

CONTRIBUTIONS OF SOCIALLY DISTRIBUTED COGNITION TO SOCIAL EPISTEMOLOGY: THE CASE OF TESTIMONY*

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RESUMEN

El objetivo de este artículo es analizar y revisar las normas que filosóficamente asociamos al proceso de testimonio, inquiriendo hasta qué puntos son consistentes con los conocimientos empíricos de las ciencias cognitivas. Tradicionalmente, el problema del testimonio surgía cuando, desde una epistemología de corte individualista, se suponía, siguiendo el dictum ya marcado en la Modernidad tanto por racionalistas como por empiristas, de que el conocimiento debía ser testado personalmente. Sin embargo, disciplinas y enfoques recientes, como la Cognición Socialmente Distribuida y la Epistemología Social ofrecen otra vía al considerar al grupo la unidad cognitiva realmente significativa e intentar solucionar el problema del testimonio desde esa perspectiva. Nuestro objetivo es analizar los motivos por los que la CSD es un buen modelo para explicar algunas de las paradojas y problemas epistemológicos cuando tenemos en cuenta el papel del testimonio en el desarrollo de la ciencia.

PALABRAS CLAVE

Testimonio, cognición socialmente distribuida, epistemología social.

ABSTRACT

The goal of this paper is to review and analyze norms philosophically associated with the process of testimony and to investigate to what extent they are consistent with empirical knowledge supplied by cognitive science. Traditionally, the problem of testimony used to arise when it was supposed, from the viewpoint of an individualistic epistemology, that followed the dictum stated by rationalists and empiricists in Modernity, that knowledge had to be tested personally. However, recent disciplines and approaches, like Socially Distributed Cognition and Social Epistemology, provide alternative ways of thinking. This is the case when we consider the group as the truly significant cognitive unit and from such perspective we try to solve the problem of testimony. Therefore, our aim is to examine the reasons why SDC offers a good model for explaining some of the paradoxes and epistemological problems that arise when we consider the issue of testimony in the development of science.

KEY WORDS

Testimony, social distributed cognition, social epistemology.

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1. INTRODUCTION

The goal of this paper is to review and analyze from a philosophical point of view the norms usually associated with the process of testimony, considering to what extent they are consistent with empirical knowledge supplied by cognitive science. The empirical work on children's use of testimony by Koenig and Harris (2007) and Koenig, Clément and Harris (2004) is especially relevant.

The problem of testimony historically arises when it is assumed, from the standpoint of an individualistic epistemology shaped by the dicta of rationalists and empiricists in Modernity, that knowledge has to be tested personally. This is achieved by either reducing such knowledge to a series of sense data, which is supposed to ensure the truth of the proposition involved –as Hume would have liked– or sifting it through a process of rational deduction –as was imagined by Descartes. In the end, the guarantor of the truth value of a proposition is the individual subject.

However, more recent disciplines and approaches provide alternative ways for thinking about knowledge. Two such approaches are Socially Distributed Cognition (SDC) and Social Epistemology (SE). In this paper we concentrate on the former approach, SDC, which considers the group to be the truly significant unit of cognition, and we try to solve the problem of testimony from such as assumption. Thus, instead of being something paradoxical or, in the best case, a nuisance of the justification process, testimony becomes a basic processing unit in a context where knowledge is not individually but collectively elaborated. In other words, we cease to consider testimony as an

anomaly of scientific research that has to be reduced –at least in principle– to individualized cognitive processes; instead we conceive of testimony as an instantiation of SDC. With the unit of cognition not being an individual subject but rather an *interaction* between a number of individuals, testimony becomes just one of several possible mechanisms for such interaction.

Our specific aim is therefore to explain in what ways SDC is a good candidate to explain some of the paradoxes and epistemological problems that arise when considering the role of testimony in the advancement of science.

By SDC we mean a very specific theory of how social interaction guides epistemology. It was first systematically described by Edwin Hutchins in his book *Cognition in the wild* (Hutchins, 1995). According to SDC, cognition is not an individual process, but a systemic one, in which one has to take into account how individuals, artifacts and the environment collaborate in order to make cognition possible. The three main components of SDC are:

- i) Most information is physically embedded in the system and is embodied by the participants, using material anchors to help the process. For example, in order to understand the cognitive process of how a salesperson takes account of a queue of customers, it is important to understand the physical distribution of the queue and not just the thoughts of the individual processing it.
- ii) Cognitive agents need to coordinate themselves in an enactive process in order to reach conclusions and generate knowledge. For example, from the research process in the lab to the final publication of the paper, several human agents and plenty of artifacts have to be taken into consideration to understand the process of scientific advance.
- iii) The environment (in the form of ecological constraints) affordances, and material anchors among other external

elements play an important role in situating cognition and making it possible to understand.

In general terms, the program of understanding the role of testimony based on the premises of a naturalized epistemology – an epistemological stance whose credibility and functionality are constantly on the rise– aims to analyze the problem of testimony from a naturalistic point of view, trying to find those empirical items that would allow us to establish: (i) the model that most reasonably explains the processes related to testimony in science; (ii) when testimony is necessary in science; (iii) what kind of knowledge testimony can generate; and (iv) how testimony contributes to generating such knowledge.

Our aim in this paper is to contribute to such a general program by describing how –following the main concepts of SDC- if we move away from a methodologically individualistic framework, some epistemic problems related to testimony are easier to solve or simply do not arise.

More specifically, we do not want to state that other models fail and that SDC is “the only game in town”. We only intend to indicate how certain conundrums regarding the epistemological role of testimony come about due to sustaining a methodologically individualistic view of cognition, and how those problems no longer arise in an epistemological model that considers the group as the relevant unit for understanding cognition. The general epistemic problem of how you can trust experimental data generated by a scientific team if you have not personally seen the results is processed very differently if we use an individualistic epistemology or if we adopt SDC.

Since its beginning, the naturalistic program has succeeded in making its way into different philosophical fields; there have been several attempts at naturalization. So far, the one with the greatest philosophical and scientific impact has been naturalization through psychology, especially that connected with the work of Quine (1969), Goldman (1986) and Giere (1988). There

are also naturalizing approaches based on biology (evolutionary epistemology) and social science. The latter consist of two main currents of thought that are quite different and even opposed in certain aspects. On the one hand, there is naturalization through substituting epistemology for sociology (e.g., Bloor, 1976). From a naturalistic point of view, this is a stance similar to that adopted by Quine, except that this time the naturalizing science is sociology instead of psychology. The most frequent label for such a view is “sociology of knowledge”, a perspective that has developed in tight connection with the “Strong Program in the Sociology of Knowledge”, and with social constructivism in general (e.g., Shapin, 1994).

The other strand of “social” naturalized epistemology seeks to include social factors in the foundations of knowledge. A common label for this approach is “social epistemology”. SE is based on starting hypotheses that are quite different from those of the Strong Program. Differences between the two approaches are well illustrated in Goldman’s statement (e.g., Goldman, 1999, p. 7) about the distinction between “episteme” (knowledge) and “doxa” (opinion). According to Goldman, when authors such as S. Shapin (1994) and especially S. Fuller refer to “social epistemology” they should write instead “social doxology”¹.

Now, we seek to establish a relation between a model of situated, distributed, and contextualized cognition and SE. To that end, in the first place, we analyze the general theses that serve as the starting point for SE; one of which refers to testimony. In the second place, we analyze the consequences of the social distributed cognition model with respect to its identification of the unit of cognition, as well as how these consequences relate to the epistemological value of testimony. If we consider that

¹ The reason for introducing references to the debate on naturalized epistemology is that, depending on the position one maintains with regard to this topic, one may have a different opinion of the roles the empirical and the normative have in the case of testimony.

philosophy and science interact in some ways, we can conceive some sort of support from epistemology to social distributed cognition. Finally, we take stock of the praxiological value of testimony as it is reinforced by the SDC model.

If we start from Goldman's view that questions in the domain of SE belong to two different levels –namely: empirical and normative– we can say that SDC contributes to the former. An empirical question is, for instance, whether the epistemic recourse of recurring to others in order to ground our beliefs is a product of some cognitive mechanism that is comparable to that of perception, or is just a social practice that varies over time and between communities. A normative question is, for example, whether knowledge acquired through other individuals is justified, or whether a scientific result produced by several agents in collaboration –some of who rely on the authority of other agents– should be trusted.

SE tackles both empirical and normative issues. It is important to compare the issues that belong to one kind with those of the other. As Kusch (2002) points out, in the case of testimony we can raise, among others, questions concerning cognitive and social psychology, for example: “What are the psychological mechanisms by means of which we (as individuals) adopt or reject what others tell us?” (p. 1). Alternatively we can ask normative questions: “Do some of the answers given to these questions provide reason to change our philosophical view of knowledge?” (p. 2). We do not enter into the discussion of whether the normative questions are biased towards (or against) some personal or cultural factors. In our case, the relevant point is that testimony requires an analysis that is as much of empirical as of normative issues. Thus, we first take the issue of testimony and analyze its weight in the acquisition of knowledge from a normative stand; and then we take a look at these norms from the point of view of empirical studies in cognitive science.

Let us emphasize, however, that both aspects are important. Norms cannot be reduced to an empirical component: if such

reduction were performed, norms would cease to be norms, and would become just an illustration of “what is available”. Such a move would put us under Hume’s guillotine or, in a more contemporary setting and leaning towards a “strong naturalization” stance, under that of Quine. Instead, following Estany (2001)², we will state a “minimalist thesis of naturalization in the philosophy of science”; a position similar to those stated in Goldman’s and Giere’s points of view.

The idea that underlies such a minimalist thesis relates to how we understand the relation between science and philosophy. Starting from the naturalization of the philosophy of science and, more specifically, from L. Laudan’s methodological naturalism (Laudan, 1998), we can establish a parallel between two relations: hypothesis/empirical testing; and epistemological principles/science. Here we find influences going in both directions: both to and from philosophy to science. For example, the influence of logical empiricism as a methodological model was determinant in making behaviorism a paradigm in psychology; this is a clear illustration of the influence of philosophy on science. An example in the opposite direction is found in some of the results of quantum mechanics that call metaphysical determinism into question and open the door to probabilistic metaphysics (Suppes, 1984). Leaving aside both an aprioristic philosophy of science and a purely descriptive one, the science/philosophy interaction makes full sense.

In the case of SDC and SE there is a difference with respect to the previous examples because there has been no direct influence in either direction: the disciplines have developed independently. However, as we will see later, there have been some factors in our societies that have made social interaction become apparent at all levels. Moreover, we can find elements in both of these approaches that reinforce the other’s theses. For example, SDC states, on the

² It has been translated to Chinese in *Cognitive Studies of Science and Reasoning*, edited by Li Ping y Xiang Chen. Series.

basis of empirical studies, that the result of an action depends on interaction with other agents. There can be no doubt that this implies that there is trust in others. For example, if SDC states that the result of an action depends on the interaction of one actor with others, there is no doubt that this involves some kind of reliance on those other actors. The general contribution of SDC consists in providing an epistemological grounding for testimony that is both cognitively possible and enjoys empirical support from cognitive science. Let us say that, just as has happened so many times before, science provides an empirical basis for a philosophical assumption. A relevant historical example of science grounding previous philosophical assumptions is that of atomism. As is widely recognized, Dalton's model provided empirical support for Democritus' and Leucippus' philosophical atomism.

The epistemological analysis of the value of testimony contributes a rational and a normative basis to SDC. That is to say, if epistemologists conclude that we have good reasons for trusting other cognitive agents, then this will provide SDC with an important rational basis. The underlying idea is that the epistemological value of testimony would be reinforced if the SDC model were scientifically consolidated. At the same time, SDC would assume an important role in the debate over the different epistemological standpoints regarding testimony. Two statements by Origgi (2004) in "*Croyance, déférence et témoignage*" suggest this idea:

While the philosophy of testimony and also epistemology focus on the central normative problem of the rational justification of beliefs acquired through the bias of others, a more detailed empirical analysis makes us face a more complex phenomenon, one that exceeds the limits of normative research and affects not only the justification of our beliefs but all levels of our cognitive and social life (Origgi, 2004, p. 176)³

³ Translated from the original French by the authors.

Current research in cognitive science, in particular on social cognition, could contribute to develop this consideration from a more empirical perspective (Origgi, 2004, p. 181)⁴

We emphasize social cognition because the goal of the present paper is to make the contribution of SDC to the empirical side of SE apparent-especially its contribution to epistemic dependence. In other words, the point we want to make is that SDC constitutes the empirical side of the epistemology of testimony.

2. THE RELEVANCE OF SOCIAL EPISTEMOLOGY

In this section we will show the importance of social factors for the foundation of knowledge and, as a consequence, for epistemology. We will analyze some of the most relevant approaches to social epistemology.

The need for social routes to knowledge has become more apparent because of an increase in knowledge specialization. Nowadays, many practical issues in everyday life as well as public issues can have no answer without recurring to an expert in some technical field. To what extent can we deem safe the foods such experts recommend us or the medicines they prescribe us? What degree of confidence do the methods used to educate our children or to generate electricity deserve? The upshot is that there are a number of issues that require the intervention of experts in order for us to obtain an answer. In such cases, each of us trusts other people. Who do we trust? To which experts do we turn? Experts frequently disagree with each other, so which of them should novices and ordinary people honor with their confidence?

This situation is, in part, a consequence of knowledge fragmentation; a price we have to pay for the development of knowledge through the centuries. Aristotle had all the knowledge of his time

⁴ Translated from the original French by the authors.

at his hands, both horizontally (physics, biology, sociology) and vertically (science, metaphysics, logic). The increase of knowledge in ever widening fields led to specialization. Individually, humans knew more and more about an ever shrinking portion of reality. Such a specializing trend implies the ever increasing importance of social factors, since from Aristotle's time to our own, we have had to trust other people's "testimony" more and more. Here we see how the dynamics of science itself has put SE at the center of every theory of knowledge. The fragmentation of knowledge may be considered an internal factor in the bursting of SE onto the epistemological world. That is to say, the very evolution of knowledge has brought specialization and the need for experts; and as a consequence, we need to trust others. It is not necessary to see any rupture in this process, just evolution; even though in the course of the 20th century the need for collaboration has increased to a gigantic extent.

Another argument in this direction is found in the work by Arias and collaborators, "Transcending the individual human mind" (Arias *et al.*, 2000): "Creative activity grows out of the relationship between an individual and the world of his or her work, and from the ties between an individual and other human beings" (p. 86). Those authors also elaborate on the following: "when a domain reaches a point at which the knowledge for skillful professional practice cannot be acquired in a decade, specialization increases; collaboration becomes a necessity; and practitioners make increasing use of reference aids, such as printed and computational media supporting distributed cognition" (p. 86).

Other factors, some social and others cognitive, are of relevance. Here we will focus in cognitive ones, but first we wish to clarify what we may take as the social factors increasing the relevance of SE. One such factor is a change in information technologies, which augments opportunities for interaction; others include academic organization and scientific policies. An

important question related to this social aspect is the extent to which certain means of communication or political organization constitute avenues that favor (or obstacles that hinder) knowledge acquisition and/or development. We may say that a good portion of the studies in the sociology of knowledge are contributions to the analysis of the social circumstances that have driven SE.

In virtue of the significance of SE, we must point out that it is not a unified field with a single set of shared principles. Just like epistemology in general, SE teems with different approaches. In the present work, we are particularly interested in the following issues: firstly, the establishment of a parallelism between, on the one hand, classical artificial intelligence (AI or good old-fashioned AI; GOFAI) versus SDC, and on the other hand, classical epistemology versus SE. Here, the following remarks by Dreyfus (1992) and Hutchins (1995) are particularly pertinent:

GOFAI is based on the Cartesian idea that all understanding consists of forming and using appropriate symbolic representation. For Descartes, these representations were complex descriptions built up out of private ideas of elements. Kant added the important idea that all concepts are rules for relating such elements, and Frege showed that the rules could be formalized so that they could be manipulated without intuition or interpretation (Dreyfus, 1992, xi).

These entities, thought to be inside the mind, were modeled according to entities of a certain class that were outside the mind: symbolic representations (Hutchins, 1995, p. 357).

The second issue, now within SE, consists of the interesting differences between Coady (1992), Burge (1993) and Foley (1994) on the one hand, and Goldman on the other. According to the former, if there are no reasons contradicting someone's testimony, we can accept it without wondering further about the circumstances of that testimony. For Goldman, in contrast –and perhaps we may add Origg (2004), among others: “Your evidence about the properties of the speaker is crucial evidence for your

overall entitlement to accept the speaker's assertion" (Goldman, 2002, p. 142). We have taken Coady, Burge, Foley, Goldman and Origggi as representative of two positions on testimony, but in no case do we think that they exhaust the different approaches to this question: work of Lackey and Sosa in *The epistemology of testimony* (2006) is also of interest here.

The question to be analyzed is this: which of the two approaches is more consistent with current theories concerning information processing in cognitive science? More specifically, it is important to know whether either of these approaches is inconsistent with some specific scientific theory and, if both of them are consistent with scientific knowledge, then which of the two is better supported by cognitive science.

Finally, Bertil Rolf's classification in "Conceptualizing credibility of testimony" is relevant to these matters. Rolf distinguishes three possible approaches to the relation between theories of testimony and epistemological theories. One such approach consecrates the primacy of the epistemological model, whose goal is to apply general concepts in order to clarify the epistemic nature of testimony. A second approach is to accept the primacy of psychological, social, or historical descriptions of the construction of rational models, in which case epistemic norms should play no role in the description or explanation of the norms among the people or societies studied (Rolf, 1999, pp. 12-13). The third approach would be a model that proposes the interdependency of epistemic and descriptive studies; one in which norms should be formulated taking into account the relevant facts.

3. CONTEXTUALIZED COGNITION

Since the intervention of social issues and social practices are central to cope with knowledge nowadays, it seems clear that cognition has to take into consideration the relevant environments

where social interactions take place. This is the main reason to analyze the notion of environment as context and how we can approach it from the point of view of cognition.

We take the notion of contextualized cognition as an alternative to the classical cognitive paradigm associated with AI, where cognition is conceived as symbol manipulation. This is why such an approach is called the “symbolic paradigm of information processing”. One of the characteristics that makes it an alternative to the traditional model of cognition has, at its center, context; which is tackled from different angles that share many aspects, but diverge in others.

Nardi (1995) indicates three approaches to context: Activity Theory (AT), Situated Actions Models (SAM), and Distributed Cognition (DC). Nardi mainly favors AT, and while she does not detract from the other approaches, she is closer to DC than to SAM.

The main problems she sees with SAM come from their emphasizing emergent and contingent aspects of human activity, so that activity is seen to emerge directly from the peculiarities of a given situation. This feature leads to one of the central assumptions of SAMs, namely that the structure of activity is not something prior to it, but an aspect that can emerge from the immediacy of the situation (Suchman, 1987; Lave, 1988). According to Nardi, such an assumption implies that structure cannot be studied because it is too contingent, and this is a problem. Another drawback of SAM that Nardi points out is that the perspective has a somewhat behaviorist ring to it; in SAM the subject’s response to his/her environment (the situation), which in the last analysis will determine action, is of major importance.

AT and DC have in common that they deem the goals of actions (either human motives or the ends of some system) important. This judgment contrasts with improvisation in the case of situated action. One of the significant differences between the AT and the DC approaches is that while the former considers that there is an asymmetry between people and things, the latter considers

them to be symmetrical. Thus, for AT, artifacts are instruments at the service of activities; while for DC, both people and things, without distinction, are agents of the system. As we will see later, Nardi's statement about DC requires some qualification.

From her remarks on DC and SAM, one can say that Nard prefers AT, despite allowing for the merits of the other approaches. Firstly, she believes that AT enjoys the clearest historical antecedents; for example work made by Soviet psychologists in the twenties. For AT, actions are conscious processes with a goal that may be altered in the course of the process. A key idea of AT is the mediating possibility of artifacts (from tools, machines and signs to language). Furthermore, there is the notion of a context, which is not understood as a mere container within which people act. People consciously and deliberately generate contexts (activities) through their own goals. As a consequence, the merging of the internal and the external is of fundamental importance in AT.

Without being utterly different, the previous view departs in some aspects from other perspectives on the study of context. In general, those other approaches are seen as an evolutionary path rather than as being simultaneous. Greenberg and Dickelman (2000) consider Salomon's (1993) studies of anthropology and cultural psychology as the antecedents of the Theory of Distributed Cognition (TDC). In turn, Cole and Engström (1993) point to the cultural historical school in psychology (Vigotsky, Leont'ev, and Luria) as an antecedent of the study of cultural context. Within this approach, DC would be the paradigm that now recovers the fundamental elements of the various projects that have included contextual factors in cognitive processes. Let us focus in DC as a model that may contribute valuable elements to an empirical basis for SE.

The core idea in DC is that cognitive activities are distributed among human minds and cognitive artifacts. Internal representations are knowledge and structure in individual minds, while external representations are knowledge and structure in the envi-

ronment (Zhang, 1997; Zangh and Norman, 1994). Zhang and Patel (2006) state that they do not argue in favor of or against a distributed system being conscious, or having the capacity to reason in the same way an individual can. They deem this a philosophical question and it would be sufficient for them to understand how information and knowledge are distributed and propagate through the system. Those authors consider that the philosophical issue is irrelevant, since it would be compatible with either position. At the same time, they address the question posed by Nardi about the symmetry or asymmetry between people and things in the same way.

All this brings us to the idea that the unit of cognition is a system in which cognition is distributed between the members of a social group; and cognitive processes imply a coordination of the inner and the outer structure. The other important feature is that cognition is mediated by tools. Nardi (1998) states that “what a person can do with a tool is profoundly different than what a person can do without the tool” (p. 39). Such artifacts can be computer simulations or counting with the fingers; hugs from a professor helping a student to perform a task or the closing of your eyes when trying to recall something to memory. Norman (1993) points out that intellect together with the environment implies a discharge of the effort for remembering and, consequently, an increase in cognitive capacities (pp.146-147). Pea (1993) holds that intelligence is not a quality of the mind alone, but a product of the relationship between mental structures and the tools provided by culture. Perkins (1993) says that DC is a system that involves people, the physical environment, and social resources; a notion Perkins calls “person-plus”. All these considerations reveal the character of the new paradigm in cognitive science, which has introduced interaction between individuals and between those individuals and artifacts as the axis of the unit of cognition.

4. THE SOCIALLY DISTRIBUTED COGNITION MODEL

Among several cognitive models that consider cognition situated and distributed, as we have seen in the previous section, we take Hutchins's approach as the one that can offer empirical support to SE.

Without losing sight of the general matters we have already elaborated on in the previous section, we now turn to E. Hutchins' model. Hutchins is known as one of the promoters of DC, and one that has applied that model in contexts such as the cockpit of an aircraft and the engine room of a ship. He has expounded his ideas in his seminal work *Cognition in the Wild* (1995). From a philosophical perspective Hutchins's model is especially relevant since it is the one taken by Giere –one of the most representative philosophers of the cognitive approach in philosophy of science– in order to show that “the cognitive and the social overlap” (Giere, 2002, 2007). Magnus (2007) expresses the same idea when he says that “distributed cognition allows us resist the dichotomy between the social and the cognitive” (Magnus, 2007, p. 297). Since in the case of testimony we find both social and cognitive factors, the relevance of socially distributed cognition is clear.

We may locate the relevance of Hutchins' SDC for the epistemology of testimony at two points: the theoretical and experimental support of SDC; and those elements of SDC that imply an interaction between knowing subjects.

Two types of interaction may be distinguished in SDC: subject/artifact and subject/subject. From the standpoint of the epistemological value of testimony, there is no doubt that the really important one is the interaction between individuals (subject/subject). However, from the point of view of the unit of cognition (and this is the great novelty in SDC) this distinction is scarcely significant, because the two types of interaction form an indivisible unity.

Of course, in a very important sense, the question of interest to you as a passenger should not be whether a particular pilot is performing well, but whether or not the system that is composed of the pilots and the technology of the cockpit environment is performing well. It is the performance of that system, not the skills of any individual pilot that determines whether you live or die. In order to understand the performance of the cockpit as a system we need, of course, to refer to the cognitive properties of the individual pilots, but we also need a new, larger, unit of cognitive analysis. This unit of analysis must permit us to describe and explain the cognitive properties of the cockpit system that is composed of the pilots and their informational environment. We call this unit of analysis a system of *distributed cognition* (Hutchins and Klausen, 1996, p. 3.)

This quote represents a milestone in cognitive science, because it considers the system and not the individual person as the unit of cognition. This move affects several disciplines, and especially cognitive psychology and social psychology. In order to avoid any possible misunderstanding here, we wish to make certain remarks. In the first place, the fact that the unit of cognition is now a system does not eliminate the cognitive properties of the subject as an individual. That individual properties need to be recognized, but also that they are not sufficient, is quite clear from the previous quote. Second, it is important to note the role of technology in the cognitive system; a fact highlighted by A. Clark's study of the notion of a cyborg (e.g., Clark, 2004). Finally, and perhaps most importantly for the problem we pose in this paper, the success of a cognitive process is a function of the collaboration with other subjects; and that collaboration in turn implies trust in the testimony of others. As in the case of pilots, good performance by a pilot is based on the trust he/she conveys to the copilot or the information air traffic controllers provide them with.

The search for success is what makes the system especially interesting as a unit of cognition. The reason is that only if epis-

temology pursues a goal will it matter whether the cognitive process meets its ends. In the case of the aircraft, this would mean that no accident occurs; in the case of epistemology, knowledge acquisition and arriving at truth (as Goldman suggests) would be our ends.

An important issue for DC is the nature and function of representations. The traditional approach to cognition does not work for DC, since it considers external representations as mere aids and frequently mixes internal and external representations. However, for DC, internal and external representations are two indispensable parts of a system engaged in some cognitive task. Thus, Zhang and Norman (1994) believe that the basic principle of distributed representations is a set in which some elements are internal and others external. In this respect, external representations offer aids to memory; they can provide information that is used without being explicitly interpreted, they can also structure cognitive behavior and alter the nature of a task (Zhang and Norman, 1994).

Finally, Hutchins also recovers D'Andrade's anthropological tradition insofar as he concedes culture a significant role in cognitive processes (E.g., D' Andrade, 1989). An illustration of this is the following quote:

Culture is not any collection of things, whether tangible or abstract. Rather, it is a process. It is a human cognitive process that takes place both inside and outside the minds of people. It is the process in which our everyday cultural practices are enacted. I am proposing an integrated view of human cognition in which a major component of culture is a cognitive process (it is also an energy process, but I'm not dealing with that) and cognition is a cultural process (Hutchins, 1995, p. 354)

Here, the question we can pose relates to the significance of this view of human cognition to SE. How do we build the bridge? We start from the assumption that epistemology seeks good reasons for trusting those beliefs we have acquired through a cognitive process. But if cognition is a cultural process and

culture cannot be fully understood without taking into account the interactions with our fellows, then neither can cognition be fully understood without taking into account interactions with others. This means, in epistemological terms, being able to trust the testimony of others, which is where its significance for SE and in particular for the epistemology of testimony resides.

Trust in others' testimony is supported by neurobiology, since all human beings share a collection of neural structures that allow them to perform certain functions. As Williams (2004) points out "because humans have the same body configurations and inhabit the same world, embodied image schemas are universal to all normally developing human beings" (p. 6). Human beings also share a culture: shared knowledge, a shared way of reasoning, and the assignment of meaning to material and symbolic things, which allow us to nimbly move through everyday tasks. Therefore, the stability of knowledge which is achieved through models and frameworks due to individuals belonging to the same species has a universal basis; yet, there is also variation due to specific individual and social characteristics. Here, social strategies of stabilization enter into the scene, among them cultural models linked to cultural practices. Consequently, the idea of culture "as the source of most of the shared representation and procedures with which we do our thinking" (D'Andrade, 1981, p. 193) cannot be elicited from the analysis of testimony.

One of the most important points is that SDC allows us to interpret social factors as a positive element (i.e., as an epistemic advantage) when, in the course of the 20th century and especially in its last decades, the social side of knowledge was seen as a hindrance to objectivity and to the grounding of beliefs. This aspect is relevant for knowledge in general, but it is essential to scientific knowledge (see Estany, 2001).

5. THE PRAXIOLOGICAL FACTOR IN THE EPISTEMOLOGY OF TESTIMONY

In this last section we analyze some of the main praxiological factors that make testimony a cognitive strategy that facilitates

scientific practice. We will present some type of experimental procedures that without testimonies wouldn't make sense, and research would be paralyzed.

If, following Kotarbinski (1965), we view praxiology as the science of efficient action, then we can understand its importance for scientific research. Thus, questions related to the acquisition and transmission of knowledge acquire a special relevance when we refer to praxiological factors.

It is important to highlight the praxiological character of introducing testimony into science, besides the empirical and epistemological reasons for introducing it, as one can see, for instance, in "Conceptualizing the Credibility of Testimony" by Rolf (1999). Clearly, there is a third set of reasons, praxiological ones, that explain the occurrence of testimony. Thus, one of the key motives for introducing testimony in particular research or a specific scientific development is prominently practical: it would be possible for us to replicate an experiment, but it is far more simple and efficient to accept the results published by the group of scientists that already performed the experiment. This fact is usually considered but only as a curiosity, with no further attention being paid to it. This is almost equivalent to saying: scientists could perform their experiments without a white coat, but then they may end up with stains on their shirts and would have to spend more money on the laundry.

Introducing testimony into science is not just a question of convenience, however, like using white coats or having a parking place available close enough to the laboratory. We are also talking about efficiency. If each published result had to be replicated by all other scientists working on the same problem, research would simply be paralyzed. We cannot take efficiency for granted, because it is one of the main reasons behind the introduction of testimony from a cognitive point of view.

Let us keep in mind that here we are dealing with a special type of efficiency; one that makes sense only when we take into

account the interaction between individuals in the sense of SDC. From an individual perspective, the alternative between putting an experiment that has already been performed to the test and engaging in a fresh one makes little sense; but if we think of the group as the unit of cognition, then it is reasonable to say that once a member of the group has already tested some results, it is much more efficient for the other members of the group to engage in other, different activities.

The same efficiency is recognized by Goldman in his text *Epistemology and Cognition* (1986), when he states that the processes related to reliability from a social point of view must guarantee not only the possibility of generating true beliefs, but also speed in establishing those truths. Clearly, testimony plays a major role in this acceleration by making it unnecessary to replicate the experiment in order to be completely sure about it.

In contrast, we see that sometimes one group's results are tested by another group. The fact that this is done over and over again does not make any sense from an individual perspective, but it does from the point of view of a team. Starting from those models that associate the probability of truth with testimony, such as those proposed by Goldman (1999) in his book *Knowledge in a Social World*, we may pose the following conjecture: a 100% reliable model is one in which each hypothesis is tested by each scientist in the community. However, such a model would have 0% efficiency, for it would paralyze research.

Starting from the premise that cognition is socially distributed, we can assign different tasks to different scientific teams, and then proceed to assign the testing of results in those cases in which the replication of the experiment sufficiently increases the probability of the hypothesis being true, without hindering the efficiency of the process too much.

A praxiological analysis will tell us to what extent it is worthwhile sacrificing some efficiency for the sake of a higher reliability of our hypotheses and when such an extra effort in

testing makes so little difference to the credibility of our hypotheses that it is not worth it.

Is it necessary to reduce testimony to a more basic unit of cognition? Following the ideas introduced in “Conceptualizing Credibility of Testimony”, there do seem to be arguments for the so-called “piecemeal reduction”. However, once we accept this praxiological explanation, it is easy to understand that we cannot expect such reduction to be individualistic. Following Goldman’s ideas, to process testimony implies making a decision about the reliability of an informant, which in turn implies processing a clearly social context.

Following Goldman further, we see that the real problem only allows us to perform a realistic analysis within an SDC context: we do not want to reduce testimony to an objective statement describing an event in the real world in order to establish its truth or falsity. We do not seek, as Carnap could in the *Aufbau*, to reduce the statement: “The witness states he has seen Mr. Smith entering the building on such and such date, at such and such time” to a physicalist statement such as: “On day such and such and time such and such a physical object identified by the definite description as ‘Mr. Smith’ proceeded to enter the building”. Rather, what we want to do is to explain from a specific social interaction how from: “A gives testimony of X”, we can establish that A is deemed reliable and that the group of scientists accepts on a provisional basis the truth of X, and starts to develop experiments on the basis of such data.

Thus, Hacking’s example (1995) of a person who, in the course of psychotherapy, recovers some putative memories that were repressed as a consequence of sexual abuse is very significant. What is of importance is not the naked truth, something that could be of interest from an individualistic view. Perhaps that person did suffer abuse. What is important is the scarce reliability of the process for establishing that this particular person does have those memories since, apparently, in this therapy system it is

rather easy to implant memories even when the “facts” referred to did not take place. In other words, the credibility of this type of testimony depends, on the one hand, on an objective datum (how frequent these types of abuse are) and, on the other hand, on the degree of veracity we assign to testimony taking into account the sort of interaction system we use to establish it (in this case, a specific type of psychotherapy). This means taking into account the context within which testimony occurs and not only the testimony itself. This interpretation is more in consonance with Goldman’s and Origg’s work than with that of Burge, Foley, and Coady; and with respect to Rolf’s classification, it seems to fit the interdependency of epistemic and descriptive elements.

What kind of social basic cognitive unit allows us to explain the need for testimony? A basic property that such a unit must have is one that offers us individual–individual or individual–artifact interaction, as in Hutchins’ model: a property that allows us to overcome cognitive barriers, for example (following “Conceptualizing the credibility of testimony” again) spatial and temporal barriers. It would be ideal –or perhaps not even that, but let us suppose it would– to have someone constantly following a polar bear in order to study its home range, whether this particular bear regularly meets other individuals, etc. However, it would be clearly inefficient and perhaps in some cases almost impossible. It would be much easier to set up a distributed cognition system, in which a small transmitter allows us to keep track of the animal’s position at any time.

Similarly, maybe it would be “perfect” for all scientists interested in Higgs bosons to be present at the place where the experiments that might at last detect such particles are performed. If this were possible, however, it could only be arranged at an immense price and it would be utterly inefficient. That is why testimony is necessary: as a way to overcome the spatial barrier and thus obtain indirect access to other people’s results.

Note that, should the technological context allow it, the choice of testimony –an individual–individual interaction– could

be replaced by an individual–artifact interaction. Thus, it is easy to imagine that when Higgs bosons are finally detected, lots of excited scientists will be participating in the discovery through streaming technology on the Internet, and everyone with an interest in Higgs bosons could be watching the detection and localization process on their screens.

The spatiotemporal barrier is not the only cognitive barrier that testimony can overcome. An experiment may involve the performance of complex calculations and different processes over a rather long span of time; should all the scientists have to perform the same calculations and repeat the same processes in order to test for the truth of the given results, the research would become highly inefficient. Even if such an effort were possible in principle, it would seem that most scientists would prefer to trust the testimony of a reliable colleague (see e.g., Casacuberta and Estany, 2003). Again, the presence of artifacts –a computer, for instance– may alter the situation and allow each scientist to contrast the relevant data using a simple computer program.

We can find the same phenomenon when dealing with other problems, such as those related to expert reliability. From an individualistic perspective, recurring to an expert when seeking an answer to a given question has always been deemed a move with little reliability. In fact, more often than not, such a move is even exhibited as a mistake in critical thinking texts: it is usually known as recourse to authority or recourse “ad verecundiam”. Recurring to an expert is a special case of the reliability process associated with testimony –one, however, with very specific characteristics that distinguish it from other cases of testimony– in which we ask our informant for predictions and/or working hypotheses. We can ask an expert for a given prediction and he/she will develop it on the basis of consultations with colleagues (individual–individual interaction) and artifact readings (individual–artifact interaction). Thus, we are able to avoid different cognitive barriers, such as spatial (e.g., not having access to the artifact) or cognitive ones

(e.g., not knowing how to manipulate the artifact). However, if the context changes and we become able to use the artifact (maybe we learn how on the Internet) and we have access to it (perhaps its price decreases significantly) then we can become experts ourselves. Thus, we can trust the weather forecaster as to whether it will rain tomorrow or not (i.e., we rely on an expert) or we can, say, get a barometer and a hygrometer ourselves and make our own prediction.

Summing up: it is easy to understand testimony as a sort of cognitive strategy that facilitates socially distributed cognition by using informants (those responsible for certain testimony) as agents in an epistemic process where a series of cognitive barriers –that would make the whole process inefficient were it not for the occurrence of testimony– are avoided. Such barriers may be merely spatiotemporal –i.e., not having access to the place of the experiment at the time it is performed– or of a processing type –some steps in the experiment are sufficiently complex from a cognitive point of view to make it clear that its replication would be inefficient.

6. CONCLUSIONS

From the remarks made here, we can conclude that SDC is superior when it comes to explaining phenomena such as testimony; either starting from empirical evidence offered by cognitive science or from the possibility of explaining, methodologically and epistemologically, some common practices in scientific research.

The key lies in letting go of the old paradigm that urged us to reduce cognitive processes to individual minds and highlighting instead how the group is actually a much more significant processing unit.

Following the best explanation criteria, we may argue that if we are to explain the function of testimony, SDC is much more useful than its competitors. Let us recall, in the first place, the two basic premises of SDC:

- a) Cognitive activity is distributed among human minds and body actions and cognitive artifacts.
- b) The unit of cognition is not the individual, but the whole system composed of different interacting individuals using a variety of cognitive artifacts.

Let us note that if we accept that cognition is a cultural process and that culture is clearly not a collection of things but a collective cognitive process, then cognition in general too should be understood as an interactive process involving different individuals, never as something residing in just one individual subject. This is the reason why trusting testimony is not an action that has to be “reducible” to facts processed by individuals, but simply a cognitive process whose reliability enjoys the support of empirical evidence from neurobiology. This last idea establishes a certain similarity between the neural structures in human beings and our model of how culture –particularly knowledge acquisition– is a system and reasoning is shared by a whole community.

We may also note the fact that for research to be efficient, it must necessarily be based on interaction between individuals. The search for a 100% reliable project inevitably leads to 0% efficiency; one of the reasons is that everybody would have to replicate the same experiment.

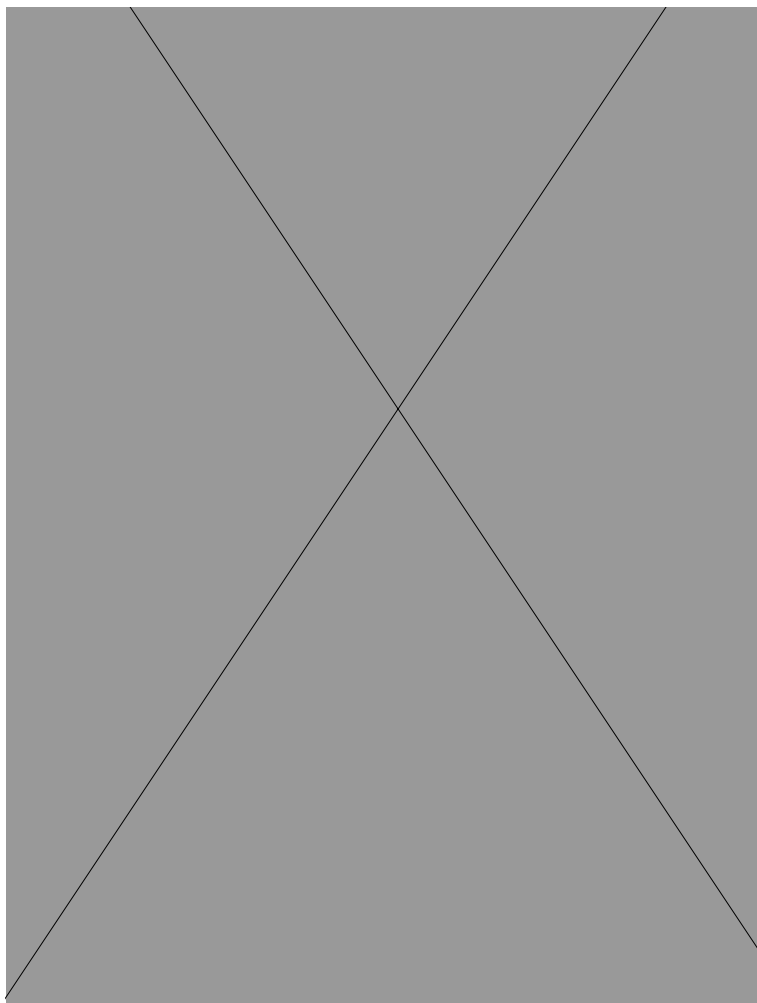
In contrast, the SDC approach allows us to see testimony not as a primitive cognitive tool, but just as a sort of social interaction; a certain way the cognitive unit functions –and there are lots of examples, such as experts and the use of cognitive artifacts. Testimony is simply another cognitive strategy that furthers group efficiency and helps avoid spatiotemporal or processing barriers.

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