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# **Complex thinking and computing organization facing contingent problems<sup>1</sup>**

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## **Compliance with ethical standards**

Laura CARMOUZE (author A) declares she has no conflict of interest and Alan SANDRY  
(author B) declares he has no conflict of interest.

## **Ethical approval**

All procedures performed in studies involving human participants (i.e. semi-structured  
interviews) were in accordance with the ethical standards of the institutional and/or national  
research committee and with the 1964 Helsinki declaration and its later amendments or  
comparable ethical standards.

Informed consent was obtained from all individual participants included in the study.

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Management and Political Philosophy” in June, the 4-5<sup>th</sup> 2018.

# Complex thinking and computing organization facing contingent problems<sup>1</sup>

## Abstract

Facing the reflexive modernity, the trend is towards collaboration between public and private spheres. Due to the complexity paradigm and contingent approach, organizations are conflicting with a “one best way” slant. Indeed, they are understood as computing ones and so they can adapt to a changing environment. The purpose of this paper is to understand how managers deal with contingent problem solving and so to characterize computing organizations. Through a qualitative methodology, this paper sheds light on an integrative model of computing organization able to solve contingent problems, with five dimensions.

**Keywords:** Complexity, Computing Organization, Problem Solving, Organizational conflicts

## Introduction

*Knowledge progress benefits action, action progress benefits knowledge* (Morin 1986, p.55). In a globalizing world, the paradigm of reflexive modernity (Beck 2001) queries the characteristics of public organizations. On the one hand, the modernization process encompasses the production of risks and threats. Conversely, this modernization process becomes reflexive when it requires the management of its own *latent induced effects* (Beck 2008).

In a French context, the loss of public action legitimacy (Fung 2007, 2015) involves public organizations facing many institutional disturbances. First, the *territorial big bang* is often used in both scientific and press articles to illustrate the last French public reforms that impacted local public organizations<sup>2</sup>. The changes are particularly reflected in the reduction of the number of regions (from 22 regions to 13) but are also visible in the redefinition of local public organizations' competences. These institutional upheavals then must be added to the phenomenon of *glocalization* (Benko 1999). Subnational territories are therefore competing globally, and the national level is no longer the medium level between the local and the international ones (Zimmerman 2005). Territories face a dual challenge - institutional and

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<sup>1</sup> Article based on a communication presented at the sixth Conference Philosophy(s) of Management “Public Management and Political Philosophy” in June, the 4-5<sup>th</sup> 2018.

<sup>2</sup> In this case, local public organizations are understood as decentralized organizations and their groups as municipalities, departments, metropolises and regions.

1 economic - that directly influences the public management (Serval 2015, 2018). Finally,  
2 falling in the scope of the two paradigms of *New Public Governance* (Dunleavy et al. 2005,  
3 Osborne 2006, Pollitt and Bouckaert, 2011) and *Public Value Management* (Stoker 2006,  
4 Bryson et al. 2014), the trend is towards collaboration between the public and private spheres.  
5 Prior literature criticizes the linear analysis of management sciences and claims considering  
6 complexity (Morin et al. 2018). In a linear way, the whole corresponds to the sum of the  
7 parties (e.g. 1+1=2) but in a complex way the whole is more than the sum of the parts (e.g.  
8 1+1=3). Moreover, certain authors reject a “one best” structural form, and consequently  
9 require a contingent approach (Chandler 1962, Lawrence and Lorsch 1967, Mintzberg 1979,  
10 1981, Battilana et al. 2012) to adapt organization to a changing environment. According to  
11 principles and rules, computing organization deals with information, signs, symbols and  
12 memory (Morin 1986) to solve complex and contingent problems.  
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14 The originality of this work is to characterize public organizations as computing organizations  
15 capable of solving complex and contingent problems. Indeed, the research question raised by  
16 this article is: how do managers deal with contingent problem solving?  
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18 This article is structured as follows: the first section provides the theoretical background to  
19 solve contingent problems through the dimensions of computing organization (1). Then, we  
20 expose the methodological design, based on a qualitative method and a unique holistic case  
21 study (2). The following sections present findings (3) that are discussed around two axes: the  
22 role of organizational conflicts to characterize the complexity of organizations, and the  
23 conceptualization of computing organization (4).  
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## 25 **1. Theoretical Background: computing organization to solve contingent problems**

26 The following subsection starts by presenting the complexity of organizations, that requires  
27 one to subscribe to contingency theory (1.1). Then, we shed light on the four dimensions of  
28 computing organization. Furthermore, we highlight a new one, the organizational conflicts,  
29 which is balancing with the relationship between order and disorder, anchored in the  
30 complexity paradigm (1.2).  
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### 32 *1.1 To think in the black-box with complexity and contingency*

33 Von Bertalanffy (1968) is the father of the systems theory and nowadays the scope has been  
34 enlarged, dealing with cybernetics, pedagogy, psychology, and more recently with  
35 management (Morin et al. 2018). The systems theory is included in a broader paradigm  
36 termed *complexity* (Morin 1986, 2005) This highlights the shift from the Cartesian paradigm  
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2 to the complexity paradigm (Le Moigne 1990). However, there is a difference between the  
3 systems theory and the complexity.

4 First, complexity is understood as a set of heterogeneous constituents such as events, actions,  
5 and interactions, which are inseparable. Moreover, complexity relates to the uncertainty  
6 within organized systems. The difference between systems theory and complexity is due to  
7 the perspective of the analysis. Systems theory aims at modelling the relationships between  
8 inputs, outputs and environment of opened/non-opened systems (Le Moigne 1990). However,  
9 complexity allows thinking inside the black box, crossing organizational complexity (i.e.  
10 focused on the object) and logic complexity (i.e. focused on the subject), in an uncertain  
11 environment (Morin 2005). Because uncertainty sheds light on the mix between order and  
12 disorder, the dialectic relationship between subject and object is overturned, considering  
13 ambiguity and contradiction.  
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21 As initiator of the complexity, Morin (*Ibidem*) has underlined the counterpoint which is  
22 necessary to criticize the simplification of thought in general, and of management sciences in  
23 particular (Bibard 2018). In constant evolution, the management sciences are facing the  
24 multiplicity and the variety of their objects. In this way, prior literature highlights the double  
25 complexity that characterizes public organizations (Christensen and Læg Reid 2010, Bartoli  
26 and Blatrix 2015, Pache 2018). On the one hand, public organizations deal with multiple  
27 logics including institutional, legal, economic, and social issues. On the other hand, due to the  
28 collaboration trend, public organizations face public and private matters, which refer to  
29 various temporalities and spaces (Dunleavy et al. 2005, Osborne 2006, Pollitt and Bouckaert  
30 2011).  
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40 As complexity is opposed to the idea of “one best” structural form, we are then concurring  
41 with the contingency theory (Chandler 1962, Lawrence and Lorsch 1967, Mintzberg 1979,  
42 1981, Battilana et al. 2012). Because public organizations evolve in a complex, uncertain and  
43 changing environment, they must adapt to it (Hernandez and Belkaid 2013). Therefore, the  
44 organizational success depends on the internal fit between the various parts of organizations  
45 such as conceptualization, action, planning, and implementation (Battilana et al. 2012). To  
46 think in the black-box of public organizations, we cross complexity with contingency to adapt  
47 solutions to a changing economic, social and institutional environment.  
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## 56 *1.2 A computing organization to solve complex and contingent problems*

57 Complexity is a *problem word and not a solution word* (Morin 2005, p.10). To think about  
58 the complexity of public organizations requires to mobilize computation (Simon 1978, Morin  
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1986, Houghton 2014). From the Latin *computare*, computation means *to calculate, to compare, and to confront together*”, and refers to a broad capability to solve various problems. Consequently, computation is a “complex organizer / producer of cognitive character comprising an informational dimension, a symbolic dimension, a memory dimension and a software dimension (Morin 1986, p.37).

First, the informational dimension refers to signs and symbols carrying information. Thus, organizations extract information from the internal and external organizational environment. To give an example, organizations must analyze frequently their environment through a strategic diagnostic and therefore deal with information (e.g. partnerships) given by the public organizations in charge of local economic development such as the regions.

Second, the symbolic dimension encompasses information which is categorized in signs and symbols. Their signification can be either objective, as a denotation process, or subjective, as a connotation process (Barthes and Howard, 1991). As illustration, an orientation towards alternative financing is a sign sent by the organization that refers to denotation process. And the choice to promote transparency is a symbol of democratic openness that can be understood as connotation process. Within this framework, computation is the organizational capability<sup>3</sup> to deal with signs and symbols. Consequently, information, signs and symbols respond to each other in a complex perspective.

Third, the memory dimension is based on the organizational capability of memorization. This reflects the different ways to work with memory, such as through extraction, registration, modification and erasure. For example, when a manager deals with users’ files, he or she works with memory. Computing capability is working on its organizational memory according to these needs/goals, and therefore the practice refers to short, medium, or long-term processes, corresponding to an adaptive, managerial, or strategic way.

Finally, the software dimension is understood as a set of principles, rules and instructions that govern the organizational functions of calculation, prescription and reasoning. As illustration, accounting standards, which exist both nationally and internationally, are rules and principles that set the way accounting works. In this way, computing capability encompasses association and separation processes to deal differently with information, signs and symbols.

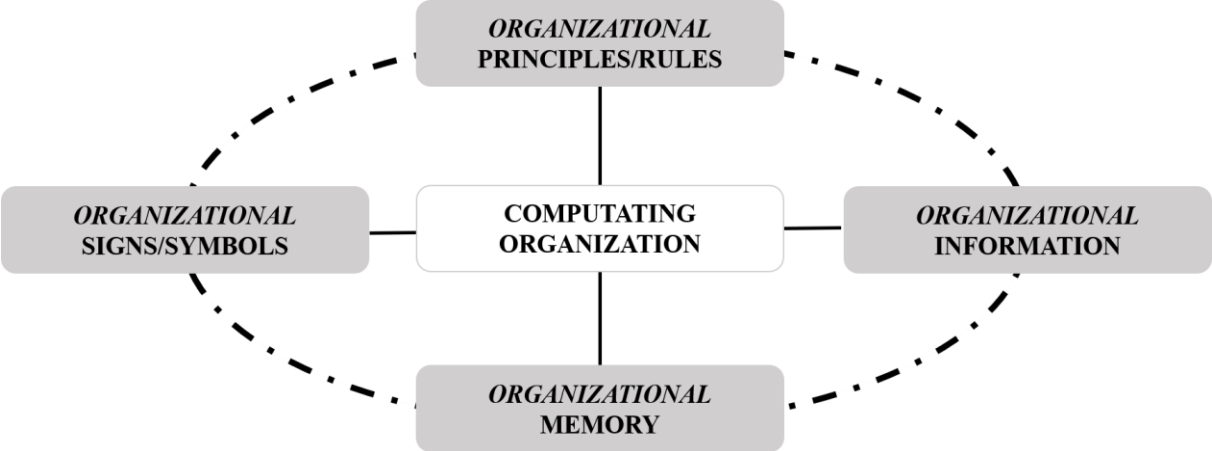
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<sup>3</sup> The term capability doesn’t refer to dynamic capabilities research. The dynamic capabilities’ goal is to understand how firms can sustain a competitive advantage through the analysis of different domains of strategy process and content (Helfat and Peteraf 2007, Teece 2007). In this research, the goal is to understand how manager deal with contingent problem solving, neither sustaining a competitive advantage, nor in a strategic way.

1 The computing organization is defined as an organization, which deals not only with  
2 information and symbols, but specifically with information, symbols and problems, according  
3 to their principles and rules (Morin, 1986). In these conditions, computing organization can be  
4 understood as a *general problem solver* (GPS) (Newell et al. 1959, Simon 1978). A GPS faces  
5 extremely complex processes that are involved in intelligent, adaptive and creative behavior  
6 (Newell et al. 1959). Thus, computing organization encompasses a broad capability, which is  
7 powerful enough to be applied to contingent problems.

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12 Morin (1986) sheds light on a fundamental principle: computation is essential for knowledge  
13 and any problem solving. Indeed, computation is essential for organizations to solve  
14 contingent problems. Due to the contingency theory, problem solving can't be understood as a  
15 unique best structural form, and computing organization adapts itself according to internal and  
16 external environments. As computing capability covers four dimensions, then it follows that  
17 computing organization deals with four dimensions to solve contingent problems, shown in  
18 the Figure 1.

27 **Figure 1: Four dimensions of computing organization**



44 *Source: Figure adapted from Morin (1986, p.39)*

48 Anything evolving in a complex paradigm requires facing up to uncertainty within organized  
49 systems (Morin 1986, Haughton 2014, Poulis and Poulis 2016). Consequently, complexity  
50 relies on a balance between order and disorder to consider contradictions. Indeed,  
51 organizational conflicts are a crucial dimension of computing organizations.

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54 A conflict refers to the confrontation between two or more people and, unlike the problem, it  
55 doesn't have to be solved. Facing a conflict implies all different types of reactions, in a  
56 continuum from the refusal of confrontation to confrontation (Thomas 1992). Conflict can be

1 managed by force (verbal or physical), or by communication/negotiation. Moreover, the  
2 representations of the conflict are generally negative because the goal is to avoid it. Broadly  
3 accepted, this solution tends to be expensive both in time and energy. However, conflict can  
4 be understood in a positive way, because it is a source of development, when the actors  
5 engage themselves in a process of resilience (Tisseron 2014). For example, all children, at  
6 some stage, enter conflict with their parents. From a managerial perspective, conflict can be  
7 the fruit of a saving or destructive power (Blondiaux 2008, Martinais 2015).  
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## 15 **2. Research Methodology: From an Exploratory Approach to a Unique Holistic Case** 16 **Study**

17 We start by presenting the comprehensive and qualitative research design (2.1). Then we  
18 successively explicit the data collection with the sample composition and the data analysis  
19 methods (2.2).  
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### 26 *2.1 Comprehensive and qualitative research design*

27 We consider computing organization as observable phenomena which are socially constructed  
28 (Berger and Luckmann 1966). This basic hypothesis involves a focus on organisation  
29 members' meanings and the interpretations of their lived experiences. Then, we opt for an  
30 exploratory investigation (Snow and Thomas 1994) with a qualitative method (Miles et al.  
31 2013) to develop new theoretical angles. In this way, we address the following research  
32 question: how do managers deal with contingent problem solving?  
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39 Our research strategy is based on a case study used to investigate *a contemporary*  
40 *phenomenon within its real-life context* because *the boundaries between phenomenon and*  
41 *context are not clearly evident* (Yin 2009, p.13). Our unique and holistic case study (Dumez  
42 2016) seeks to analyze public organizations facing complex and contingent problems. The  
43 local public organizations studied are Municipal Centers for Social Action (MCSA) that are in  
44 charge of meeting the social needs of users.  
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### 52 *2.2 Data collection and data analysis*

53 The data collection comes from two different collection modes. To commence, six participant  
54 observations (Spardley 2016), namely meetings and presentations, were carried out from  
55 January to March 2017. Additionally, six semi-structured interviews (Fylan 2005) with  
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territorial managers<sup>4</sup>, working in three MCSAs, were conducted in May 2017. The focus on the territorial managers' perceptions allows us to place the study at the meso level, and thus to highlight the balance of power between the political pressures (macro level) and the social demands (micro level) (Cloutier et al. 2015). Indeed, managers are considered as essential intermediaries. The following table details the type of participant observations and the sample composition of semi-structured interviews.

**Table 1: Contents of observations and sample composition of interviews**

Participant Observations	Semi-structured Interviews
Meeting with the Regional Device of Social Data Observation - <i>Observation 1</i>	Project Manager responsible for the Analysis of the Municipal Social Needs - <i>Interview 1</i>
Meeting for the Analysis of the Municipal Social Needs - <i>Observation 2</i>	Territorial Manager in a Municipal Center for Social Action - <i>Interview 2</i>
Meeting with the Muncipial Direction of Sports - <i>Observation 3</i>	Territorial Manager in a Municipal Center for Social Action - <i>Interview 3</i>
Meeting with the Muncipial Direction of Youth - <i>Observation 4</i>	Territorial Mediator of Muncipal Social Problems - <i>Reference : Interview 4</i>
Meeting with the Participative Web TV about a public mission for Youth - <i>Observation 5</i>	Head of Department responsible for Muncipal Social Action - <i>Interview 5</i>
Presentation of the Municipal Center for Social Action - <i>Obsevation 6</i>	Territorial Manager in a Municipal Center for Social Action - <i>Interview 6</i>

*Source: Authors*

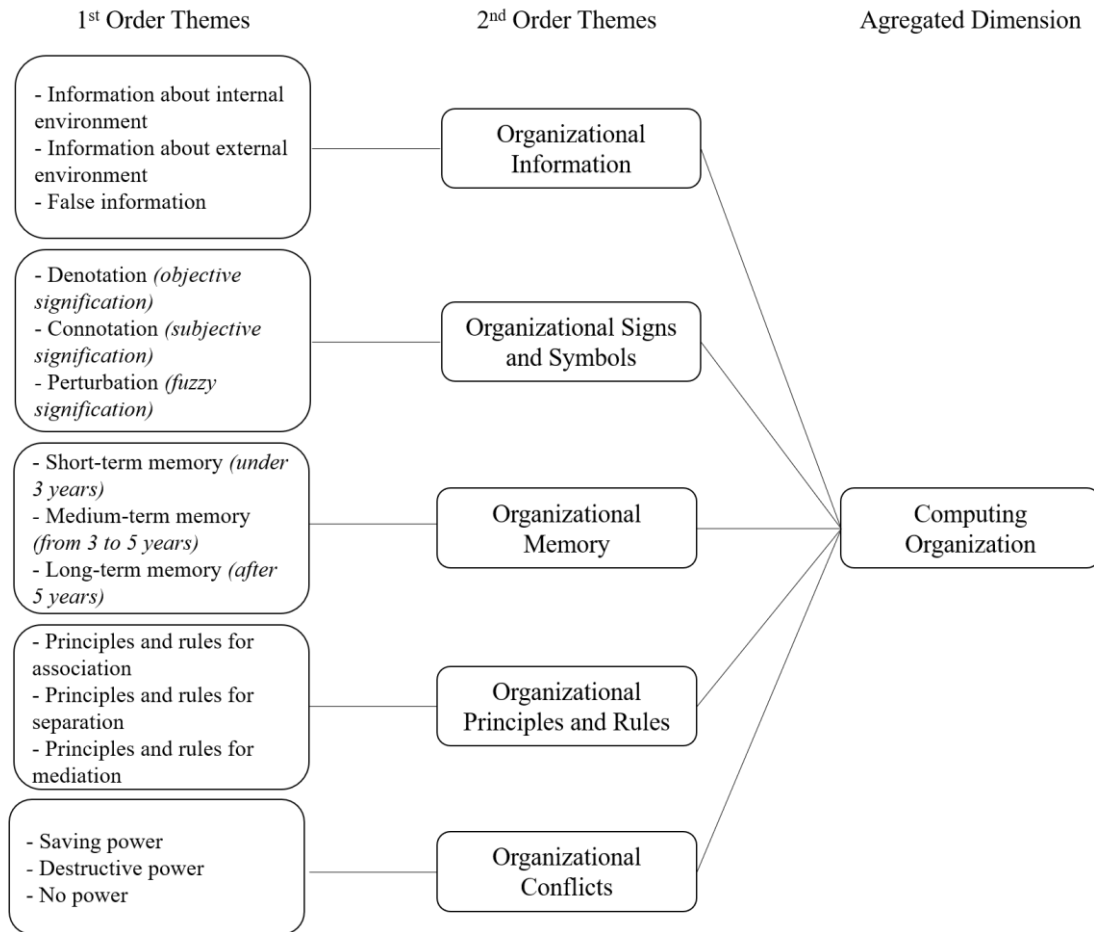
The interview protocol consisted of the following themes: (1) rules and principles governing the organization, (2) analysis of internal and external environment, (3) extraction, registration, modification and removal of information, (4) tools used by managers.

To examine the computing organization, data analysis is based on inductive and abductive logics, following the methodology of Gioia et al. (2013). We start with an inductive approach to generate a first-order analysis, which identifies themes faithfully linked to informant terms, through an open and axial coding (Strauss and Corbin, 1998). Based on this first-order analysis, we constructed second-order categories to identify *whether the emerging themes suggest concepts that might help us to describe and explain the phenomena we are observing* (Gioia et al. 2013, p.20). Taken together, the first and second order analyses are the building blocks of our data structure (Figure 2). Subsequently, the research process shifted from an inductive to an abductive logic by considering the data structure and existing theory in tandem

<sup>4</sup> This person is a public manager who makes territorial management, which encompasses all the managerial processes used to implement and adapt the strategy of a local public organization (Hernandez and Belkaid 2013).

(Alvesson and Kärreman 2007). The abductive logic leads us to identify new concepts and interrelationships dynamics, through the construction of a theoretical model.

**Figure 2: Data structure for a computing organization**



*Source: Authors*

### 3. Findings: the five dimensions of a computing organization

The findings describe the computing organization in five parts, exposed in the data structure (cf. Figure 2). The information is the first dimension (3.1), which deals with signs and symbols, identified as the second dimension (3.2). This is to work organizational memory, the third dimension (3.3) through association and separation processes, which are the fourth dimension (3.4). The last dimension is a new one, shedding light on conflicts, the part of disorder that balances with order in a complex paradigm (3.5).

### 3.1 Organizational information: interaction with internal and external environment

The data collected through observations and interviews illustrates the managers' representation about the role of information for a computing organization (Table 2).

**Table 2: Data supporting organizational dimension**

ORGANIZATIONAL INFORMATION	
<b>Information about internal environment</b>	<p>“The goal is to raise the difficulties and exchange on the establishment of good practices, so to exchange information. This space is missing” <b>Interview 5</b></p> <p>“We gathered and consulted the employees of the municipal center for social action. This approach is a participative one, because it is important to know their needs in order to mobilize them” <b>Interview 2</b></p> <p>“I wanted to talk about the refoundation of our municipal center for social action. This year is a pivotal period, which will allow us to position users at the center of all our actions, and this will be done in project mode ” <b>Observation 6</b></p>
<b>Information about external environment</b>	<p>“For the past six months, I have been trying to find someone working for the region, who can explain to me what this abbreviation means, or why there is something that seems inconsistent with another. Nobody answers” <b>Interview 1</b></p> <p>“We often consult young people, and we have met them about the content of the questionnaire. Their priorities are not necessarily ours so it is important to reach an agreement. Next week we will meet them to test the questionnaire, and to put back the information they give us” <b>Interview 3</b></p> <p>“As part of the study on young people aged 11 to 17, we want to make a qualitative study more than quantitative, which implies the realization and dissemination of a questionnaire to users” <b>Observation 3</b></p>
<b>False information</b>	<p>“The brakes are present but they refer to misunderstandings, often due to false information” <b>Interview 3</b></p> <p>“The work is dense, I am alone, so it is sometimes difficult to respond to emergencies in the time available, especially if we have contradictory information about a user's situation” <b>Interview 6</b></p> <p>“One of the strategic objectives of the municipality is to improve external communication with users, i.e. to make known the skills and services offered by the city, but also to fight against false information disseminated by local or national newspapers” <b>Observation 3</b></p>

*Source: Authors*

First, the information extracted from the internal environment displays communication about the organization, the exchanging of data to achieve goals or to solve problems and knowing the needs of the organization's employees. These exchange times are both formal, through regular meetings, and informal, through coffee breaks and lunches. However, due to the context of a reduction in expenditure, and hence a lowering of the number of employees', the exchange time between services is reduced, and mostly informal.

Second, the information exchange with the external environment is also formal (e.g. contractualization) and informal (e.g. lunches and telephone exchanges). Moreover, the information extracted from the external environment comes from public organizations (e.g. another territorial level), private organizations (e.g. enterprises, and associations) and citizens. Third, managers deal with false information which means incorrect information. This can of information can come from the internal and external environment and be transformed voluntarily or involuntarily.

Finally, the computing organization deals with information extracted from the internal and external environment. The information exchange tends to be standardized and, consequently,

there is the risk of failing in adapting the missions of the organization, according to the territories' specificities.

3.2 Organizational signs and symbols: from denotation to connotation

The data collected illustrates the managers' representation about the role of signs and symbols for a computing organization (Table 3).

**Table 3: Data supporting organizational signs and symbols**

ORGANIZATIONAL SIGNS AND SYMBOLS	
<b>Denotation</b> <i>(objective signification)</i>	<p>“The new logo of the municipal center for social action symbolizes the link with the city (color code and typology identical to that of the logo of the city) and the dynamism of the service (logo with a man who flies away)” <b>Observation 2</b></p> <p>“Faced with reforms and decreases in staffing, a sign must be communicated: a clear sharing of resources and risks to build a welcoming territory. This is what must be understood by users” <b>Interview 2</b></p> <p>“We share the data with the region, so it is normal for the studies to be shared. They participate in the planning process of studies, and it is a sign of a good agreement” <b>Interview 1</b></p>
<b>Connotation</b> <i>(subjective signification)</i>	<p>“There must be a pilot, a facilitator who makes the actors on the territory work together. The goal is to make sense, to create bonds” <b>Interview 5</b></p> <p>“The service house allows the public to offer all services to the public in the same place; everyone can find the help needed. These are all values of the public service” <b>Observation 2</b></p> <p>“It is important that each of the actors of the territory feels concerned by what is happening at home, even if it's not translated by the same involvement” <b>Interview 6</b></p>
<b>Perturbation</b> <i>(fuzzy signification)</i>	<p>“Words differ, as do the ways of doing things, of organizing, of thinking. The important thing is to find a common language for everyone's needs to be expressed. However, it is difficult to get private organizations to work on these social issues, because their discourse is not very adaptable and therefore sometimes very vague for social actors” <b>Interview 5</b></p> <p>“There is a lack of space to connect the actors of the territory and this contributes to disturbing their mutual understanding” <b>Interview 6</b></p> <p>“The means of communication, in this case the computer, can disrupt the message and make it incomprehensible to those who do not know how to use the tool” <b>Observation 2</b></p>

Source: Authors

First, when the signification of the signs and symbols used by the organizations is objective, it refers to the definition and creation of tangible resources, such as a new logo, a reform process, and a share of indicators. Indeed, the message is formalized to define a unique signification (e.g. a slogan, or the contract terms).

Second, the signification of signs and symbols used by the organizations can be subjective, and it refers to the definition and animation of intangible resources, such as the commitment of the employees (e.g. making sense), or the values (e.g. sharing of public values). Consequently, the association of different messages requires a distinct process of mental appropriation.

Third, signs and symbols can also have a fuzzy meaning, which then disturbs the understanding of the situation and/or problem. This may be due to the transmission tool

chosen (e.g. unknown mapping software) or the type of person using it (e.g. lack of mutual acculturation between public and private actors in social action).

To sum up, computing organization uses signs and symbols through either a denotation process, targeting tangible resources to diffuse an objective message, or a connotation process, targeting intangible resources in order to disseminate several messages.

*3.3 Organizational memory: an adaptive, managerial and strategic one*

The managers’ representation is analyzed through observations and interviews illustrating the role of organizational memory for a computing organization (Table 4).

**Table 4: Data supporting organizational memory**

<b>ORGANIZATIONAL MEMORY</b>	
<b>Short-term memory (before 3 years)</b>	“There is few interactions between the sports services and the cultural service, so it is important that we begin to map the structures funded by the town that the two services have in common” <b>Observation 4</b> “For someone who is in expulsion process, it is important that he or she can report their problems. The information is then recorded to help us throughout the follow-up” <b>Interview 4</b>
<b>Medium-term memory (from 3 to 5 years)</b>	“We rely on the region that has been providing municipal and communal data for more than four years” <b>Interview 1</b> “For more than four years, workshops have been conducted by the House of Adolescents. It is a mission in which the territory is engaged, because the artistic mediation makes it possible to sharpen the individual and collective imagination” <b>Observation 1</b>
<b>Long-term memory (more than 5 years)</b>	“Our actions can only be implemented in their relationship to the territory; it is our main reflection. When welfare actors work together it's good, if they work together to serve a strategy for the territory it's better” <b>Interview 6</b> “It is like a loop, the more the users, the institutional and non-institutional partners are involved, the more their opinion is taken into account, and the more the answers provided by the public actions solve problems. These practices are already institutionalized, and they make it possible to sustainably increase the local quality of life” <b>Interview 3</b>

*Source: Authors*

In a first phase, the short-term memory refers to the treatment of information in order to define processes and tools (e.g. expulsion procedure and map) under three years. This type of memory is an adaptive one.

In a second phase, the medium-term memory deals with actions and processes that will be implemented in three, four and/or five years. This type of memory is a managerial one, because it requires a formalization, such as the signature of a contract to exchange social data.

In a final phase, the long-term memory is based on an institutionalized process, crossing different types of information to achieve strategic goals in more than five years. This type of memory is a strategic one, which uses the short-term and the medium-term memories. Indeed, a computing organization deals with different types of memory according to these goals.

### 3.4 Organizational principles and rules: from association to separation

The data collected refers to the managers' representations and highlights the role of principles and rules for a computing organization (Table 5).

**Table 5: Data supporting organizational principles and rules**

ORGANIZATIONAL PRINCIPLES AND RULES	
<b>Principles and rules for association</b>	"In the digital age, the expression of everyone's needs is essential for a better life. Society evolves, generations and their codes change; we need to adapt our communication tools" <b>Interview 2</b> "The principle is simple: we send the addresses of our server to the partner institution, which sends us its data that they are made anonymous in the sense of the national commission computer and freedom. It is a very effective partnership" <b>Interview 1</b>
<b>Principles and rules for separation</b>	"The weakness of the system is the lack of the citizens' participation. This participative process is not integrated" <b>Interview 5</b> "At the departmental level, we had signed an agreement with them for a data sharing and, against all odds, they conducted their study on their side without respecting our prior agreement" <b>Interview 3</b>
<b>Principles and rules for mediation</b>	"This mediation system is very new so we have not yet translated the request into action, the goal is simply to propose solutions to agents to facilitate their users follow-up" <b>Interview 6</b> "Despite the will of the users, it's not possible to increase the number of places in residence. However, the municipality favors the use of personal services, even if this can only be done in the short term according to the needs of each user" <b>Observation 2</b>

*Source: Authors*

A computing organization uses principles and rules to deal with information, symbols and memory. First, principles and rules can be used to associate people within the organization, and/or organizations between them. In digital areas, the modes of association tend to be virtual, and the principles and rules must be adapted (e.g. principles of computer data exchange).

Second, principles and rules can foster separation when the modes of association fail. Accordingly, these principles and rules of separation are only revealed by the limits and the failure of the association process.

Third, principles and rules can foster mediation, referring to a third way between association and separation. These principles propose solutions to foster interaction when collaboration is not yet possible (e.g. new social mediation associations). A computing organization associates, separates and/or mediates, depending on the principles and rules that are used.

### 3.4 Organizational conflicts: between saving and destructive power

The data collected illustrates the managers' representation about the role of organizational conflicts for a computing organization (Table 6).

**Table 6: Data supporting organizational conflicts**

ORGANIZATIONAL CONFLICTS	
<b>Saving Power</b>	<p>“In the case of the house for dependent elderly people, the conflict initially encountered has helped to unblock other problems” <b>Interview 2</b></p> <p>“The work remains complicated because the social action is under-sized, there are only two receptionists and a part-time social worker. The situation creates a lot of tension, but it is changing. Facing the blockage, two full time jobs will be funded by the municipality” <b>Interview 4</b></p>
<b>Destructive Power</b>	<p>“For the past six months, I have been trying to find someone working for the region, who can explain to me what this abbreviation means or why there is something that seems inconsistent with another. Nobody answers” <b>Interview 1</b></p> <p>“There are cases of conflicts with users, which block the support” <b>Interview 6</b></p>
<b>No Power</b>	<p>“In general, the tensions arise mainly on the way of doing and not on the bottom, so they dissipate quickly” <b>Interview 5</b></p> <p>“To question the value of fraternity was not easy work because young people often went into conflict. However, these tensions rapidly disappeared, and didn’t affect the remarkable work of these young people” <b>Observation 5</b></p>

*Source: Authors*

To transpose this thinking into a computing organization, the complexity of processes, actions and tools must be put into perspective through a dialectic between order and disorder. Indeed, the organizational conflicts can refer to a saving power, a destructive power, or no power at all.

First, organizational conflicts can generate positive consequences, and thus be the fruit of a saving power. For example, a conflict can help to unblock problems when the mode of resolution involves several shareholders (e.g. the opening of a new childcare center).

Second, organizational conflicts can produce negative consequences, and so refer to a destructive power. In this case, conflicts create inertia, and can stop a process or an action (e.g. analysis of young people needs sharing between services).

Third, organizational conflicts can have consequences without long time effects, when referring to low tensions. However, as perception of tensions change from one person to another, speaking about “low” tension can vary in time and space. For example, tensions, and stress, associated with a way of doing something can be considered as major for one person and minor for another one. These perceptions can also change according to different time-periods.

**4. discussion: the role of conflict for a computing organization solving complex and contingent problems**

The last section discussing the findings is twofold. First, we put into perspective the role of organizational conflicts to characterize a computing organization into a complex paradigm

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(4.1). Second, we propose the conceptualization of computing organization, able to solve contingent problems, with five dimensions (4.2).

#### 4.1 *The role of organizational conflicts to characterize a computing organization*

A computing organization (Morin 1986) deals with information, signs, symbols, and memory through association, separation and mediation processes in order to solve contingent problems. However, the lack of balance between order and disorder conflicts with the complexity paradigm (Morin 2005). The goal is to consider a set of heterogeneous constituents such as events, actions, and interactions which are associated, and rely on the uncertainty within organized systems. Indeed, the focus on organizational conflicts sheds light on the influence of saving or destructive power.

Prior literature identifies the distinction between conflict processes and the structures in which that process occurs (Thomas 1992). On the one hand, the analysis of conflict processes outlines the temporal sequence of events, such as the mental and behavioral activities of the conflicting parties. In contrast, the structural aspect of conflicts analyzes the system parameters through the conditions that shape or control the system process. As we target the role of saving or destructive power that arises from the system process, our position is oriented on the structural aspect of organizational conflicts.

To go further, saving power refers to positive tensions emanating from conflicts within and around the organization in the medium-to-long-term. Destructive power designates the negative tensions. Likewise, as shown in the findings, conflicts can generate no power whatsoever, and therefore no positive or negative consequences. However, this situation depends on the tensions' perception, and varies from one person to another.

*The quest for harmony and common goals can actually obstruct teamwork. Managers get truly effective collaboration only when they realize that conflict is natural and necessary* (Weiss and Hughes 2018, p.67). Indeed, any organization faces conflicts, and any organization is looking for a balance between positive and negative tensions, referring to a saving and a destructive power. Where there is no tension, and therefore no power, there is no requirement to search for balance. Furthermore, a computing organization is looking for balance between order and disorder, and so a computing organization is dealing with saving and destructive power to face complex and contingent problems. Considering the organizational conflicts completes the computing organization and gives it the capability to solve contingent problems in a complex world.

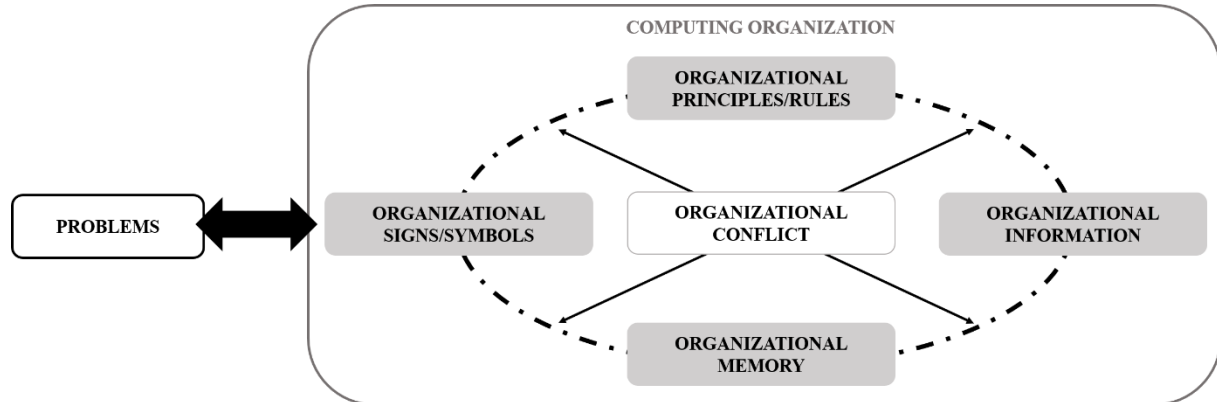


#### 4.2 Conceptualization of a computing organization in a complex and contingent approach

The unique and holistic case study confirms the four dimensions identified in a computing organization (i.e. information, signs and symbols, memory, rules and principles), and improves the model with a new dimension (i.e. organizational conflicts), anchored in the complexity paradigm. Figure 3 shows the interactions between the five dimensions of a computing organization to solve complex and contingent problems.

Local public organizations are facing a set of reforms and are answering an injunction to collaborate with the other public organizations, private organizations, and citizens. Evolving in the new paradigms of new public governance and public value management, these organizations are seeking to solve complex and contingent problems. These issues offer us an opportunity to rethink the ontology of local public organizations in the manner of complexity. The main goal encompasses the search for a balance between order and disorder, putting into perspective the association and the separation processes. Therefore, the organizations come alive through these interactions and deal differently with information, signs, symbols, and memory, according to their rules and principles.

**Figure 3: Computing organization facing contingent problems**



*Source: Authors*

#### **Conclusion**

This research poses a challenge to the purpose of local public organizations, in the complexity paradigm.

Thinking in the black box, the goal is to answer the question: how do managers deal with contingent problem solving? According to the contingency theory, we don't propose a "one best way", but a way, which has to be adapted to the context of time and space.

1 A computing organization deals with information, signs, symbols and memory according to  
2 its rules and principles. However, an organization is looking for a balance between order and  
3 disorder to maintain itself in a competitive and uncertain environment. To do so,  
4 organizational conflicts refer to the new dimension of a computing organization, which sheds  
5 light on the role of a saving and a destructive power. This search for balance is essential to  
6 solve contingent problems. Indeed, we propose a model of a computing organization with five  
7 dimensions.  
8

9 The first limitation of this research refers to the unique thematic content analysis. The  
10 discourse of public managers could be reviewed with a structural analysis (Barthes et Howard  
11 1991). Indeed, the public managers' perception could be collected with explanatory  
12 interviews (Vermersch 2017), which allow one to focus on a specific problem.  
13

14 The second limitation of this work is its external validity, related to the qualitative  
15 methodology. A new line of research would be to conduct other case studies on different  
16 types of local public organizations (regions, departments, metropolises...). Finally, it would  
17 be interesting to carry out a quantitative study on a larger scale in order to test the  
18 characteristics of the computing capability.  
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