

# THE STOLEN IDENTIFIER: AN INQUIRY INTO THE NATURE OF IDENTIFICATION AND THE ONTOLOGICAL STATUS OF INFORMATION SYSTEMS

*Completed Research Paper*

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## Abstract

*Based on real-world examples of identity theft, and particularly a recent incident in Sweden, this paper explores the nature of identification from a social ontology point of view. This is contrasted with the traditional representational view, which is shown unable to handle critical aspects related to institutional control of identifiers and identity. Specifically, the paper shows that identification and the definition and allocation of identifiers is an institutional and political rather than scientific process, and that since “identity” in itself is a social construct, the process of identification depends on the institutional context in which the objects to identify exist as valid institutional facts. These institutional objects are often originally generated by the use of information systems, which means that genuine real-world institutional objects and their identifiers can be found within these information systems. This implies that the representational view of information systems with a sharp distinction between the real world outside the information system and the system itself (only seen as a model or perceived state of that real world) cannot be maintained.*

**Keywords:** Conceptual modelling, Information infrastructure, Identity theft, Ontology

## Introduction

As he approached his dark-blue Toyota Auris, Lars could not help noticing something unusual. In the brisk autumn morning his car appeared somehow different. Something was missing. At first he could not tell just what. Then suddenly it dawned upon him. Instead of the license plate, all he could discern was a vacuous space. Why would someone take someone's license plates, he thought to himself while rushing back inside to look up the number to the local police and the road administration authorities. He stopped to catch his breath, called the police to report the theft and then went on to ordering a new set of plates from the road administration. He received the new plates in a heartbeat and everything seemed fine. About a month later he also received a letter from the police stating that they had found a burnt-out car carrying his license plates and that this car was now going to the scrap yard. Everything still seemed fine. Well. Everything was fine until Lars one day received 13 parking tickets. He had used his car very sparsely lately. It had in fact been parked in front of his house most of the time so how could it be? It turned out that the tickets were for the burnt-out car and not his. Bummer. As if this was not enough, shortly after the tickets he also received a letter from the insurance company bluntly stating that his car insurance policy was void. According to the notice, his blue Toyota no longer existed. How odd, he could clearly see the sparkingly blue car parked in the driveway. He pondered, "if it doesn't exist, although I'm pretty sure it does, can I still use it or would that perhaps violate some regulations? I guess I better not since apparently it is no longer insured. How could this happen? Why?"

This slightly dramatized narrative is based on a true story that recently unfolded in Sweden (Sjöberg, 2010). In the paper we use this case as a backdrop to discuss the nature of identifiers (such as license numbers), identification and its implications, particularly in relation to information systems and identity management. Indeed, the story may seem innocent enough and the company running the car breaker's yard eventually took responsibility and sent a letter to the Swedish Road Administration (SRA) explaining the situation and asking them to re-register Lars' Toyota. However, identity theft is clearly not a harmless activity, and the story goes to show that today's information society is frighteningly vulnerable when it comes to identifying, and managing the identity of things with far-reaching economical, legal and social implications. Lars, who certainly was not too happy about the whole situation (Sjöberg, 2010), became painfully aware of this and others have lived through similar experiences, also in other parts of the world (e.g. K, 2010).

In what follows we will explore how and why the traditional information systems development (ISD) literature with its foundation in a representational view of information systems fails to recognize the importance of institutional control of identifiers and identities in relationship to information systems. The aim is to form a basis upon which to construct ontological model for information systems design that acknowledges that information systems are tools for social interaction and that such systems are part of the world and not simply representations of a material world external to the systems.

In the ISD literature identifiers generated within information systems are typically considered to be meaningless technical constructs (surrogates) that represent the natural key or the set of identifying properties that actually identifies a thing in the real world (Date, 2004, p. Codd, 1979; Wieringa and Jonge, 1991; Evermann and Wand, 2005). However, this straightforward technical understanding of identifiers is problematic because it does not reflect the social and institutional meaning of the identifier construct. Nor does it reflect the social context of its use, its ontological status or its fundamental role for information infrastructures and society. This implies that the ISD literature gives little advice concerning identity management routines. Improper identity management is a main reason for escalating problems related to identifiers and identification, which cause significant costs to people, organizations and society (LoPucki 2001; Baum, 2004; Eriksson and Ågerfalk, 2010;) due to lack of institutional control. Drawing on Searle's (2006) social ontology and Eriksson and Ågerfalk's (2010) concept of the institutional object and understanding of the identifier construct, we present an alternative approach to address contemporary information systems problems. In keeping with Iannacci (2010), the proposed approach emphasizes the importance of constitutive rules in the process of institutionalization. As such, it can be seen to rest on the cultural-cognitive pillar of institutional theory (Scott, 2001; 2003) in which institutions are conceived of as systems of constitutive rules that govern the existence of identity as social fact and the validity of what we refer to as institutional objects. To paraphrase Scott (2003), our attention is directed to the shared conceptions that constitute the nature of socio-material reality and provide the symbolic

frames that support social sense making in an information systems (IS) context. In the paper we adopt a conceptual-analytical research approach (Järvinen, 2000), which means that we provide analytical and logical arguments based on real world examples. The real-world example with the stolen vehicle identifier is used to illustrate that identification and identity is a matter of a collective acknowledgement of institutional objects, which is based on constitutive rules and routines in a certain institutional context, and that genuine real-world institutional objects can be generated and exist within information systems. This is important to understand in order to discuss the ontological status of identifiers and information systems.

The paper proceeds as follows. The next section presents an analysis of the case of the stolen vehicle identifier introduced above. The analysis is performed in two phases. In the first phase, the traditional, representational view of information is adopted. The second phase then applies an alternative, social ontology perspective. The third section elaborates on the problems with identifiers and the objects they identify. The fourth section discusses the implications for information systems in more general terms, and the fifth section concludes the paper.

## **The Problem with the Stolen Vehicle Identifier**

For the purpose of analysis, the case of the stolen vehicle identifier can be described in terms of a number of critical actions:

- A-1. The license plates of Lars' blue Toyota Auris are reported stolen.
- A-2. New license plates are produced and delivered to Lars who mounts them on his car.
- A-3. Burnt-out car with Lars' stolen license plates is demolished and the traffic vehicle is de-registered.
- A-4. Lars' insurance policy is cancelled.

In order to understand the problem it should be clarified that to have a Swedish car insured it has to be registered in the Central Vehicle Registry (CVR), which at that time was the responsibility of the SRA. In the CVR, vehicles are described and identified by their license number, ISO-VIN number, vehicle type, model, model year, first date of registration, body, length, width, number of passengers, motor effect, total weight, and tax weight. The vehicle object would typically be represented in a relational table and the attributes of the vehicle would be columns in such a table (see Table 1).

### ***A Representational Explanation***

The traditional view commonly adopted in information systems research has a strictly representational focus and is typically underpinned by scienticism and (dialectical) materialism (Wysusek, 2006), spearheaded by the seminal work of Wand and Weber (1990; 1995). From a representational point-of-view, the object in Table 1 should be considered as representing a thing in the real world outside the information system (IS), i.e. it is thought of as a state tracking mechanism (Wand and Weber, 1995). The table can be used to inform users about the real world without them having to observe it directly. This view emphasizes correspondence between a domain (the universe of discourse) and its representation in the IS (Lyytinen 1987). This is how information systems and information stored in databases are typically conceived in the ISD literature. Date (2004, p. 291) confirms this view when acknowledging that "It was Codd's very great insight, when he invented the relational model back in 1969, that a database is not really just a collection of data (despite the name) rather it is a collection of facts, or what logicians call true propositions."

Based on the representational view, the situation can be explained by saying that the insurance company and the SRA had an unjustified belief because the vehicle obviously existed as a physical thing in the real world that possessed the property of having a license plate with the license number "KHH901" printed on it. This implies that the CVR did not represent the real world in a true way because it contained a false proposition, caused by A-3; the proposition in the database did not correspond to the material world outside the system. Consequently, the only thing needed would be to insert a new object (row) into the database with the value "KHH901" in the license number column that better represents the status of the

real world outside the system. It appears to be a simple correction of the information stored in the database.

But how should this correction be made? If the CVR with its objects is only considered a model of the outside real world, it is uncertain whether or not the CVR really is in an incorrect state. It is true that the burnt-out car was demolished. It is equally true that it possessed the mutual property “KHH901”. Considering these facts the CVR is indeed correct and nothing should be done. The question, then is how do we know which of the two license numbers were the genuine one, the one possessed by the burnt-out car or the one possessed by the Blue Toyota? How do we identify the correct vehicle in this case given that the two vehicles possess the same identifying property? According to (Wand and Wang, 1996, p. 92) this is a garbling situation, caused by an operational flaw that is beyond the scope of data quality concerns: “analysis of design and operational flaws does not encompass the case where the user perceives a ‘wrong’ state of the real world (either by error or due to malicious intent). This is because the information system is only required to enable mapping into perceived states, not ‘real’ states.”

<b>Table 1: Traffic Vehicle Table</b>											
<b>License number</b>	<b>ISO-VIN</b>	<b>Type of vehicle</b>	<b>Model</b>	<b>Model year</b>	<b>Date of registration</b>	<b>Colour</b>	<b>Width</b>	<b>Number of passengers</b>	<b>Engine power(KW)</b>	<b>Total weight</b>	<b>Tax weight</b>
KHH901	SB1KV56E80F0003 86	Private light goods vehicle	Toyota Auris	2007	2007-08-08	Dark Blue	1760	4	91.0	1750	1380

### ***An Explanation Based on Social Ontology***

If information systems are considered to be tools for performing language acts to create objects that are as real as the physical world, the problem and the questions asked above can be explained quite differently. Based on social ontology it can be maintained that the insurance company is correct because they are not denying that a physical vehicle exists. They do deny, though, that there is a traffic vehicle because a genuine traffic vehicle can only exist in the CVR. The reason for this is that Traffic Vehicles are instantiated at the SRA using the CVR performing an act of registration more or less automatically, following a certain statute (SFS, 2001:650), which have been issued by the Swedish government. This registration act at the SRA is an important declarative speech act (language act), and creates three important objects: the Registration, Traffic Vehicle and Owner objects. The Traffic Vehicle (Table 1) table must therefore be complemented with an explicit Registration Act table (Table 2) and an Owner table (Table 3) to provide the full picture.

This registration act is performed under the authority of the SRA and as such these objects do not only carry semantic meaning, they also carry deontic meaning—they are used for instantiating responsibilities, rights, obligations and commitments. The instantiation of a traffic vehicle means that a physical thing is related to the traffic vehicle object. By virtue of this, that physical vehicle becomes allowed for use on

public roads. Furthermore, being an owner of a traffic vehicle gives the registered owner the right to sign a car insurance policy for the physical vehicle. It also incurs a commitment to pay road tax.

<b>Table 2: Traffic Vehicle Registration Act table</b>				
<b>Action No</b>	<b>Action Date</b>	<b>Action Type</b>	<b>License No</b>	<b>Owner</b>
11234768	1996-02-29	Registration	KHH901	123982839
12647688	2005-05-19	De-registration	KHH901	123982839

<b>Table 3: Owner table</b>				
<b>Owner_ID</b>	<b>Name</b>	<b>Street Address</b>	<b>City</b>	<b>Postal Code</b>
123982839	Lars Kjellman	Finn Malmgrens väg 81	Johanneshov	121 50

All three tables are required in order to represent the complete act of registering a traffic vehicle at the SRA. Considering Table 2, it is important to see that there is an identifier (the Action No) of the registration act as such. Essentially, the registration act instantiates itself and the institutional objects Owner and Traffic Vehicle. Neither the genuine traffic vehicle object nor the genuine owner object exist outside the system because the CVR is the means for assigning the rights and responsibilities that is represented by the Traffic Vehicle and Owner objects. Although a certificate is printed out and sent to the owner to verify the ownership of the traffic vehicle object, this is only a copy, a representation, of the reality constituted by the CVR. The certificate is part of the CVR, and a precondition for its creation is that a Traffic vehicle object already exists. The physical things outside the system are a physical person and a physical car that should conform to the rights and responsibilities that have been assigned to them. Effectively, these rights and responsibilities are represented by the reference to the license number and the owner identifier in the RegistrationAct table (Table 2). The registration act table is also used for performing and storing information about deregistration acts, which withdraw the rights and responsibilities that were previously assigned, and this is what happened in this case. In performing A-3, the car breaker firm invalidated the Traffic Vehicle instance in the CVR, which certified car breaker firms in Sweden are allowed to do. Upon realizing their mistake, however, they could not just reverse the change to the database, which is something only the SRA is allowed to do. Re-registrations follow a strict procedure in which the car breaker firm that performed the de-registration act has to explain the particular circumstances. SRA then approves and performs the re-registration act because they are the only authority with the right to register traffic vehicles in Sweden.

If the problem is explained based on social ontology, a number of interesting features are exposed. For example, it shows that the license number on the license plate is only a representation of the original traffic vehicle object, and thus a copy of the license number stored in the CVR. The answer to the question of which of the two identifiers that is the genuine one, the one possessed by the burnt-out car or the blue Toyota, is, neither. They are both only copies of the genuine one. The burnt-out car obviously did not possess the genuine one, and the copy that was attached to the blue Toyota became useless when the traffic vehicle was deregistered and thus invalidated in the CVR. This proves that the genuine traffic vehicle object, with its license number, is stored in the CVR. Another important conclusion is that it was not untrue that the burnt-out car did have the license number KHH901. The problem was that it did not have the right to carry the license plate with the number KHH901, and this was not properly checked before the traffic vehicle was de-registered. By stealing the identifier the thieves could use the rights represented by the license number. They had not, however, assumed the responsibility associated with the institutional object represented by the license number (hence the parking tickets sent to Lars). It is important here to understand that the license number is an identifier of a traffic vehicle object, which is a constituent part of social reality with associated rights and obligations. Although such objects may have to match physical reality, such as in this case—they are not simply objects that represent and correspond to things outside of the system. Identifying an object is a social interpretative process using rules in a certain institutional context. This is clearly illustrated by the stolen vehicle identifier example. The car breaker was successful in identifying the traffic vehicle when the traffic vehicle object was de-registered because

he was able to provide an identifier of a valid traffic vehicle object to the CVR in a correct way. Although the identification was successful in the sense that the car breaker could find an existing traffic vehicle in the CVR, the de-registration was certainly a mistake because the traffic vehicle object was not correctly matched with the right physical thing. Compare this to Lars who was unable to identify the traffic vehicle object after it had been de-registered although he had access to both a physical car and a license plate with the same number as the traffic vehicle object that had been de-registered. This shows that a necessary condition for the identification process is to be able to identify the traffic vehicle object in the database. But how then can this be the case? How can real-world objects and their genuine identifiers exist in information systems? How can identifiers represent rights and obligations, and how are real-world objects in general identified. In the next section we will address these questions explicitly.

## Identification and Identifiers

As noted above, the representational view of information systems is closely related to dialectical materialism. In the following we contrast this view with social ontology, which is based on the works of Searle (2006) and Habermas (1979) but also incorporates ideas introduced by Eriksson and Ågerfalk (2010) that are central to information systems particularly. This discussion leads on to an exploration of the importance of institutional control for identification to work.

### *A Representational View of Identification*

From a representational point of view, an IS should adequately represent “the meaning of the real-world system the information system is intended to model” (Wand & Weber, 1995, p. 206). The IS literature is weak on explaining just what that real world actually is, but it is commonly described in terms of dialectical materialism based on Bunge (1977). According to Bunge (1977) there are two types of objects: concrete objects (which he refers to as “substantial individuals”, “material objects”, or “things”) and constructs (which he refers to as “conceptual”, “formal” or “ideal” objects). Things have intrinsic (physical, substantial) properties, conceptual objects do not; they are characterized by attributes that humans define them to have. Such constructs are objects that are studied and created in logic, mathematics, and semantics (e.g. sets and categories). To quote Wand et al. (1999), “Any domain can be described in terms of concrete things and the linkages that exist among them. Therefore, we use the word ‘thing’ to refer only to substantial individuals or concrete things. [...] the notion of a concrete thing applies to anything perceived as a specific object by someone, whether it exists in physical reality or only in someone’s mind.” From this follows that “All attributes and relationships in a class represent properties of things in the class.” (Wand et al., 1999, p. 512) An object is thus identified via its set of attributes, which is different from objects of any other class. According to Evermann and Wand (2005, p. 149), “No two things have exactly the same set of individual properties. Thus, properties can be used to identify things.”

In keeping with Bunge (1977), Wand et al. (1999) refer to properties of concrete things as substantial properties, or simply properties and properties of objects (conceptual things) as attributes. A property can depend on one or more things. A distinction is made between intrinsic properties that depend on one thing only, and mutual properties that depend on two or more things. This is exemplified by saying that (Wand et al., 1999):

- the height of a person is an attribute that represents an intrinsic property of a person;
- a student number is an attribute that represents the mutual property of being a student at a particular university;
- the name of a person is an attribute that does not represent any specific property, it is an attribute that stands for the person as a whole, if it is unique.

Accordingly, class definitions are based on attributes that represent properties of things; i.e. substantial properties. Wand et al. (1999) admit that “At first glance, this implication is counterintuitive, as “name” and “key” are usually the first attributes of a thing to be identified. Rather, it indicates that they have no significance in modeling the world.” According to Evermann and Wand (2005, p. 149), “In an information system, we may not know or care about all properties and instead use artificial identification attributes to represent the set of identifying properties.” This means that an object is seen only as an identifiable thing

and since no two things have the same set of individual properties, attribute values of identifying properties are used for identifying objects. Identifiers can also be used for identifying objects. However an identifier is seen only as an artificial attribute that represents identifying properties. It conveys no meaning whatsoever.

### ***Social Ontology and Identification***

Speech-act theory (Searle, 1969; 1995, Habermas, 1979; 1984) has been used by to discuss how interpersonal relationships and the social world at large is constructed. Searle (2006) claims that the aim of speech-act-based social ontology is to make it clear that the social world is created by human actions and attitudes but at the same time has an epistemically objective existence and is part of the natural world. The fundamental question that Searle is asking is: How can such animals as ourselves create a “social” reality? It is an objective fact that a piece of paper can be money, that a living person can be a resident in a country, and that a physical moving thing can be a traffic vehicle. But these socially constructed, institutional objects can only exist in virtue of collective acknowledgment (Searle, 2006). These objects have deontic powers, by creating desire-independent reasons for action, based on responsibilities, rights, commitments and duties. In order to understand the notion of institutional objects it is important to understand the distinction between what Searle (1995, p. 27) terms “brute facts” and “institutional facts”. Essentially, the difference between the two is that brute facts concern physical things and their properties and only require the institution of language in order that the facts can be asserted; for example, the assertion “The vehicle is blue”. Institutional facts, on the other hand, require human institutions and language for their very existence. Something or someone can be money, a resident, or a traffic vehicle only insofar as it is represented as such in an inter-subjectively agreed upon manner.

Institutional objects, their attributes and relationships, are examples of institutional facts. One way of creating institutional objects is by using explicit declarative speech acts. For example, a representative of SRA may performs this speech-act: “I declare this dark-blue car to be the traffic vehicle with the license number KHH901.” This speech act instantiates a Traffic Vehicle institutional object. In this case the speech act requires that there exists a physical dark-blue car that is named KHH901, otherwise the speech act is meaningless. However the creation of institutional objects does not always require that a physical thing exists. For example, a corporation can come into existence, but there need be no physical thing that is the corporation. Instead the decisive requirement is that there has to be some obligations, commitments, rights or duties, which can be declared and collectively recognized as an organization (Searle, 2006, p. 28; Habermas, 1988 p. 273-274).

A fundamental insight of speech act theory is thus that language constructs are used not only to describe reality as it is. Using language also implies constructing social reality (Searle, 1995), and thus conceptual and institutional objects. A conceptual object (Eriksson and Ågerfalk, 2010):

- is created via a language act at a certain point in time;
- is self-representing because a language act is used for its creation;
- is created with some kind of media, and thus has a physical representation, e.g. in the form of sound waves, paper, steel plates or traces of a computer disc;
- is created based on constitutive rules;
- is an instantiation of a concept;
- is something that is referred to in human communication;
- conveys both semantic and deontic meaning;
- represents brute and/or institutional facts.

A conceptual object is an institutional object if it also fulfils these criteria (Eriksson and Ågerfalk, 2010):

- represents rights, responsibilities, obligations, commitments or duties;
- it is an instance of a general institutional phenomena;
- is collectively agreed upon in a social context.

According to Searle (1969), there are two ways to identify objects using language (there are two reference mechanisms); using a definite description (such as, Lars' blue Toyota) or an identifier (such as, KHH901). This does not mean that an identifier is the same as a definite description, as assumed by the representational view of information systems. In fact, trying to present a definite description based on a set of identifying properties of a thing as the identity of the object would lead to the peculiar consequence that the meaning of the identifier would change if there were any change at all in the properties of the thing (Searle 1969). This means that the two expressions "Lars' blue Toyota" and "KHH901" only pick out the same object in a specific use situation, for example, as long as Lars is the owner and as long as the car is blue. If they had exactly the same meaning, then the identifier would have a different meaning depending on how the attributes in the definite description changed over time. Thus it would not fulfil its referential function, i.e. to represent the existence of the object and the thing over time. It would also imply that we would only be able to refer to an object by describing it. But this is precisely what the identifier construct avoids and which makes it a very practical construct (Searle 1969, p. 172)

It is true that in the case where the object also represents the existence of a physical thing the identifier has to be connected to attributes that represent properties of the physical thing. This is because we must be able to substitute the identifier for an identifying description in certain contexts of use. For example, if someone asks you which car is "KHH901", assuming that they cannot see the license number, you could answer, "Lars' blue Toyota". In that sense the identifier has a semantic meaning, but it should not be seen as a strict definition of the identifier. In case the identifier also represents an institutional object it also has a deontic meaning, because it represents rights and responsibilities. This is why they are of interest to steal; they give the thief the rights connected to the object without incurring the responsibilities. Of course, they do not give the rights to the thief in a legal sense. However, by using the stolen identity, the unsuspecting will likely assume that the possession of the identity equals such rights. This also means that although the identifier is tied to the thing named, they are not the same. An identifier can only be an identifier by virtue of a genuine difference between the identifier and the thing identified: "If they are the same, the notion of naming and referring can have no application." (Searle 1969, p.75). The identifier represents the existence of an object, and existence is not a property. This is not acknowledged in the representational view, which treats, for example, the license number as a mutual property between the physical vehicle and the SRA (Everman & wand, 2005).

### ***Identification and Institutional Control***

Based on the discussion above we can ask ourselves what really went wrong in the stolen vehicle identifier case. The representational way of explaining this could be to claim that it was wrongfully assumed that the license plates were attached to the right vehicle, i.e. that the license number was a mutual property of the burnt-out physical vehicle. Since the license number is a mutual property (between the car and SRA), a better choice, representationalists could argue, would have been to use the ISO-VIN, which appears to be an intrinsic property of the physical vehicle as suggested by Evermann & Wand (2006). Indeed the ISO-VIN is described by many organizations as the automotive equivalent to human "DNA" or fingerprint (DMV 2011; P&S, 2011). Based on Wand and Wang's (1996) recommendations for ensuring data quality, the garbling arising from having two vehicles with the same license number could be solved by making sure that the lawful states of the information system reflect the lawful states of the real-world system. This could be achieved if the ISO-VIN is regarded as the real identifying property of the vehicle. Traffic Vehicle could then be treated as a specialization of Vehicle that inherits the intrinsic property ISO-VIN. Traffic vehicles also have a mutual property (ownership) with a vehicle owner, since ownership can only be legally established (in Sweden at least) between a registered vehicle with a license number and an owner with a valid civic registration number or organization number. But this solution introduces new problems because it suggests that license numbers depend on ISO-VIN numbers in a rather counterintuitive way. For example, since the ISO-VIN was first officially described in ISO Standard 3779 in February 1977, and revised in 1983 all physical things that are classified and registered as traffic vehicles do not possess ISO-VIN numbers. This means that the traffic vehicle class cannot be a subclass of the vehicle class. The reason is that a subclass must possess the properties possessed by all things in the super-class (Wand al., 1999), and the traffic vehicle class requires the property license number but not the property ISO-VIN. Arguably, this does not properly represent how the ISO-VIN and license number are related. The reason is that the representational view fails to recognize how objects are identified and the special meaning of identifiers. Based on social ontology we can argue that the license number and ISO-VIN are not properties



at all because they are identifiers of two different institutional objects. It is clear that they are different institutional objects because the rules that govern their creation are completely different. The creation of the traffic vehicle object is governed by a statute (SFS 2001:650), and the ISO Standard 3779 governs the creation of the ISO-VIN. Furthermore the statute (SFS 2001:650) does not require that the physical vehicle possess an ISO-VIN, and the standard that governs the creation of the ISO-VIN does not require that the vehicle possess a license number. The creation of the traffic vehicle object was described above and is done through CVR by the SRA. The ISO-VIN is created by vehicle manufactures and is created by the procedure described below.

To start with there has to be a physical vehicle (a thing) that is typically created in a vehicle factory through material actions such as welding and assembling of parts. The ISO-VIN is usually applied to the vehicle in three different places. The build plate is fitted at the manufacturing plant, the compliance plate is fitted either at the manufacturing plant or, in the case of imports, at the holding yard, and the number is also stamped into the metal. However, these physical representations of the ISO-VIN should not primarily be understood as physical properties of the car, but as imprints of an institutional object. In many countries the original act is performed by use of an information system and the resultant institutional object is stored in the database of the vehicle manufacturer, or in a national VIN database (which is the case in, for example, Australia). A possible representation and instantiation of this act in a relational database is shown in Table 4. Here the action number identifies the whole declarative act (an institutional object). The action type describes the communicative intent of the object, the propositional content consists of the ISO-VIN, which identifies and describes the institutional object (Manufactured Vehicle), which consist of the ISO-VIN parts VIS, WMI and VDS.

<b>Action ID</b>	<b>Date of action</b>	<b>Action type</b>	<b>WMI</b>	<b>VDS</b>	<b>VIS</b>
1123989899	2007-03-01	Registration	SB1	KV56E8	oF000386

Notice that it is only the VMI part, which represents the Car Manufacturer, together with the VIS part that is necessary to make the ISO-VIN unique. The VDS section contains a coded description of the vehicle making the whole ISO-VIN a complete institutional object. The physical genuine representation is traces on a computer disc. The syntax of the institutional object is defined by the structure of the table. The semantic meaning of this object is that it is true that there exists a thing (a physical vehicle) that has properties that correspond to the attribute values represented by the VDS column. The deontic meaning should be understood as a commitment made by the manufacturer that this is a genuine vehicle authorized by the manufacturer. This is of great importance for a number of reasons. For example, the information in the Manufactured Vehicle table (Table 4) together with the ISO-VIN stamped onto the vehicle can be used to make it more difficult for criminals to attach an ISO-VIN from a wrecked car to a stolen car in order to “re-birth” it. Car thieves do this because selling a car with an ISO-VIN that has been reported stolen is almost impossible. It is therefore important also to keep a record of another type of declarative act, namely deregistration of the ISO-VIN numbers of wrecked cars, thus invalidating these institutional objects. As pointed out by Executive Director of the National Motor Vehicle Theft Reduction Council in Australia, Ray Carroll (2000), “An accurate and reliable VIN system is the cornerstone of all the procedures being implemented to stop re-birthing”. The registration and deregistration of an ISO-VIN, and associating it with a physical vehicle is thus an extremely important declarative act that must follow strict procedures.

## Discussion

The examples with the ISO-VIN and the license number show two things. First, constructs such as the ISO-VIN number and the license number are neither intrinsic nor mutual properties. They are identifiers of institutional objects. Second, the creation and management of institutional objects require strict institutional procedures. In order for institutional objects to be valid, they have to be instantiated following certain institutional rules. The identity of an object, even if it involves a physical thing, is established and verified in a social and interpretative process where its validity has to be controlled and

maintained over time. That is, an identity management system for institutional objects has to be established. Essentially, for any information infrastructure, and even society, not to break down, there has to be constitutional rules and routines that govern the creation, invalidation, and destruction of institutional objects.

This points to one of the things that clearly went wrong in the case of Lars' stolen vehicle identifier. The institutional control of de-registration of traffic vehicles was not sufficient to avoid de-registration of an unsuspecting vehicle. Here it is important to recognize that each of the four central actions involved different actors, and thus institutions with different responsibilities: A-1 concerned Lars and the police, A-2 concerned Lars and the SRA, A-3 concerned the car breaker and SRA, and A-4 concerned the insurance company, SRA, and Lars. To manage, and possibly to change, the institutional control process in this case thus involves a number of design decisions regarding responsibilities, actions, and possible information sharing between governmental agencies. For example, future problems of this kind can be mitigated by implementing an institutional control routine within the CVR that prevents car breakers from deregistering traffic vehicles when several license plates with the same license number have been issued. Essentially, the responsibility for deregistration should in these cases be transferred explicitly to SRA, who should contact the owner to have them report whether or not they still use the license number. A problem with many identity management systems is that they do not involve the owner of the institutional object who can verify the status of the identifier (LoPucki, 2001). Thus, A-3 should involve also the traffic vehicle owner. This could be straightforwardly implemented as an on-line service in CVR. This changed design of the CVR emphasizes that the responsibility for deregistering traffic vehicle objects is that of SRA, not car breakers. It also emphasizes that the responsibility of the police is to investigate reportedly stolen goods, and that A-2 consequently should not be considered as part of the de-registration problem. Likewise, A-4, which is triggered by a deregistration act, is prevented if A-3 is properly managed as suggested by the proposed institutional control routine.

In the case of the stolen vehicle identifier using only the license number to identify the institutional object associated with the burnt-out car was insufficient. From a representational view, this could have been explained by saying that the license number is a mutual property and that the ISO-VIN should have been used instead since it can be seen as an intrinsic property of the car. However, the re-birthing example clearly shows that neither license numbers nor ISO-VIN numbers, conceived of as properties possessed by things in the real world, are sufficient in and by themselves to correctly identify objects. This echoes Searle's message that an identifier is not a property, neither intrinsic nor mutual. An identifier stands for the object as a whole, not for the sum of its properties (Searle, 1969; Eriksson & Ågerfalk, 2010). That is, identifiers are used to represent the existence of institutional objects, and existence is not a property. The very concept of identity is in itself a social and institutional construct—a social fact that enables us to refer to other social and brute facts by using language (and information systems). From this follows that identification is not primarily to do with a correct mapping of a physical entity's properties onto a conceptual representation of a domain. Rather, identification is concerned with institutional objects, which may or may not involve the establishment of a correspondence relationship to some physical entity (Eriksson & Ågerfalk, 2010). Correspondence relationships are not core to understanding identity and identification. Rather, the essence of identification lies in the validity of the institutional object identified. Establishing validity involves the institutional processes that creates, maintains and invalidates such objects. These processes rely on constitutive rules that regulate the existence of the objects. In cases where a correspondence relationship between the institutional object and a physical thing is required, such a relationship has to be maintained and be possible to verify. However, assuming that this correspondence always represents a true mapping from physical reality to IS is clearly misleading and nothing but an instance of Austin's (1962) "descriptive fallacy". Rather, the opposite is often the case. That is, a physical thing is declared to have an identity and this declarative act is performed using an information system. Institutional objects are increasingly instantiated and maintained within information systems as the original and genuine facts to which the physical world should retain some fidelity. Institutional objects represent also rights and responsibilities, which cannot be empirically inferred from a physical thing. This means that the important question to ask is whether or not a thing is allowed to use a particular identifier and thus claim a normative relationship with a specific institutional object. Whether or not it is true that the thing is in possession of the identifier is subordinate.

Institutional control of institutional objects and their identifiers is fundamental to understanding the nature of identity and identification in information systems. Institutional objects are an important

constitutional component of the social world. That these objects are increasingly created and maintained within information systems implies that information systems are an increasingly important part of the “real world”. Certainly, from a semiotic point of view, institutional objects are signs and as such exist also physically in some form (Stamper, 2001). However, an institutional object does not relate to a physical thing in the same sense as it relates to the physical medium that carries and stores it. The physical manifestation of institutional objects is typically in the form of stored data on magnetic disks in a computerized information system. However, institutional objects are socially constructed facts that represent rights and obligations related to the social and material world. Sometimes also physical imprints outside the system represent institutional objects, for example, the ISO-VIN or the license number attached to a physical vehicle. Understanding identification in terms of the relationship between institutional objects, identifiers and physical things is increasingly important with the digitization of society where RFID technology and sensor networks connect things in automated processes. The development of the so-called Internet of things (ITU, 2005) is further evidence of this trend.

## Conclusion

Our analysis reveals a number of important insights in relation to identification in an information systems context.

First, information systems and the information they contain are an important part of the real world. This implies that the representational view of information systems with a sharp distinction between the real world on the one side and the information system and its representations on the other cannot be maintained.

Second, identifiers generated within information systems are not merely meaningless technical constructs (surrogates) that represent the natural key or the set of identifying properties that actually identifies the thing in the real world outside the system. These identifiers are often the genuine ones and carry both semantic and deontic meaning, which makes them valuable and susceptible to theft and misuse. This is because they allow dishonest people to do things they should not be granted, while at the same time avoiding associated responsibilities.

Third, the identification of objects is not a scientific process. It is meaningless to try to define universal criteria for valid identification based on true empirical observations of brute facts alone. The designer of information systems, and associated identity management systems, has to deal with how information systems and institutional control routines are designed in an integrated manner and how the world ought to be. With goals, “oughts” and institutional contexts the tensions between normative and descriptive is introduced (Simon, 1969). A major problem with the representational view of information systems is that it excludes the normative and concerns itself solely with descriptions of the real world. This is insufficient for understanding how objects are identified and identities are verified.

Fourth, since “identity” is, in itself, a social construct with material consequences, the process of identification depends on the institutional context in which the objects to identify exist as valid institutional facts.

Fifth, the definition and allocation of identifiers, including institutional objects and possible claims to correspondence, is an institutional, and thereby social and political, process. Essentially, identifiers and institutional objects form critical boundary objects that mediate between different communities of practice and enable shared social worlds. A strict representational view cannot properly support IS development given this context since “Conflict and multiplicity are often buried beneath layers of obscure representation.” (Bowker and Leigh Star, 1999, p. 47).

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