Knowledge Artifacts: When Society Objectifies Itself in Knowledge

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Abstract: The paper deals with knowledge artifacts as knowledge socially objectified. A typology of knowledge is considered, comprising forms (intellectual, practical, objectified); families (knowings, acquaintances, acknowledges) and kinds (for objectified knowledge: encapsulated, environments, symbols). A model for knowledge-society (as a new societal layer sedimenting over precedent ones) is also introduced in four logic phases (generation; institutionalization; diffusion; socialization) in order to show the mechanisms for its production.

1 INTRODUCTION

With the term 'knowledge' we make reference to many different 'things'. In this paper I will deal with the concept of *knowledge artifact,* which has been recently reconsidered as a multidisciplinary concept to focus on in the intersection between informatics and the humanities (Cabitza and Locoro, 2014). To this aim, I will treat knowledge artifacts as *objectified knowledge* (tangible forms), after Marx (1858), i.e. one of the three forms in which knowledge comes under own direct disposal, the others two forms being *practical knowledge* (resident within a large but definite social species) and *intellectual knowledge* (the explicit or the taken-for-granted forms widely shareable and so the only considered by the Enlightenment epistemology). However, a whole typology (Cabitza *et al.* 2014; Cerroni to be published) comprises these three forms of knowledge directly acquired (the family of *knowings*) and other forms gained in two other ways of acquiring knowledge: through a social network of *acquaintances* and through external and internal *acknowledgements*. Few words for the last two will be enough for our ends. On one side, the family of acquaintances comprises knowledge I can more or less easily reach through my own social network, similarly to the social capital. On the other side, the family of acknowledgments comprises knowledge capacities attributed to me by others, maybe just stuck, and which, in the long run, become acknowledged as my own conscious knowing.

Let us now focus on *objectified knowledge*.

2 ARTIFACTS AS OBJECTIFIED KNOWLEDGE

This is a wide species of knowledges, indeed.

A first kind is *encapsulated* in physical objects: food made in a well-established gastronomical tradition, objects made by an artisan or an industry (e.g., a compass), tools for making either other objects (e.g., an assembly robot) or other knowledge in some form (e.g., a word processor) etc. The value we can enjoy using such objects comes without necessarily having to de-capsulate the knowledge therein. In effect, sailors have been using compass far before having developed a theory of magnetism. We do not even need neither to know the recipe in order to enjoy good food nor to be a program developer in order to write a good book using a word processor, even if we should have some benefit in being a great chef or a good a programmer. When we do not have the expertise to de-capsulate the knowledge inside our object, however, we have to rely on some expert, quite often anonymous agencies, with a more or less blind trust. The endless fiduciary chain thus born links our daily life with huge other people so that the most educated and connected people of the entire human history are by far the less suited to survive by their own means to the challenges of common daily life (this is *the paradox of the knowledge society*). The reason for such situation is obvious: knowledge has been growing faster than our personal education and our acquaintances. While life-long learning is an answer

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to the need of education, new media are an answer to the need of social cooperation: knowledge has an unbeatable cooperative and not simply additive nature.

A second kind of objectified knowledge is not encapsulated inside objects, but rather aroused by cultural/artistic goods or *environments* as paysages. When we enjoy seeing, hearing or 'living' a piece of art we realize that knowledge is therein and we have the opportunity to use it for future uses or, possibly, creations, too. This knowledge educates our esthetic sense, supplies us with the comprehension of a singular author or historical epoch, a human situation and much more: we can introject it as our own (cognitive, relational, emotional) system-of-reference. The Stendhal syndrome, also named Florence syndrome or *hyperkulturemia*, can be considered as a sort of information overload, occurring when we do not have the time and/or the opportunity to metabolize it within our own knowledge assets. Think of visiting artistic towns such as Florence or closed locations so dense in knowledge as Sistina Chappelle in Vatican City. In such cases, clearly extremes of a continuous (wide open paysages – closed environments), knowledge is what transforms stark matter in an artifact, a piece of marble in a Michelangelo's Prigione, a natural *landscapes* in humanized *paysages* as a wild lagoon into the lagoon-town of Venice, or the experience with a pile of software & hardware components into a pretty new life experience with the electronic device I just bought to my children. We can benefit from such knowledge through a simple sensorial 'immersion'; however, the more we know before, the more we can 'extract' from it in view of our own interest, of course. Similar argumentations can be made for artificial environments, where hyperkulturemia is frequent in own experience while surfing within the web, moving across multiple electronic devices more or less interconnected each other and connecting within social networks with other people.

Lastly, the third kind of objectified knowledge collects peculiar aspects of social *symbols*, such as religious ones, nation flag, or any other artifact with symbolic value. In these cases knowledge is not to be found inside the stark object, but it is shared within a social community acknowledging the symbolic meaning while acquiring it as (part of) own identity. However, everything has (can have) a symbolic component, for some people. Even an equation may become an icon (e.g., $E=mc^2$) being tattooed on the back. A gesture may become a social practice of mutual identification with hierarchical and/or strong political meaning (e.g., raising the right hand to the cap; outstretching the right arm; raising a clenched fist, the right rather than the left, colored rather than not). It is particularly interesting the case of concrete objects and other artifacts. Think of dozens of town named *Venice* in Northern and South America, the European 'Venices of the North', Asian 'Venices in the Orient': we recognize both symbolic value addition to real towns and a 'disneyfication' of a symbol-town (Settis 2014). The same transformations occur to any consumer object through fashion, fads and foibles. Sometimes, the same occurs to artistic or intellectual production, as well. All of these families are made of knowledge tacit(ated) (Polanyi 1969); they are *dead knowledge* (cf. dead/living work in Marx 1858), explicit to someone but not (necessarily) to the specific user, who, instead, has to work creatively (consciously or not) in order to bring it back to life as a *living knowledge*. Moreover, a commodification of knowledge can either enhance the knowledge-value of an artifact or wasting it, definitively.

As we see, the net result of creating and using knowledge depends on its circulation, from the first stage of innovation to its common use and, possibly, its abandonment. Indeed, this conception of knowledge as a *shared understanding* is in close connection with the three Indo-European roots of the Latin word *cognoscentia* (cfr. Eng. *cognizance*; It. *conoscenza*; Fr. *connaissance*; Sp. *conocimiento*; Port. *conhecimento*), from which the English 'knowledge' comes. They are: (1)**kom*: Lat. *cum* meaning *together-with* and/or *near-to*; (2) **gn*: Eng. *to Know* meaning a *savoir*; (3) **sk*: Lat. *scire*, Eng. *sced*, meaning *to distinguish*.

3 EPIGENETIC KNOWLEDGE CIRCULATION (EKC)

In spite of the growing attention that has been devoted to knowledge outside philosophy in a growing number of disciplines during the last decades, the only theoretical model relevant for applications in innovation studies still is the Nonaka's model of knowledge (e.g., Nonaka and Takeuchi 1995). We don't consider the 'Triple helix model' (e.g., Etzkowitz, Leydesdorff 1995), another model once proposed, as it is not able to take into account the knowledgeable citizens that are now having growing attention from innovation studies and science production and communication (e.g., Wynne 2007, Destro Bisol 2014, Austen et al. 2014), too.

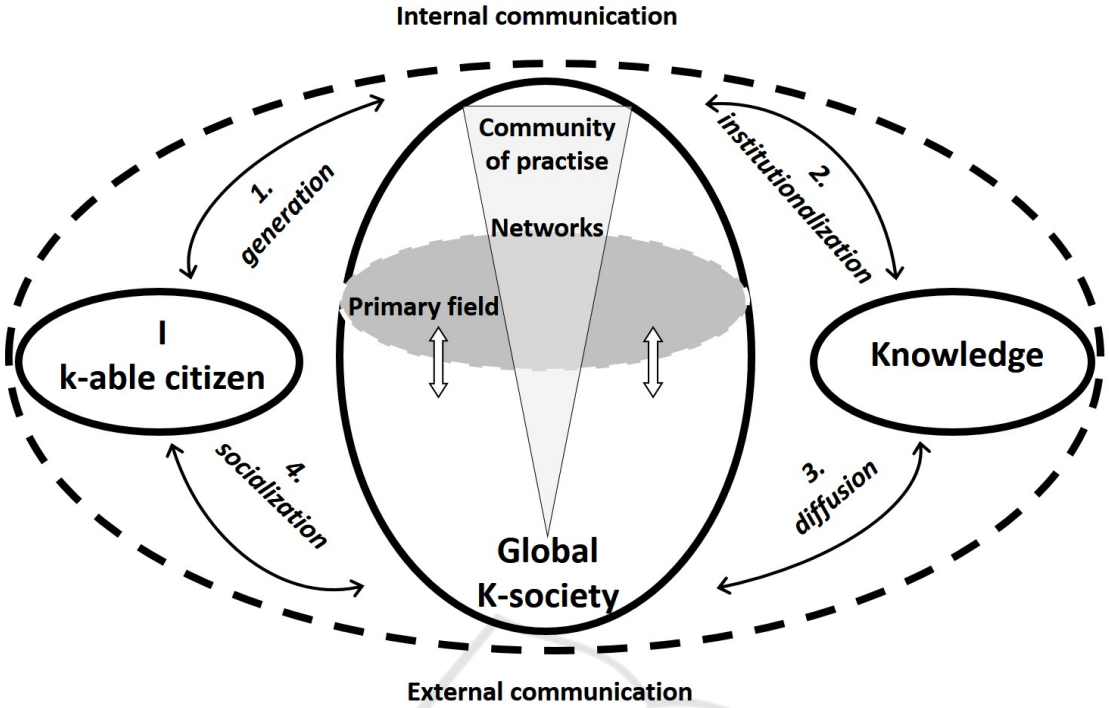

Figure 1: The circulatory model.

Knowledge-society has become a locus within the analysis of the contemporary society (e.g., Richta 1966; Bell 1967; Masuda 1981; Stehr 1994; Castells 1996; European Commission 1997; World Bank 1999; David, Foray 2003; European Commission 2007; Rohrbach 2007; Fagerberg *et al.* 2012), sometimes confused with information society, but always with big changes envisaged both for organizations (e.g., Nonaka, Takeuchi 1995; Stewart 1997; Davenport, Prusak 2000) and science community (e.g., Gibbons *et al.* 1994; Dasgupta, David 1994).

However, it is better to think about knowledge-society as a layer of contemporary society, functioning through the mechanism of producing knowledge by means of knowledge, with surplus of knowledge (Cerroni 2006; Cabitza *et al.* 2014; Cerroni to be published). Of course, such knowledge is never 'pure', but may be 'developed' as a linear combination of its components, as already seen, within a multidimensional space of ideal-types of knowledge.

Then, we can now look at the *knowledge-society* as a new social layer added via knowledge productions, sedimented over pre-existing layers (*in primis*, industrial-society). We call such a way of development *social epigenesis*, in close analogy to recent epigenetics within biological science (e.g., Rose, 2005).

Moreover, if the function of sharing knowledge is communicative (and cooperative), then, when there is no communication, there is also no knowledge, strictly speaking, although there may be conspicuous personal understanding hidden into a drawer (e.g., artisanal *know-how*).

To articulate a model for social production of knowledge artifacts, we can now recall the three main logical components of sociality: individuals, knowledge, and society in the middle between the two, with the role of *medium*. Individuals are more and more understandable as knowledgeable citizens, empowered in knowledge and vested of public rights/responsibilities. Society comprises the primary field of those people strictly cooperating together (micro-society) and also the society at large (macro-society). *Communities of practice* (Wenger, 1998) intersect the primary field via the strong informal ties of a *Gemeinschaft* developed around knowledge practices. Knowledge comprises any form of heritage, as considered before.

4 A CIRCULATORY MODEL FOR SOCIAL PRODUCTION

A functional model of circulation within the global, *knowledge-society* now considers interactions

between the individuals level and their societal environment and between this environment and a collective heritage (collectively named *knowledge*), and vice versa. In doing so, we obtain four-phase model as shown in Figure 1.

Clearly, the four phases are just logically distinguishable, neither *in re* nor in time (as they are in other models). Let us now look a little closer to the four phases, focusing on knowledge artifacts.

4.1 Generation

G*eneration* (G) comprises production of new pieces of knowledge, i.e., those processes in which the individual provides knowledge to its own knowledge institution (team, community or formal organization). An artifact is partly due to true innovative processes (ideation, action or construction) but also to novel *combinations* of already available knowledge of any kind. Anyway, it is important to draw attention from (actual and potential) publics of an innovation so as to enhance the possibilities of future innovations.

4.2 Institutionalization

The *institutionalization* (I) of knowledge consists in the identification, selection, coding, validation, corroboration, design and settling of the local knowing community in order to share knowledge claims both internally and with the wider society. A knowledge artifact is, then, acknowledged by a community and/or the society at large, as meaningful. The role played by institutions is in reducing variants coming from the generation phase and also adding a public value.

4.3 Diffusion

The *diffusion* (D) of knowledge so institutionalized, however, is not a mere transfer of something which is already pre-formed, but it is rather the 'percolation' through the wider society. This process makes a knowledge artifact accessible to the active involvement of other subjects –the community members, the consumers – possibly giving rise to new and different institutionalizations (artifacts and/or other knowledge kinds). A participatory decision-making and creative uses of this knowledge by workers, customers/users and citizens creates a shared value (*open innovation*: Chesbrough 2003). Knowledge artifacts, then, may diffuse in their explicit content, in their practices and in their objectified knowledge. The intellectual knowledge diffuse through the language of communication. The practical knowledge diffuse through the social exchanges within the daily life. The objectified knowledge diffuse as objects (material and symbolic) circulating within society.

Anyway, the role played by other individuals is *de facto* a creative production rather than passive re-production, so stimulating a 'spontaneous' innovation.

4.4 Socialization

Through *socialization* (S) knowledge is passed through markets (commercialization), social strata (communication *strictu sensu*) and generations (education and learning), while being more or less legitimated by public opinion, and eventually forensic practices (e.g., Jasanoff 1995; Lynch 2008) and other regulations. Of course our use of the term socialization is quite different from Nonaka's one, being in compliance with the use of sociology. In this phase, knowledge artifacts get internalized and acquire a *normative value*, possibly becoming a *reference* both publicly sanctioned and privately interiorized, e.g., as a recognized artistic object, a technological forerunner, a *must*.

Knowledge artifacts, then, end up raising expectations, and dissatisfactions, too, along a characteristic *hype curve*, out of which they become either art or rubbish, an outdated relic or a classical reference.

Innovation (δ), in the end, emerges from a (logic) cycle as shown in Figure 2, where it is indicated that, at the end of a clockwise cycle, the available knowledge increases and spiralizes becoming socially pervading.

We should also consider as a counter-clockwise cycle either the anticipation as *pro*-jected effects while designing or the shared culture *intro*-jected by actors and/or institutions. However, the model, as any model, is just an epistemological tool for making understanding and experience, not a metaphysical mirror for 'Reality'.

The stratification of knowledge layers (made of knowledge of any kind) makes the innovation process *path-dependent*. If this process takes place when the conditions of the previous levels are not equal, it may end up amplifying these uneven conditions. Circulation does not brings about equality in itself, but rather rises divides in access (*primary*) and, still more subtly, in use (*secondary*). Indeed, it enhances pre-existing divides to which adds its specific divides, in absence of a proper governance of a *public good*.

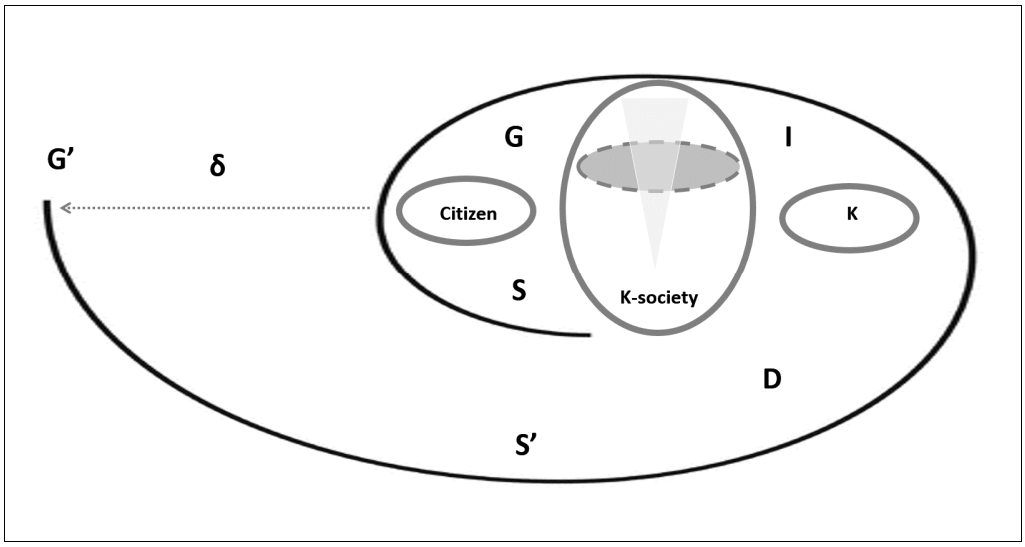

Figure 2: The model for innovation.

5 CONCLUSIONS

It should be clear that the distinction into three forms of knowledge correspond to the three dimensions abovementioned. The ideal-type of intellectual knowledge is the most close to the more vast and lasting heritage of human genus (e.g., Pythagoras's theorem, Homer's Iliad etc.). The ideal-type of practical knowledge is shared by many individuals of some generations within a particular social form, historically and geographically well-delimited. The ideal-type of objectified knowledge is confined to an object (or environment), directly perceivable through the senses and strictly defined within space and time.

In the end, we should deal with knowledge as a multidimensional space described through a 3x3x3 matrix of 'pure states': three dimensions (individual/delimited, social/aggregated, cultural/wide), three forms (intellectual, practical, objectified) and three families (knowings, acquaintances, acknowledgements). Here we also noted three kinds within objectified knowledge. In the more general case, however, knowledge appears in a 'mixed state' that we can develop as a peculiar series of 'pure states' (*ideal-types*).

We noted that knowledge-society can be thought as a process of producing knowledge through knowledge; however, we have also to observe that such process, not only doesn't deteriorate the knowledge that is used, but it generate new knowledge that can be 'externalized', and a surplus of knowledge 'internalized' by the users, too. If I use more times the 'same' knowledge (e.g., Pythagoras' theorem, the compass) I augment my own capacity to extract value from it: this is the meaning of *know-how*. If others use it, and a circulation process is active, everybody will benefit of such added value (we now have a better Euclidean geometry than Pythagoras or Euclid themselves; we have more refined uses of a compass and also better 'compass' then Chinese had over 1000 years ago). The process guiding knowledge-society, then, is self-catalytic *if and only if* a knowledge circulation is guaranteed. This is the reason why we have to deal with knowledge as a (*global*) *public good* (Callon 1994, Stiglitz 1999), settling conditions to stimulate an active, wide cooperation without exclusions, in order to let knowledge itself flourish. In our previous analysis it means to go beyond the digital divides of first order (technology access) empowering each citizen's knowledge capital. In other words, it means to enhance the diffusion of already available knowledge (*knowings*), to let proliferate the social opportunities of knowledge exchange (*acquaintances*), and, to use a couple of sociological concepts, to lower the *symbolic violence* (Bourdieu) onto citizens while enhancing their capability of *sociological imagination* (Mills) (*acknowledge*).

Lastly, we see that knowledge artifacts are cases of knowledge that is objectified by and within a collective agent: the subject of (co)production being shortly *society*.

The case for Ict artifacts deserves a deeper insight. They are, indeed, (a) a product, (b) a process, and (c) an enabling technology.

(a) Ict artifacts are products always having a material basis, even as material machinery, and so they are vehiculated by a general circulation of knowledge.

(b) However, Ict is also a process of communication, i.e., in our model, itself *circulation* in all its phases. They enhance the capacity to institutionalize knowledge, making more visible and manageable the knowledge generated and act on the diffusion phase both expanding modalities and empowering participants. However, they also have effect onto socialization both in reaching people and in giving them new opportunities to generate new knowledge.

(c) Moreover, Ict is a vehicular technology, enabling any knowledge to fill in our perceptive experience, empowering, enhancing and virtualizing presences in it. Rather than to a dematerialization, our lives are undergoing to a re-materialization driven by new technologies. Apart from Ict, other vehicular technologies are biotechnologies and nanotechnologies. Through such vehicular technologies, not only is the intellectual knowledge enabled to enter any object, but also practices (from automation to web interactions).

As far as possible concrete uses of the concepts and models here introduced, suggestions can already be seen in various areas of research, such as *participative informatics* (Cabitza et al. 2014; cfr. Carroll, Rosson 2007), *agricultural knowledge and innovation systems* (Di Paolo and Vagnozzi 2014; cfr. EU SCAR 2012), *open science* and *citizen science* prospects (e.g., Destro-Bisol et al. 2014; cfr. Austen et al. 2014).

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