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# CONCEPTUALIZING THE IT ARTIFACT: A NON-REFLEXIVE ACTOR

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## ABSTRACT

Orlikowski and Iacono (2001) issued a call for improved conceptualization of the IT artifact. This paper has responded to that call. After a review of three approaches to conceptualization of the IT artifact, it articulates a conception of the IT artifact as a non-reflexive actor. Based on Archer's analytical dualist approach to social theory, it argues that IT artifacts need to be considered as actors, able to act independently of humans based on environmental characteristics to perform different tasks. They are non-reflexive in that they cannot consider their own actions and change their behavior. This conception has certain implications in how we approach artifacts. We to consider them as actors which certain skills and abilities and communication characteristics to bring to our business processes. For research purposes, we have to take a more sociological or anthropological approach to the study of these actors. For practical purposes, we need to build approaches analogical to those of human hiring practices to determine where and how to employ these actors.

## Keywords

IT artifact, Structuration Theory, Actor-Network Theory, Knowledge Management, Analytical Dualism

## INTRODUCTION

Orlikowski and Iacono (2001) have made an appeal for a conceptualization of the IT artifact. In their study of ISR articles, they found that IS research “draws on commonplace and received notions of technology, resulting in conceptualizations of IT artifacts as relatively stable, discrete, independent, and fixed.” (p. 121) They further argued that this lack of a conceptualization of the IT artifact presents a “unique opportunity and ... challenge to engage seriously and explicitly with the material and cultural presence of the IT artifacts that constitute the IT in IT research.” (p. 130) This paper attempts to respond to their call and address specifically how the IT artifact should be conceptualized in social situations.

The paper will proceed by a brief review of some of the pertinent literature bearing on how the IT artifact may be conceptualized. It then proposes an alternative conceptualization.

## BACKGROUND

In this section, I survey some of the literature bearing on this topic and give some examples of how IT artifacts appear within social situations. In doing so, I will attempt to relate those observations to what Orlikowski and Iacono (2001) have proposed as the necessary considerations for IT artifact theorizing:

1. IT artifacts, “are by definition are not natural, neutral, universal or given ... they are always implicated in action and effect.”(p. 131) We need to have “explicit theorizing about specific technologies with distinctive cultural and computational capabilities, existing in various social, historical, and institutional contexts, understood in particular ways, and used for certain activities.” (p. 131) This theorizing will not allow a one-size-fits-all conceptualization; multiple conceptions and theories about technology as it exists.
2. IT artifacts “are always embedded in some time, place, discourse and community.” (p.131) “Detailed practices need to be recognized and integrated into theories. ... How people engage with [them] ... needs to be a central [part of the theorizing].”(p. 132)
3. IT artifacts “are usually made up of a multiplicity of often fragile and fragmentary components whose interconnections are often partial and provisional and which require bridging, integration, and articulation in order for them to work together.” (p. 131) The material and cultural properties of an artifact are not the same in all contexts meaning experience will vary.
4. IT artifacts “are neither fixed nor independent but they emerge from ongoing social and economic practices.” (p. 131)
5. IT artifacts “are not static or unchanging but dynamic.” (p. 131)

## Knowledge Management Perspective

In the knowledge management literature, (Kogut et al. 1992) have observed: “Because personal and small group knowledge is expensive to re-create, firms may desire to codify and simplify such knowledge as to be accessible to the wider

organization, as well as to external users. ... The reason why software has been successful is that it is codified so as to demand a lower fixed cost on the part of the general user. The user is required to understand the function of the program without knowledge of the substantive technology (p. 390).” The implication of above observation is that in such cases as described by Kogut and Zander, the information system (software) replaces the human performance in a substantial part of the task for the business process, while the human, instead of performing the details of the process itself, addresses the system at a higher (functional) level allowing the information system to execute the detailed activity. We can see from this that the IT artifact is embedded in some practice within the society. The specific meaning of the artifact is based on how the process that surrounds the artifact relates to or incorporates the artifact. However this view does not conceptualize how the artifact replaces human actors or what its capabilities are.

### **Actor-Network Theory**

Actor-Network Theory (ANT), developed by Bruno Latour (1987; 1993; 1999), Michel Callon, John Law and others has been advocated in the IS literature by Monteiro, Hanseth, McMaster, and Wastell and others, ANT offers a novel social ontology that refuses an essential difference as actors between humans and non-humans. “There is no room for essences . . . (a prior a historical properties that capture the intrinsic nature of the phenomenon or entity . . .)” (McMaster et al. 2005). Instead, ANT argues that all actors are actually networks of actants that it refers to as “collectif”s. Both humans and non-humans form these collectifs as equals. There is no distinction between macro and micro or local and global as it is traditionally considered (Mutch 2002). The modern world is so pervasively fabricated, tools and technology so ubiquitous, that we simply cannot meaningfully separate humans and non-humans. The symbiosis is mutually critical; literally neither can exist without the other. “The place where a person and a tool exist independently is a distinction for convenience’s sake, not a functional one. Where does the person hammering in a nail exist independently from the hammer? (Dreyfus 2004)” (McMaster et al. 2005).

This is not to say that there is no difference between humans and machines in ANT. Humans and technologies (in the traditional sense) are not equal or symmetrical beyond the fact that they are, when they act, parts of hybrid collectif that should be seen as the ‘real’ actor: Humans and technologies are different – as different humans (the CEO and truck driver in a multinational organization) and different technologies (a pen a nuclear plant) are different. (Hanseth 2005).

In terms of the analysis of agency with ANT, the collectif represents the ultimate actors in social life. “Boeing 747s do not fly, airlines fly” (Latour, 1999, p. 193). It is hybrid actants composed of humans and non-humans that act; the act and the actants cannot be separated (McMaster et al. 2005). Thus the human qua human or machine qua machine do not “act” except as it is part of a collectif. Thus social forms are the outcome of these networks rather than the condition of their existence. Mutch (2002) “All actants have a history, and it only through their action in the world that they have an identity. . . . An ERP without agency is an ERP that, by definition, does not exist. By their deeds yet shall know them (McMaster et al. 2005)”.

Here the artifact is also embedded in the network, but it is not the proper level of analysis. The collectif to which it belongs is the proper level of analysis here. This makes it rather difficult to assess the impact of the artifact as it is entangled with the collectif. Thus this view can be considered as obliterating the artifact by absorbing it into the collectif.

### **Structuration Theory**

Structuration Theory (ST), derived from Giddens (1979; 1984) and popularized into the information systems literature by Barley (1986) and Orlikowski (1992; 1993; 1996; 1991), views social structures as not being real things, they are viewed as “virtual” structures composed of rules and resources. They are “. . . abstract properties of social systems . . . not something concrete, situated in time and space, . . . [they] lack material characteristics . . . [they] cannot exist apart from the human actors who enact and interpret its dimension” (Orlikowski et al. 1991, p. 147). Thus structures exist only due to “this people now acting.” Where there are no people now acting they cannot exist. According to ST, past actors cannot create structures that persist into the present time without being carried forward by current actors. They could only be “memory traces” when not “instantiated” by current actors. (Jones et al. 2004).

Orlikowski recognizes that Giddens has done little to bring information technology into ST (Orlikowski 1992; Orlikowski 2000; Orlikowski et al. 1991). She posits that it is a duality being created by humans and also used by humans and that it is interpretively flexible (Orlikowski 1992). Technology facilitates, constrains and influences human action in the process of structuration. Information technology is seen as a way of representing reality that influences the users to adopt the same interpretation of the world. Additionally, it is a system of domination in that it reinforces an order of authority and institutionalizes premises for making decisions. It thus formalizes the sanctions and creates an institutionalized moral order (Orlikowski et al. 1991). Orlikowski has changed her position on this last point, coming to purer form of Giddens’ theory rejecting the view that technology embodies structures since structures are only instantiated in practice (Orlikowski 2000). She argues instead that technology, while being a durable artifact with limited malleability, is enacted by its users as a

*technology-in-practice*. That is, over recurrent use, the users develop a perspective of the technology based on their experience with a subset of its capabilities. This perspective is then enacted into structures in ways that the developers may or may not have anticipated. These technologies-in-practice and the structures created change over time and thus any structure enacted by users is only provisionally structured (Orlikowski 2000).

The handling of technology within ST has received some criticism. Rose, Jones and Truex (2005) claim that even with Orlikowski practice lens enhancement, ST unduly privileges human agency which causes technology to vanish into being simply “an occasion for structuring”. Similarly, Hanseth (2005) claims that Orlikowski’s technology-in-practice formulation does not allow for any description of the relationship between the technology-in-practice and the technology artifact and how they mutually influence each other. As dealt with in Orlikowski (2000), information technology is held to be a non-actor. It is treated as a multi-faceted tool from which users select features to be employed in structuring the organizations. In Orlikowski (2005), she seems to recognize this and advocates that we look at “different conceptual treatments of human and technological agencies” (p. 185). She recognizes a difference between human and technological agency preferring to call the later “technological performativity”.

Thus in looking at these three approaches, we see that the knowledge management view acknowledges the artifact as a replacement for human actors but does not conceptualize how it does it. ANT seems to level humans and artifacts making both of them cogs in the mechanism of the collectif, but again not articulating how they can participate equally with humans. Finally, ST has a much lower view of the artifact as a non-actor which seemingly cannot explain how the artifact can replace humans in business processes as described the knowledge management approach.

### PROPOSING A DIFFERENT CONCEPTUALIZATION

A different conceptualization can be arrived at the might be able to resolve these issues and help us to arrive at a conceptualization of the IT artifact. To facilitate this discussion consider four different ways that an IT artifact may interact with a business process.

First, an IT artifact may *operate* substantially all of a business process. Consider a claims processing system. The author was involved with EDS in the 70s working with Medicare claims processing systems and in his doctoral research with Medicaid process in the 2000s. In these systems, the claim is substantially processed by the system. Humans enter the claim data, the system processes the data and produces an explanation of benefits. The system handles the claims by itself except when human adjudication of a situation is required.

Second, an artifact may *co-operate* a process with humans. Consider MS Word. In entering a document, the human enters the letters and images desired, while Word provides formatting services, spell and grammar check etc. In fact in many of these functions Word operates to overrule the human operator: correcting spelling, inserting outline levels even if contrary to the wishes of the operator. Each operates independently of each other to create the document.

Other artifacts *enable* a process for human operators. For example, Broadbent (1999) found that email and other electronic communications methods were necessary enablers to achieving enterprise-wide BPR. In this scenario, email enables BPR by providing the ability to communicate instructions and information over distances in time factors not possible using physical communications such as letters. Here the artifact does not perform any of the process but enables the human actors to execute the process.

Finally, an artifact may simply *monitor* a process. In the example of a manufacturing plant monitoring system, the artifact may extract data on machine production from programmable controllers and then perform statistical analysis and sound alarms to humans who take corrective action. Or the artifact may provide reporting on production volumes and machine status.

Depending on the implementation of the artifact in the process, the same artifact in a similar process might in one case operate the process but in another might only co-operate the process. The key consideration is how much of the particular process is handled by the IT artifact. In the operate situation the artifact handles close to 100% of the substantive operations of the process. In the claims processing example, simply entering the data and assisting with exceptions is not the substantive part of the process, which is performed by the artifact. In the co-operate designation, there is close to an equal division of the substantive parts of the process. In the example of MS Word, while the user enters the text into the system and thus it seems similar to that of the claims processing system, which operates the process. However, when using MS Word, the user is not merely keying data in, they are making a substantive contribution to the process: the creative aspect of what is written. Word operates as an assistant. In terms of the enabling function, the artifact would not perform much of the process, but would provide a necessary part of the process, e.g. information transportation, storage and retrieval that makes the process possible. In the last consideration, monitoring, the artifact does not operate or provide enabling capabilities but rather simply collects data and reports on the process.

A key observation from each of these examples is that the artifact acts independently of humans to perform the function assigned to it by the human creators of the process. To be sure, Orlikowski and Iacono are quite right in informing us that each of these artifacts are very different from each other with different characteristics that prevent us from saying that the effects of employing one are the same as the effects of employing another. And indeed even the use of the same artifact in different organizations will have different impacts. However, there is a commonality between them that allows us to conceptualize the IT artifact in its interaction with humans. I term this relationship one of being a *non-reflexive actor*.

By the term, non-reflexive actor, I mean an entity that interacts with humans in the business process. By non-reflexive, I mean that unlike humans, IT artifacts are not capable of reflecting on their actions, conceiving action and changing their process. It remains for humans to perform this function. Perhaps as artificial intelligence develops, this capability may develop in which case the artifact will become a full actor like a human. But as of this writing, artifacts do not have that capability. Today, we have some artifacts that have some capability for changing their behavior. Examples might be drawn from commercial websites such as Pandora, Netflix, Amazon or iTunes which utilize the customer's interaction to make recommendations for future purchases. These are not examples of reflexivity. In these cases, we see that these sites are simply executing programmatic instructions that make recommendations. The software does not consider its actions and for example, consider that it has information on purchases and decide it would be a good thing to make recommendations. It can only follow its programming. It requires the ability to change or add to its programming to become reflexive.

To fully develop how IT artifacts can be actors, I extend Margaret Archer (1995)'s Morphogenetic Approach to Analytical Dualism. Below, I briefly describe her approach to agents and actors and then extend her conceptions for IT artifacts.

### **Archer's Requirements for Agents and Actors**

Archer holds that Agents and Actors are two different things. Actors are role incumbents. They occupy a particular place in society. Agents become Actors by choosing to identify themselves with a particular role within a society. Agents are born into a social order, which provides incentives and enablement for adopting certain roles and disincentives and barriers for pursuing others. Over time, Agents either are able to transcend society's structuring forces and achieve something different for themselves or else adopt the role that societies structuring forces seek to have them adopt. Agents acting together can become Social agencies, which can then affect social change.

Agents however have certain requirements. Following Locke, Archer (1995) seems to define personhood as "a thinking intelligent being, that has reason and reflection, and can consider itself as itself, the same thinking thing in different times and places." (p. 282, note 23, citing Locke, Essay II, xxvii, 2). She puts considerable emphasis on a continuity of consciousness and sense of self as definers of human personhood. We wish to add to this sentience, the characteristic of reflexivity: the capability of reflecting upon itself and its actions. It is reflexivity that creates the capability for morphogenetic action. Through the human characteristics of imagination, sentience and continuity of consciousness, humans are able to consider their condition and envision actions that would effect changes in it to improve their situation. Included in the concept of reflexivity is the concept of initiative. Humans have the capability to take unilateral action to attempt to implement their visions. Similarly included is the concept of decision-making. Humans can decide between alternative visions based on various criteria. Without these characteristics, morphogenesis is impossible.

### **A Typology of Technological Actors**

When considering non-human or technological actors, we have to consider in what ways they differ from humans. We saw above that reflexivity and its two component parts, initiative and decision is key to morphogenetic activity. We propose that these three characteristics that differentiate actors. What follows below is a description of two types of non-human actors based on different levels of these characteristics.

#### *Tools*

Tools are non-reflexive, non-decisive, non-initiatory items. They are not actors since they are capable of only performing deterministic processes at the initiation of an actor. Classical examples would be a hammer or a chain saw. Both do not initiate action, it requires a human to start them and use them to accomplish a purpose. They also respond to all situations with a single action whether they are accomplishing the intention of a human such as a hammer hitting a nail or an accident such as a hammer hitting a thumb. They do not reflect on their actions and change their actions accordingly. It requires a human to consider their performance and then to effect change in their structure based on the desired performance changes.

#### *Non-reflexive actors*

Non-reflexive actors make decisions and can initiate actions based on environmental conditions but are not capable of changing their processes autonomously. They receive a set of environment signals, evaluate them and then make a decision based on pre-programmed criteria. Simple examples of these actors include burglar alarms and automatic shedders. A burglar

alarm may for example have open window/door sensors or room motion sensors and when the alarm is set, given the proper amount of opening of a door or window opening or motion in a room, an alarm is sounded. Similarly, a shredder when it determines that paper is in contact with its feed mechanism activates its shredding mechanism. No human action is required for it to do so; it evaluates the environmental conditions and initiates the appropriate action.

Information systems are more sophisticated examples of these types of actors. A hypothetical health care claim processing system might receive a claim electronically from a doctor's office. It might then evaluate the claim according to pre-programmed rules to determine if all the fields on the claim are completed correctly, the claim is not a duplicate claim, is not an excessive charge for the services performed, the service is appropriate for the diagnosis, etc. It may then determine, again based on pre-programmed rules, to pay the claim, cut back the amount to a reasonable charge, deny the claim or refer it for human review. We see that it initiates processing based on presentation of a claim, then without human intervention processes the claim and decides based on pre-programmed criteria the disposition of the claim. It is not reflexive in that it is not self-aware and cannot change its programming. Humans are required to perform this function.

It might be objected that neural networks are reflexive since they are capable of changing their responses to environmental stimuli but only within limits such as changing some of its decision criteria but it cannot change its inputs or outputs. It is also not self-aware and cannot consider a radical change beyond its programming. Thus they cannot be considered reflexive.

It might also be objected that I anthropomorphize information systems by describing them as evaluating situations and taking action. Information systems are simply (or not so simply) collections of circuits and wires that no more 'evaluate' or 'decide' than a mousetrap 'decides' to spring based on pressure on the trap. I answer that the definition of an actor does not require reflexivity; it simply requires the ability to respond to environmental conditions independently of another actor. This ability to respond is what determines an actor whether or not it is a mousetrap, a 'Rube Goldberg contraption', a medicare claims processing system or a human. It is reflexivity that separates humans from the other actors mentioned.

This distinction points to another. Non-reflexive actors are non-social actors. That is, they cannot participate in business process structuring activity. This is a function that only reflexive actors can perform. IT artifacts will always be passive in this type of activity.

## DISCUSSION

The conceptualization of IT artifacts as non-reflexive actors has certain implications. First is that we can no longer consider artifacts as simply "bundles of affordances" that do not have a social impact nor can we consider them to be equal with human actors. Rather we must treat them as actors who can fill roles within a social setting but rather limited ones not requiring learning capability. For placement in our processes, we must assess their capabilities and strengths in a manner analogous to that of assessing a human for a position. I say analogous because we cannot use exactly the same processes that we do with humans although some might be quite similar. For example, references and testing might be very similar. However, interviewing might look quite different.

Consideration of artifacts as non-reflexive actors also points out that these systems bring rigidities to the business process. Whereas humans can adjust independently to novel situations, artifacts cannot. Therefore, depending on the difficulty of implementation, once implemented, the skills and abilities of the artifact along with its communication capabilities can disable an organization from moving in certain directions as much as it enables it to function in others.

In terms of Orlikowski and Iacono's five criteria, we can make the following observation of how this conceptualization of IT artifacts aligns. In regards to the first criteria, we see that by giving them actor status, that they are always implicated in the action and effect of a business process. The capabilities of the actor impact the human actors around them for good or ill. Each artifact having different capabilities and each organization also have capabilities from other organizations will create a unique environment. Therefore, even with the same artifact, we cannot generalize it having the same impact in different organizations. Second, we can see that just as human is embedded in a context, the non-reflexive actor is embedded in a context. As seen before they interact with the organization into which it is placed and different organizations will make different uses of this actor just as the same person will have different employments in different organizations. In terms of the third principle, this conceptualization differs with Orlikowski and Iacono's perspective slightly. Their perception is like that of ST. An artifact is not socially "real" until it is used and then only that part of it being used is real. As a non-reflexive actor, it is held to be a real thing with a defined set of skills and abilities and communications patterns. While different organizations might make different use of them, the material properties remain the same in all places. In terms of the fourth and fifth criteria, this is the area of the greatest divergence from their views. We see that as non-reflexive artifacts, they are fixed and independent of the people around them. Orlikowski and Iacono's view seems to be based on a social construction of reality position, which does not allow for the reality of the artifact has having a material impact. However, I take a realist position regarding the artifact. It is what it is, humans make take advantage or not of the different capabilities just as they

would a human. Left to themselves they do not change. It is required for humans to change them. Now this process is a social and indeed a political process in which the artifact itself is the end result of a negotiated process in which power plays a role.

## CONCLUSION

This paper has articulated a conception of the IT artifact as a non-reflexive actor. Based on Archer's analytical dualist approach to social theory, it argues that IT artifacts need to be considered as actors, able to act independently of humans based on environmental characteristics to perform different tasks. They are non-reflexive in that they cannot consider their own actions and change their behavior. This conception has certain implications in how we approach artifacts. We to consider them as actors which certain skills and abilities and communication characteristics to bring to our business processes. For research purposes, we have to take a more sociological or anthropological approach to the study of these actors. For practical purposes, we need to build approaches analogical to those of human hiring practices to determine where and how to employ these actors.

## REFERENCES

1. Archer, M.S. *Realist Social Theory: the morphogenetic approach*, (1st ed.) Cambridge University Press, Cambridge, 1995, p. 354.
2. Barley, S.R. "Technology as an Occasion for Structuring: Evidence from Observation of CT Scanners and the Social Order of Radiology Departments," *Administrative Science Quarterly* (31) 1986, pp 78-108.
3. Broadbent, M., Weill, P., and St. Clair, D. "the Implications of Information Technology Infrastructure for Business Process Redesign," *MIS Quarterly* (23:2) 1999, pp 159-182.
4. Giddens, A. *Central Problems in Social Theory* Macmillan, 1979.
5. Giddens, A. *The Constitution of Society* Polity, Cambridge, 1984.
6. Hanseth, O. "Beyond Metaphysics and Theory Consumerism," *Scandinavian Journal of Information Systems* (17:1) 2005, pp 159-166.
7. Jones, M., Orlikowski, W.J., and Munir, K. "Structuration Theory and Information Systems: A Critical Reappraisal," in: *Social Theory and Philosophy for Information Systems*, J. Mingers and L. Willcocks (eds.), John Wiley & Sons, Chichester, 2004, pp. 297-328.
8. Kogut, B., and Zander, U. "Knowledge of the Firm, Combinative Capabilities and the Replication of Technology," *Organization Science* (3:3) 1992, pp 383-397.
9. Latour, B. *Science in Action*, (1st Edition ed.) Harvard University Press, Cambridge, Massachusetts, 1987, p. 274.
10. Latour, B. *We Have Never Been Modern* Harvard University Press, Cambridge, MA, 1993, p. 157.
11. Latour, B. *Pandora's Hope: Essays on the Reality of Science Studies* Sage, Beverly Hills, CA, 1999.
12. McMaster, T., and Wastell, D. "The Agency of Hybrids: Overcoming the Symmetrophobic Block," *Scandinavian Journal of Information Systems* (17:1) 2005, pp 175-182.
13. Mutch, A. "Actors and Networks or Agents and Structures: Towards a Realist View of Information Systems," *Organization* (9:3) 2002, pp 477-496.
14. Orlikowski, W.J. "The Duality of Technology: Rethinking the Concept of Technology in Organizations," *Organization Science* (3:3) 1992, pp 398-427.
15. Orlikowski, W.J. "CASE Tools as Organizational Change: Investigating Incremental and Radical Changes in Systems Development," *MIS Quarterly*, September 1993, pp 309-340.
16. Orlikowski, W.J. "Improvising Organizational Transformation Over Time: A Situated Change Perspective," *Information Systems Research* (7:1) 1996, pp 63-92.
17. Orlikowski, W.J. "Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations," *Organization Science* (11:4) 2000, pp 404-428.
18. Orlikowski, W.J. "Material Works: Exploring the Situated Entanglement of Technological Performativity and Human Agency," *Scandinavian Journal of Information Systems* (17:1) 2005, pp 183-186.
19. Orlikowski, W.J., and Iacono, C.S. "Research Commentary: Desperately Seeking the "IT" in IT Research--A Call to Theorizing the IT Artifact," *Information Systems Research* (12:2) 2001, pp 121-134.
20. Orlikowski, W.J., and Robey, D. "Information Technology and the Structuring of Organizations," *Information Systems Research* (2:2) 1991, pp 143-169.
21. Rose, J., Jones, M., and Truex, D. "Socio-Theoretic Accounts of IS: The Problem of Agency," *Scandinavian Journal of Information Systems* (17:1) 2005, pp 133-152.