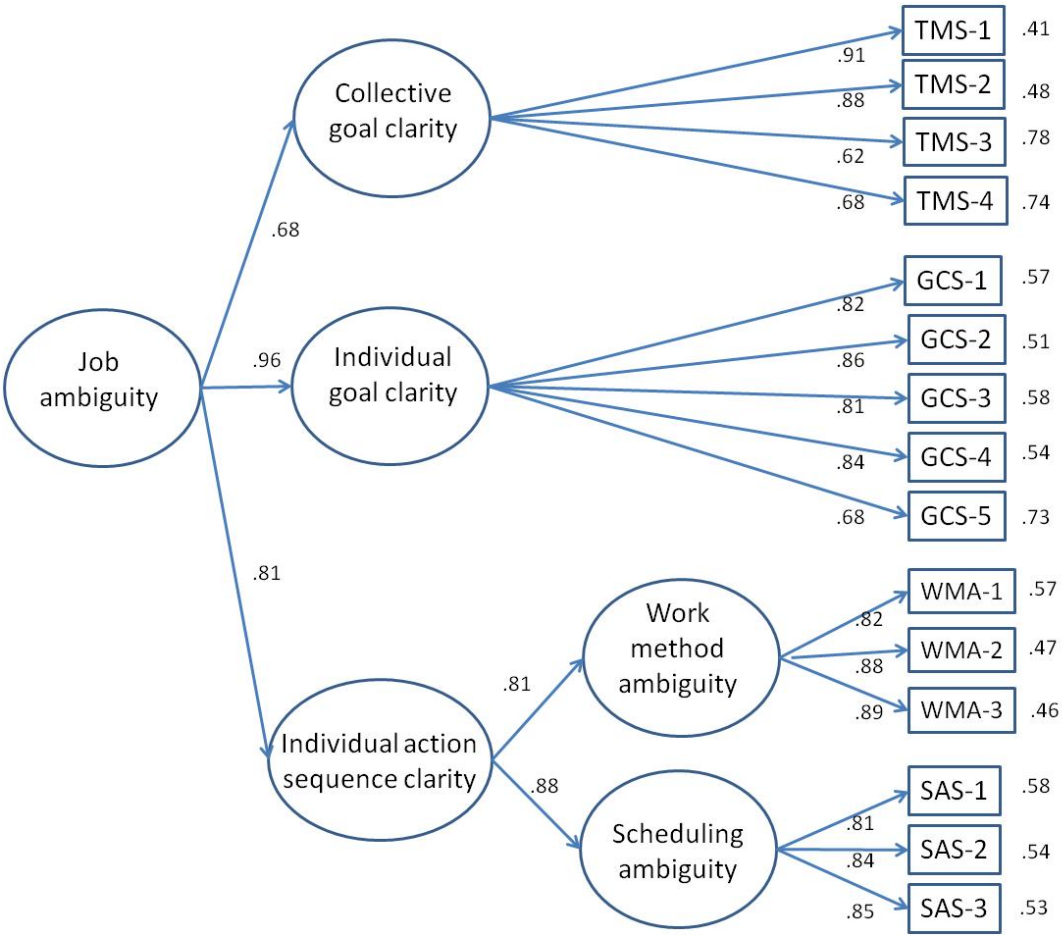

Figure 2 - Confirmatory Factor Analysis model of the scales used to measure the sub-dimensions of job ambiguity with significant coefficients presented in standardized form.

III. Structural equation modeling: testing the validity of the hypothesized causal structure

The focus of our subsequent analyses will be to test a structural modelization of the relations among the latent construct measured, rather than testing the factor structure of the already validated instruments used in the study. Manifest indicators (or parcels) have been created for the different

latent constructs of our models. The two sub-scales used to measure the individual action sequence clarity, the work method ambiguity and the scheduling ambiguity scales, have been aggregated together in a common factor comprising three parcels. Items were carefully grouped according to content in order to represent both facets of method and scheduling ambiguity in each parcel (Hagtvet & Nasser, 2004; Kishton & Widaman, 1994). The goal clarity scale, the competence and autonomy satisfaction scale, and the GHQ scales each have been aggregated in three parcels based on the Alpha-if-deleted method because these scales covered a single facet (Little, Cunningham, Shahar, & Widaman, 2002). The team mission scale has also been aggregated based on the Alpha-if-deleted method, but only two parcels have been created because of the limited number of items of the scale (four).

The analyses have been executed with the program EQS using Maximum Likelihood estimation with robust standard error estimation. Model fit was assessed using the following fit indices: the $\chi 2$ likelihood ratio test, the ratio of the $\chi 2$ divided by its degrees of freedom ($\chi 2$/df), the Satorra-Bentler scaled $\chi 2$, the Robust Comparative Fit Index (R-CFI), the Standardized Root Mean Square Residual (SRMR) and the Robust Root Mean Square Error of Approximation (R-RMSEA). Robust statistic test and indices are presented because inspection of the multivariate kurtosis normalized estimate indicates that our data depart from multivariate normality. Values above 0.95 for the R-CFI, lower than 0.08 for the SRMR, and lower than 0.06 for the R-RMSEA would be considered a close fit (Bollen, 1989; Hu & Bentler, 1999). Also, the pertinence of different modifications to the models has been evaluated based on Chi-square difference test, which tests the null hypothesis of identical fit between both models. Scaling corrections have been used for Chi-square difference test done using Satorra-Bentler scaled $\chi 2$ (Satorra & Bentler, 2001).

1. Measurement model and descriptive statistics

Results for the hypothesized measurement model indicate that the model fit the data well (Robust CFI ≥ 0.95; SRMR ≤ 0.08; Robust RMSEA ≤ 0.06). All indicators loaded significantly on their corresponding latent construct ($p < .05$). Table 3 reports the means, standard deviations, estimated reliabilities, and intercorrelations of the study variables. As it can be seen, the internal consistency values were satisfactory for all substantive variables.

Table III - Descriptive statistics and intercorrelations

	Variables	1	2	3	4	5	6
1.	Collective Goal Clarity	(0.90)					
2.	Individual Goal Clarity	.56**	(0.90)				
3.	Individual Action Sequence Clarity	.45**	.68**	(0.85)			
4.	Autonomy Satisfaction	.54**	.55**	.51**	(0.82)		
5.	Competence Satisfaction	.25**	.37**	.58**	.43**	(0.82)	
6.	Psychological Well-Being	.34**	.39**	.43**	.40**	.42**	(0.90)
Mean		3.82	4.84	3.94	3.48	4.03	2.03
Standard Deviation		.91	.86	.67	.68	.59	.56
Theoretical Range		1 to 5	1 to 6	1 to 5	1 to 5	1 to 5	1 to 4

Note. n = 153. ** $p < 0.01$. Reliability estimates (Cronbach's alpha) are presented on the diagonal.

2. Structural model

The fit indices of the structural models that have been tested are presented in table 4. We first tested our hypothesized model (SM_1) presented

in figure 3. This model displayed a good fit (Robust CFI = 0.974, SRMR = 0.061, Robust RMSEA = 0.039). When inspecting the estimates of the parameters of SM_1, one path was not statistically significant. The path from individual goal clarity to competence satisfaction (*B* = -0.07, *SE=0.08, p › 0.*05) hypothesized in our model was not supported by the data. No other additional path would have resulted in additional and significant level of variance. A second model (SM_2) has been tested where the path from individual goal clarity to competence satisfaction was deleted. This model displayed a good fit (Robust CFI = 0.974, SRMR = 0.060, Robust RMSEA = 0.039) and all paths were statistically significant and consistent with our hypothesized model.

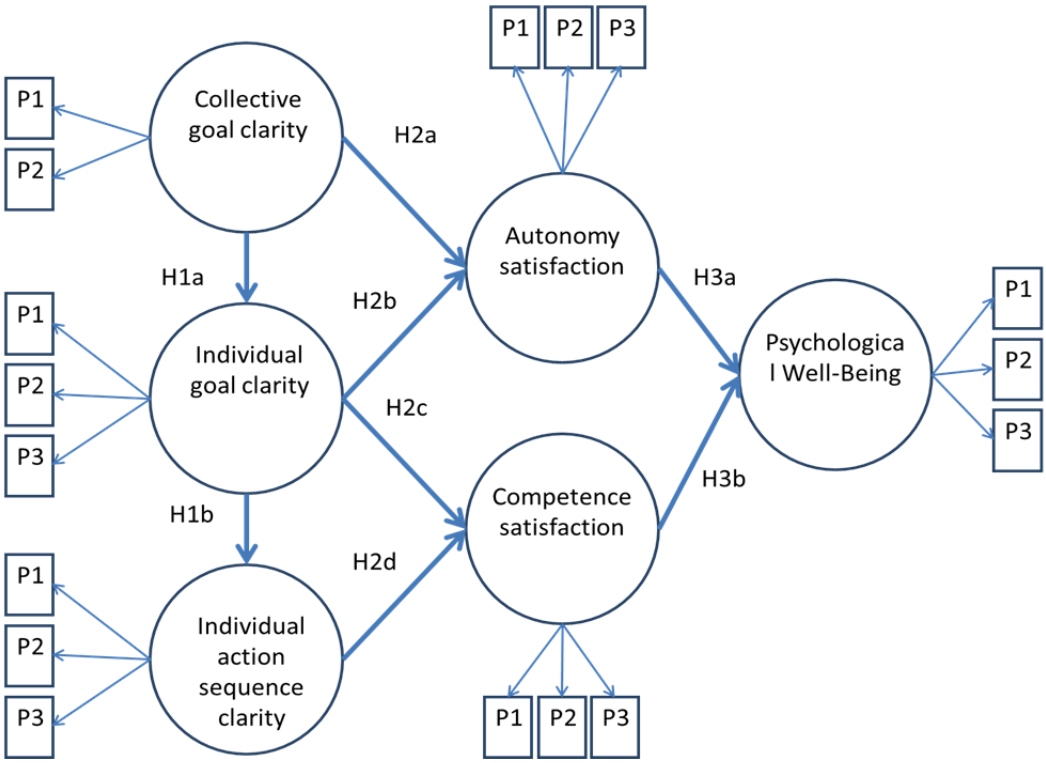

Figure 3 - Hypothesized model (SM1)

SM_2 has been tested against different alternative models in order to confirm some of the assumptions underlying the hypothesized model. In the first alternative model (SM_3), we reversed the causal direction of the paths linking the three sub-dimensions of job clarity. The path was thus changed to reflect a causal route from individual action sequence clarity toward individual goal clarity and toward collective goal clarity. Model SM_3 displayed a fit identical to the model SM_2 making of these two models, equivalent models. On a theoretical basis, ART would suggest a top down, hierarchical and sequential effect like the one suggested in SM_2. ART would also suggest that a bottom-up effect would be mediated toward upper cognitive levels through feedback processes originating from action, a feedback process not captured by the variables measured in this study. On that ground, we decided to favor the top-down alternative proposed in model SM_2. A second alternative model (SM_4) was then tested reversing the causal direction of SM_2 by positioning psychological well-being as a predictor instead of an outcome. The SM_4 causality path thus became psychological well-being toward autonomy and competence feeling and toward job clarity sub-dimensions. This model displayed a relatively good fit with the data but was inferior to SM_2 (Robust CFI = 0.954, SRMR = 0.102, Robust RMSEA = 0.053)

Table IV - Structural equation modeling fit statistics for the models tested

	$\chi2$	df	$\chi2$/df	SB$\chi2$	R-CFI	SRMR	R-RMSEA and 90% CI
Measurement Model	141.2**	104	1.36	126***	.978	.048	.037 (.00-.058)
Structural Model 1	154.1**	111	1.39	137***	.974	.061	.039 (.004-.059)
Structural model 2	155**	112	1.38	137.6***	.974	.060	.039 (.000-.059)
Structural model 3	155**	112	1.38	137.6***	.974	.060	.039 (.000-.059)
Structural Model 4	180.3	112	1.61	159.6*	.954	.102	.053 (.032-.070)

*Note : *** p › 0.05, ** p › 0.01, * p › 0.001.*

We then tested the structural assumptions of our model proposing that autonomy and competence satisfaction mediate the effect of the sub-dimensions of job clarity on psychological well-being. SM_2 was thus tested sequentially against three alternative models where we added, one at a time, a direct path from the three job clarity sub-dimensions toward psychological well-being. Results indicated that the addition of a direct path from collective goal clarity to psychological well-being was not statistically significant (*B*=0.04, *SE=0.04, p › 0*.05). The indirect effect was statistically significant (*B*=0.08, *SE=0.03, p < 0*.05) and accounted for 68% of the variance of collective goal clarity on psychological well-being. Then the addition of a direct path from individual goal clarity to psychological well-being was again not statistically significant (*B*=0.08, *SE=0.09, p › 0*.05). The indirect effect remained statistically significant (*B*=0.17, *SE=0.61, p < 0*.05) and accounted for 69% of the variance of individual goal clarity on psychological well-being. Finally, the addition of a direct path from individual action sequence clarity to psychological well-being was again not statistically significant (*B*=0.09, *SE=0.09, p › 0*.05). The indirect effect remained statistically significant (*B*=0.12, *SE=0.06, p < 0*.05) and accounted for 55% of the variance of individual action sequence clarity to psychological well-being. When adding these three paths simultaneously in a single model, the Satorra-Bentler Chi-Square difference test was not significant $\Delta\chi2(3) = 1.55$, *p › 0*.05 and the addition of these three paths lead to no additional explained variance to psychological well-being compared with SM_2. Taken as a whole, these results support the assumption that the feelings of autonomy and competence are good mediators of the effect of the job clarity sub-dimensions on the level of the psychological well-being in our sample.

Table V - Indirect effects of job ambiguity sub-dimensions on psychological well-being

Type of fit	Psychological Well-being
Collective goal clarity	
Indirect effect	.34*
Individual goals clarity	
Indirect effect	.31*
Individual action sequence clarity	
Indirect effect	.21*
Model R^2	.293

*Note: * $p < 0.05$*

SM_2 was also tested against another alternative model, adding a direct path between collective goal clarity and individual action sequence clarity. This alternative model allowed the testing of the structural assumption in our model of mediation through individual goal clarity of the effect of collective goal clarity on individual action sequence clarity. Results indicated that the addition of a direct path from collective goal clarity to individual action sequence was not statistically significant (B = 0.05, $SE=0.04$, $p \rangle 0.05$), while the indirect effect through clarity of individual goals was statistically significant (B = 0.19, $SE=0.04$, $p < 0.05$) and accounted for 80% of the variance. When adding the direct paths, the Satorra-Bentler Chi-Square difference test was not significant $\Delta\chi2(1) = 0.99$, $p \rangle 0.05$. The addition of this path lead to no additional explained variance to psychological well-being compared with SM_2. Figure 4 presents the estimated standardized path coefficients for the best-fitting model.

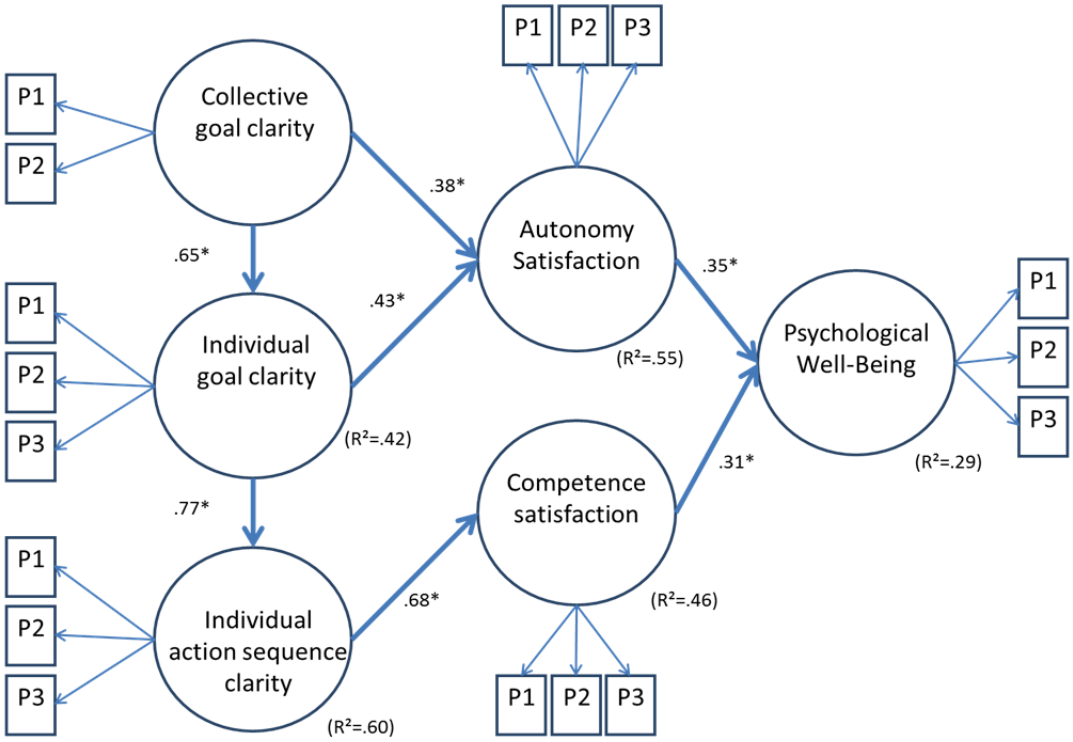

Figure 4 - Best-fitting model (SM2) with standardized path coefficient

Discussion

It is the theory which decides what can be observed.

- **Einstein**

In this chapter we will discuss the principal findings of this research and put them into context. We will a) review the objectives of this research, b) present the results of our study, c) discuss the limits of this research, and d) propose new research development opportunities raised by our results.

I. Review of the research objectives

This research aims at giving a preliminary answer to the practical questions faced by organizations undertaking creative endeavours: How can we structure an innovative organizational environment without interfering with the creative processes of individuals? Our investigation is multilevel in the theoretical perspective, trying to link conceptual constructs from organizational theories to a model of individual functioning in creative and complex work contexts. Our empirical research is however at the level of individual cognitions and focuses on the mental preparation process supporting the action regulation of employees. Our research objectives have been formulated as follows:

1. Position theoretically the work processes of creative and complex collective tasks in the perspective of organizational theories. Through this investigation, define a psychological approach to study the structure of creative and complex work environments.

2. Define an operationalization of different mental structures, at the individual level, orienting the execution of creative and complex collective tasks.

3. Study the relations of these mental structures with other variables pertaining to the individual psychological functioning at work.

Our first objective resulted in a theoretical investigation to position a psychological approach to the study of complex and creative organizational work contexts. This investigation had two main sub-objectives: 1) identify how these work contexts influence the way organizations structure their work processes; and 2) discuss how these particular work contexts impact employee's psychological processes of work regulation. Our second objective is associated with the development of a model based on an understanding of agent based organizational systems and on key propositions pertaining to the cognitive regulation of tasks by employees. We thus ended up building our model based on a job design theory that puts the study of action at the junction of the individual and his work environment. At the methodological level, this model leads us to define our key variables as hierarchically structured goal levels. We deliberately opted to avoid measuring management practices because they were deemed to be too situation specific, and we favored instead cognitive variables, the clarity of different goal levels, that were deemed to have a better potential of generalizability across situations. Our third objective was to propose hypothesis on the relations that our goal levels variables would have with well established motivational and psychological health variables. Doing this, we were able to document how these factors may serve different functions in the regulation of work and may thus impact distinctive aspects of the psychological functioning of individuals. The results of our research will now be discussed in the perspective of these objectives.

II. Review of the empirical results of the research

Many studies have been designed to investigate in what way a manager can support the autonomy of his employees, and the results described different key elements guiding the managerial style and interpersonal approach to embody. However, little is known about the actual content of managers' action when they adopt autonomy supportive management practices. This distinction pertains to the difference between knowing how to address management issues and knowing what issues are to be managed. Such a distinction is reflected in the distinction SDT makes between autonomy support and structure. In our research we aimed at identifying three distinct and broad levels of goals that managers should take into account when managing. We thus investigated the impact of the level of clarity of these different goals on the psychological functioning of employees. Our results support our hypothesized model of goal structure and begin to explain the processes through which these different goal contents relate to important employee needs and ultimately to psychological well-being. The main findings are the following:

- Different facets of role clarity can be measured simultaneously and consist of independent psychometric constructs albeit correlated ones.

- These facets are interrelated in a pattern supporting the hierarchical and sequential organization of the cognitive preparation phase of action as proposed by ART.

- Aside from this inter-facet organization, the facets of role clarity are also related differentially to basic psychological needs, supporting their differential functions within the motivational process.

- The job clarity facets' relationship to psychological well-being is fully mediated by the satisfaction of basic psychological needs for autonomy and competence.

Below we discuss in more details the implications of our results for both theory and practice.

1. Operationalization of organizational factors facilitating the regulation of creative and complex collective tasks

The first phase of our analysis was to validate the construct validity of our different measures of role clarity. As presented, different researchers had already proposed that different, more specific, facets of role clarity should be measured (Jackson & Schuler, 1985; King & King, 1990). We thus proposed a measurement model that mixed scales measuring different facets of role clarity and articulated specific hypothesis as to the relation these scales would have between them. Our first major finding is that we can measure within a single instrument, and with a great level of nuances, a good variety of facets of role clarity. Both through exploratory and confirmative factorial analysis, we have been able to confirm the sound structure of our different scales and the reliability of our measurement model. Moreover, the SEM analysis supports the hypothesized model for the interrelations expected between these scales. Our proposed model of three levels of goals, the collective goal, the individual goals and the individual action sequence, was based upon

assumptions derived from ART. ART proposes a sequential and hierarchical organization of these levels of goals structure that has been replicated within our data. Indeed, our results suggest that individual goal clarity mediates fully the relation of collective goals on individual action sequence. Taken as a whole, these results suggest that, within a creative environment, three levels of goal clarity can be measured and that these levels of information interact between each other based upon the hierarchical expectations of ART.

Inherent to our discussions so far, is the idea that the study of creative work environments implies a strong link between knowledge and action. Such a conception is not only present within ART, it is also present within models of CAS and within the work of Giddens reviewed previously. So far, we have discussed very broadly this relation between action and knowledge; however, the Organizational Knowledge Creation Theory (OKCT) (Nonaka, 1994) proposes one of the most elaborated conceptions of knowledge in action. This theory depicts the underlying organizational dynamics leading to the development of new knowledge as well as the interaction between action and cognition. Indeed, the definition of knowledge within this theory "relates to the capacity to act, define and solve problem" (Nonaka & von Krogh, 2009) or otherwise, "the actuality of skillful action ... and/or the potentiality of defining a situation so as to permit (skillful) action" (Nonaka & von Krogh, 2009). OKCT is fundamentally pragmatic in nature and conceptualizes knowledge as helping individuals or groups to act and shape reality (Nonaka & von Krogh, 2009). Some of the major premises of the OKCT are a) that knowledge can be explicit or implicit in nature and that this distinction can be conceptualized along a continuum, and b) that tacit and explicit knowledge interact and mutually enhance each other in a dynamic called conversion.

On one side, explicit knowledge can take several articulated forms facilitating its communication like sentences, pictures, diagrams, numbers and formulas. It is objective, universal and rational; it supports the capacity to act across contexts and tends toward becoming independent of the actor. On the other side, tacit knowledge is embodied within actions, emotions, senses, intuitions, values, routines and implicit rules of thumb. This embodiment makes the tacit knowledge subjective, experiential and situated, and also much more actionable and practically useful (Nonaka & von Krogh, 2009). The dynamic of conversion is at the root of the creation process of new knowledge. Central to the dynamic of conversion is that tacit and explicit knowledge are not two completely separate and static forms of knowledge. Rather, they are two mutually complementary forms that knowledge can take by alternating along the tacit-explicit continuum (Nonaka, 1994). Explicit and tacit knowledge thus co-exist together in a particular situation and feed action. It is the alternation between the two forms of knowledge, tacit knowledge that makes the discovery of new explicit knowledge possible, or explicit knowledge that makes the discovery of new tacit knowledge, that feeds the knowledge creation process. For example, as we articulate embodied knowledge and externalize it so that it becomes subject to reflection, knowledge becomes much easier to share as well as more flexible and meaningful. However, as people move toward taking action, they internalize knowledge by integrating "situated elements" with explicit knowledge (Nonaka, 1994; Nonaka & von Krogh, 2009). Moreover, the tacit-explicit continuum is positioned in the light of recent research on knowledge acquisition, learning and cognition, such as that "explicit knowledge starts as slow and consciously modifiable cognition but, with a certain repetition, gradually becomes tacit knowledge" (Nonaka & von Krogh, 2009).

We believe that a plentiful of literature, OKCT and ART being the two main theories presented in this thesis, support the idea that behind visible action a complex cognitive process is at work. The path toward action thus implies an elaborated action preparation process of goal definition and mental structures elaboration, both of which are hidden within cognitions and allow for the formulation of task approach strategies. Such a process can be quite straight forward in routine tasks and well defined situations. It is however important to recognize the complex and demanding mental operations underlying the regulation of new tasks and creative problem solving. It is the result of this regulation process, a feeling of clarity of specific aspects of task preparation, that we aimed to measure with our levels of goal clarity scales.

A second objective of our research was to link this mental regulation process with deeper motivational constructs at the center of the individual psychological functioning. We continue our discussion by addressing this second objective.

2. The relations between the different facets of role clarity and the basic psychological needs

"The person who knows 'how' will always have a job. The person who knows 'why' will always be his boss."

- Diane Ravitch

Once the structure of our model of the different levels of goals at work has been confirmed, we then tested, within a structural equation model, the relation of these constructs with basic psychological needs and psychological well-being. Our results suggest that the different levels of goals do not only

follow the hierarchical nature of ART. In fact, this hierarchical organization is also reflected within the relation these levels of goals have with basic psychological needs of SDT. The goals that are higher in the hierarchy display stronger links with the satisfaction of the need for autonomy. The lower in the hierarchy is the goal, the stronger is the link with the satisfaction of the need for competence. Such a pattern of results reflects the hierarchical and sequential nature of the organization of these levels of goals within ART. We believe that higher level goals are more abstract and are used to progressively clarify action downward toward execution. Thus, the higher we are in the hierarchy, the more the goal can be used to position action in its broader context and give choice and learning opportunities, or basically, sustain a feeling of autonomy. On the other hand, the lower the goal is in the hierarchy, the more this goal can be used to feed execution and executive planning, and thus sustain a feeling of competence. Such a finding brings a lot of redundancy to the full mediation pattern found within the three levels of goals that we presented earlier in this discussion. Not only are our results suggesting that different goals can be measured and that they reflect the ART sequential and hierarchical process of information regulation, but they also support the assumption that these levels of goals have specific and differential relations to psychological needs of a complementary theory, SDT.

Within our analysis of these results, we must not forget the importance of the gap between individual goals and collective objectives. The nature of our collective objectives variable is, per se, a construct whose content pertains to the team level but that is measured at the individual level. In our statistical analysis we use the interindividual variance of this “team construct” to predict phenomenon at the individual level. We should not forget this multi-level perspective that is inherent within our model. As such, our results take a deeper signification when positioned within the empowerment perspective of

organizations, a fundamentally multilevel conceptualisation of job design. Indeed, when performing complex team tasks, employees need team level information to have the opportunity to take action in an empowered manner and to accomplish the team goal. The empowerment of workers, by allowing the optimization of their creativity and skills, becomes increasingly necessary in the face of complex tasks and supposes actions that go well beyond the simple delegation of responsibilities (Collins, 1999; Collins & Ryan, 1999). It is to say that empowerment in a job design perspective means much more than decision latitude or delegation of responsibilities or authority. The access to strategic information on the global context of work, on the goals pursued, as well as on the technical aspects of the job is at the core of the empowerment of knowledge workers. In fact, by facilitating the vertical and lateral alignment of workers objectives, these types of information allow employees to develop a collective and global understanding of team tasks which raise their efficiency (Cohen, Dunbar, & McClelland, 1990). As such, it is our contention that our results are tied to such an empowerment phenomenon linking the strategic perspective of the work context to the execution of employees. Further, as proposed by the tenants of ART, we believe that a high level of clarity for the different goal levels is part of what this theory calls a "complete job". As such, a complete job, by representing a work environment facilitating the development of control and active learning would be an efficient way to deepen mastery of one's role. Within the frame of our results pattern linking the role clarity facets and basic psychological needs, such mastery could be interpreted in the perspective of the development of autonomy and competency. We will now turn to the interpretation of our results in a SDT perspective.

Within the frame of the conceptual and psychometric modelization of this research lies a preliminary operationalization and definition of the concept

of structure within the perspective of SDT. As mentioned previously, structure within SDT is considered to facilitate the development of an efficient action intention (Reeve et al., 2004), and is linked to the quantity and quality of the information at the disposal of the individual regarding the expectations for him and the means to reach his objectives (Connell & Wellborn, 1991). In organizational contexts, we believe structure can be conceptualized as reflecting the different means by which the organization can facilitate the development of high quality mental structures facilitating the orientation of employees toward the organizational environment, definition of individual goals and definition of action plans. We further suggest that we can do so by clarifying the collective goals, individual goals and individual action sequence. Finally, we propose that these three levels of goals represent distinctive and meaningful portions of the cognitive process, linking intention to action or, simply, linking strategy to execution.

Furthermore, it is interesting to interpret these results as a way to deepen our understanding of the basic psychological needs. As mentioned earlier in our review of the Cognitive Evaluation Theory, the social context will have a different impact on the motivation developed depending on the actor perception of the environmental cues as controlling his behaviour or simply providing important information supporting attainment of his goals (Deci & Ryan, 2002). We also mentioned the importance in SDT of the provision of those key types of information to facilitate the development of an efficient action intention and support the satisfaction of the need for competence (Reeve et al., 2004). Our results show that our role clarity facets, which can be associated with different goal level information, can have a distinctive impact on the basic psychological needs of autonomy and competence. As such, we believe that the role clarity facets we measured can be used to propose a content perspective of the SDT needs and further develop

our understanding of the nature of these needs and of their specific signification within the motivational regulation processes. Such an investigation implies trying to explain why the job clarity facets we measured would not have a simple additive relation to the satisfaction of the need for competence but rather a differential relation to both the need for competence and autonomy?

Within our results the need for competence is strongly related to the clarity of individual action sequence which measure the clarity of work approaches and the clarity of action sequencing. This suggests that this need pertains to the evaluation individuals make of their actual capacity to define what has to be done to reach their goal in a particular situation. The need for competence is thus tied to answering the question of "how to reach the goal" or, more practically, "what should be my approach". On the other hand, within our results the need for autonomy is strongly related to the collective goal clarity. This suggests that this need pertains to the evaluation individuals make of their capacity to position their work within the global perspective and orientation of the organization. The need for autonomy is thus tied to the contextualisation of one's work and implies answering the question "why one should follow his own personal goal" or, more practically, "why the goal I am pursuing is the right one". This pattern of result gives an interesting perspective of the contrast between autonomy and competence.

As we said, the content related to autonomy refers to "why we do a certain goal", whereas the content related to competence refers to "how we can reach a certain goal". When contrasting the autonomy – competence relation on the basis of contents, this suggests that the need for competence is somewhat a need to define what strategy to follow in order to reach our goals, while our need for autonomy is rather a need to know why the strategies we

chose are pertinent in our current context. Meaning, competence content could refer to the extent at which an individual is able to define what particular course of action will lead to goal attainment, and autonomy content refers to the extent at which the individual is able to define why in this situation this particular course of action is working. Thus, the hierarchical nature of the cognitive sequence of action regulation that is present in ART, and its relation to SDT, suggest that when aiming at reaching a goal, an individual is simultaneously faced with two challenges. The first one is to define the right executive strategy in specific technical behavioral terms, which refers to competence. But at the same time, this quest of executive knowledge happens in a particular context. The individual also has to know what this context is, in order to adjust his technical executive plan and reach his goal.

The question remains, why all these types of goal content information are not simply linked to the need for competence? SDT and its internalization process give hints as to a potential explanation of our results. Indeed, the global context is not only related to the need for competence through the top-down path linking cognition to action proposed by the hierarchical structure of ART. Contextual information is also directly tied to autonomy because individuals aim not only for situational action efficiency but also for integration as defined by SDT. Information about the global context can be hypothesized to help the individual understand and legitimate for himself and for others the reasons why his particular plan of action is the right one. Contextual information thus represents a way for the individual to transform specific and situated action strategies and knowledge into higher order levels of knowledge. The results of putting into context specific action plans allow for a conversion of tacit knowledge, as defined by OKCT (presented earlier in this discussion), into explicit knowledge that will take the form of higher order strategies that are more generalizable and universal. We thus believe

that contextual information could consist of an essential ingredient in the conversion dynamic proposed by the OKCT and that, by facilitating this conversion process, and thus the knowledge creation associated with it, contextual information sustains autonomy through higher order learning. Such an assertion has an underlying assumption that when doing a task, for it to be fully complete within the perspective of ART, it must simultaneously allow for current attainment of objective as well as allow for a future-oriented mastery of a task, a theme that is central to ART. Our propositions have an underlying time perspective and make a distinction between an orientation for mastery and for achievement. Both these conceptual approaches to human behavior have been discussed extensively within the Achievement goal theory (Ames, 1992; Dweck, 1986; Urdan & Maehr, 1995; Urdan, Pajares, & Lapin, 1997) and the Future time perspective of motivation (Husman & Lens, 1999). Although these theories were designed to explain motivation in an educational context, we suggest that in a work context dealing with conceptual problem solving and creativity, a dual orientation may be present and impact individuals simultaneously. That is, individuals simultaneously aim at proximal objectives attainment confirming situational competence and more distal mastery empowering long term behavioural autonomy. This could represent meaningful explicative mechanism of what ART considers complete action and its relation to the mastery of one's role. This also opens the door to more extensive description of the inherent psychological mechanisms at work within the learning trends proposed in modern discussions on empowerment in the workplace and on knowledge management in organization.

We now turn to the relation between the psychological processes inherent to the regulation of creative problem solving with the individual psychological health at work. Our objective will be to explore different

explicative roots having the potential to explain in what way complex creative tasks could be linked to psychological well-being.

3. Our model and the explanation of psychological health at work

So far we have discussed extensively the inherent structure of our job clarity facets as well as their differential relations to the autonomy and competence needs of SDT. We will now discuss the pattern of these relations as they pertain to an explication of the level of psychological well-being of individuals undertaking complex collaborative tasks. Our structural model proposes the hypothesis that the job clarity facets measured in this research will be linked to the psychological well-being of the workers through their relation with the autonomy and competence needs of SDT. More specifically, this global hypothesis implies two main components: a) the need for autonomy and competence will be significantly linked to our measure of psychological well-being; and b) most of the psychological well-being variance explained by the job clarity facet will be explained through an indirect effect mediated by the satisfaction of SDT needs for competence and autonomy. First of all, our results support our hypothesis that SDT needs for autonomy and competence are significantly linked with psychological well-being. Such a link has been extensively replicated in different life domains (Ryan & Deci, 2000), but our results demonstrate the robustness of these links within the workplace and their validity for creative and collaborative work contexts. Furthermore, our results demonstrate that the contribution of job clarity facets to the level of psychological well-being is completely mediated by the needs for autonomy and for competence. Indeed, as we hypothesized, we failed to observe a significant direct relationship between job clarity facets

and psychological well-being over and above the relationship of SDT needs. These results are coherent with the extensive body of literature and empirical researches documenting the validity of SDT basic psychological needs as meaningful mediating constructs linking social context factors and their impact on individual psychological functioning (Deci & Ryan, 2002).

Taken globally, our results show that individual's psychological well-being is related to the presence of key goal contents information associated with the job clarity facets measured in our study. This suggests that managers and organizations could impact the psychological well-being of their employees by managing the communication of these specifics goal content information. A defining feature of our research is the decision to study job clarity facets and their relationship with the basic psychological needs in order to explain the level of psychological well-being of workers. Such a decision is one of research method and of epistemological approach. First of all, as discussed previously in our description of soft projects work environment, the measurement of performance outputs is faced with various challenges. These work environments are characterized by ill-defined and abstract goals, by success measure that are qualitative in nature, by a level of uncertainty that make planning and assessment of progress difficult (Atkinson, Crawford, & Ward, 2006). Taken as a whole these characteristics make it difficult to apply traditional project management tools including performance management tools at the individual level (Winter, Smith, Morris, & Cicmil, 2006) and lead us to position our question outside of a performance perspective. As such, our study has been rather oriented toward answering the question "what should be structured in a complex and uncertain collaborative environment", and our approach to answer this question has been: We should structure what allows people to alleviate the stress experienced during the accomplishment of the task. This approach is tightly linked with the definition of the basic

psychological needs of SDT as well as the SDT organismic approach. SDT's organismic perspective suggests that fundamental psychological needs are part of a meaningful approach to decipher in what way the social environment can influence the optimal psychological functioning. It is our contention that by studying the problem of "what to structure in a complex environment?", and by investigating "what people fundamentally need to function optimally", our results will have a better potential of being transferable from one complex context to the other and will avoid situational paradigms associated to the definition of performance. Such a position also put the attention on the modelization of mechanisms through which complex tasks accomplishment can impact the psychological well-being of employees. We believe that such an approach has more potential to yield meaningful insights than approaches solely interested in identifying specific management practices and their relative impact on psychological health, without explaining the underlying psychological mechanisms that could explain the results obtained.

We now turn to the explicative mechanism by which task accomplishment could impact psychological well-being. In an ART perspective, the explicative mechanism of such a phenomenon depends on the development, at the individual level, of control over a particular task. Such a control requires that the task regulation be complete. More specifically, the individual should be able to regulate his actions based on the different phases of mental preparation of the action that will enable him to display autonomy in his actions and have learning opportunities (Hacker, 2003). ART highlights the importance for the individual to have job latitude (autonomy) and have control over the task in order to develop an intrinsic motivation (Hacker, 2003). A position also highlighted by the demand – control model of occupational stress of Karasek (1979), as well as the basic psychological needs of SDT (Ryan & Deci, 2000). However, SDT and the demand-control

model have traditionally put a lot of emphasis on the decision latitude and the autonomy support of the individuals. These approaches are thus much more focused on defining how to manage people than on what to manage in order to promote psychological well-being. There lies an important distinction with our research approach. By measuring different role clarity facets, our model of the three levels of goals did not aim to explain how leaders should manage, but rather what they should manage, to provide both autonomy and competence and ultimately promote control over the task. Also, these theories do not provide an in-depth explanation of the mechanisms by which we could link our job clarity facets to the psychological well-being of individuals. At most, this explanation is justified, with SDT, through the basic psychological needs and their empirical relationship to well-being or, with the demand-control model, through organizational factors alleviating the strain associated with a high workload. We now continue by proposing an explicative model of the cognitive mechanisms by which we can link our measures of job clarity facets to the level of psychological well-being of the workers.

A. Ego depletion as a possible explanation of the link between job clarity facets and psychological well-being

The dual process model of the mind (Chaiken & Trope, 1999; Cohen et al., 1990) makes a distinction between automatic and controlled mental processes. The automatic processes are defined as being stimulus driven, inflexible, rapid and largely unconscious, while the controlled processes are top-down regulated, flexible, slower and generally more conscious. Self-control is associated with the mental effort deployed to override, modify and inhibit automatic, habitual or spontaneous thoughts, emotions and responses patterns that would otherwise interfere with the exertion of planned, purposeful behavior (Baumeister et al., 1994; Muraven & Baumeister, 2000).

Of importance is the fact that self-control is considered as a mediator between thought and action and is described as a resource whose function is "to connect abstract principles, standards, and intentions to overt behavior" (Baumeister, Bratslavsky, Muraven, & Tice, 1998). The strength model of self-control proposes that engaging in acts of self-control draws from a common pool of resources enabling the various and different domains of self-control actions and that, when depleted, results in a reduced capacity to engage in further acts of self-control (Baumeister et al., 1998; Muraven & Baumeister, 2000). In the model, this self-control resource is viewed as working alike a muscle for which every self-control effort reduces the strength available for subsequent acts of self-control, unless the individual has the opportunity to recover and replenish his self-control strength. The state of exhaustion of the self-control strength has thus been termed ego depletion.

Over the last 15 years, a great number of studies have tested this effect and lead to a first meta-analysis on the effect of ego depletion on task performance and other related outcomes (Hagger, Wood, Stiff, & Chatzisarantis, 2010). The results support the propositions of the strength model of self-control and identify some initial biological mediators of the ego depletion such as an association between ego depletion and a decrease in the glucose level of the blood. Also, concordant with new evidences that logical reasoning is tied to the conscious controlled system (DeWall, Baumeister, & Masicampo, 2008), Hagger and colleagues (2010) demonstrated moderating effect of task complexity and difficulty on the effect of ego-depletion such as that "the degree of ego depletion evoked by cognitive processing tasks is dependent on task complexity". The very high adaptive nature of self-control processes (DeWall et al., 2008), although they may not constitute an important proportion of daily actions (Muraven & Baumeister, 2000), can prove to be

essential when facing ambiguous or uncertain situations in which one cannot rely only on automatic and rigid behavior patterns.

Ego-depletion can be a key construct explaining the conditions leading to burnout and other psychological difficulties experienced by individuals (Baumeister et al., 1998). Also, having to cope with stressful and unpredictable situations leads to ego-depletion (Muraven & Baumeister, 2000). However the link between ego-depletion and stress, and more particularly stress at work, remains unclear. Over the last few years, recent attempts to investigate the link between self-control demands to sources of stress at work have been engaged. Schmidt and Neubach (Schmidt & Neubach, 2007), in an attempt to demonstrate the incremental value of self-control demands to the concept of job ambiguity in predicting stress at work and emotional exhaustion came to the conclusion that self-control could rather constitute a mediator of the effect of job ambiguity on these outcomes. Two important conclusions to their research concern the important predicting value of the concept of self-control demands in explaining symptoms of stress and the explaining potential of self-control demands to the well-known relationship between job-ambiguity and stress. In this study, however, only a very limited portion of job ambiguity facets have been measured. In another study on the link of self-control demands and symptoms of stress, Diestel and Schmidt (Diestel & Schmidt, 2009) observed very different impacts between quantitative and qualitative workload on self-control demands and, ultimately, on stress symptoms. A key result of their study relies on the important mediated impact of qualitative workload through self-control demands on the symptoms of stress, when compared to the impact of quantitative workload. Overall, these studies on ego-depletion support the basis of an explicative model of the link between job ambiguity and symptoms of stress at work. As such, job ambiguity associated with qualitative workload can lead to demands

on the conscious and controlled system, by requiring the processing of highly difficult mental tasks as well as requiring self-control to overcome automatic or spontaneous emotional and thought patterns that could interfere with the exertion of planned, purposeful behavior.

The ego-depletion model of self-regulation and its powerful explicative potential to link motivation, cognition and psychological health could prove highly relevant in the workplace context. In the context of our research, the high level of qualitative workload associated with video game development projects makes this work environment prone to highly demanding cognitive tasks as well as aversive emotional states in the face of frequent failure and high uncertainty. As such, we propose that the design of efficient team processes and structures, within the project environment, can have a direct impact on the communication of information pertaining to the collective goals, individual goals and individual action sequence. The communication of high quality information on these goal levels could facilitate the cognitive action regulation of the complex tasks faced by employees and facilitate the satisfaction of the autonomy and competence feeling of individuals. Indeed, through different intervention in the job design and management practices of their managers, organizations can act on the clarification of the collective goals, individual goals and individual action Sequence. Clarification of the goals structure could ultimately lead to a better regulation of workers' actions and alleviate numerous obstacles faced by employees that have the potential to deplete their inner psychological resources (such as lack of information and/or knowledge to define effective objectives and action strategies, difficulty to initiate proactive action in the face of equally desirable or uncertain alternatives, inability to position one's role within the collective and the ensuing difficulty to coordinate one's action with the rest of the team, etc.). Ultimately, satisfaction of the basic

psychological needs of workers would represent central domains of action of the ego that, when satisfied within the social environment, allow for better availability of individual's inners resources to accomplish the complex and creative tasks at hand. As such, the job clarity facets identified in this research, within an ego-depletion perspective, would represent a diagnostic measure of the work environment capacity to optimize ego resources. It would thus represent a work environment capacity to empower and orient individual actions instead of generating confusion.

III. Limitations and future researches

This study, in spite of its contributions at the theoretical and empirical levels, faces some limits that have to be specified.

The first limit pertains to the correlational design of this study. Because of the applied nature of this research, no experimental manipulations have been executed. We thus cannot determine the direction of association between job clarity facet evaluation of employees and the satisfaction of their fundamental needs and psychological health.

A second limit pertains to the self-reported nature of our measures. All our measures were reported by the same informant through self-reported questionnaires. Shared method may thus be associated with common variance and consequently inflated relationships (Lindell & Whitney, 2001). To mitigate this problem two different strategies have been adopted. The first one has been to divide the measurement protocol into two measurement phases, an initial phase measuring the independent variables, and a second one measuring the mediating and dependent variables. A second factor mitigates the impact of the common method variance, the nature of the instruments

selected for this research. The goal content measures of job clarity was targeted on task information, the needs satisfaction measure was targeted on individuals' attitudes, and the psychological health measure was targeted on specific symptoms. In our opinion, even though the method was the same, self-reported questionnaires, the psychometric approach and psychological construct were quite distal. Nevertheless, future researches should attempt to replicate the present study by integrating objective sources of information that could complement self-reported measures of job clarity facets (e.g., objectively testing specific formulation of goals and vision statements in order to assess if they are shared and well understood within the team), as well as more objective measures of health outcome (e.g., biological measurement of the stress level).

Another limit is the generalizability of our results. We specifically aimed at studying complex and uncertain work environments and our data collection targeted a single organization. Also, although the gender proportion of our sample represents the actual state of the video game industry, our sample is constituted by a majority of men. As such, the generalizability of our results cannot be taken for granted. Whether it is the generalizability to other organizations in the same industry, other industries similar to the video game industry or generalizability across different sectors of the economy, only additional research and replications of our results in other contexts could allow us to extend the generalization of our results and of their implications.

Another limitation consists of the exclusion of the need for relatedness that is a central part of the self-determination theory. Although we excluded this variable for reasons that we have already presented, we believe that future researches in line with the modelization put forward in this thesis should explore the conceptualization and operalization of schemas related to the need

for relatedness. We also believe that investigation of feedback processes could be integrated very easily to the theoretical model underlying this thesis. Indeed, for each level of goal regulation, specific feedback loops are hypothesized to sustain the regulation process. We suggest that an investigation of a hierarchic conceptualization of different levels of feedback could be integrated in an extension of our model.

Finally, our measure of psychological well-being, the General health Questionnaire (GHQ) consist of items formulated both in terms of negative indicators (eg. Have you lost much sleep over worry?) and positive indicators (eg. Have you felt capable of making decisions about things?) of psychological health. Such an approach is consistent with the conceptualization of health as not only consisting in the absence of illness but also in the presence of positive elements (Achille, 2003; Keyes & Lopez, 2002). Such a conceptualization of psychological health implies the proposition of a bidimensional construct consisting of psychological well-being and psychological distress that should be measured separately (Keyes, 2005, Labelle, et al., 2001, Massé, et al., 1998). Although the objective of this thesis was not to revisit the structure of the GHQ to separate the positive and negative elements in two distinct latent variables, we believe that such an approach could yield good opportunities to further the understanding of the psychological phenomenon described in this thesis. We encourage that tool measuring these two distinct facets of psychological health (eg. Gilbert et al., 2008) be used in future research.

IV. Review of our psychological approach to the organizational structuration of uncertain and complex work environment and formulation of theoretical propositions.

We have positioned within the frame of ART and OKCT the complex mental operations underlying action orientation and preparation, and more precisely creative and knowledge intensive actions. As discussed previously, different levels of goal clarity, as measured by our scales of job clarity facets, seem organized hierarchically. Our results show that in creative and complex environments, all three levels of information are important in explaining how the clarity of the social environment can be related to the psychological well-being of individuals. Also, our results show that not only all three levels of goals are essential, but also, that these levels pertain to different basic psychological needs in a different way. This is to say that all three levels of goals are important in orienting individual actions but for different reasons. Our results have shown that the more global and abstract goals pertaining to collective goals and individual goals satisfy the need for autonomy, while the more specific and concrete goals pertaining to individual action Sequence satisfy the need for competence. In a nutshell, our explanation of this pattern of results is that individuals, in a complex and changing work environment, face the requirement of developing both a solid proximal and a distal mastery of the task at hand. They thus concurrently try: a) to reach proximal objectives and task performance; while, at the same time, they try b) to develop higher level structures of knowledge that are valid across situations and that will ensure control of the tasks in the future in environments that change at a fast pace. This leads us to the formulation of two initial theoretical propositions that should be subject to further empirical investigation: **1) When the**

environment's rate of change and complexity level increases, workers have to raise the level at which action is regulated and add, to the executive level of action regulation, a more strategic orientation level associated with the satisfaction of the need for autonomy. 2) Higher levels of regulation of actions are associated with additional and more demanding cognitive operations as compared to lower levels of regulation consisting of routinized work tasks. These mental operations are described within OKCT and ART as being associated with knowledge creation and learning processes taking place prior and during action.

Psychological well-being, as the dependent variable within our model, has been a defining feature of our approach. This approach focused on identifying, in the work environment, different job design factors related to deep psychological structures (the basic psychological needs). Our assumption was that these needs would serve as key mediators of the relationship between job clarity facets and psychological well-being, as well as clarify the differential function of these facets within the psychological functioning of individuals. As such, our approach implies that we tried to define organizational design factors based on the empirical basis of their "impact" on individuals. This approach departs from a more prescriptive and a priori perspective taking roots in job design traditional variables that refer to categories of job factors that may be less related to the psychological functioning of workers. Our perspective is that a work environment can facilitate the clarification for an individual of the different task facets proposed in our model or, on the opposite, generate confusion around these key information types. As such, an assumption central to the ego-depletion theory can give a better perspective on the link between task clarity facets and psychological well-being. Ego-depletion suggests that facing tasks that are ambiguous, uncertain and cognitively demanding requires contribution of self-

control processes that deplete a limited psychological resource. Our previous two main propositions suggested that a higher level of task complexity and uncertainty require a higher level of task regulation, and thus imply more intensive mental processing prior and during the action: In continuation we would suggest a third and fourth theoretical proposition: **3) The mental processing and emotional control implied by a higher level of action regulation tap on a psychological resource that is limited. 4) The demand associated with mental processing of complex and uncertain tasks can be influenced by the availability of different types of goal content information conveyed by the work environment that clarify important facets of task regulation and preparation.**

Also, in the first section of our theoretical context, we made an investigation of organizational theories and presented different approaches and models of uncertain and complex collective tasks accomplishment. Our investigation brought us to the definition of a psychological perspective of the structuration of organizations.

We first documented the high distinction of creative problem solving tasks as compared to more traditional and routine tasks in an organization. The uncertainty attached to these tasks has an impact on the capacity of individuals to plan ahead of time the course of actions to follow and make classical management techniques insufficient or improper to manage and organize these types of tasks.

The project team approach of structuring work environment has been proposed as an efficient way to organize complex and uncertain tasks because of its potential to flexibly adapt its structure to the requirements of a rapidly

changing task. Some of the inherent characteristics of the project seem to support the linkage of elaboration processes and execution into a single and unique structure, rendering it proper to conception and development of creative outcomes. However, a major re-questioning of the project management field has happened over the course of the past 15 years in the face of the appearance of soft projects where uncertainty seems harder and harder to reduce with traditional project management techniques. These projects face major challenges, particularly: a) the translation of the initial intention and the situational analysis of the project into a concrete action plan, and b) the management of the convergence and continual adaption of the instable representation that all the actors have of the strategy and the vision. The definition of the complex social and psychological mechanisms affecting project structures in contexts of high uncertainty is now becoming a central concern for project management literature. This need follows also a particular concern expressed by some researchers of creativity in organizations highlighting the high number of research and models identifying different factors tied to creative outcomes, without however modelizing and defining theories of creative processes in work environments.

Our investigation of structure then lead us from its functional role, the division of a collective task in different individual tasks and the coordination of the different actors at play, to a description of the structuration processes. From formal to more informal means of structuration of organizational processes, we found out that structure takes place in between the interpretative schemes residing within employee's cognition and the concrete action and social interactions creating and recreating the reality of those interpretative schemes. A conception of structure as an emergent psycho-social phenomenon has been proposed as constraining but also enabling human behaviour. Moreover, new models of organization from complexity theories build upon

these principles. Explaining how organizational systems can develop a state of constant adaptability in the face of a fast changing environment, they proposed a description of the inner functioning of Complex Adaptive Systems (CAS). In these systems the adaptability comes from decision making capabilities at the level of agents within the system rather than from a centralized top-down control as proposed in traditional bureaucratic organizational systems. This model of systemic adaptability is based on a cognitive modelization of individual agents' actions and different social interaction mechanisms explaining the self-organizing nature of the systems and emergence amongst multiple actors. The definition of the individual agent that is present in these models is one that comprises:

- A definition of cognitive schemas as complex representations of the reality and as representing fundamental regularities of the environment.

- A representation of employees as agents that take action based on their cognitive schemas and environmental perceptions.

- Localized adaptation of the agent due to his incapacity to predict all the consequences of his action on the whole system and because of his situated positioning in the system.

- Constant interactions with other agents making the value of any single possible action dynamically varying depending on the action of other agents.

- An ensuing co-evolution dynamic in-between the agents of the system making any permanent and optimal stability impossible in the system.

- The presence of feedback loops between agents and their environment enabling the development of self-reinforcing dynamics of efficient behaviours across the system.

- When such behaviors and their underlying schemas get to stabilize across the system, emergent structures can temporarily appear within a group without the need for a centralized control of the system.

This view of systems functioning and its underlying definition of agents' agency is inherently psychological in nature. It gives importance to the way people perceive and interpret their environment and to the complex pattern of their interactions. By proposing that emergence and learning occurs in situations of information treatment, by individuals aiming at maximizing their own individual adjustment, those theories raise the question of what types of information people need to operate in these contexts. It also gives prime importance to the schemas present within the system and their central impact on individual action as well as systemic emergence of collective structures. In the terms of the CAS theories, we could suggest that the facets of job clarity measured in our research are different categories of schemas impacting the actions of agents. Following our main propositions, these different categories of schemas go from the more specific schemas depicting procedural execution to more general schemas depicting higher level vision of the collective action. We thus additionally propose the following theoretical proposition: **An important structuration mechanism at work within CAS is the research and definition of high quality schemas at each of the levels of action regulation. By being efficient across numerous situations, high quality schemas have the potential to stabilize across the system and across time and thus allow for better action regulation and coordination in very unstable environments.**

As such, within this framing of the structuration process, what is the consequence of a rise in complexity and uncertainty within an environment? In a low complexity and uncertainty system, executive schemas are easily optimized and stabilized and do not have to change because of the environment stability. As the complexity and uncertainty of the environment rise, optimization of executive schemas is harder and more unstable. The stabilization of the system can be more easily reached at higher levels of action regulation, at the level of individual goals and collective vision. This proposition follows our interpretation of Ouchi's (1980) model that is: when complexity and uncertainty rise, regulation of individual action must change from a focus on specific behaviours to higher level cognitive goals. Let's come back to the central question of what balance should be made between better structure to promote efficiency and less structure to maintain adaptability (March, 1991). In other words, this question asks "what should be structured" in these environments? We propose that in these environments, structuration can be promoted by a focus on the quality of all categories of schemas orienting and defining actions of the individuals. We further suggest that, the higher are the levels of complexity and uncertainty, the more important are higher levels of schemas pertaining to collective goals and vision.

Conclusion

Different ways of improving the quality of the schemas orienting actors' actions can be proposed. Although an extensive discussion of these means would be outside the boundaries of this thesis, we would like to conclude by discussing very briefly a few avenues. Fundamentally, our complete set of propositions goes along the line of a deeper development of the strategic perspective of individual agents. As such, complexity and uncertainty call for a decentralization of the strategic perspective of the collective action. Such decentralization allows for decisions to be made and adjusted at the hierarchical level at which proper knowledge is available. This proposition is thus highly compatible with traditional approaches of empowerment in organizations.

We however proposed a framework to better define concrete mechanisms through which this responsabilization can be enacted to really allow a rise in control and mastery over the collective task. It is thus in the perspective of knowledge creation and learning that we positioned our approach by including the ART model of action preparation. In their well-known book, Davenport and Prusak (1998, p. 5) define knowledge as "a fluid mix of framed experience, values, contextual information, and expert insight that provide a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms". In line with this definition, we believe that complex and uncertain work environments call for a deeper and more systematic approach to the engineering of the psycho-social materials of the social system in place. Areas of action that could be considered relevant now include the organization's culture, norms, values, group dynamics, climate, key professional and managerial competencies, identification and utilization of expert knowledge,

to name a few. For example, practices associated with the Organizational Development philosophy and that focus on the social dynamics of groups can support various intervention and new models of group functioning in order to stimulate emergence of collective schemas and facilitate their transmission across the group.

Also, the roles of managers or leaders have already begun to change (Uhl Bien & Marion, 2009). From the old conventional role of operation experts and controllers, they are increasingly called to act on team dynamics in order to manipulate the work environment psycho-social structure and to engage in different, and sometimes day to day, sensemaking interventions in their teams. This new role requires them to influence the culture and vision of the organization rather than to define operational procedures and control them. The rigid plan and control paradigm of work design may be able to optimize a low level regulation of operations. It seems, however, less and less sufficient to design and orient the qualitatively different endeavour of optimizing regulation of workers at the level of their individual objectives and collective vision and goals. As such, managers must be ready to open themselves to a whole new set of competencies that can flexibly address the operational as well as the strategic portion of work their employees have to do.

Finally, scholars in management and organizational studies are themselves called to develop and transfer better sense making tools and visions to these managers. We have to find concrete ways to communicate the particularities of the new knowledge intensive work environments and to make more vivid their impact on the increasing psycho-social nature of work design.

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Appendix A

Survey Questionnaire

Goal clarity scale
(Sawyer, 1992)

Given your experience on this job over the last two or three weeks, please indicate how certain or you are about each of the following aspects of you work.

Very uncertain	Uncertain	Somewhat uncertain	Somewhat certain	Certain	Very certain
1	2	3	4	5	6

1. My duties and responsibilities.	1	2	3	4	5	6
2. The goals and objectives of the project.	1	2	3	4	5	6
3. How my work relates to the overall objectives of the project.	1	2	3	4	5	6
4. The expected results of my work.	1	2	3	4	5	6
5. What aspects of my work will lead to positive evaluations.	1	2	3	4	5	6

Work Method and Scheduling Ambiguities Scales (Breaugh & Colihan, 1994)

Please indicate how you agree with the following statements.

Disagree strongly	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

In my job, over the last two or three weeks:

1. I am certain about the method to use to get my job done.	1	2	3	4	5
2. I know what the best approach to get my work done.	1	2	3	4	5
3. I know what procedure to use to get my work done.	1	2	3	4	5
4. I know when I should be doing a particular aspect of my job.	1	2	3	4	5
5. I am certain about the sequencing of my work activities (when to do what).	1	2	3	4	5
6. My job is such that I know when I should be doing a given work activity.	1	2	3	4	5

Team Mission Scale

(an adaptation of Campbell & Hallam, 1994)

Please indicate how you do agree with the following statements.

Disagree strongly	Disagree	Neutral	Agree	Strongly agree
1	2	3	4	5

In my job, over the last two or three weeks:

1. The overall purpose of the project is clear to me.	1	2	3	4	5
2. I have a clear vision of where we are going with this project.	1	2	3	4	5
3. I understand the time schedule for achieving our goals in this project.	1	2	3	4	5
4. I am not sure of what we are trying to accomplish as a team in this project.	1	2	3	4	5

Work-related Basic Need Satisfaction Scale (Preliminary version of Van den Broeck, Vansteenkiste, De Witte, Soenens & Lens, 2009)

Please indicate how you do agree with the following statements.

Disagree strongly	Disagree	Somewhat disagree / Somewhat agree	Agree	Strongly agree
1	2	3	4	5

In my job, over the last two or three weeks:

1. I feel free to express my ideas and opinions in this job.	1	2	3	4	5
2. I feel like I can be myself at my job.	1	2	3	4	5
3. I feel free to do my job the way I think it could be best done.	1	2	3	4	5
4. At work, I feel part of a group.	1	2	3	4	5
5. At work, I can talk with people about things that really matter to me.	1	2	3	4	5
6. Some people I work with are close friends of mine.	1	2	3	4	5
7. I am good at the things I do in my job.	1	2	3	4	5
8. I really master my tasks at my job.	1	2	3	4	5
9. I have the feeling I can accomplish even the most difficult tasks at work.	1	2	3	4	5
10. At work, I often feel like I have to follow other people's commands.	1	2	3	4	5

11. I feel pressured at my job.	1	2	3	4	5
12. In my job, I feel forced to do things I do not want to do.	1	2	3	4	5
13. I don't really feel connected with other people at my job.	1	2	3	4	5
14. I don't really mix with other people at my job.	1	2	3	4	5
15. At work, no one cares about me.	1	2	3	4	5
16. I don't really feel competent in my job.	1	2	3	4	5
17. I doubt whether I am able to execute my job properly.	1	2	3	4	5
18. I often think my job is difficult.	1	2	3	4	5

General Health Questionnaire (GHQ-12)

(Goldberg, 1972)

Given your experience on this job over the last two or three weeks:

More so	Same	Less	Much less
1	2	3	4

1.	Have you been able to concentrate on what you were doing?	1	2	3	4
2.	Have you felt capable of making decisions about things?	1	2	3	4
3.	Have you been able to face up to problems?	1	2	3	4
4.	Have you lost much sleep over worry?	1	2	3	4
5.	Have you felt constantly under strain?	1	2	3	4
6.	Have you felt you couldn't overcome your difficulties?	1	2	3	4
7.	Have you been feeling unhappy or depressed?	1	2	3	4
8.	Have you been losing confidence in yourself?	1	2	3	4
9.	Have you been thinking of yourself as a worthless person?	1	2	3	4
10.	Have you felt that you were playing a useful part in things?	1	2	3	4
11.	Have you been able to enjoy your normal day-to-day activities?	1	2	3	4
12.	Have you been feeling reasonably happy, all things considered?	1	2	3	4