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Mutations de l'environnement, mutations des organisations, mutations de la GRH ?

CAREERS IN CONTEXT: ANALYSIS OF CAREER TRAJECTORIES OF PHD HOLDERS OUTSIDE OF ACADEMIA.

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Abstract

Why, in increasingly fuzzy boundaries and resemblances on knowledge production between academia and other organizations, do careers outside academia after doctoral studies struggle to emerge, with some PhD students preferring to stay “sad” in short-term contracts and waiting lines to access academia? This research interviews 20 PhD holders from the University of Lyon who currently work in private companies to understand their career trajectory. The research draws from a literature in career studies that puts an emphasis on contexts in understanding career-making and changes, and Activity Theory (AT), to show how the object of doctoral research activity transforms across the career trajectory of PhD holders towards the private sector. With the help of a life interview technique and an analytical framework based on AT, I show common dimensions of the object of work across career trajectories and how young PhD holders progressively reconceptualize the object of their work in their personal travel, with a strong emotional exigency. Communities, instruments, life history and divisions of labor are both resources and sources of tensions across the trajectory. This shows an epistemic work on career that a young scientist does and which is related to their knowledge construction during the thesis, and a stabilization of objects when entering the firm. This research contributes to knowledge on career trajectories of PhD holders outside of academia and the conceptualization of context in career studies, with the help of AT, and elaborate practical implications for universities.

Key words: career in context; activity theory; object; expansion

Résumé

Pourquoi, dans un contexte institutionnel où frontières et manières de produire la connaissance entre le monde universitaire et d'autres organisations s'amenuisent, les carrières vers les organisations hors secteur universitaire après le doctorat peinent à émerger, certains doctorants préférant rester "tristes" dans des contrats temporaires et des files d'attente pour accéder à la profession académique ? Cette recherche interroge 20 diplômés de doctorat de l'Université de Lyon qui travaillent actuellement dans des entreprises privées, pour comprendre leur trajectoire de carrière. La recherche s'appuie sur une littérature dans les courants des carrières qui met l'accent sur les contextes pour comprendre la construction et les changements de carrière ; et sur la théorie de l'activité (TA), pour montrer comment l'objet de l'activité de recherche doctorale se transforme à travers la trajectoire de carrière des diplômés de doctorat vers

l'entreprise privée. A l'aide de la technique des récits de vie et d'un cadre d'analyse basé sur la TA, je montre ce qui est commun aux trajectoires de carrière vis-à-vis de l'objet du travail de recherche (dimensions et transformations) et comment les jeunes docteurs re-conceptualisent progressivement l'objet de leur travail dans leur parcours, là où une exigence émotionnelle est forte. Les communautés, les instruments, l'histoire de vie et la division du travail sont à la fois des ressources et des sources de tensions à travers la trajectoire. Cette recherche montre que les jeunes docteurs réalisent un travail épistémique mouvant sur leur carrière en même temps qu'ils produisent de la connaissance scientifique. L'objet de leur travail se stabilise lors de l'entrée dans l'entreprise. Cette recherche contribue à la connaissance sur les trajectoires de carrière des jeunes docteurs en dehors du secteur académique et à la conceptualisation du contexte sur les recherches sur les carrières, à l'aide de l'AT, et établie quelques recommandations pratiques pour les universités.

Mots clés : carrière en contexte ; théorie de l'activité ; objet ; expansion

1. Introduction

Institutional shifts have changed the way science is done, according to new norms and market needs in increasingly fuzzy boundaries between academia and other organizations (Lam, 2019; Lam & Marsden, 2017). This drives new careers and workers such as hybrid scientists (Lam, 2019) who engage in both academia and other organizations while continuously participating in the emergence of overlapping structures of science. However, the careers of PhD holders who decide to work outside of academia after their doctoral studies have drawn very little attention in management studies. Why do, in such vague boundaries and resemblances on knowledge production (Lanciano-Moranda, 2019), those types of careers struggle to emerge, with some PhD students preferring to stay “sad” in short-term contracts and waiting lines to access academia (Lam & de Campos, 2015)? Even though research has highlighted employability determinants and career agency mechanisms for those PhDs (Ibid.), the practice of science, e.g., the passionate relationship one scientist can endure with knowledge (Landri, 2007) being produced, instruments that are used (Knorr-Cetina, 2007), in this moving institutional context has not been studied with respect to career trajectories across the non-academic sector.

Meanwhile, literature on careers in context (Tams et al., 2020) seek to understand and conceptualize context in careers – career agency (Lam & de Campos, 2015), transitional careers (Ruiz Castro et al., 2020) or scripts (Duberley et al., 2006) – by drawing on Grand Social Theories such as Giddens' structuration theory or Bourdieu's, among others (Tams & Arthur, 2010; Gunz et al., 2011) to overcome dualisms such as structure/agency, objective/subjective, micro/macro. However, literature still struggles and sometimes stay in the “dualisms deadlock” (Lorino et al., 2011), preferring to use dualisms as a device to show mechanisms and to keep them in the end (Cohen & Duberley, 2015). Also, even though practice theories are good candidates to conceptualize context in career issues (Chudzikowski and Mayrhofer, 2011), career trajectories are not studied according to concrete work, what people do on a daily basis (Schatzki, 2001) with respect to moving environments, while it is commonly argued that careers account for societal and organizational transformations (Gunz et al., 2011).

In this research, I draw on Activity Theory (Engeström & Sannino, 2021) to understand career trajectories of PhD holders who went from doctoral research to the non-academic sector. Indeed, AT, with heritages from Vygotski (1978) and Leontiev (1981), focuses on the object of work (Adler, 2005) both in its concrete aspect (the contingencies of the structures) and the idealistic one (the choices, the representations of individuals), reintegrating objective, subjective and projective dimensions of human agency (Haapasaari et al., 2016; Pralong, 2011)

that unfolds in expansive movements of resolutions of contradictions. These are inherent to tensions between use and exchange values in objects of work – science for knowledge *vs* science for economy – that increasingly changing institutional contexts and overlapping structures cultivate (Blackler & Reagan, 2009). The object is analyzed according to a meso perspective: activity is context (Sannino & Engeström, 2018). AT conceptualizes context as a multilayered, systemic view of and mediated activity that involves communities, division of labor, rules and instruments.

Therefore, I investigate how the object of doctoral research activities transforms across career trajectories of PhD holders who work outside of academia. I rely on the analysis of 20 semi-structured interviews of PhD holders from University of Lyon and who currently work in private companies in the form of life story interviews (Maclean, Harvey & Chia, 2012; Bouilloud, 2009) focused on the career trajectory. Results show common dimensions of the object of work in the career trajectory and how young PhD holders progressively reconceptualize the object of their work in their personal journey, with a strongly emotional exigency. Communities, instruments, life history and division of labor are both resources and sources of tensions across the trajectory. This shows an epistemic work on career that a young scientist does with respect to their knowledge construction during thesis. When spanning boundaries (shown by contradictions in the trajectory), this epistemic work, incomplete and moving, is stabilizing in new objects of work in private companies that HR instruments fuel (such as the notion of competence). I contribute to knowledge on career trajectories of PhD holders outside of academia and the conceptualization of context in career studies with the help of AT. Also, I show that contradictions can account for boundaries in the social world and how one can surpass them. Eventually, I sketch practical contributions for universities regarding reflexivity.

2. Conceptual framework

2.1 Careers in context

Even though career research has increasingly focused on “individual and agentic perspectives where context only plays a minor role, often limited to single aspects of, for example, organizations” (Mayrhofer et al., 2020), context is pivotal in understanding careers, both terms often seen as pleonastic (Gunz et al., 2011; Tams et al., 2020; Mayrhofer et al., 2020; Andressen et al., 2017). The following definition of what career development is, provided by Van Maanen and Schein (1977, p.36, quoted by Tams & Arthur, 2010) illustrates the core issue of integrating context in career research: “[A] lifelong process of working out a synthesis between individual interests and the opportunities (or limitations) present in the external work-related environment, so that both individual and environmental objectives are fulfilled”. Growing accounts of research on careers strive to restore its significance to contexts in influencing careers and career-making. Interweaving factors such as culture, organizations, economy, a moving environment, supervision and management (Lam & de Campos, 2015), scripts (Dany et al., 2011), time and space (Mayrhofer et al., 2020) and other contextual issues can overlap in a web of dimensions as parts and parcels of action, careers and how individuals draw meaning upon it (Cohen & Duberley, 2015). These perspectives are part of what Tams et al. (2020) call the “inside/out” accounts on context conceptualization in career studies: “people’s construction of careers in relation with their lived experiences” (p.3). Others draw attention on the deterministic character of context: micro forces – situational mechanisms in the context of work – mark macro forces of the profession and/or more or less multiple organizations (Abbot, 1991) in career trajectories (Leleblici & Jeong, 2018). This is also the case of Dubois & François (2020), who, with the help of the concept of boundary, seek to test a specific boundary in the careers

of poets – its existence – and ask the latter whether they are aware of it. The “outside/in” perspective on context (Tams et al., 2020) therefore refers to “external system or environment in which individual careers are embedded” (p.3), where contextual issues are “exogeneous factors that influence careers of individuals and the organizations and “fields” they are in” (Mayrhofer, Meyer & Steyer, 2007, p.216). These two streams on how research makes sense of career in context are labelled by Tams et al. (2020) as either entity-based or constructionist ways of thinking. The former relates to discrete entities that build career in time and space (causal relationships starting from attributes of the context). The latter draws on relational stances of career and career-making, such as Lam & de Campos (2015). For the latter authors, career is seen in a threefold dimension: objective, subjective and projective, every dimension being constitutive of a career agency that relies on types of social exchanges embedded in psychological contracts that explain the nature of the relationship young scientists have with their supervisor. They thus exert control over their environment *via* this relationship, which relates to a proxy agency in Bandura’s terms.

Context is often conceptualized with the help of Grand Theories to solve the structure/agency, micro/macro and individual/context dualisms, among others (Tams & Arthur, 2010; Gunz et al., 2011). Theories of practice (Feldman & Orlikowski, 2011) are good candidates to relate *how* these dimensions are intertwined and generated in contexts (Chudzikowski and Mayrhofer, 2011, p. 29). For instance, literature has drawn on Bourdieu’s theory (Chudzikowski and Mayrhofer, 2011; Mayrhofer et al., 2007; Valette & Culié, 2015), or, in the case of scripts, structuration Theory (Giddens, 1984) and Barley’s structurational model (Barley, 1989), which has gained a lot of attention (Gunz et al., 2011; Duberley et al., 2006; Andressen et al., 2019; Cohen & Duberley, 2015; Tams & Arthur, 2010; Garbe & Duberley, 2019; Dany et al., 2011). For instance, Dany et al. (2011) seek to overcome the bounded/boundaryless debate on careers by drawing on the concept of promotion script in a cognitive approach to show how academics exert agency regarding their representations and use of rules and norms of expected career behaviors in their work context. The notion of script is widely used in the literature on careers to show how it mediates decisions, career trajectories and agency in relation to structures and shared interpretive schemes (Laudel, Bielick & Gläser, 2018). Earlier on, Duberley et al. (2006) sought to understand how scientists build their career by focusing on how they draw meaning on both scripts and contexts and engage with them. The theoretical account leads to adoption of a vision of career as conceptualized in relation to a dynamic context and its interaction with both interpretation (of scripts) and action. However, they maintain a duality of reality from the start to the end of their research, in an interest to understand what happens in practice with a structured device (the structurational model of Barley). This is disputable when we consider other ontologies such as pragmatism which the proponents argue is a “dualism deadlock” (Lorino, Tricard et Clot, 2011).

A practice theory such as Activity Theory – AT – can provide an understanding from the very work activity of individuals of the way careers unfold.

2.2 Career in context, or career in activity

This research draws on AT (Vygotski, Leontiev, Bakhtin, Engeström) as a theory of practice (Miettinen et al., 2009) to "exemplify the potential use of grand social theories for supporting an interdisciplinary career dialogue" (Chudzikowski and Mayrhofer, 2011, p. 22) and "provide an alternative perspective to further our understanding of the particular subject matter in question" (Alvesson & Sandberg, 2011). It shares with Pragmatism the view of the human as first and foremost a social and historical being. Specifically, AT’s perspective of human agency is both distributed in a collective, historically and culturally mediated activity (which *is* the context) and transformative, as "breaking away from the given frame of action and taking the

initiative to transform it" (Virkkunen, 2006, p. 49). It integrates, in the processes of work, objective, subjective (Adler, 2005; Pralong, 2011) and projective dimensions (Lam & de Campos, 2015), for historical and social individuals engaged in a collective and social productive activity that is directed towards the ongoing transformation of an object in time and space (Engeström et al., 2003).

First, such agency is volitional: the object of activity that drives people's action and change refers to what an individual and a collective invest in a material entity according to their needs, life history and projections (Miettinen, 2009). Hence, the object represents the real motive of the activity: understanding the object means accessing the motivations of individuals. An object-oriented activity is both contingent and symbolic (Adler, 2005): in its contingent dimension (the task, the *objekt*), subjects produce or transform a given object with the help of tools, techniques and according to norms in a collective that divides its actions (vertically and horizontally); in its symbolic dimension, the object (*predmet*) is the true purpose of a personal and collective involvement: it is the horizon of possibilities of the activity, the motivational force. "With this definition, an object of activity can obviously be either material or ideal. The key point is that behind the object there always stands need or a desire, to which it always answers" (Leontiev, 1974, p. 22).

Second, the object is constantly moving, either because questions remain unanswered (Knorr-Cetina, 2001) or because motives relating to its purpose drive conflicts among the activity or raise dysfunctions of coordination between groups, or because new tools or purposes have incorporated the activity and disturb the standard scripts of action (Miettinen, 2009). For instance, in a baseball game, if the course of the action is disturbed by sport gambles, the object of the activity shifts from a representation of the game in progress to the pursuit of financial gain; the former was oriented towards victory, the latter is oriented towards profit; the game can be altered in its actions and orientations (Engeström, 2000). These conflicting values can take the form of two regimes that are historically inherent to capitalism: use value and exchange value. For instance, a conflict can emerge from a use value of labor in terms of knowledge and competence that one perceives they have acquired and be useful for other professional settings, and an exchange value in terms of salary or innovation potentialities an employer perceives from these knowledge, competences and past experiences. In the first example, conflicting values arise when the gambles are discovered, revealing a *contradiction* (Putnam et al., 2016) between the excitement of the game (use value) and the potential profit (exchange value). Hence, use value depends on the exchange value (Marx, 1859) without which it will not have any horizon.

Third, these contradictions can be experienced in the development of one's activity, work practices and career trajectory. They are mediators of interactions, learning, personal history across professional spheres, or innovation. Expansive and transformative agency is a way to surpass and adapt dialectically to conflicts while making sense of the situation and reshaping one's needs in a collective according to new projections and developmental potentialities (Haapasari & Kerosuo, 2015). The object *and* the individuals (subjects) change over time and with practice according to constant resolutions of contradictions, creating new entwined practices and knowledge. Expansion, however, is not a rupture, but a transformation, a reconceptualization of the object and at the meantime a subject's personal travel (Gherardi, 2004). The object indeed shows a horizon of possibilities, enabling the (re)construction of the activity to achieve moving ends according to constant reconfiguration of the *why* question: motivation, needs (the true purpose of the activity) and the transformation of the object of activity according to envisioned and expected results: "It is this projection from the object to the outcome [the results] that, no matter how vaguely envisioned, functions as the motive of this activity and gives broader meaning to my actions" (Engeström, 1999, p. 31). These

(re)configurations happen with interrelated dimensions of an activity (instruments, rules, division of labor, community and the subject involved), which characterize the distributive human agency (Engeström, 1987) in the process of expanding the object.

These dimensions of human agency – object, contradiction between use and exchange values, and the expansion process, provide an analytical framework by considering a threefold perspective of the object (technical, symbolic and conflicting values) according to mediators of the activity. It can provide the concept of career with a relational, contingent, institutionalist and evolutionist account (Adler, 2005) of human agency while viewing context as "constellations of mediating factors through which practices are enacted" (Blackler & Reagan, 2009, p.173). For the latter authors, talking about agency with AT needs, in the end, answering four questions: 1) where do we come from? (a historical and social being) 2) What are the tools and signs that are available for the subjects of activity and how are they used to construct the object of activity? 3) what are the inner contradictions of the activity? And 4) what can and will be done? i.e., the projective dimension according to the expected results of the work activity (Ibid, p.174).

In this research, I apply this framework to understand career trajectories, i.e., the trajectory of its object, dialectically surpassing itself with the resolutions of contradictions it may live in the encounter of several activities. It thus accounts for a framework to understand how the object of doctoral research activity transforms across career trajectories of PhD holders who work outside of academia.

3. Empirical study

3.1 From doctoral study to nonacademic sector: an extreme case

In this research, I consider doctoral research as an extreme case (Yin, 2018) because the object of scientific practice is complex (Knorr-Cetina, 2005; Miettinen, 2009). The relationship one scientist nurtures with the object of her practice is indeed constantly moving. Knowledge creation process can encounter ruptures and accelerations because results of scientific inquiries are uncertain. This can stimulate emotional states, such as passion, that a scientific and local community may increase (Landri, 2007), or hatred, in a love-hate relationship. As a result, verbalization of knowledge under construction that is mostly tacit can blur one's knowing of themselves during practice, and hinder abilities to communicate with others, for instance to grasp professional opportunities. Furthermore, careers of scientists outside of academia is a burning issue for a knowledge-based economy so as to facilitate flows of knowledge and to foster the recruitment of PhDs and subsequent innovation in companies. For instance, it is critical that France only has 12% of PhDs in innovative companies (Research and Development activities). The case is all the more extreme that one could expect that career trajectories towards private companies would have been facilitated, in the same recursive way than knowledge and career flows between organizations for academics (Lam & Marsden, 2017), in a networked economic era (Boltanski & Chiappello, 2011).

3.2 Analyzing trajectories of PhD holders towards private companies: going backwards from current employment to life story

To access the dimensions of the object of career of PhD holders during their doctoral research through their trajectories, I conducted interviews with 20 PhD holders from University of Lyon, of diverse research disciplines and funding, who now work in a private company either in France or abroad. Interviews lasted about 1.3 hours and were recorded. I selected the following criteria for the construction of the research population: PhDs from the Université de Lyon; any discipline; having defended between 6 months and 5 years, therefore between 2013 and 2017;

having passed through transversal or non-transversal training; exercising any type of activity in a company or other organization in the socio-economic world (research intensive or not; related to research or not). A more precise selection of PhDs was made after sending 20 451 emails (4503 for PhDs who graduated in 2013; 4810 in 2014; 4564 in 2015; 3298 in 2016; 3274 in 2017). I received 1219 invalid emails in return. Of those who responded, I counted 492 who were out of scope (unemployed, entrepreneur, teacher-researcher in the private sector). In the selection process, I have tried to be statistically representative of the UdL's doctoral students according to the three main disciplinary fields. Also, the distribution of the population by disciplinary field by year of defense is quite homogeneous (except for the year 2016). The types of contracts obtained for the thesis were mainly academic funding (doctoral contract, ANR, Labex) and CIFRE (see characteristics of the population in Appendix 1). The interviews were conducted between 28/02/2018 and 22/05/2018.

I drew on a narrative approach as social construction (Rantakari & Vaara, 2016), with the use of life stories about professional practice, as a means of co-construction (Engeström, 2006) and meaning-making about one's career path. This technique is deeply rooted in processual ontology of becoming (Maclean, Harvey & Chia, 2012) and related to a French stream on life stories interviews (Bouilloud, 2009). I primarily focused on the professional part of their lives starting from their engagement in doctoral studies, but did not eliminate the wider life story if it was relevant for interviewees (spontaneously told, or, clues on which I thought it would be useful to elaborate). In these interviews, I adopted the techniques advocated by Bourdieu (1993): self-forgetfulness, benevolent and active listening, and non-violent communication. As I was a doctoral student at the time of the present research, particular attention to his reflexivity was necessary (Bourdieu, 2001). I also have been in search of a reflexivity thanks a collective confrontation with the research community (Girin, 2016) to socialize results and convictions.

Interview guidelines followed the themes in table 1.

Tableau 1. *Themes of the interviews with PhD holders*

Themes	Description
Before doctoral study and during	What motivated the individual to engage in the doctoral study, how the experience was lived, in relation to the various dimensions of the thesis, including cross-curricular training; key moments of the thesis.
From thesis to current employment	Professional project at the time of the defense, motivations for working in the company and type of position envisioned.
Current employment	Activities and link with research / academia if ever; link with thesis; job satisfaction; integration in the company
Overall career path	Coherence of choices, career path and perception of a use value of the doctorate in the career path

It also included follow-up questions to rebound on what was told, to reframe or rephrase it if the interviewee got lost or in order to have more information, to perceive moments of bifurcation in the trajectory that would be symptomatic of critical tensions and resolutions (expansions). I also intended to understand "the experience of feelings, the reconstruction of past experiences or events, the study of the meaning individuals make" (Bah, Tiercelin, & Ndione, 2015, my own translation). To confirm what the interviewees said on factual and chronological elements, I triangulated the data with other accounts and documents on social networks such as LinkedIn.

Interviews enabled to grasp what happens in activities one may encounter in their trajectory so as to seize the dimensions of the object of situated career in its expansion, i.e., towards the private company. I answered the four questions of Blackler & Reagan (2009): 1) Starting from

current employment, where does the subject come from? 2) What tools, signs, communities, divisions of labor, rules, other mediated activities were available and how the subject used them in their career paths? 3) What were the inner contradictions related to the technical task, the idealistic aspect of activity and conflicting values (Adler, 2005) of the subject lived? 4) What has been done to overcome these contradictions (expansive character of career) and what did it lead to?

Considering these questions, the analysis was inductive (Charmaz, 2006). I first gathered cases according to the three types of activity they are currently involved in, referring to interviewees' descriptions of their jobs and paths, which I confronted to their LinkedIn profile when it exists, the company's website they work for and Google Scholar for potential recent publications: 1) Research and/or Development, 2) research project management, 3) other activity that is not related to research. For each cluster, I coded the interactions within the doctoral study activity of each individual, using the three dimensions of the object of activity (task, symbolic and conflicting values, for the doctoral research and other possible personal activities involved) that are related to questions 1, 2 and 3 (Blacker & Reagan, 2009). Codes could then overlap in a same unit of coding, which shows overlapping dimensions of the scientific activity. I then looked for patterns of resolution (question 4), i.e., surpassing the possible impasses of activity and projection. This was a means to look at processes embedded within the reconstruction of life stories during the interviews, in particular what were the dimensions of the expansions which eventually led to current employment. I then returned to each case, compared them and gathered them according to similarities, i.e., distinctive patterns of expansion. The analysis thus follows the work of the interviewer in a life story interview, going back and forth in the process of becoming and the co-construction and re-reconstruction of the trajectory (Maclean, Harvey & Chia, 2012).

4. Results

In this section, I show how the objects of scientific work are involved in career trajectories of young PhDs, on the task, ideal and values dimensions. I show how contradictions resolve in an expanding movement in career trajectory and the objects of this expansion. I eventually show the new objects of the current work activity in the private company, how they dialogue with the doctoral study and new arising contradictions.

4.1 The objects of doctoral research activity: task vs motives

At this stage, the initial object of the research activity when entering doctoral studies is manifold and very little defined. Professional projects are not that clear. However, the PhDs interviewed share the following characteristics of their objects that stress the tasks of scientific research and the related motives. Knowledge construction is emotionally demanding due to complex technical and cognitive tasks, the relationship one nurtures with the scientific community and their professor. Therefore, research activity can be both stimulating and perceived as violent, and it can foster a change in the career trajectory and use value construction.

A first dimension refers to the functioning of a community of peers, in the case of French scientific one, perceived as loosely organized with fuzzy hierarchies in practice. Therefore, community can be rejected because competition is too fierce – much more than in private companies – due to opacity of rules that can translate into “symbolic violence” (Paul) by a both visible and invisible community of peers.

“I had a huge slap in the face because the research world was not at all the ideal world I had hoped for. People who were working on the same subject were competitors. Just this shocks

me. I mean, if you see someone working on the same thing at a conference, you mustn't do it. [...] I found it very disappointing", (Elisabeth)¹

Also, instruments used to create knowledge can drive uncertainty and a strong emotional states. Different levels are involved: the technical task, its related instruments (machines and research funding) and unplanned consequences (a machine that breaks, a longer period to obtain results, a research funding that ends in the middle of the doctoral research, of that is very dependent on the organization that provided it, e.g., CIFRE).

"It takes time. (...) because it was science of materials, we were very dependent on equipment, on financing, on who could do this or that experiment and the fact that there is always a cost associated with these things which was not foreseen at the beginning in the thesis and so we had to jump back and forth between people who could help us on the subject and whom we were going to help in return" (Benoît).

Eventually, the relationship with the professor (supervisor) is prominent. Indeed, this emotional exigency requires psychological support from a mentoring relationship. In contrast to close relationships between PhD students and their professor, cases of rupture show that the professor gathers all the disillusionments about academia and the profession.

"The work we did was very complex. I had to deal with problems that I didn't understand. (...) researchers around me also did not understand anything, except for a few, including my boss, who were rather at ease with this kind of problem. There is always a position of intellectual suffering in relation to the problems that I was tackling. I was lucky enough to have a very good thesis supervisor who put pressure on me, but in a good way. That is to say that he always gave the right advice, it was always at the right time so that I could learn in the right way without ever breaking my momentum" (Paul).

Use value also depends on personal life history: personal connections, close relatives (and their own professional path), previous experiences before the doctoral research (e.g., engineer curriculum), migrations, and sometimes, when it is spontaneously expressed, childhood.

"I did a baccalaureate STL (*Sciences et Techniques des Laboratoires*) and I realized that I didn't like it and that I would rather be sitting in a chair, at a desk working on a computer than at a laboratory bench doing things. Then, my whole career path was oriented according to this. I said to myself: I can't do this all my life. I'm going to make sure I have a job where I don't do this. At the end of my PhD, I was between communication and research" (Nathalie).

4.2 Use value vs exchange value of the object of doctoral research activity

The object of doctoral research activity experiences conflict between its use and exchange values. The conflict is related to on one hand the knowledge quest for the sake of it and knowledge for applications and economic outcomes (Lam, 2019). Engeström calls this "more culturally advanced instruments and activities" (Engeström, 1987). It is fueling contradictions within the object of career trajectory.

Indeed, use value of the knowledge construction depends on exchange values according to external demands (from the industry or the state in a problem-driven logic) or a market logic (e.g., in CIFRE research and an ongoing market strategy) that considers knowledge to be valid.

"We had to respond to a lot of calls for projects, we were not sure they would succeed, and often responding to calls for projects also means being a bit in the trends, finally doing what people expect from us in the industry" (Michael).

¹ My own translation of verbatim collected in French.

It also depends on the instruments used during research. This is particularly the case for those who engaged in a very fundamental approach to research, which increased uncertainty and a will to engage in more concrete application of science. The object, in this case, cannot be uncertain and constantly moving, it needs a shorter horizon of outcomes/concrete results.

“At the beginning of my third year, when my subject changed, I found myself working with doctors, I said to myself: I like it, I remain more concrete and less fundamental. I looked at my bosses and said to myself that I don't want to become like them. That's not mean. They are very competent people. Then I knew that I would really stop doing basic research” (Camille).

The changing nature of work and structural constraints had impacts on a perceived adequacy of contribution and retribution of the doctoral research. Competing demands between the expected tasks and retributions show that use value depends largely on an expected exchange value *during* doctoral research: the knowledge quest (Guerardi, 2014) is also a financial one, not for the sake of it, but as in any type of work activity, conditioning the involvement, far from the Weberian vocation. The object of doctoral research activity here evolves in its horizon towards a more stable form, i.e., clearly contractually defined between parties.

“I had an argument with my supervisor [when] I told her that for me it was inconceivable to work without being paid. She told me: listen, if I had known you were thinking like that, I would never have taken you on. Did Baudelaire ask to be paid to write poems? For me, research is a beautiful profession but it remains a profession that requires a salary” (Elizabeth).

4.3 Expanding use value: the resources of reconstruction of the object

Surpassing the tensions involves expanding the use value initially associated to the doctoral research.

Networks that arise from new work structures with other organizations (e.g., scientific platforms), and the professional relationships of a supervisor in the industry account for objects of expansion. Indeed, communities invested during the doctoral research participate in expanding the use value and career trajectory (beyond industrial funding such as CIFRE). The division of labor is, as we know it, a mediator of professional socialization, when one has nurtured good relationships with them. Hence, the object is reconceptualized through the reconfiguration of spaces of its valorizations, i.e. spaces that seek to create and offer value upon the PhD and that mostly lies within communities of scientific inquiry.

“What helped me was that people called me! Once I was working at the hospital, I was lucky that my boss has a lot of connections, so I now have a lot of networks and when I was in big trouble in January and I turned to my network, I got 3 job offers without any effort, which is great. And it also shows that networking is useful. When I needed it, I had a choice, so it was great” (Morgane).

Career catalysts can drive changes in the career trajectory, focusing on other aspects of work and recalling former intentions when one engaged into doctoral research, or strengthening personal values attached to work and a life project. Peer interactions between PhD students of various disciplines are helpful in order to feel considered. However, these are very rare straightforward cases among interviewees. It is indeed complex to seize effects of such career catalysts otherwise than when it is spontaneously expressed or when the research population is directly involved in a specific curriculum of such.

“It's nice to have a bit of a diverse audience. The only thing I liked was talking to the PhD students about their thesis topics. That was the only interest for me (...) to see what can be done differently. Because outside of one's field, one always wonders what a researcher in

French [literature or linguistics] can do, what a researcher in history can do. It's nice to see the implications they can consider" (Béatrice).

Other objects outside the doctoral research activity can influence professional *outcomes*. They usually come from the State's devices to facilitate career transitions: *Crédit d'Impôt Recherche* (3 cases), public employment agencies (*Pôle Emploi*) or other trainings that individuals seek. Hence, the object is fully reconceptualized: its use value does not depend on the utility of knowledge at first, but on a financial gain/saving in a win-win deal, or in helping to reconfigure the dimensions of activity that are useful in the process of its valorization by adding a positive signal to them.

4.4 The (new) object of work in actual employment

The overall discourse is that of an ideal compromise between research (or non-research), with an intellectual balance at its core, the concrete (one can *see* the results), which requires technique, projects or management, teamwork (return of the collective) and life stability (preserved from the university environment where pressure and stress reigned and prevented a balanced family life; a better salary and mechanisms of recognition).

Applied science according to economic expectations drive new forms of publications and work when data and discoveries are to be protected (for those in research and/or development activities). Publications and patents fuel exchange value on markets for companies. Outcomes of the new object are clearer and the time horizon more cadenced with priorities.

"The industry, sometimes, finds his interest in patenting, but sometimes publication is useful because if they see clients who are really experts, they ask: What can you send us about this product? "Sometimes publications are a means of communication. However, we're not going to spend 50% of our time on publication, that's for sure" (Kenza).

Career trajectories related to research and/or development, or research project management, benefit from entwined infrastructures between their organization and the academia. This can take various forms: publications with academic laboratories (for the two first activities), investments in teaching activities or helping PhD students find their professional path (for instance for the third activity). Hence, it is valorized the autonomy at work and the trust due to the level of expertise (a PhD).

Perceived compromises are at the heart of the new objects concerning the work collective and community, nature and retribution of tasks (perceived stability), and clear work objectives, with respect to a "business"-related outcomes of the activity which is somewhat in tension.

"For me, it's a compromise between a salary that's still correct and that corresponds to the work you have to do, and the spirit, in fact, start-up spirit.

F. what is the start-up spirit?

M. It's somewhat a combination of a good relationship with people, of a certain freedom in the choices that we can have in terms of technology, that we have discussed certain things less and see things being born, things being built" (Michael).

Eventually, tools used during the doctoral training that one has struggled to master are reused in a more concrete and collective practice that even though does not participate to research, contributes to being in the *real* social world. For several cases, this new object dialogues with previous life story.

F. What attracted you in [name of a company in diagnostic in the medical sector. Here: X]?

M. We have many hospital/X partnerships. We are close to the real life, to real medical needs, it's not just for the sake of science, to show that the centipede has a thousand and one legs. At the end of the day, I could practice my specialty, data analysis, on the centipede, just as I could do it on humans, it doesn't change a thing in the slightest to what I do on a daily basis. I would use the same tools, the same technology, I would analyze the same types

of data, but I wouldn't find any interest in it, because there is no human behind it. I wanted to do biology applied to medicine, I hesitated between an engineering school and biology and medicine, but I thought I did not want to cure people directly, I wanted to understand how it works, so I studied medical biological engineering" (Camille).

5. Discussion

Results are summarized in figure 1 that the following discussion elaborates through contributions of the research.

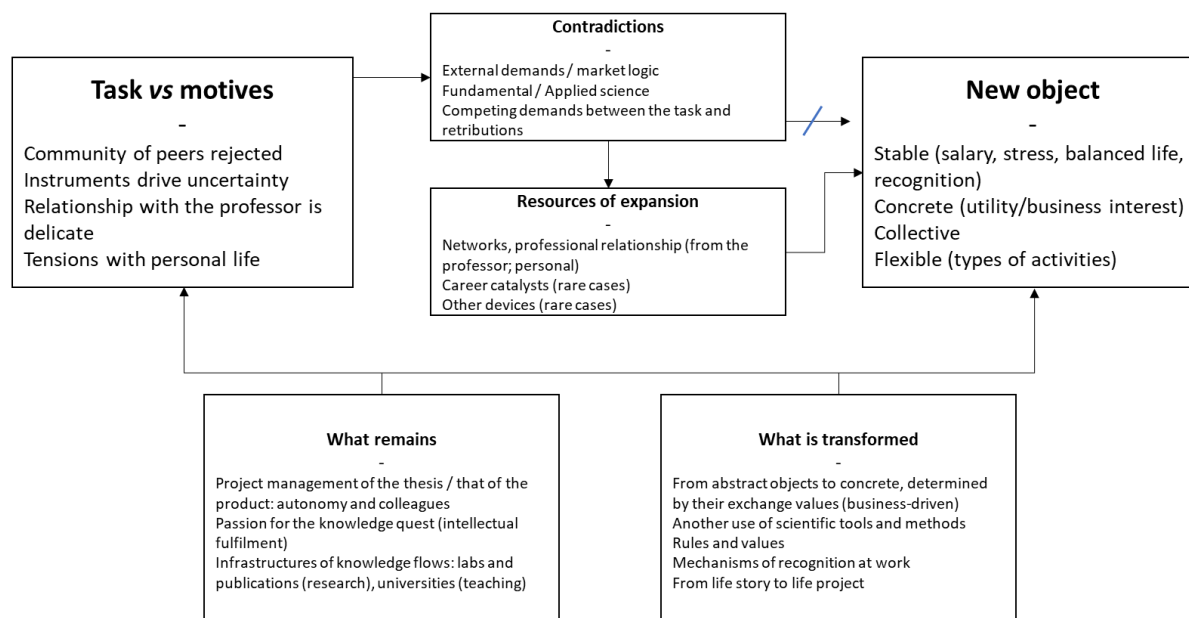


Figure 1. Transformation of the object while entering the non-academic sector after doctoral training

This research contributes to a better understanding of career trajectories of PhD holders who wish to work outside of academia after their doctoral study. It provides a synthesis of factors and resources of such career, from the perspective of the concrete work delivered, in a moving context of the way science is done. That dimension is characterized with incomplete objects that drive uncertainty and a strong emotional state (Knorr-Cetina, 2005). It is in this way significant to highlight that communities, division of labor and instruments are both sources of tensions (inherent contradictions, two first parts of figure 1) and resources to surpass them (third part of figure 1). I assume this is symptomatic of three dimensions of a career move.

The first dimension is an epistemic work on epistemic objects (Ewenstein and Whyte, 2009), going from abstract and vague to concrete and, continuously evolving, incomplete, to more stable entities enabling coordination across organizations through knowledge flows (Lam & Marsden, 2017) (private company, laboratories, universities). Also, this epistemic work spans different narratives of various communities, including from a personal life history (close relatives, former experiences and educational socializations, etc.), or other PhD students, postdocs and professors in various encounters in scientific practice, that work as legitimations (Lyotard, 1979) of new transformations of the object of work in career trajectories to reduce lived tensions. In these dynamics, communities are threefold, according to the results: scientific, field of research and others from life history. They account for an epistemic community close to a community of inquiry (Lorino, 2018) enabling career moves and knowledge flows.

Second, knowledge production is also an epistemic work for career (Bouilloud, 2009) with the work of objects across activities. It is what hybrid scientists (Lam, 2019) do when they

cross and enact indistinct boundaries between academia and other organizations (Lam, 2019; Lam & Marsden, 2017).

Third, this epistemic work on career trajectory is connected to an emotional work due to the incompleteness of the community, instruments and division of labor and a full commitment to knowledge, at first. Emotion and passion are part of the “journey” of knowledge (Landri, 2007). This has consequences that the results of this research have highlighted both for PhDs in their career trajectories and for organizations outside academia. Indeed, in resolving the tensions when entering in private companies, a numerous account of interviewees talked about compromises found in the new object of work with the help of HR instruments (remuneration and working conditions that offer a perceived stability; mechanisms of recognition at work; a perceived autonomy and freedom to invest in various activities). Hence, the epistemic objects of doctoral research seem to have stabilized in infrastructures that enable PhD holders to expand the use value of their new work across mobilities and still refer to a researcher and/or teaching expertise. Nevertheless, those who did not do research anymore seemed to be frustrated and missing this activity for it drives passion and intellectual curiosity. Eventually, the context of careers are activities that individuals cross in their lifespan, always reconfiguring their institutional and historical productions (norms of scientific activity, in our case) in constructive and creative ways according to their ongoing life projects, imaginaries of their future selves and results (which gives a horizon of possibilities) as “meaning-making processes of signification” (Cohen and Duberley, 2021).

This research also adds knowledge on careers in context and the issues on boundaries. I show the interest of studying boundaries of the social world not from selected and a priori identified ones, but as part of a process of becoming in career trajectories, from a joint perspective between individuals and their work activities. With AT, I show that the contradictions highlight boundaries in career trajectories. These boundaries are driven by conflicting use and exchange values that create tensions between task and motives reveal in the activity. Hence, I show that the main mode of relationship with the context that configures *via* the object is about emancipating from the norms that are not considered ethical, both on the financial retribution dimension according to the efforts in knowledge production and around its evolutions toward problem-driven research and related actions. It is also about emancipating from that are hard to experience, e.g., in more fundamental research where the signification of the object is constantly unfolding and uncertain (Knorr-Cetina, 2001). Redirecting use value is also a matter of ethical work and action around values *with* the collectives of the activity, networks constructed, routines, embedded norms of the context, and one self’s life story. It’s not always a matter of discrepancies between use and exchange values, but also a matter of what one considers a quality work (Clot, 2020). Careers for PhDs are changing and expanding beyond academia, reconceptualizing the very object of a scientific research both for individuals and organizations, as the two parts of figure 1 (“what remains”, “what is transformed”) show. In the end, it raises epistemological issues on knowledge production *vs* knowledge (re)construction.

Hence, this research conceptualizes context in careers and careers in context according to attributes of the context (social and historical production), relational resources that (re)construct career moves (a construction) and a dialectical perspective that explains career boundaries and their surpassing.

Third, the narrative approach used in interviews as a co-construction and reconstruction of the career trajectory has practical implications. It can be transformed as a method used during doctoral studies for PhD candidates, within a career catalyst apparatus that is supported by a simplified framework of analysis of the work activity used in this research with peer interactions and confrontations to foster reflexivity (Chia, 1996) on the way science is done to (re)think one’s career trajectory according to the dimensions of the research activity. Hence, it

could participate in showing PhD students that careers from academia to elsewhere is not necessarily a matter of a rupture (except for critical cases as I showed) but a reflexive work on their own research activity in a two-fold knowledge construction: for knowledge itself *and* for a career (with different modes of relationship between the two).

6. Conclusion

This research shows that context is both a social and historical production *and* a (re)construction part of an epistemic work on objects of career moves, which goes from abstract and vague to concrete, towards designing a network of expansion.

However, it did not study directly the emotional state and work of PhDs during their journey in relation to their epistemic work and skills transfer. This will need dedicated research within the context of doctoral training (Levecque et al., 2017) and regarding the emotional dimension inherent to the knowledge quest that can drive the innovation process in organizations. Also, I did not study the differences among research disciplines, which will need more inquiry. AT could be of use in this project, focusing more specifically on disciplines such as Human and Social Sciences in career trajectories outside academia. Eventually, the career perspective proves useful to explain mechanisms of knowledge and career flows from academia to the non-academic sector. More research is needed in this career perspective, for instance, with the concept of protean career related to values.

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Appendix 1

Name	Field of research	Viva	Before PhD	Research activity	Types of employment	Thesis funding
Béatrice	Hard sciences	2014	Research master degrees	R&D	Associate	Ministerial scholarship
Sofia	Hard sciences	2015	Engineering school	Research	CDI (long term)	Short term contract with IPFEN (semi public/private)
Morgane	Life sciences	2013	Research master degrees	Research	CDD (short term) Autoentrepreneur	Ministerial scholarship
Christine	Human and social sciences	2016	Research master degrees	Other type of activity	Independant	None
Bastien	Hard sciences	2015	Research master degrees	Development	CDI	CIFRE
Louise	Human and social sciences	2014	Professional master degree	Other type of activity	CDI et vacations	CIFRE
Michel	Life sciences	2013	Engineering school	Research	CDI	CIFRE
Nathalie	Life sciences	2017	Research master degrees	Research project management	CDI	CIFRE
Camille	Life sciences	2015	Professional master degree	Other type of activity	CDI	Labex
Pauline	Hard sciences	2017	Engineering school	R&D	CDI	Labex
Kenza	Hard sciences	2013	Other master degrees	Research	CDI	Foreign scholarship
Alexandra	Human and social sciences	2015	Other master degrees	Other type of activity	CDI	Foreign scholarship
Maud	Hard sciences	2014	Engineering school	Other type of activity	CDI	Ministerial scholarship
Michael	Hard sciences	2017	Professional master degree	R&D	CDI	ANR
Romain	Life sciences	2016	Research master degrees	Other type of activity	CDI	Ministerial scholarship
Marine	Life sciences	2014	Engineering school	Research	CDI	CIFRE
Elisabeth	Life sciences	2013	Research master degrees	Other type of activity	CDI	Ministerial scholarship
Paul	Hard sciences	2017	Research master degrees	R&D	CDI	Labex
Clément	Life sciences	2013	Professional master degree	Research project management	CDI	CIFRE
Benoît	Hard sciences	2015	Engineering school	R&D	CDI	CIFRE