Form-ing Institutional Order: The Scaffolding of Lists and Identifiers

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This paper examines the central place of the list and the associated concept of an identifier within the scaffolding of contemporary institutional order. These terms are deliberately chosen to make strange and help unpack the constitutive capacity of information systems and information technology within and between contemporary organizations. We draw upon the substantial body of work by John Searle to help understand the place of lists and identifiers in the constitution of institutional order. To enable us to ground our discussion of the potentiality and problematic associated with lists we describe a number of significant instances of list-making, situated particularly around the use of identifiers to refer to people, places, and products. The theorization developed allows us to better explain not only the significance imbued within lists and identifiers but the key part they play in *form*-ing the institutional order. We also hint at the role such symbolic artifacts play within breakdowns in institutional order.

Introduction

A *data structure* is a term that is used broadly to refer to some systematic format for organizing data (Tsitchizris & Lochovsky, 1982). This concept is clearly central to the interests of the information disciplines (information science, information management, information systems, computer science). Much of the infrastructure of information and communication technology, for instance, is clearly taken up with the mechanics of data structures, particularly as it pertains to applications within business and government.

However, although much research and development continues to be devoted to finding better ways of storing, retrieving, and manipulating data structures, this concept is only rarely examined critically within the information disciplines. By this we mean that the data structure is treated largely as a technological artifact, helping to support, but somewhat isolated from, considerations of institutional order. As such, data structures appear to form part of the accepted and unexplored background to the conduct of investigation and explanation in these disciplines.

In previous work we adopted the technique of sense-breaking to help reveal some of this accepted and unexplored background (Beynon-Davies, 2013). Sensebreaking is a standard anthropological technique which is particularly useful for thinking about the accepted or conventional in different ways. Hence, we particularly wish to decouple the concept of data structure from that of digital computing and communications technology in the current paper. To do this we consider two apparently mundane and related symbolic artifacts that are used by pretty much everybody and as such form part of the conventional background of contemporary life. The first is that of the list and the second is that of the identifier. We shall show how these interrelated artifacts are critical to *form*-ing the contemporary institutional order.

The hyphen is deliberate in the term *form*-ing. This is because we want to argue that both the list and the identifier are important examples of the way in which actors create form from substance with the intended purpose of in-forming themselves and others. We therefore utilize the terms *form*, *form-ing,* and *in-forming* in a specific sense, which will become clear in the body of the paper.

To help in the development of theory about the place of the list and identifier in the formation of institutional order, we draw substantially upon three theoretical traditions, which we shall demonstrate are related in the body of the paper.

We base the development of theory about the data structure mainly in the work of Austin (1962) and the early work of Searle (1970), which is generally denoted with the term *speech act theory*. Speech act theory has been much applied in the information disciplines, for many years. This domain of application is typically encapsulated in the term the

language/action tradition (Weigand, 2006). We also draw upon the more recent work of Searle, and particularly his development of what he refers to as *social ontology* (Searle, 1995, 2010). For Searle the social world is constituted from the physical world using three key building blocks, which he refers to as *status functions*, *constitutive rules,* and *institutional facts*.

But there is another tradition which we shall draw upon in our account of the workings of lists and identifiers. This goes under various names such as information modeling, data modeling (Simsion & Witt, 2005), conceptual modeling (Chen, 1976), or even perhaps enterprise modeling (Dietz, 2006). Within these traditions the data structure as representational form is typically portrayed as a "mirror" of institutional reality (Agre, 1997). We shall break with this framing of the data structure by particularly using certain modeling constructs from this tradition, such as attribution, association, and classification, to help explain how institutional facts are constituted through lists of identifiers.

The main body of the paper is taken up with considering what Searle's social ontology offers to the framing of both data structures and the relationship of such artifacts to institutional order. The work of Searle never directly engages the notion of a data structure itself. Hence, the second main contribution of the current paper is to develop a perspective on the data structure that is consistent with Searle's theorization.

This leads to another contribution, which is to demonstrate how data structures *scaffold* the constitution of institutional order. Bowker and Leigh Star (1999) and Iannacci (2010) made a convincing case for the place of classification schemes and data standards as critical elements of what they refer to as the information infrastructure of institutions. However, their theorization does not attempt to explain the "mechanics" of how the data structures reliant on such classification and standardization support and frame institutional action. A scaffold is a structure used in the construction industry to support the building or repair of physical structures. To use a term originally developed in the work of Gibson (1977) and later modified in the work of Norman (1999), the scaffold *affords* the act of construction or repair. We fundamentally want to argue that lists and identifiers act as crucial internal scaffolding in the continual reconstruction of contemporary institutional order. Such symbolic artifacts serve to represent and communicate aspects of the institutional order. But they also afford people access to numerous systems of action that make up institutional order.

Therefore, to decompose our overall aim into a series of objectives, we want to do three main things with this paper:

- To develop a theorization of the data structure through a consideration of the list and identifier. To do this we intend to draw upon work within speech act theory, the language/action tradition, and conceptual modeling.
- To show through further theorization how these apparently mundane and "insignificant" artifacts are critical to helping form institutional order. To do this we draw upon the building blocks of Searle's social ontology—status functions, constitutive rules, and institutional facts.
- To utilize the metaphor of scaffolding to show how lists and identifiers afford institutional action. To help ground this we consider identifiers of people, places, and products and show how lists of such terms act as scaffolding not only for intra-institutional action but also for inter-institutional action. We also hint at the ways in which such scaffolding by its very nature is prone to break down.

Because we utilize so much of the work of John Searle it seems right to try to emulate not only his "method" but also some of his style of exposition in this paper. Searle, in most of his work, clearly adopts the method of analytical philosophy (Dummett, 1993). This broadly is that philosophical tradition characterized by its emphasis on clarity of argument. Such argument is frequently conducted in relation to an analysis of language as well as a general respect for the background of knowledge established in the natural sciences. One common approach to doing analysis in this approach to philosophy involves isolating or working back to something considered fundamental but which is taken as given. Explanation then takes place in a process of reconstruction or synthesis from first principles, by means of which something can then be demonstrated.

Argument in this tradition is also typically presented in what might be called a "tutorial" style of writing. The aims of many analytic philosophers adopting this style appear to be two-fold. They want to be as clear as possible to as wide a readership as possible. This fits neatly with our aims in this paper. We want to be as clear as we can about why we think data structures should matter more significantly to disciplines such as information science, information systems, and information management. But we also want to reach as much of a potential readership in these communities as we can with this style of exposition.

An Infinity of Lists

Goody (1977) provides a review of a number of uses made of lists by ancient cultures. He sees the list as a particularly important artifact because of its central role in the "domestication of the savage mind." This refers to the transition between ways of thinking characteristic of primitive societies to those ways of thinking characteristic of societies in the modern age. In a similar vein, Eco (2009) believes that societies make lists as part of their attempt to impose order or control on the world. He argues as such, that society is reflected in an infinity of lists. This idea has some pedigree. Schmandt-Besserat (1978) proposed that clay tokens dating back to 8,000 B.C. are some of the earliest examples of lists of commodities used among the first city-states. Ezzamel (2009) has argued that the construction and dissemination of lists were performative rituals critical to the maintenance of the ideological order of ancient Egypt. Urton (2003) has argued for the place of assemblages of knotted strings, known as khipu, as unique artifacts for the

making of lists among the Inka. Rosenberg and Grafton (2010) consider the history of the timeline, a particularly interesting type of list.

More recently, Lyon (1994) pointed to the dangers of what he refers to as social sorting—the way in which contemporary institutions make life-critical decisions about individuals on the basis of inclusion or exclusion of personal identifiers on particular lists. He argues that such lists are explicitly devices which serve to sort those persons regarded as "eligible members" of a particular institutional area and to exclude others, regarded as in some way "undesirable" (Lyon, 2004). Gawande (2010) takes a more positive outlook on the list, arguing for the importance of check-lists as key aids in the control or coordination of behavior in critical areas of contemporary life such as engineering and surgery.

In this paper we want to argue that lists not only have history, they make history. Lists are also debated and discussed not only in the academic media but also in the entertainment media. For instance, there are a number of infamous lists described in Black's (2002) study of the malignant institutional order which constituted the "Holocaust." He particularly focuses on the way in which this order relied on the various ways in which the Nazis used electronic tabulators to produce and manipulate lists of persons to be transported to the death camps. In another list made famous by the film directed by Steven Spielberg, nine important lists were used to assign Jews from the Warsaw ghetto to work in the factories of Oskar Schindler (Keneally, 1982). These lists enabled a small and select group to escape the death camps.

In a recent book, Usher (2014, p. xv) cogently and eloquently lists some of the key functions that lists play in human society. Many of these functions of lists will be considered in this paper.

"1. *Life is chaotic—often unbearably so. The ability to divide some of that chaos into lists, to make the onslaught manageable, can bring much-needed relief.*
2. *Human beings are fearful of the unknown and as such have a real need to label and group things, to assign them to comfortable lists.*
3. *Lists can make us more productive and eradicate procrastination. Nothing on earth, resignation aside, cuts through the thick fog of a daunting workload as effectively as a to-do list.*
4. *Everyone is a critic. Ranking things—best to worst, biggest to smallest, fastest to slowest—can be strangely addictive, no doubt because it makes us feel knowledgeable.*
5. *Time is precious. Distilling huge swathes of monotonous information into easily digestible lists ensures that we have more time to enjoy ourselves and make lists.*"

Lists and Identifiers Matter

In undertaking our analysis we therefore start with that which we shall consider fundamental but which is normally taken as given: that of a list of identifiers as a data structure. We then attempt, using speech act theory and the theory of social ontology as key anchors, to reconstruct the relationship between data structures and institutional order by examining the critical role that both lists and identifiers play in constituting institutional action. By means of this synthesis from first principles we hope to demonstrate how this reframing of the data structure has a number of important consequences for the way in which we approach data structures in the information disciplines.

We started the paper by defining a data structure as a particular way of organizing data. In this sense, a data structure is clearly an abstraction—a set of principles for both storing and accessing data. In certain literature (Guttag, 1977) this abstraction is sometimes referred to as an abstract data type. But data structures such as lists are clearly instantiated—given form. In this sense, a specific instance of a list, such as a product list, passenger list, or picking list is also a data structure (Kent, 2012). In the concrete, a data structure is used to represent things and through such representation to help constitute institutional order. In the discussion that follows we shall utilize the term data structure both to refer to an abstraction and to an instantiation, and we shall try to be clear in the body of the argument when the particular sense of the term applies.

At its most basic, a list corresponds to a *set* of elements: an assembly of distinct "things," considered as a thing in its own right. Most lists used for modern institutional purposes are actually built upon the abstract data type of the *ordered set* known as a *sequence* or a *tuple*, implying that both the elements of the list and the position of the elements in a list are significant—hence, the tuple <1,2,3,4 > is different from the tuple <2,4,3,1 > .

Treated purely as artifact, a data structure can be considered a set of data elements, which in turn consist of a set of data items (Tsitchizris & Lochovsky, 1982). In the discussion that follows we shall treat the list as a data structure consisting of a set of list-items. Each of these elements will take a similar form that we shall model upon a binary relation (Frost, 1982). A binary relation can be considered a triple of data items, in which the first data item is termed the subject, the second the relation, and the third an object. Subjects, relations, and objects are unrestricted in the original theory of binary relations (Frost, 1983). However, to start from first principles we shall use an even simpler representation in which the subject and object of such relations will be restricted to the use of identifiers, and the relation itself will be specified as an infix predicate.

Binary relations are useful because it can be shown that many other forms of data structure can be constructed from these simple, atomic forms (Frost, 1983). For instance, a related set of binary relations can be used to form a *tuple*. Tuples are an inherent and important construct in Codd's (1970) theory of a relational database. A relation in a relational database is formed from a set of tuples. This particular data structure, of course, underlies the data management systems used in mainstream digital computing systems.

But there is another reason we choose to focus on the list and identifier. We deliberately utilize the idea of the list and the associated construct of an identifier to help ground the notion of a data structure because, as is evident from the previous section, such artifacts are ubiquitous and as such are typically treated as mundane and accepted. Within the current paper we use these artifacts as sensebreaking devices—to attempt to break through entrenched and limiting conceptions embedded in the worldview of the information disciplines. We shall also deliberately use the term *list* rather than file, table (relation), or record, because the term *list* has some useful connotations in everyday English usage. People inherently connote the creation of lists with doing things. They create shopping lists, picking lists, to-do lists, admissions lists, and check-lists. But we would argue that files, tables, and records as other forms of data structure are constitutive of and help constitute institutional order, in much the same way as described for the list and the identifier in this paper.

So lists for us are sets of binary relations. Also, binary relations, at least in the context of our paper, consist of a coupling of identifiers. This suggests the first question: *What is an identifier?*

In his early publications, Searle (1970), drawing upon the work of Austin (1962), argues that the terms making up the message in some act of communication fulfil one of two functions—they refer to or they predicate things. The referring function enables actors to identify a thing while the predicating function serves to describe a thing. We use the term *thing* here in an entirely neutral way to stand for anything that can be referred to or predicated. It may be a physical thing such a person or place or product. It may also be something which has a purely institutional status such as a contract or a sale or a payment.

Referring is a critical function that allows the sender of some message to specify one and only one thing to which an utterance applies, while also providing the means for a receiver to identify the thing from the utterance. Within his theory of speech acts, Searle maintains that language is used to refer in two major ways: either through use of an identifier or through some definite description. Identifiers are particularly useful in the context of patterns of communicative action because they can refer to some instance of a thing without actually the need to describe it. They can also refer to this instance across many different communicative situations. For instance, personal names such "Joe Bloggs" are typical identifiers, while a definite description of this person might consist of the phrase "*the man with red hair and a pronounced limp*."

Why Lists and Identifiers Matter

We can demonstrate how identifiers and lists matter to individuals and organizations in contemporary institutional order using two related contemporary examples.

Traditionally a journal article is identified by a composite of its attributes such as journal name, author(s), date of publication, article title, volume number, issue number, and page numbers. This particular combination of data items is often cumbersome to use in searches for articles and is frequently error-prone, typically because of incorrect representation of such details in references. This particular approach to identification of articles is also becoming obsolete, as many online-only journals have moved away from the practice of publishing in delineated volumes and issues.

For such reasons, an approach to uniquely identifying publications or their parts through a digital object identifier (DOI) has been developed internationally. A DOI is a character string used to uniquely identify a digital object, such as an electronic document. The DOI system is implemented through a federation of registration agencies coordinated by the International DOI Foundation. Organizations such as journal publishers pay to become registrants in the DOI system, which enables them to assign DOIs for their electronic documents (DOI, 2014).

A DOI is divided into a prefix and a suffix, separated by a slash. The prefix identifies the registrant of the identifier, while the suffix is chosen by the registrant to uniquely identify a specific digital object. For example, in the DOI 10.1000/182, the prefix is 10.1000 and the suffix is 182. In terms of the prefix, *10* refers to the particular DOI registry, while *1000* identifies the particular registrant; in this case the International DOI Foundation itself. The suffix 182 identifies a single digital object—the latest version of the DOI Handbook (DOI, 2014).

One key advantage of a DOI is that it can be used to identify a complete journal, an individual article in the journal, or a single figure in the particular article. Another key advantage is that in the DOI system a clear separation is made between an identifier for a particular object and its so-called metadata, such as the location where the object can be accessed. This means that while the DOI for a document remains "persistent" for its lifetime, its metadata, such as its location, may change a number of times. DOIs plus their associated metadata are deposited by a registrant in the international DOI registry. The metadata, such as the document's location, are updated whenever this changes.

Now consider lists and why they matter. In business schools in the UK academics are encouraged by their deans to treat one particular list with respect. This is the Association of Business Schools (ABS) list of journals and their rankings. This particular list has driven the activity of academics in business schools in the UK for over 5 years.

To understand why lists matter so much, here we need to describe something of the context of this institutional order. Each year funding bodies in the UK allocate around 7.6 billion pounds sterling of research funding to higher education institutions. As major input into decisions as to where to best allocate such funding, the British government, through its funding agencies, has required all UK higher education institutions to engage in a regular audit of the quality of their research. This audit (known in the past as the Research Assessment Exercise or RAE) has been conducted in approximately a 4- to 5-year cycle, starting in 1986 (1986,

1992, 1996, 2001, 2007) (Barker, 2007). The latest audit (now known as the Research Evaluation Framework or REF) was conducted in 2013.

To help manage the process, a number of performance indicators are requested in each submission and form the basis on which the quality of research is assessed by panels. The key such performance indicator is a listing of the four best-quality publications for each academic submitted by a university under a particular unit of assessment. As such, this publication list of DOIs in association with a list of rankings of business journals becomes a key facet serving to define a "research active" member of some university department.

In the past, many panel members claim that they assess the quality of a particular submission by either reading each and every paper submitted or reading a majority sample from those submitted (Cooper & Otley, 1998). Many others believe that panel members either formally or informally use lists of journal rankings to establish a convenient proxy for the "quality" of journal papers. Within the Business and Management unit of assessment, for instance, there is much discussion of the use of one particular rankings list: that published on a regular basis by the ABS.

Therefore, the outcomes of lists and list-making often have important consequences for both institutions and institutional actors. For instance, REF panel members make decisions as to ranking of particular university departments in the UK and, as a consequence, implicitly rank the quality of research of individual academics. On the basis of a list of the rankings assigned to university departments, the UK government, through its funding agencies, decides how much to award each university in terms of research funding. For low-rated departments this means that they will receive no monies for research and will have to rely on money provided for teaching. For high-rated departments, monies can contribute many tens of thousands of pounds sterling per research-active academic. The proportion of money assigned for both teaching and research to universities is a key determinant of the amount of infrastructure support provided to academics for the conduct of research. For instance, higher-rated university departments are generally more able to provide lower teaching quotas to staff and to support activities such as conference attendance.

Lists, Identifiers, and Status Functions

Lists and identifiers clearly matter both to individuals (such as academics) and to institutions (such as UK universities). The very presence of such artifacts directs the actions of numerous different actors acting within the space or frame of numerous different institutions. But how do these artifacts work? How is it possible to theorize about the significance of lists and identifiers to institutional action?

We start by establishing that lists and identifiers are both examples of what Searle calls a status function. Searle believes that status functions can be represented as constitutive rules of the form:

X counts as Y in C

where X is some thing that counts as some other thing (Y) in some context (C).

The term *constitutive* in the term *constitutive rule* is used in that sense adopted in the work of Giddens (1984). His constitutive cycle was introduced as a means of addressing the intellectual division between an action perspective on the nature of institutions and a structural perspective on the nature of institutions (Walsham & Han, 1991). Giddens believes that these two perspectives on institution can be brought together through the idea of *structuration*. On the one hand, the structure of social institutions is created by human action. Through human interaction, the social structure of institutions is reproduced but may also change. On the other hand, humans utilize institutional structure as a resource in interpreting their own and other people's action. This means that institutions act as a constraint on human action. This cyclical process of structuration is the process through which the patterned order we consider as institution is constituted and reconstituted.

Take the idea of a DOI as an example of an identifier, which in turn is an example of a status function. As a constitutive rule the relationship between a DOI and the document it identifies might be expressed as:

X (a DOI) counts as Y (a specific journal article) in C (the registrants and users of the international DOI registry)

It is also possible to consider lists as status functions in their own right. In other words, the act of creating a list typically involves naming the list. The naming of the list acts as a form of proxy for the common context declared on the members of the list. For example, we might name a list important to the institution of the business and management panel of REF as the *list of journals in the Information Management subject area of the ABS*. We might further express the members of this list of significance to this institution and its communicants in the following manner:

Journal of the American Society for Information Science and Technology (JASIST) MEMBER OF <List of journals in the Information Management subject area of the ABS>
Annual review of information science and technology MEMBER OF <List of journals in the information management subject area of the ABS>
· · ·

Within this set of binary relations the subject of each relation consists of an identifier, while the object of each relation consists of the list. The relation MEMBER OF consists of a membership predicate that serves to form a list of identifiers. But inclusion in a list also implies an order or ranking in the list. Hence, each subject area in the overall ABS 2010 list is ordered in terms of the "star" rating associated with journals (from 4 indicating the highest ranked through to 1, the lowest ranked).

This means that particular institutional actors in the UK academy used the formation of the ABS list 2010 to constitute or "declare" the notion of the overall "quality" of a particular journal. The ranking or ordering of a particular journal in the ABS 2010 list served to "direct" the formation of further lists by other institutional actors such as the *list of publications submitted for the Information Management area by university X to REF 2014*. By implication, the assignment of a particular DOI to this latter list served to declare or constitute the "quality" of the article referred to. By further implication, the inclusion of four DOIs in this list also served to constitute the declared "quality" of particular academics working in UK higher education bodies.

The Notion of "Speech" Acts

The major claim of speech act theory is that much communication of interest to institutions is accomplished through what Searle, following Austin, refers to as *speech acts*. Within the last paragraph of the previous section various lists operate as speech acts. According to Searle, individual speech acts such as this can be viewed from at least three different viewpoints: as a locutionary act, an illocutionary act, or as a perlocutionary act.

A locutionary act defines the *content* of a speech act and is divided further into an utterance act and a propositional act. An utterance act corresponds to the act of physically creating some form from a particular substance. In contrast, a propositional act consists of the act of using such a form to refer to or predicate some things. For instance, we may speak the words "*JASIST is a 3-ranked journal on the ABS 2010 list*." As an utterance, this would be considered purely in terms of a number of forms—phonemes formed in the substance of air. As a proposition, such forms would be treated as a series of terms that identify or predicate some things of interest. Hence, JASIST is a term (an identifier) we use to refer to a particular journal.

But speech acts not only have content they have *intent*. Locutionary acts, as we have seen, can be decomposed as propositional acts and utterance acts. But speech acts are also illocutionary acts. Each speech act not only expresses the proposition being communicated, it also expresses the attitude or "force" of that being communicated. This is because illocutionary acts are focused on getting the receiver of the message to do something, to take further action. Indeed, we typically recognize that the intent of some communication has been achieved by observing the actions of the receiver and seeing whether certain conditions set by the attitude, force, or intent of the communication are satisfied. The result here is what is meant by a perlocutionary act.

Searle (1970, 1975) maintains that it is possible to formulate five key types of communicative act in terms of differences in the intentions that the actor communicating has, and which he labels with the terms assertives, directives, commissives, expressives, and declaratives. These types of communicative act can be distinguished in terms of *illocutionary force* or *propositional attitude* (the kind of attitude a speaker has when she/he says something) and the *direction of fit* between the world and the *propositional content* of the communicative act (the word).

For example*,* in terms of illocutionary force, *assertives* are communicative acts that explain how things are in the world, such as in, "*Our orders have fallen by 10% this month*." In contrast, *directives* are communicative acts that represent the senders' attempt to get a receiver to perform an action, such as—"*Please ensure that our production target is met next quarter*." *Declaratives* are communicative acts that aim to change the world through the communication itself, such as "*This order has been fulfilled."*

The term direction of fit was used by Austin (1962) to refer originally to the relationship between mental states (perhaps rather confusingly called the *word*) and reality (or what philosophers refer to as the *world*). In the work of Searle and others the *word* is expanded to denote the notion of an "utterance" discussed earlier. Three directions of fit are proposed between an utterance (word) and the world: word-to-world (intended to describe the world), world-to-word (intended to change the world), and null (making some utterance implies that some fitting to the world has already taken place). Each type of illocutionary act, as we shall see in the next section, has a different direction of fit.

The Performativity of Lists

The language-action tradition, approach, viewpoint, or perspective has been around for over 30 years, if we take the publication of a paper by Flores and Ludlow (1980) as its starting point. Generally, the term is used to refer to the adoption or translation of a series of ideas from the philosophy of language, particularly the work of Austin, some of the early work of Searle, and possibly some of the work of Habermas, into the information disciplines (Goldkuhl & Lyytinen, 1982; Lyytinen, 1985; Lyytinen & Hirscheim, 1988; Te'eni, 2006; Weigand, 2003; Winograd & Flores, 1986).

The language/action tradition is so called because of its focus on communicative action and the use of such communicative action by actors to do things. It takes something of an intellectual leap in treating a data structure, such as a list-item, as an act of communication—as a speech act. More precisely, the data structure itself corresponds to an utterance act (Searle, 1970). However, each utterance in a list also corresponds to a propositional act because the status functions comprising the utterance are used to refer to things or to describe things.

But lists, as we have seen, are not only locutionary acts, they are also illocutionary acts—they not only communicate content, they communicate intent. Take an example modified from that given by Searle (1983). Assume that a retail manager gives her procurement operative a list of products needed to replenish a particular store. Further assume that these products are referred to by the identifiers P1, P2, P3. . . . (Searle, 1983). Hence, we might represent this list as follows:

P1 MEMBER OF <Procurement list for store 1>
P2 MEMBER OF <Procurement list for store 1>
. . .

Now for the procurement operative each item in her list is an illocutionary act. It <u>directs</u> her to purchase the item referred to by the identifier. The entire list also acts as a directive to the operative. It probably establishes the action-context for the list—to procure items for store 1.

Now consider the same list used by another actor. Assume that the retail manager also employs an external consultant to audit procurement. He is therefore given access to the same procurement list as the procurement operative. The consequence of this is that the audit consultant uses the same procurement list in a different way from the procurement operative. He probably interprets each list-item not as a directive but as an assertive.

We can understand these differences more clearly by considering the direction of fit of these two lists. The procurement operative takes the list to the market and makes purchases to match items on the list. Hence, the list functions as an order or desire and has a world-to-word (list) direction of fit. It is the responsibility of the procurement operative to make the world, in terms of his purchases, match the items on the list (the word).

Suppose the man's activity is tracked by the audit consultant. The consultant writes down everything the operative orders. When both the consultant and the procurement operative return to report to the manager, they have identical lists. However, the function or direction of fit of the two lists is different. In contrast to the operative's world-to-word direction of fit, the consultant's list has a word-to-world direction of fit.

The differences between these two functions become apparent when we examine what happens when an error is made—when a breakdown occurs in the use of lists. Suppose the operative fails to procure product P1, but instead procures a different product with the identifier P1.1. In terms of the consultant's list the error is easily corrected. He crosses out the identifier P1 and substitutes the identifier P1.1. However, in the case of the procurement operative the situation is not so easily corrected. Correcting his list does not change the state of the world.

To reiterate, the consultant's list comprises a set of assertives, which have a word-to-world direction of fit. It is the function of the consultant's list to match reality—it functions as a list of assertions of what happened. In contrast, the procurement operative's list comprises a set of directives, which have a world-to-word direction of fit. It is the responsibility of the procurement operative to make the world match the items on the list (the word).

The Materiality of Lists

Within this example of procurement as an institutional process we have a clear linkage between a list of identifiers, its use for communication, and the instrumental actions effected by such communication. But there is a mysterious thing going on here. In a classic speech situation the retail manager would be issuing a series of spoken instructions to the procurement operative—"*buy P1, buy P2, . . .*" But in the example described the list is actually communicating. The logical consequence of this is that it makes sense to think of lists of identifiers as engaging in limited action—as displaying what Cooren (2004) calls "textual agency."

Data structures such as lists not only matter as institutional actors, they are clearly built from matter. The typical material of speech act theory by implication is the act of speaking. The majority of the examples cited in the work of Austin (1962) and Searle (1970) relate to actions in which one actor utters a spoken sentence and one or more actors interpret and respond to this verbal message. Speech acts are also typically analyzed as isolated utterances between two actors, although there is typically a background assumption that a particular speech act is likely to be part of a larger conversation or dialog (Searle, 1991). There are some isolated references in the extant literature associated with Searle to the idea of treating data structures such as records as speech acts—but these are only mentioned in passing and never elaborated upon in any detail.

This means that the language/action tradition makes a leap in treating data structures as speech acts. But in doing so, most of this literature tends to adhere to the assumption that the only thing that changes between a spoken sentence and a data structure is the mode and material of delivery (the utterance) (Goldkuhl & Lyytinen, 1982). All other things remain the same, in terms of the nature of a speech act.

In this section we want to challenge the validity of such a background assumption. We want to argue that data structures not only differ from the spoken word in terms of delivery mode—there are a number of specific characteristics of data structures which might explain their special status in the constitution of institutional order. There are not only a set of subtle differences between what an utterance act means in relation to data structures as compared to speech, there are consequential implications for ideas of agency associated with data structures that relate to the particular materiality of such form.

First, there is the fairly obvious point that, whereas it makes sense to talk of a *speaker* and *hearer* or more broadly a *sender* and *receiver* in terms of acts of speech, it makes more sense to refer to the *writer* and *reader* of a data structure or more broadly perhaps a *creator* and *user*. Both an act of speech and an act of creating a data structure are likely to be embodied acts (Mingers, 2001), meaning that an actor uses one or more parts of his effector apparatus in making the spoken sentence or the data structure. In the case of the spoken sentence the actor primarily uses his larynx to manipulate sound. In the case of the data structure, however, the actor creates or forms an artifact from some persistent material, typically using further artifacts, such as a digital computer, in the production of the data structure itself.

Second, this difference in labeling of actors is related to a difference in the material from which data structures are formed, as compared to the material of speech. Speech is clearly composed of sound waves which degrade in air. This means that the life of an act of speech is a short one and inherently bound to a specific performance of situated action between two or more actors—all of whom are co-present. A data structure in comparison is typically designed to persist beyond the act of creating this artifact. This inherently means that a data structure, as an instance of written communication, has a "life" over and above the actors who produce and consume it (Derrida, 1971).

Third, in the case of an act of speech it makes sense only to think of one actor sending or "creating" a series of sound waves and another actor (or a limited number of co-present actors) receiving or "reading" such vibrations in air. In the case of the life of a data structure it is likewise initially created once by a certain actor. The artifact should also be deliberately disposed of or deleted once by one actor. In this sense, there must be a deliberate act of "forgetting" as well as "remembering" in the case of data structures. But within its intervening "life" the data structure may be read and possibly updated a number of times and these acts may be undertaken by a multitude of different actors. In this sense, any one data structure in terms of its life-history is perhaps better considered an institutional "conversation" or "dialog" between some defined collection of actors.

Fourth, the whole point of creating data structures is to enable communication across time and space between multiple actors. The elements of a list, for instance, as "utterance" persist beyond their act of production (Derrida, 1971). The very persistence of the list-item enables it to fulfil a purpose subtly different from speech: that of referring to or predicating things across time and space to multiple actors. This means that the creator of a data structure is likely to be remote from the consumer of this data structure—where the term remote implies some temporal distance as well as probably some spatial distance. The communication is also likely to travel between one actor and many other remote actors, in such senses.

Fifth, the properties of a data structure listed earlier lead us to break with the framing of the data structure employed in much of the language/action viewpoint—that only humans act in relation to data structures. In other words, humans have agency but data structures do not. Following Cooren (2004) and others (Agerfalk, 2004; Ashcraft, Kuhn, & Cooren, 2009), we feel it important to think through some of the consequences of applying speech act theory to the idea of data structures—namely, to think of data structures as having agency.

Agency is typically defined as the ability to perform actions that have outcomes (Rose, Jones, & Truex, 2005). Agency is a characteristic of agents and an agent is seen as any-thing that can produce an effect or a change. Clearly much action within contemporary institutions is not enacted by humans but by machines, particularly by information technology (IT) systems. This means that the concept of agency is particularly problematic for any discipline that attempts to deal with the relationship between technology and institution. In social determinist accounts only humans have agency. In technological determinist accounts technology has agency in the sense that technology influences institutional activity.

Cooren (2004) and others attempt to develop a middle ground where technology, such as data structures, not just serve to influence but serve to constitute institutional activity. He makes the key argument that "texts" such as reports, contracts, memos, or work orders can be said to be performing action that have outcomes in the sense of producing effects upon the actions of other actors. In short, texts on their own appear to make a difference to institutions and as such should be considered as having a limited form of agency. To demonstrate this he provides a number of thought experiments. For instance, imagine a visual sign placed in the reception area of an organization building. This sign acts in the sense of directing people to do certain things such as swiping their entry pass at the entry gate or visiting reception to authorize their entry. As such, the sign stands in place of particular actions typically undertaken by security personnel responsible for controlling organizational entry. The sign acts to instruct people without the need for security personnel to reiterate the same thing time and again in acts of verbal communication.

The key argument we make here is that we should adopt the stance of considering artifacts such as data structures as displaying the potential to take limited action in the production and reproduction of institutions. In doing so it becomes possible to consider lists of identifiers as particularly potent actors in the constitution of institutional order. List-items serve to stand in place of the assertions, commitments, directions, or declarations of particular human actors in multiple situations where such actors are not co-present. This idea is indicative of "the communication as constitutive of organization" viewpoint—the idea that "*communication generates, not merely expresses, key organizational realities*" (Ashcraft et al., 2009, p. 3).

Institutional Facts and Social Ontology

To help understand the place of the list and the identifier in the formation of institutional order we need to unpack two further concepts from Searle's theoretical edifice. We need to explain how constitutive rules produce institutional facts and how such institutional facts help constitute social ontology (institutional reality).

For Searle, institutional facts are the very "stuff" of social reality and he contrasts such facts with what he calls brute facts. Brute facts are matters of brute physics, chemistry, and biology, and as such, these facts exist independently of human institutions. An example of a brute fact is that *the sun is 93 million miles from the earth*. In contrast, institutional facts are matters of culture and convention. They exist only within the context of human institutions, such as *JASIST is considered a 3-star journal on the ABS list 2010*.

Institutional facts rely on the background of collective intentionality ("aboutness"). In *Making the Social World* Searle (2010) adds a further claim: that status functions are created through declarative speech acts. This results from that peculiar property of such declarations, which we have already seen—that they have both a world-to-word and word-to-world direction of fit. Collective intentionality is thus built from mutual acceptance or recognition of status functions by a group of actors. We, as actors, make something the case by declaration that a given status function X exists.

So the social world relies upon collective acceptance of status functions. But such acceptance by its very nature is not permanent, it is temporary. It relies upon the continual accomplishment by institutional actors of collective intentionality. This is why in the next section we use the metaphor of scaffolding the institutional order. Lists and identifiers are important elements in the institutional order, but they always contain in their application the potential for the breakdown of such order.

We use the term *breakdown* here in the sense adopted in the philosophy of Heidegger and utilized by some proponents of the language/action tradition (Winograd, 2006). Such proponents adapt this concept from Heidegger's insistence that things and their properties are not inherent in the world but arise only in an event of breaking down, a process in which human actors undergo an experiential shift in which things change from being ready-at-hand to being present-at-hand. The classic example of the hammer and the nail is typically used to explain this experiential shift. To a person hammering in a nail the hammer as such ceases to be foregrounded in perceptual terms. In Garfinkel's (1967) terms it is seen-but-unnoticed; part of the background readiness-to-hand that is taken for granted. The hammer presents itself as a hammer only when there is some kind of breaking down, such as when it breaks, slips from the hammerer's grasp, or bends the nail. In a similar manner a data structure, such as a list or list-item, is normally ready-to-hand. Only when there is some breakdown, such as when the identifier fails to identify something or a list-item identifies or classifies the *wrong* thing in institutional terms, do we experience it as being present-at-hand.

The primary difference between a brute fact and institutional fact relies on the different status that such facts have in relation to some theory of existence—some ontology. Brute facts are observer-independent. Within a brute fact the status of the thing referred to has an existence independent of institutions. Indeed, brute facts are independent even of the institution of language. In contrast, institutional facts are observer-relative. Within an institutional fact the status of the thing depends on a collective attitude or acceptance by the actors concerned that the thing has a certain function. This actually defines the notion of a status function for Searle.

One might be tempted to use this polar distinction to make the claim that institutions deal solely with institutional facts. Institutions, such as manufacturing companies, healthcare organizations, or higher education institutions, clearly have to deal with both brute facts and institutional facts. Indeed, many things can be referred to and described not only by brute facts but also by institutional facts. Searle has even acknowledged that, whereas brute facts are independent of language, we need language to represent such facts (Searle, 2006, 2007).

Consider a thing familiar in the institutional context of manufacturing—that of a stillage. Stillages are physical things and as such have an existence independent of the institution. In other words, they can be described in terms of brute facts such as—*a stillage is a steel box being approximately 1 meter in depth, height, and width*. These brute facts can be confirmed by any observer of such objects.

But what is the function of a stillage? A stillage may be a physical structure but these physical structures are assigned a particular status in the institution concerned. A stillage is used to store various stages of finished product—"stock"—in the context of the manufacturing plant. We might even frame the constitutive rule in this case as being:

A stillage (X) actually counts as a unit of stock (Y) in the manufacturing plant (C)

In the same way, treated purely as a material artifact, as a form, a data structure can be considered a brute fact, or more accurately a series of brute facts. In other words, as a sequence of perhaps written letters or numbers a particular identifier is observer-independent. But this term can also be treated as both an informative and a performative artifact. As such, this term acts in the capacity of what Searle calls a status indicator. This is because "*we impose intentionality on entities that are not intrinsically intentional. A status indicator is a representational device that allows an entity to represent something beyond its physical features*" (Searle, 2006, p. 21). Hence, a passport number, postcode, or a commodity code, as we shall show, are all brute facts that act in the capacity of status indicators to institutional facts.

The Scaffolding of Lists

Scaffolding has been applied particularly as a metaphor in areas such as learning theory, child development, and distributed cognition. In such areas *scaffolding* is a term used to refer to augmentations that allow humans to achieve goals that would normally be beyond us. The scaffold helps structure human action by supporting and guiding it. But such scaffolding also serves to discipline or guide such action. This idea appears to have a certain synergy with Giddens's constitutive cycle discussed earlier.

We have argued in the current paper that lists and identifiers are critical scaffolding in the institutional order. In this section we examine this notion of scaffolding more closely to learn what it tells us about the nature of institutional lists and identifiers.

Orlikowski (2006, p. 461) describes certain characteristics of physical scaffolding that provide insight into the way

in which what she refers to as "*everyday knowing in practice*" is constituted. It is useful to reflect on some of these characteristics and apply them to understanding the case of the list and identifier as material scaffolding for institutional order. According to Orlikowski, scaffolds are temporary, flexible, portable, dangerous, generative, and constitutive.

Scaffolds are temporary structures designed to support particular aspects of construction. Once this aspect of construction is regarded as complete they are dismantled. Scaffolds are flexible in the sense they are erected in many different situations but adapted to the particular exigencies of the situation. Scaffolds are portable. They can be quickly and easily assembled and disassembled across many different sites. Scaffolds are dangerous. Because they are temporary, flexible, and portable they are vulnerable to breakdown and failure. Scaffolds are generative in the sense that they augment the process of physical construction. Finally, scaffolds are constitutive in the sense that they play an important part in affording the very act of construction.

Although we tend to regard our lists of identifiers as permanent, they are in fact temporary structures, with a lifespan typically determined by the duration of the institutional order they scaffold. The very value of lists lies in their flexibility. As symbolic artifacts the general principles of listing and identifying are applicable and adaptable to many different situations. They are particularly portable structures in the sense that we can expand and contract lists to account for many different institutional situations. They are dangerous in the sense that our infrastructure of lists and identifiers contain within them the potential for breakdown. But they are necessary because they are generative of institutional facts. And such institutional facts are constitutive of the institutional order itself.

However, we should be careful not to take the metaphor of scaffolding too far in relation to data structures. Unlike physical scaffolding, which tends to afford the acts of construction or repair, the scaffolding of data structures is a crucial part of the action of institutions. Lists of identifiers are necessary to institutions because they are constitutive of the institutional order itself. Hence, the scaffolding of lists is not something external to the idea of institution, it is critical to the institutionalizing process itself.

Lists of identifiers are normally ready-to-hand for institutional actors and are initially created typically to scaffold some delimited domain of routine institutional action on the part of such actors. However, over time such scaffolding is often extended to supporting other aspects of institutional action not framed by the initial contextualization of such lists. This sometimes assumes the status of interinstitutional scaffolding and in such situations the scaffolding of lists is particularly prone to breakdown.

To help ground the theorization established we consider in the next three sections a number of contemporary examples of lists of identifiers that are crucial to form-ing order in and between a number of institutional domains. We begin with personal identifiers that scaffold the developing area of digital identity management. We then consider the related identifiers of place and identifiers of products. These three particular types of lists of identifier are critical scaffolding for contemporary interinstitutional orders underlying electronic commerce and electronic government.

Identifiers of People, Place, and Product

To demonstrate how personal identifiers work in scaffolding institutional order, consider one particularly significant example of a personal identifier—the passport number. Each country in the world is able to create its own *form* for such an identifier. In the UK a passport number currently consists of nine digits. So key facts important to the institution of governance in the UK are established in the form:

[< *Passport no.* > *REFERS TO* <*Person*>]

For instance:

[*109999555 REFERS TO Joe Bloggs*]

Note, we cannot actually represent or record as a fact the relationship between a physical thing and an identifier directly. We have to use other terms as proxies. The fact we have just listed above actually relates two identifiers. One is a "natural" identifier and consists of a personal name; one is a "surrogate" identifier, created by a particular institution (in this case the UK Passport Office on behalf of HM Government) to uniquely refer to a particular person. Both natural and surrogate identifiers can refer to some thing, but surrogate identifiers are used by institutions to attempt to enforce the uniqueness of reference across contexts or situations important to the institution concerned. Hence, the surrogate identifier *109999555* will always refer to one and only one British citizen or citizen of the British Overseas Territories. In contrast, while the natural identifier *Joe Bloggs* is sufficient to refer to this person in many contexts, in certain situations the referring function will break down, because there are likely to be more than one person named *Joe Bloggs* in the UK.

Now consider lists and why they matter to the institution of governance—particularly lists of identifiers. Suppose we build a list of the following form:

[*109999555 REFERS TO Joe Bloggs*]
[*105599544 REFERS TO Anwar Prakash*]
[*103399565 REFERS TO Zu Cheng*]
. . .

This list can be used in a number of different ways by different institutional actors across different government agencies. For instance, a member of the UK Passports Office can use this list to *declare* British Citizens. In doing so, such actors are inherently using the identifiers in this list to instantiate a class, in the following manner:

[*109999555 ISA British citizen*]
[*105599544 ISA Citizen of the British Overseas Territories*]

[103399565 ISA British citizen]

. . .

The relation ISA in these list-items serves to classify a particular identified person as a British citizen or as a citizen of one of the British Overseas territories. Passports and passport identifiers were originally designed to enable the declaration of citizenship in the activity system of international travel. But such tokens and identifiers are now used in many other situations relating not only to government and its agencies but to interaction with private sector institutions.

For instance, a member of the UK Borders Agency can use a list-item from the list given earlier to authenticate a person. In other words, an institutional fact from this list *asserts* that the individual is who they say they are. But passports and passport numbers are used as a form of personal identification in many other settings. For instance, many financial institutions demand the strong authentication provided by a passport when opening a bank or building society account in the UK. Passports are also frequently used by young people to prove their age in situations such as the purchase of alcohol. The usefulness of this token and associated identifier is particularly evident in that some 71% of the UK resident population hold a passport, according to the 2011 census.

Passport numbers are, of course, not the only identifiers important to the scaffolding of governance. Other personal identifiers are used in other institutional settings and provide access to the activity systems of these institutions for individuals. For example, the NHSNo (National Health Service number) is used in the institutional context of the National Health Service, while a national insurance number (NINo) is used in the institutional context associated with legal employment by UK institutions.

Identifiers, as we have seen, do not describe. For this, constitutive rules need to work in a process which Searle refers to as the iterative or recursive application of constitutive rules (Searle, 2000). This is the process by which one status function counts as another status function, which in turn counts as another status function, and so on . . . In other words:

A counts as B; B counts as C; C counts as D . . .

The process of iterative recursion of constitutive rules is particularly evident in the way in which actors use status functions to abstract. The idea of classification or instantiation (ISA), which we have already discussed, is a key example of abstraction. As we have seen, as a constitutive rule, classification can be expressed as:

X ISA Y in C

The relation ISA (Brachman, 1983) here may be taken as a special type of counts as relation, in the sense that one status function X is taken as representative of a more encompassing status function Y. Within this rule X is normally a placeholder for some identifier, while Y is a class or category to which the

thing identified by X applies. C denotes the institutional context in which this particular classification rule holds.

Constitutive rules are important because they serve to generate institutional facts. Hence, an example of an institutional fact generated by the instantiation rule would be:

[109999555 ISA British citizen in the context of international travel]

Institutional facts such as this not only serve to identify these particular things to the institution concerned, they bring these things into existence for the institution. Hence, such facts serve to help define the so-called *ontology* of the institution—its notion of what reality is. Institutional facts such as what counts as a British citizen clearly do not work in isolation. They typically work within lists. The very act of creating or making an item within a list brings these things into existence, through a process of declaration.

A passport as an identity token does not just, of course, contain details of the passport identifier which refers to a particular person. The passport number as the main identifier is not the only status function used on a passport. Hence, when a particular passport is issued it serves to declare a whole series of institutional facts about the person, such as:

[109999555 GIVEN NAME Joe]
[109999555 SURNAME Bloggs]
[109999555 DATE OF BIRTH 15/03/1957]
[109999555 SEX male]
[109999555 NATIONALITY British]

The relations between status functions here are all matters of attribution or designation. In other words, they all describe or attribute particular values to a particular person. Hence, through a process of recursion of status functions we start to *form* a necessary scaffold for that part of the institutional reality which is defined by the context in which these facts are utilized—whether this is in international travel or financial transactions or acts of leisure.

We can demonstrate the importance of lists of personal identifiers to scaffolding both the intra- and interinstitutional order by considering what we have termed in previous work the *personal identity web* (Beynon-Davies, 2006, 2007). Individuals in the information society utilize a complex web of personal identification for existence and action. In our information society an individual may take on a number of different identities—one for each electronic service in the public, private, and voluntary sectors with which the individual engages.

As a consequence, an individual may accumulate a vast array of personal identifiers for such "services" and is also likely to accrue a range of physical representations or tokens of such multiple identification: credit card, debit card, driving licence, passport, library card, parking permit, etc. This means that organizations spend considerable effort in collecting, storing, and maintaining lists of personal identifiers of various forms. The public sector, in particular,

typically experiences key difficulty in tracking the institutional facts of personal identification across multiple agencies. In the UK, for example, a report from the Office of National Statistics (ONS, 2005) estimated that in 2005 there were approximately 300 million personal contact detail records held in the UK public sector—each with their own personal identifier. This constitutes almost five such institutional facts for every UK citizen, and excludes, of course, all the array of other institutional facts making up the personal identity web.

Therefore, the central place of the list in forming contemporary institutional order can be demonstrated in terms of the problematic of personal identity management, sometimes referred to as digital identity management (Neubauer & Heurix, 2010). Expressed purely as a technological issue, this can be seen to involve the use of various technologies to manage identifiers associated with persons in their use of IT systems. It should be apparent from the previous discussion that we wish to broaden this conception. For us, digital identity management resolves around the use of lists of personal identifiers used as collective declarations of significance. This particularly helps explain how and why the management of personal identity through such lists is such a problematic area for modern individuals, organizations, and societies (Whitley, Gal, & Kjaergaard, 2014).

Personal identity management is a term used to conflate three critical and entangled processes of signification: authentication, identification, and enrolment. Authentication involves answering the question—*Am I who I claim to be?* Authentication is typically signaled by lists of personal identifiers: utilized and possibly stored in some institutional system of data structures. Personal identifiers, as we have seen, are status functions used to reference an individual actor. Identification in the large involves answering the question—*Who am I?*—and is typically signaled to institutions by attributes or properties stored about the individual, including a recorded history of events in which the individual has participated. Enrolment involves answering the question—*What can I or should I do?*—and involves constituting the range of expectations used as both a resource and a constraint by actors in a particular institutional domain of action.

Take the issue of identity fraud, which usually results from identity theft. Identity fraud occurs when someone uses personal data gained about another person (particularly personal identifiers such as usernames and passwords on an access control list) to "impersonate" that person. In such situations the identifiers serve to institutionally count as the person in situations of remote action. Identity theft occurs when an unauthorized person uses another person's identity to make purchases or engage in other illegal activity (Jones & Levi, 2000). What is interesting is that the focus on digital identity management and its related issues is a comparatively recent phenomenon. Poster (2006), for instance, finds no reference to the notion of identity theft before 1995. Indeed, the US government only made identity theft a crime in 2003.

This suggests that both identity fraud and identity theft only became significant in the context where various remote but communicating actors rely on lists of identifiers for the constitution of their collective intentionality. The rising amount of identity fraud and the identity theft upon which it is based is actually the fraudulent use of identity only in the sense that much of our institutional sense of who people are and what they are entitled or expected to do—both institutional facts—is represented in a multitude of lists shared across multiple actors working in many different institutional realities. This constitutes the contemporary problematic of digital identity.

Identifiers of Place

Another critical element of the scaffolding of much institutional order is the identification of place. A particular place is normally referred to through the identifier of some address, Hence:

[<Address> REFERS TO <Place>]

Addresses, as we shall see, scaffold institutional action in a number of ways. Within the urban landscape of much of the world, identifiers of place are typically formed as compound status functions. By this we mean that they are formed as a compound of a number of significant elements, typically organized in some hierarchical manner. Hence, addresses are often formed from house numbers, street names, town names, or city names and possibly even country names. For instance:

[<12, Friars Road, Dagenham, England, United Kingdom> REFERS TO <Place>]

To help manage identifiers in the institutional order of place, many countries have introduced a much more succinct form of surrogate identifier, critical to scaffolding a number of contemporary institutional contexts. The postcode in the UK, the zip code in the US, and the Postleitzahl in Germany all have different forms and work in slightly different ways. In this section we shall therefore focus on the British postcode.

In the UK a postcode is an alphanumeric identifier between five and eight characters long. It consists of two parts divided by a space. The outward code consists of a postcode area and postcode district. The inward code consists of the postcode sector and postcode unit. In contrast, in the US a zip code consists of a sectional center facility code (SCF code) followed by a postal-zone number followed by a hyphen followed by an add-on code.

Postcodes are not simple identifiers. This is because what they refer to in relation to place varies. Within the UK, for instance, each postcode unit can identify a street, part of a street, a single address, a group of properties, a single property, a subsection of some property, an individual organization, or a subsection of some organization. What is

appropriate in each case is often based on the amount of mail received by the postcode unit. Hence, the following identifier,

[PO16 7GZ REFERS TO <A particular set of residences in Fareham>]

Whereas, the following identifier,

[CF99 1NA REFERS TO <The National assembly of Wales>]

As revealed in their name, postcodes were originally designed as supporting scaffolding for the delivery of letter and parcel mail. They were particularly designed to expedite the delivery of mail by improving the mail sorting process. But breakdowns still occur in this institutional setting. Mail still gets delivered to the wrong address. Part of the reason for such breakdown revolves around the granularity of the postcode. In other words, a postcode frequently identifies an area of residences rather than a particular residence. This is part of the reason that Ireland, which never introduced postcodes, is now introducing a more sophisticated form of identification based on a seven-digit code that will uniquely identify each of its 2.2 million residential addresses (Economist, 2014b).

The list of postcodes in current use in the UK is maintained in something known as the Postcode Address File. This list establishes not only the form of identifiers but also the boundaries of each postcode unit. This list currently serves to enable the identification of approximately 29 million delivery points. But this list is not a fixed structure. To cope with the continually changing nature of the built landscape in the UK this list is continuously maintained and periodically updated.

But postcodes help scaffold various other types of contemporary institutional action beyond the mere sorting and delivery of mail. Many commercial and public satellite navigation systems allow the user to navigate to an address by street number and postcode. This may be life-critical in cases in which an emergency response ambulance needs to arrive within minutes at a particular incident location. Life insurance companies and pension funds frequently use postcode areas to assess the longevity of customer segments and determine appropriate pricing for premiums and contributions. Car insurance companies frequently use postcode area as a convenient proxy for the risk of events such as theft or accident. Primary healthcare units and secondary schools use postcodes to define the catchment area for their services.

Because of its ubiquity as an identifier of place, postcodes in many institutional areas have become indicators of social status. The perceived linkage between house pricing and postcode area means that residents sometimes campaign to the Royal Mail to change their postcode to that of an adjoining area. Conversely, the catchment area of some desired school, as formed in a list of postcodes, frequently influences house pricing.

The addressing of place is thus not only important scaffolding for the constitution of intrainstitutional order, it is critical for effective interinstitutional action. For this reason, many countries have decided that the management of lists of identifiers of place is too important to be left to individual institutions. Denmark, for instance, has one central body which publishes and updates addresses (Economist, 2014a). In the UK, the official address register known as the National Address Gazeteer is owned by a private company established in a partnership between central and local governments.

Identifiers of Products

Finally, we consider the identification of products. In particular, we shall consider the mechanics of using barcodes as classifications of standardized commodity coding and the use of such systems of classification in identifiers for products.

A barcode is a machine-readable representation of a code. Traditionally, barcodes are one-dimensional representations that serve to code data in terms of the widths of lines and spaces between lines. Typically, such a code is used as an identifier for many different things in many different institutional settings. Almost every food retail store, from the largest to the smallest, now sells products that contain barcodes. Patients in hospitals are frequently tagged with plastic bracelets containing barcodes. Books and other forms of documents are now given barcodes for ease of tracking. Airline luggage is frequently tracked across the world using barcodes.

The relationship or mapping between a barcode as form and what it refers to is frequently and perhaps confusingly termed a symbology. The most commonly used form of symbology is that to standard commodity coding. The European Article Number (EAN), now renamed as the International Article Number, is widely used in association with a standard for barcoding. As a form it consists of 13 digits in which the first 12 digits code the item and the last digit acts as a check digit. The first three digits of an EAN identify the member organization to which the product manufacturer belongs. The next three to eight digits identify the manufacturer itself, whereas the last two to six digits identify the product itself.

Strictly speaking, a barcode in the realm of commodity coding typically does not identify, it classifies. In this context, a barcode as an existential object classifies some thing as a particular product class. But barcodes can be used to represent not only commodity codes but also serial numbers. In this extended form a barcode can actually both refer to and classify some thing:

[12345–5901234123457 REFERS TO <A particular product>]
[5901234123457 ISA <product type>]

Food retail outlets in the European Union use identifiers such as this in various aspects of performance: tracking

goods from suppliers, controlling stock in warehouses, managing food displayed in supermarkets, and associating particular products sold with sales made to customers. To facilitate standardization of data and hence effective analysis for management information, many forms of electronic procurement will use standard commodity classification coding. Such standard coding schemes may also enable faster searching for a particular item among a range of possible suppliers. Commodity coding involves the assignment of standard codes to item records (at the part number level) and to purchase orders (at the purchase order line item level). So a simple coding scheme in association with their use as identifiers is critical to a vast amount of organizational communication, decision-making, and action in and between contemporary institutions that engage in commerce.

Conclusion

We return to the three major objectives set for this paper in its introduction.

As a first objective, we have attempted to develop a better theorization of the data structure, drawing upon work in speech act theory, the language/action tradition, and conceptual modeling.

In this paper we have attempted to focus an exercise in sensebreaking by considering the ontological basis of data structures through a close examination of two apparently mundane but related symbolic artifacts—that of the list and the identifier. Considered as a data structure, a list consists of a set of list-items, each of which can be considered a binary relation. We also restricted our consideration of binary relations to those containing identifiers, predicated in some way. Identifiers are terms that refer to some instance of a thing across many different communicative situations. Because of the function they serve, identifiers are particularly important data items in larger data structures utilized by all institutions.

Although not specifically proposed as such in speech act theory, the language/action tradition considers data structures, data elements, or data items (such as lists, list-items, and identifiers) as speech acts. This means that we can analytically decompose any data structure into a locutionary, illocutionary, and perlocutionary act. As a locutionary act, for instance, a binary relation can be further considered as both an utterance act and a propositional act. As an utterance a data structure is some form created from some substance. As a propositional act the data structure is considered as a set of "forms" that refer to or predicate some things.

But data structures as speech acts are also illocutionary acts. Each data structure not only expresses the proposition being communicated, it also expresses the attitude, "force" or intent of that being communicated. This is because illocutionary acts are focused on getting the receiver of the message contained in a data structure to take further action. We recognize that the intent of the data structure as communication has been achieved by observing its perlocutionary effect. In other words, data structures are not only

forms, they serve to in-form, which in turn cause people to per-form.

Gawande (2010), for instance, argues for the central place of the check-list in improving systems of healthcare. A check-list, like the procurement list we mentioned in the body of the paper, can be treated merely as a set of descriptions. Each description on Gawande's check-lists has a specific intent—they direct multidisciplinary healthcare teams to do certain things in specific sequences. The end result, if such lists are successful, is that appropriate procedure is followed in terms of medical intervention. Appropriate medical procedure is likely to contribute, in turn, to successful medical outcomes.

As a second objective, we have attempted to show how data structures in their capacity as speech acts help form institutional order. To do this we drew heavily upon the building blocks of Searle's social ontology—status functions, constitutive rules, and institutional facts.

We have argued that making or form-ing a list-element consisting of identifiers is a significant part of the way in which modern institutional reality is constituted (Searle, 2010). Lists take a central place in the way in which organizations and society at large form order through the construction of institutional facts that declare states of the world (March & Allen, 2014). Such facts rely on a background of collective intentionality and are used as a key resource in communicating and reinforcing the nature of institutional order through action.

Identifiers can only be used to refer to things. Such things may be physical things or what Eriksson and Agerfalk (2010) refer to as "institutional objects." But through a process of iterative or recursive application of constitutive rules such status functions are typically used to connect to other status functions that designate and prescribe.

Identifiers are particularly used to authenticate "things" (people, places, commodities, etc.)—to declare their existence to institutions. But identifiers are not isolated artifacts. We typically collect together such constructs in lists, and it is the list which typically stands as a proxy for the institutional context of the identifiers in the list. Thus, through this process of membership, identifiers in lists form critical scaffolding for the identification of things. They serve to help construct institutional facts which constitute the reality for the institution concerned.

As a third objective, we utilized the metaphor of scaffolding to show how lists and identifiers afford institutional action. Three domains of identification were used to ground this analogical thinking. We considered identifiers of people, places, and products and attempted to show how lists of such terms act as scaffolding not only for intrainstitutional action but also for interinstitutional action. We also hinted at the ways in which such scaffolding by its very nature is prone, on occasion, to break down.

Just like Bowker and Leigh Star (1999), the exercise we have attempted here can be seen to employ a meta-level of analysis above that of particular technologies; a way of unpacking the enacted environment in which IT systems are

designed, constructed, and used. This enables us to understand not only the ways in which order is constituted but also the ways in which breakdowns (Bødker & Grønbæk, 1991) can occur in contemporary institutional order. But the work considered in this paper differs in a number of respects. Bowker and Leigh Star, for instance, make a convincing case for the place of classification schemes as critical elements of institutional infrastructure. However, their theorization does not attempt to explain the "mechanics" of how the data structures reliant on such classification support and frame institutional action. This has been the objective of the current paper.

Clearly, digital computing and communications technology has made the making of and use of lists much easier. Larger lists can be built and such lists can be manipulated far more quickly than in the past; such manipulation being particularly reliant on the constructive importance of the identifier. Hence, it is comparatively easy to search a list containing millions of identifiers in many varied and complex ways in a matter of a few seconds. The practical ease with which modern list-making can occur, linked to the increasing rationalization of action in modern life, has meant that we rely on lists more than at any time in human history. However, the increasing ease with which we can create and manipulate lists frequently masks much of the nature of lists as significant artifacts.

Lists of identifiers act not only as supporting "infrastructure" (Bowker & Leigh Star, 1999) or "scaffolding" (Orlikowski, 2006) in particular organizations, but as institutional objects shared between organizations. The identifiers of people, places, and products are particularly important scaffolding not only for the actions of governance but also for the actions of commerce. Such data are typically held in registers of various forms—basic information systems storing necessary identity data. Because of the criticality of such data structures, many nation states have made efforts to centralize registers of identification. In Finland, for instance, four base identity registers are specified by central government: a personal identity register, an enterprise identity register, a building identity register, and a land identity register (Rekisteripooli, 2003).

But lists of identifiers as institutional objects not only serve to constitute institutional order but also are critical elements in breakdowns in such order. For instance, lists of personal identifiers act not only as critical scaffolding in the inter- and intrainstitutional order, such lists help form a considerable problematic for modern individuals, organizations, and societies (Whitley et al., 2014). Breakdowns in institutional order are evident in the case of the Criminal Records Bureau in the UK (Beynon-Davies, 2011), the ownership of automobiles in the European Union (Agerfalk & Eriksson, 2011), and in the management of foreign students in higher education in Sweden (Eriksson & Agerfalk, 2010).

Much has been written in communities of practice, particularly in the public sector, about both the potentialities and pitfalls associated with the sharing of lists of personal identifiers between institutional agencies. The framework and approach described in this paper allows us to unpack not only the key function that lists play but also some of the inherent dangers that lie in any attempt at list-making. In future work we particularly wish to use such sense-making to demonstrate the importance of understanding not only how intrainstitutional order is constituted but also how interinstitutional order relies on the collective declaration of significance through the scaffolding of data structures.

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