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Case Study

The role of digital identifier systems in the theory of digital objects

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ABSTRACT

Theory of Digital Objects (TDO) can be considered as one of the important theories for explaining distinctive attributes and social practices of digital objects. The main aim of this study is to determine the role and position of digital identifiers and digital identifier systems in social practices of TDO. Results of applying comparative evaluation method demonstrated that the digital identifier systems can be considered as a third approach called identifiable Web, among memorable and navigable web in TDO. Moreover functions, technologically-induced tensions, challenges, counter mechanisms and emerging practices of the proposed approach had been investigated in contrast with the two existing social practices approaches. Results of this study could provide new ideas to administrators and researchers of these systems for promoting them from the sociotechnical aspect.

1. Introduction

The theory of digital objects (TDO) proposed by Kallinikos, Aaltonen, and Marton (2010, 2013), consideres three areas of distinctive attributes in digital objects, inherent characteristics of technology that drive these distinctions and social practices approaches of them. In the first part, it has been argued that digital artifacts are different from other physical objects. On the whole and after a fairly comprehensive literature review, they have introduced these attributes as follows: Digital objects are editable, interactive, open and distributed.

Afterwards they expressed inherent characteristics of digital technologies, which extracted from these attributes: modularity and granularity. In their view, modularity refers to organize items and operations that make up a digital object or objects interactive ecology, in distinct block or units, which allows independence in a broader yet looser network of functional relationships and dependencies. They also introduce granularity as the size and resilience of the elementary units or items that constitute a digital object (Kallinikos et al., 2010, 2013).

Eventually, they focused on transferring types of these attributes toward social practices. Also they investigated two social practices of these attributes as two approaches at two ends of one spectrum, Memorable and Navigable web. In the first approach, memorable Web (archive), special attention is given to the issues of digital documents' identification within the overall context of social memory. The main objective of this approach is to control the inherent fluidity characteristics of digital objects and to maintain their identification capabilities over time with goals such as better organizing and preserving digital born culture. In the second approach, Navigable web, the focus is on the find-ability of digital objects through deep search in digital online environment (Kallinikos et al., 2010, 2013).

On the other hand, with development of electronic environment, one of the concepts that has been particularly important, is digital identification of objects in its process. For this purpose, in recent years, digital identifier systems have been widely developed. These systems pay special attention to the concept of digital object (Khedmatgozar, Alipour-Hafezi, & Hanafizadeh, 2015). So far, existing identity and development approaches of the digital identifier systems were considered from a technical perspective by their developers and users, but less attention has been paid to the nature of these systems from the perspective of theories relating to digital objects and their social practices.

This study attempts to help clarifying the status of digital identifier systems in the digital environment by looking at the nature of these systems from the theoretical and socio-material points of view. This approach is in compliance with the foundations of socio-material perspective provided by Orlikowski (2007). In this perspective, the technological system is considered as a material component organized with the social life, both sharing a socio-material structure. Attending to this perspective and its

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applications in TDO and advantages in the Information Technology (IT) domain by Kallinikos et al. (2013) are also another reasons for the importance of examining these systems by this perspective. This view could suggest new approaches to these systems' developers and researchers in order to develop them simultaneously from technical and social aspects. Accordingly, the main question that was considered in this study was that, what is the role and position of digital identifiers and their managing systems in the spectrum of social practices, which was expressed in TDO? Answering this question is the main aim of this study.

2. Research methodology

Used method in order to answer the research question was comparative evaluation method which its principles was proposed by Vartiainen (2002). According to him, the goals of comparative evaluation are understanding, explaining, and interpreting different phenomena. Comparative evaluation was done for controlling and seeking evidence that is supporting or contradicting the accuracy of certain generalizations when implemented in various cases. Vartiainen (2002) states that 4 major principles should be specified for comparative evaluation. In continuation, while introducing these principles, the ways they were specified, in the present study are explained.

- Selection of the object for evaluation: According to this principle, it must be stated that what object and how it is selected for comparative evaluation. In this study, digital identifier system is the object that was known as the main basis of the comparative evaluation. The system is deeply introduced in the next section. Two important reasons in selecting the object are the need for attention to digital identifier systems in terms of the nature and main features of the digital object, as the main purpose of identification, and the importance of examining digital identifier systems from the perspective of the social practice in addition to their provided technical solutions.
- Level of comparison: This element refers to specify the scope of evaluation and its principles. Another point regarding the level of comparison is the degree of similarity or difference between units to be compared. Of course, this evaluation was limited to the spectrum of social practices in TDO which was described in the introduction. Regarding the similarity or difference of the nature of the compared objects, one can argue about their nature, relevance and so on. Vartiainen (2002) argues that in comparison of similar cases, it is more natural and interesting to evaluate their difference rather than similarities. Thus, the present study focused on their differences.
- Conceptual comprehension: A clear definition of the existing elements is the third principle that can be considered in comparative evaluation. This element should be followed to standardize concepts existing in comparative evaluation. The presented definition of concepts in the TDO which was presented in the previous section by Kallinikos et al. (2010, 2013) and were accepted from the definitions of digital identifiers which was presented by Khedmatgozar and Alipour-Hafezi (2015) formed the basis of this study.
- Analyzing the findings: Vartiainen (2002) argues that comparative evaluation yields more efficient information when the evaluated units are too similar to each other. He introduced illustrative comparison as one of the general methods of comparison. In illustrative comparisons, the evaluated units are compared indirectly according to the proposed model or framework of the study. He considered standardization and generalization of the application of the framework used in evaluation as one of main applications illustrative comparisons. In the present study, the spectrum of social practices provided by Kallinikos et al. (2010) in the TDO was considered as the basic framework for comparative evaluation. This basic framework includes a range of social practices resulting from the attributes of digital objects, in which there are two approaches (memorable and navigable web) on both sides of one spectrum. This framework has also defined characteristics for each of these social practices; include institutional setting, function, technologically-induced tension, challenge, counter-mechanism and emerging practices. The aim of this study is to determine the role and the position of the digital identifier system in this basic framework. Thus, the analysis of this study can be regarded as an illustrative comparison.

3. Digital identifier systems in TDO

In the last two decades, one of the approaches that have been considered in electronic environment and particularly in the field of digital objects is digital identification of objects with an identity. Essence of these Identifiers points out to two main problems of identification in the electronic environment: uniqueness (Coyle, 2006) and persistency (Paskin, 1999; Campbell, 2007). These two problems, as well as other side problems in this area (Khedmatgozar and Alipour-Hafezi, 2015), led to the emergence of digital identifier systems.

The main solution of digital identifier systems for these issues is using indirect names instead of URLs; what worked for the DNS (Domain Name System) in stabilizing internet hostnames should work for digital object references (Kunze, 2003). Put simply, the proposed strategy is based on creating a system called digital identifier system in order to manage digital identifiers and a process called resolution. Resolution is identifier submission process based on a name to a network service (digital identifier system) and in return, to receive one or more pieces of current information related to the identified object, such as the location (URL) of the object. Resolution creates a level of managed redirection between the output and the identifier (IDF, 2016; Khedmatgozar and Alipour-Hafezi, 2015). With this description, the position of digital identifier system from the perspective of the TDO can be specified by comparing the basis of this system (uniqueness, persistency and resolution mechanism) with characteristics of two approaches (memorable and navigable web) in basic framework of the study.

Digital identifier systems, with accepting the overall attributes of the digital objects in the TDO (Kahn and Wilensky, 2006), and emphasizing on the element of uniqueness and persistency, try to control the fluidity of digital objects, through the identification of different versions at different levels and maintain the persistency of these identifications. At the same time, while these systems identify and control these objects, are required to maintain their metadata records. However the main focus of these systems, instead of preserving digital culture and creating an archive, are on better and more precisely identification of digital objects. In the strict sense, they are trying to create an acceptable level of granularity in identifying (Paskin, 2003) relying on basic conceptual models such as Indecs (Paskin and Rust, 1998) and FRBR (Oh and Lee, 2009). So it can be said that digital identifier systems have a relative adaptation with the approach of memorable web in the TDO.

On the other hand, digital identifier systems by providing resolution mechanism, try to focus on the find-ability of digital objects on the web. From this perspective, they can be considered consistent with the approach of navigable web. However, these systems do not provide this find-ability through search engines, but also offer it through the assignment of an actionable identifier to access identified digital object on the Web by resolution mechanism and its publication in the electronic environment (Park, Zo, Ciganek, & Lim, 2011). Furthermore, by combining resolution mechanism with

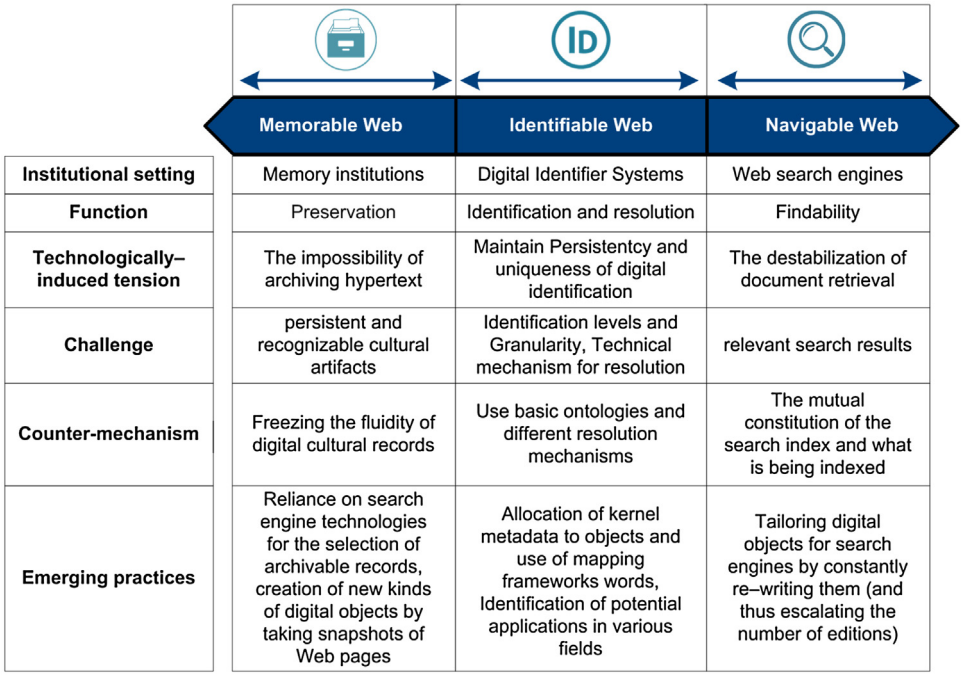

Fig. 1. Identifiable web in Social practices spectrum of TDO.

assigning kernel metadata to the detected objects and mapping those on conceptual models by number of these systems, tendency of them have been elevated to increase find-ability of identified digital objects (Paskin and Rust, 1998). With this explanation, it can be concluded that digital identifier systems also have a relative adaptation with the approach of memorable web in the TDO.

With this reason, the digital identifier systems can be placed between the two approaches of memorable and navigable web. This approach called **identifiable web**. It is natural that this approach has been faced with challenges such as its both side's approaches. These challenges exactly return to functions of this approach. In identification function, the main challenge of this approach is to determine the level of identification and granularity for the more precise identification of digital objects. As mentioned above, Digital identifier systems try to cope with this challenge by relying on the basic conceptual models and conceptual structures based on them for identification of digital objects. Some types of these solutions are visible in DOI[1] and UCI[2] systems. Still, there is no complete agreement on the usage of a detailed framework based on conceptual models to achieve the desired granularity. Also available systems try to reduce these disparities in various types and with different solutions.

Another challenge in identified web approach is technical issue in the method of implementing resolution mechanism in the form of a digital identifier system. Among various existing resolution mechanisms, can be pointed to the mechanisms that offered in the ARK,[3] URN,[4] DOI,[5] UCI and PURL[6] systems. Of course, the implementation and effectiveness of these mechanisms are at different levels that can be considered more by researchers.

From the emerging practices in this approach, we can point to the following two areas: Using vocabulary mapping frameworks to map kernel metadata with metadata structures in the field of general and specialized information management (VMF, 2009), and to solve the problems of copyright management based on these systems (Arnab and Hutchison, 2006). On the other hand, by revealing the many uses of digital Identifiers, many applications based on these identifiers are being gradually identified and developed in the electronic environments (Khedmatgozar and Alipour-Hafezi, 2015).

4. Summary

According to the theory of digital objects, we can say that basis of digital identifier is an approach between social practices spectrum in TDO, consist of memorable and navigable Web, entitled identifiable web. On one hand this approach is close to the memorable web approach with a focus on uniqueness and persistent identification of digital objects, and On the other hand, provides the main feature for navigable web approach, by focusing on resolution mechanism for instant and online access to digital objects. For better understanding, Fig. 1 shows a summary of the functions, technologically induced tensions, challenges, counter mechanisms and emerging practices of this approach in contrast with the other two approaches, which are analyzed in the previous section. As is clear in this figure, due to the variety of solutions and complementary mechanisms that were employed by digital identifier systems in order to create uniqueness and persistency at the same time and create availability through the resolution mechanisms, Spectral look to this approach seems reasonable.

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[1] http://www.doi.org/doi_handbook/4_Data_Model.html.
[2] http://www.uci.or.kr/eng/download/UCI20110801110731.pdf.
[3] https://wiki.ucop.edu/display/Curation/ARK.
[4] http://tools.ietf.org/html/rfc2276.
[5] https://www.doi.org/doi_handbook/3_Resolution.html.
[6] https://sites.google.com/site/persistenturls/.

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