Article

Social Ontologies Online: The Representation of Social Structures on the Internet

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Abstract

It is commonly said that "there are" social structures on the Internet. But how can they exist there, how can we identify and classify them? A theoretical and methodological framework is presented that describes the relationship between data structures, algorithms, and different types of social structures. We suggest that the latter are "represented" online in different senses of the word: They are not only described, but, by manipulating data, social structures can also be constituted and modified. We then outline a methodology for the analysis of social structures on the Internet: By analyzing the practical meaning of the structures of Internet platforms, we can reconstruct their providers' and users' ontological commitments (i.e., what kinds of social structures they have to assume "there are").

Keywords

social structure, Internet, ontology, theory of action, algorithms, analytical philosophy

It is said that "there are" certain social structures on the Internet or the Web 2.0, such as groups, social networks, or communities (e.g., Boyd, 2007; O'Reilly, 2005), that social structures are "built into" the Internet (Flanagin, Flanagin, & Flanagin, 2010), or that we can describe software "as" culture (Fuller, 2003). So according to the scholarly literature and non-scientific discourses, a number of specific types of social structures "exist" on the Internet in some way. However, three fundamental questions can be asked when confronted with the aforementioned types of statements.

First, what does it mean if we say that there "are" certain social structures on the Internet? How can they "exist" there (a question of *ontology*)? This question is intimately linked to a second one: How can we identify a structure, that is, how can we be certain that we are confronted with one type of structure instead of another, and how can we choose among competing descriptions (a question of *methodology*)? We will see that this "existence" cannot be understood in an essentialist way, but we argue that structures are symbolically represented online, that they consist in meaning ascribed to algorithms and data structures by users and providers of Internet platforms.

So far, research has focused on a few types of social structures that have been regularly identified on the Internet. Furthermore, most of the contributions describe only one or very few types of structures. We find publications on forms of sociality such as communities, networks, social relationships, or groups (cf. also Peng, Zhang, Zhong, & Zhu, 2013, who found "community" and "networks" to be among the most important keywords in the subfield of Internet studies dealing with social implications).

However, it has been criticized that concepts such as community, network, and peer production have been used too unreflectedly, that the classical social theories behind them have been neglected, that they have become catchall terms, and that they normalize particular forms of sociality while disappointing when used to describe structures and behavior on the Internet empirically (Fernback, 2007; Juan, 2013; Kreiss, Finn, & Turner, 2011; Mejias, 2010; Postill, 2008).

Therefore, a third question arises: Is the Internet really only about these few types of structures? And how can we classify the types of structures we encounter? If we accept the criticism of sometimes imprecise structural analyses, we have to clarify what it means for a type of social structure to exist online. We therefore propose a theoretical framework that helps identifying the whole range of social forms that have

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been described by theorists and researchers of social structure: When, exactly, is a type of structure present on the Internet? If some structures described in social theory do not have an equivalent on the Internet, we may then ask why. However, in the present article, we would only like to describe a general methodology to deal with the existence and (potential) diversity of social structures on the Internet, while we hope to provide approaches to a typology elsewhere.

First, we clarify the relationship between data structures, algorithms, and social structures. We introduce distinctions between different types of structures, explain our focus on "represented" structures, and draw some methodological consequences. We then turn to the concept of ontology and justify our approach as mainly a program of interpretive empirical social research. Analyzing different meanings of "representation," we finally explore the role of acts and algorithms.

Data Structures, Algorithms, and Representations

To begin, we must acknowledge the peculiarity of data structures if they are to represent social structures: their arbitrariness and abstraction, combined with the potential of automated processing.

Technically speaking, the software that Internet services are based on consists of algorithms and data structures (Wirth, 1976) that are highly unspecific. For example, databases can contain information on any kind of entity, and search algorithms work regardless of the types of patterns being matched. What makes them specific is not their encoding and technical layout, but some meaning ascribed by their users and providers. Data structures and algorithms abstract from their meaning, and meaning abstracts from the technical structure.

For example, if I am asked to enter my name on a website, I assume that there is some data structure that represents names. I do not need to know what this data structure looks like in detail, and I may enter some pseudonym or anything else that is accepted by the system. But there will probably be some agreement among the users and providers that the regular specific meaning of this data structure is to store users' names.

At the same time, the representation is unspecific: It is irrelevant for the system's general functioning and integrity whether I personally enter my name (it has not been established for my personal use); it cannot completely prevent me from "deceiving" it or misusing the data structure for other purposes; and it is mostly irrelevant who I am. A data structure is quite indifferent as to specific type of entities or properties, be it friendships, personal messages, bibliographic entries, or information about group memberships; and the represented structures are typified and abstracted again in comparison with the wide range of aspects of existing social structures and with individual cases (e.g., my particular

friendship with you in all its complexity). Social structures are represented in data structures as universal types and instantiated in standardized tokens instead of capturing the particularities of relationships. For example, many social groups do not exist independently of their members and specific practices that enact blurry boundaries, whereas formal online groups are based on the abstract binary distinction between membership and non-membership.

As a consequence of this relationship of representation, our main concern is not with the analysis of data structures and algorithm but with meaning (a merely technical analysis would not contribute to the analysis of meaning). Our approach is interpretive and consists to analyze how users and providers take them to be representations of social structures without caring for the technical details.

However, users can be assumed to know that data are automatically processed. We can have elements and relations compared, searched for, counted, and so on. Representations are thus more or less specific (but abstract from the complexity of social structures), and their technicality is taken into consideration to a different degree. But again, we are interested in how it is *interpreted*: What others think the technical structures do.

Types of Structures: Distinctions and Methodologies

When discussing how social structures can be represented, we have to clarify our understanding of "social structure" and delimit the type of structures considered in our framework. Furthermore, we have to provide some methodological principles for how to deal with the diversity of subjective conceptions and descriptions of social structures by providers and users and given in self-descriptions and interfaces of Internet platforms. How can we reduce the complexity of possible descriptions and finally arrive at some generalizations?

As we want to avoid preemptive conceptual choices that would a priori restrict the range of structures that empirical analyses could find on the Internet, we use a very abstract definition. By "structure," we denote any combination of elements and relations among them, where the type of relations is restricted and expectable even if elements vary (Luhmann, 1984, p. 382ff). Structure is thus indifferent to the identity of single elements, but if some type of element is given, the number of possible relations is restricted, so that stable expectations are possible. Structures may consist in relations among persons, in relations between persons and positions or properties, in the relative distribution of socially relevant resources and differentiations of social functions, in patterns or sequences of events such as acts, in stable patterns among constitutive elements of acts, or in other shared or potentially communicable patterns of meaning, for example, including institutionalized conceptualizations and categorizations of entities (Blau, 1977; Bourdieu,

Table 1. Examples Illustrating the Types of Structures Covered by the Social Ontology of the Internet Approach and the Main Aspects of the Theoretical Framework.

Type of structure	Manifest versus latent	Descriptive versus constitutive/performative	Human versus technical agency
Relations between persons	Friendships are formally represented on different platforms, but social inequality remains latent (cf. also Krämer & Springer, 2017, on the (non-)representation of antagonistic structures such as enmity or competition)	Online groups can represent offline groups or be constituted independently	Friendships can be constituted online by a single act, but are sometimes enacted by automatic performance of "amicable" behavior
Constitution of acts or patterns of acts	Actions can be "forbidden" by implicit norms or by algorithms explicitly "forbidding" or "allowing" certain acts according to some rule	Shopping websites do not describe acts of buying that happen independently, but successful manipulation of data constitutes acts of buying	Technical systems exhibit activities interpreted as recommendation, abstracting from intentions (cf. also Krämer, 2017)
Institutionalized conceptualizations and categorizations of entities	Some cultural entities distributed online can be classified as "memes" by observers (without this classification being manifestly represented), but some platforms provide functions to classify and create "memes" as manifestly represented entities (Krämer, 2013)	Streaming and music recommendation platforms represent existing entities (artist, song, album, etc.) and constitute new entities (e.g., personalized "radio stations"; Krämer, 2017)	Platforms are usually unable to check whether something is a person's real name, but the meaning of the unspecific input is to represent a name

1979; Durkheim & Mauss, 1903; Giddens, 1984; Luhmann, 1984; Schimank, 2007). Structures are social structures if they are relevant in relationships between human agents or other entities that are temporarily or permanently treated as actors (Lindemann, 2012).

We will confine ourselves to Web-based and similar (e.g., app-based) platforms such as social networking sites, news websites, online shopping websites, blogs, and so on. Within these platforms, we focus again on data structures and algorithms that are available to normal users. Other technical structures are used for internal purposes without communicating their content or the purpose and results of information processing to the end users. While the social analysis of these respective structures is quite important (e.g., in terms of capitalist accumulation; cf. Fuchs, 2010; Gehl, 2010), we would like to draw attention to the distinction between this type and representations, and focus on the latter. This also excludes organizational structures of providers and social structures that influence Internet use but that are not represented online (e.g., the internal structure of information technology [IT] enterprises, some kind of digital divide, or informal political processes concerning the regulation of the Internet are not regularly represented by distinct data structures on publicly used platforms).

While the aim of this article is to outline a theoretical framework, we will include different examples that illustrate the main aspects of our approach (see Table 1). These examples are complemented by analyses we have undertaken in other contexts (Krämer, 2013, 2017; Krämer & Springer, 2017). We use examples of different types of structures

covered by our broad definition of social structures: relational structures, structures pertaining to actions, and shared conceptualizations and classifications of different types of entities (see the rows in Table 1). Furthermore, we will introduce the distinction between manifest and latent structures (second column), emphasize that online representations do not only describe previously existing social structures but also constitute them (third column), and discuss how structures can be based on human action and the activities of technical systems (fourth column).

Different types of structures can be related to the Internet, but our analysis focuses on a specific type: structures that are *formally represented*. Represented structures can be opposed to latent ones (or we may speak of "latent" vs "manifest" structures, to use Merton's, 1968, classical distinction—this distinction always refers to an observer to whom something is manifest or latent; cf. Luhmann, 1993. In the present case, this is the typical end user; see Table 1, second column).

Manifest representation, on one hand, does not mean that the structures' meaning is fully available to consciousness and can be made explicit at any time. However, we roughly know what we are doing when we represent certain types of structures or act on their basis, and we recognize them (even without having an expression for them). This knowledge is rather practical than theoretical (in the sense of Bourdieu, 1972, 1980): We know what a group, friendship, buying something, voting for someone, and so on mean although we cannot necessarily express this knowledge very precisely. Some manifest structures are intentionally created (e.g., one actively enters a group), while others are made visible

through representation (e.g., it may automatically be indicated that one is the *n*th most active contributor to a forum, even if one has not counted all the posts).

We have to distinguish between formal representations as meanings of technical structures and informal representations. In the case of *formal representation*, particular structures of the technical system exclusively represent a particular social structure. In the case of *informal representation*, text or (audio)visual content may refer to the most different types of entities and relations without any particular technical structure representing them (e.g., there are formal structures on common social networking sites that represent friendships, but none representing social classes, while posts may explicitly or implicitly refer to social stratification).

Although we could ask any single user, any contributor, or any representative of a provider for their interpretation of what is formally represented on a platform, an ideal-typical description will be sufficient or even more appropriate for many analytical purposes: To understand a representation, it is helpful to identify its most important features and consistent meanings, its institutionalized, that is, reciprocally typified, meaning (cf. Schütz & Luckmann, 2003, p. 58). Alternatively, we may classify meanings if there is a considerable difference between different groups.

On the other hand, *latent structures* are not part of the (practical) meaning of representations. In the extreme case, they surpass the individual horizon of users by far. One may have a vague idea that posts in a forum are distributed unequally or that parts of social networks are not equally dense (cf. Stegbauer & Rausch, 2006, on this type of structure); but without a local, accessible representation of measures of inequality or of the whole distribution, or without a graph of the whole network, and so on, one cannot be sure. To the degree that these structures as a whole are not created intentionally, we can also call them emergent.

Other types of unrepresented structures include all kinds of expectations (cognitive and normative) that are not thought of as being represented in particular data structures or algorithms. For example, rules of netiquette or grammar, ascriptions of social class, and so on structure what is happening on some Internet platforms and may be represented informally in verbal form, but seldom in technical structures. Other latent structures, such as groups or functional subdivisions, can be open to formalization by representation. However, software developers may also try to emulate more diffuse informal structures, for example, by writing algorithms to detect indecent behavior.

Today, many services provide users with an egocentric perspective on the represented structures (Langlois, McKelvex, Elmer, & Werbin, 2009). However, users can try to take the perspective of others or a fictive bird's-eye view (sometimes, this view is really represented, for example, by displaying subgraphs of social networks). Users can mentally extend the structures they "see," assuming that they are homogeneous in principle (the attitude of "and-so-on" that we take in a

natural attitude toward social facts; cf. Schütz & Luckmann, 2003), or at least implicitly take into consideration that the whole structure is much larger and continues according to some pattern. The notion of a "horizon" can be borrowed from phenomenological sociology and more recent social system theory (Luhmann, 1984; Nassehi, 2011; Schütz, 1993; Schütz & Luckmann, 2003) to describe the range of elements a system (psychic or social) could attain (but never exhaust) from its present state: all associations of meaning up to the most far-reaching that vaguely come to mind, or all elements up to the most distant within a social structure one can refer to at present. For example, on a social networking site, we can think of friends as connected to friends who are connected to further friends, and so on almost infinitely. The whole network is the horizon of meaning within this type of structure although we cannot connect to everybody or take everybody into consideration when acting. In a forum, we know or sense that a number of posts are published, have been published, or will be published that we could answer, anticipate, or otherwise take into consideration when writing our own contributions, but substantially referring to this entirety is beyond our capacity. This whole is only a regulative idea, an almost infinite limit. The idea of a horizon creates borderline cases of representation: We may say that a platform not only represents social relationships, but also "social relationships that form a whole network," although this network itself is not locally represented to us.

But what is the role of interfaces in representing social structures? Do users care for data structures and algorithms (or, more precisely, abstractions thereof), or do they just interact with Web pages or other interfaces? We may answer this by turning to the example of buying something via the Internet. Of course, there will be some page saying that by clicking on some button, one will buy a certain item. Verbal information is always important to determine what kind of social structure is represented, for example, a product that can be bought (socially defined as a commodity), the opportunity to perform the social act of buying (instead of, say, rating the product), and finally, the act of buying itself. But when do we say we have bought something on the Internet? By clicking on the respective button, surely, but we may be in doubt whether we have "really" bought the article: The page that is returned does not clearly indicate that our order was taken, or we may even notice that we have clicked the button while the Internet connection was interrupted. Thus, it is constitutive for the act of buying that by clicking we have manipulated some data (whatever it looks like in detail), that our order is now registered (represented) "in the system" (of course, all other institutionalized conditions of the act of buying have to prevail). Thus, by manipulating some data by clicking on a button, we buy something.

Websites and other interfaces usually provide hints as to the meaning of the social structures that are being represented (e.g., if a button is labeled "Buy now"). Data can be transformed into outputs ("represented" in the sense of being

"shown," for example, displaying a user name) and their meaning can be explained or information can be displayed *about* them ("representation" in the sense of description, for example, clarifying that this is the user's name). But it is the data structures themselves, not their description on a meta-level or an actual output at a certain occasion, which represent social structure in the first place. We must be careful to distinguish between these descriptions on interfaces and the search for the most appropriate interpretation of the practical meaning of structures. A structure may be called a "group" according to a website. But if membership rules refer rather to the willingness to perform specific tasks than to an undifferentiated set of persons, that structure may be closer to an organization (a structure that combines functional differentiation with the inclusion of persons instead of a mere classification of persons) than to a group.

Thus, from a methodological perspective, we have to consider the implicit rules constituting the practical sense of representation and look for aspects of structures: What kinds of primary elements are related (e.g., persons, elements of acts, acts themselves, or objects)? What types of relationships do they enter into? Are persons associated with properties or among each other? Are differentiations made between persons, between functions of persons, between categories of objects, and so on? Are elements of acts combined to form an institutionalized whole? and so on. We can then stepwise piece together these parts and judge whether the entities we identify fit a definition of a type of social structure. Of course, notoriously ill-defined concepts have to be clarified before applying them to a structural analysis of Internet services.

For example, informed users of Wikipedia will assume that there must be some kind of database wherein information on user accounts is stored and that there must be some data dividing authors into two types. Users familiar with the platform know that one of the types is called "administrator," whereas the other type does not have a particular name but includes all ordinary authors. Based on this term and the functionalities the former type of authors but not the latter can use (such as deleting pages), users can infer that the above data structures represent the social role of the administrator according to a constitutive rule: A person is classified as an administrator if his or her account is listed as an administrator account in the system and if, consequently, this person has particular rights that serve to discipline other users. This type of social structure thus groups persons into two categories and relates one group to a particular role. That role may be called differently on other platforms but constitutes a type of social structure that has evolved on the Internet and is usually formally represented by technical structures that enable certain persons to enact their role. Although the role is intimately tied to the technology, the underlying technical structure is not specific to the social meaning of the status. It is simply based on some binary classification of accounts and an algorithm that makes sure a number of buttons or links is displayed to one of the types of users (clicking on these buttons or links then, for example, deletes pages or user accounts). However, these technical structures have the socially shared meaning of referring to that role and to real persons fulfilling that role as well as to the constitutive rights associated with the status. Parts of the institutionalized definition of the role are again represented by technical structures, such as the power to ban users. Other aspects of the social definition and further meaning of the role as well as other ways of enacting it are not themselves formally represented. For example, administrators are only allowed to use these special functions in particular cases. Such rules are either listed on particular pages or even remain unwritten and thus latent. While we may ideal-typically assume that a competent author of the encyclopedia will subscribe to this interpretation of the representation, other informal and latent aspects of the role's meaning will probably be more contested and can only be revealed by extensive ethnographic studies of narratives and practices pertaining to Wikipedia (e.g., Jemielniak, 2014). Such an analysis would then cover a different level of social structures than the ones the present theoretical framework aims at. Our perspective is thus complementary to methodologies that serve to familiarize the researcher with the intricacies of implicit patterns of meaning shared and negotiated by the users of a given platform. However, one should not conclude that our approach is somehow superficial because it avoids delving into minutiae of online cultures. Instead, it focuses on other and, as we would argue, equally important aspects: the already typified meanings of formally represented social structures whose abstractness can have particular consequences (as we will argue below).

Thus, carefully analyzing represented social structures in terms of elements and relations, and matching them with theoretical or everyday terms that designate given types of structures, are the two sides of the methodology we would like to propose. Theoretical terms or clarified expressions of everyday language are used to grasp the practical meaning of representations. For example, users normally would not speak of "functional differentiation" as a platform's main structural feature. However, they may enact such a structure by interpreting the features of a platform as representing different tasks following a different logic, instead of representing, for example, differentiations among persons or objects according to pre-defined properties. For example, Wikipedia users may competently engage in either the editing of articles or their discussion, represented by two types of pages with their respective structure and possibilities to manipulate them (while it is clear that users are not classified according to a fixed role of either editor or discussant). Furthermore, social theory can ensure that we do not overlook structural features, and it may even be used in counterfactual analyses: If a type of structure is described in social theory, why don't we find it represented on Internet platforms?

Having analyzed the types of structures on different platforms, we may proceed to generalizations over a larger number of websites. Such generalizations can then be compared with what Luhmann (1980) has called "semantics": higher order generalizations of meaning (*Sinn*) that a society deems worthy of conservation or dissemination, including self-descriptions of society (p. 19). Such semantics also exist with regard to the Internet: It is said to be egalitarian, democratic, global, decentralized, neutral, based on cooperative action, panoptic, uncontrollable, capitalist, and so on (for some more elaborate generalizations, cf., for example, Flanagin et al., 2010; Langlois et al., 2009). Although one could try to "falsify" those generalizations by rigorous empirical and counterfactual analyses of a large sample of platforms, it is probably more interesting to ask how these semantics relate to social structures, and how both are adapted to one another. For example, the debate over the semantics of the Internet seems to cherish illusions and to disillusion itself by ignoring or implicitly using the distinction between latent and manifest structures: "The Internet" is (or seems) egalitarian (mostly a network of friends or sites without hierarchies), but if you look "more closely" (at latent structures) there are powerful bloggers and large corporations. Furthermore, changes in the represented or latent structures or changes of perspective may cause historical and social variations in semantics. For example, the Internet has been described as an "information superhighway" or as a means to maintain or establish social relationships, as unable to forget or as ever-changing and without history, and so on.

Empirical Social Ontology

The theoretical framework can be linked to the concept of ontology and ontological commitment. It should become clear that the present framework is a guide to empirical analyses of how actors see the (social) world and the Internet, which requires minimal commitments to specific social or philosophical theories.

The starting point of the present analysis was ways of speaking, such as that "there are" social structures on the Internet. If ontology is the analysis of "what there is" (Quine, 1948), we are attempting to answer the ontological question of how social structures "exist" online, namely, that they are symbolically represented as we will argue below. We think that as researchers, we are only committed to this minimal ontology that is an idealized reformulation of actors' practical knowledge and of the prerequisites or their practices: Actors give meaning to data structures according to certain constitutive rules. As we will see, these rules also imply that, in some cases, users are able to create new social facts by manipulating data, according to the ontology of this type of social facts (cf. Searle, 1995).

The rest depends on the actors. Their further ontological commitments (Quine, 1948) may then be analyzed: By accepting or creating certain representations, they are committed to the existence of certain types of social or socially defined structures (acts, persons, material objects, etc., and certain relations among them), or at least to the existence of other facts into which these structures can be decomposed. Thus, we do not have to commit ourselves to particular social theories or to the existence of specific social structures or their elements in the first place. We may just analyze what users think there is: Persons disclosing some of their properties, groups, recommendations, technical systems that can or cannot "act" in certain ways, and so on.

Analyzing users' commitments means to "carefully follow the large range of expressions, metaphysics, social theories, used by humans to account for the human-nonhuman associations" (Callon & Latour, 1992). This may amount to radical "empirical metaphysics" (Latour, 2005), but it is important to note that this reconstruction is independent from our own metaphysical commitment that may or may not be that radical: Latour's critics have argued that reconstructing others' ontologies does not oblige us to commit ourselves to any particular extraordinary ontology that would be more basal but that ours can even be identical to the ones under analysis (cf. Bloor, 1999). We may find that users know strange entities, create new social structures, and blur the line between human and non-human actors, but it may also be wise to remain conservative and parsimonious (but open-minded) when theorizing representations on the Internet, assuming that by default, representations on the Internet tend to reproduce or resemble known social structures.

Even if our approach refers to users' interpretations, it does not substitute but complement ethnographic and similar analyses (cf., for example, Hine, 2015) on how Internet platforms are appropriated and navigated, how they are used to constitute and manage social relationships, organizations, and so on, and how existing social structures are transformed by the use of new technologies. In our terminology, these structures and the everyday practices of using certain platforms remain latent if they are not directly represented online (e.g., the topics, purpose, norms, and narrative and argumentative forms, pertaining to an online community as opposed to the social structures represented on the platform being used, such as groups, threads, and friendships). Concerning the manifestly and formally represented structures, we then ask, If it is assumed that "there are" certain structures on a platform, how is it possible for them "to be there," what does it mean for them to exist online, how are they typically defined, and how can we identify them with sufficient certainty?

In informatics, the concept of "ontology" has been employed to describe all formal representations of knowledge, of entities or concepts with their relations, often in the form of taxonomies (Gruber, 1995). Ontologies are then selective representations according to the interest of actors concerned with the respective realm of knowledge (Smith, 2003). This understanding blurs the distinction between ontological realms (ways to exist according to philosophical analysis) and taxonomies of the existing. However, this is not

harmful to empirical analysis, as actors themselves may not draw clear boundaries either. In sum, our main question amounts to asking what social ontology (or ontology of the social, including ontological commitments on a lower, "non-philosophical" level) we find represented on different online platforms.

Representation, Action, and Technology

Now it should be possible to provide a precise analysis of the notion of "representation." We will show that manifest social structures imply constitutive rules and acts, and shortly discuss how we can deal with "acts" performed by technical systems (although we will have to leave a more thorough discussion of agency to another publication).

Is "representation" an appropriate concept if it has been argued in recent approaches in social theory that social reality is always produced, enacted, or performative? In particular, actor–network theory (ANT; Latour, 2005) and related frameworks (Law, 2004; Mol, 1999) offer a new ontology for the analysis of the social: They propose an infra-language that operates below the level where human and non-human entities are distinguished; this language can then be used to describe how actants (both human and non-human) assemble, associate, and how they struggle and cooperate to produce new entities. Although these authors' approaches sensitize us for the multiple ontologies held by various actors, their linguistic and metaphysical reform seems more important to them than the interpretive reconstruction of others' conceptions of reality (it becomes hard for them to account for actors' natural attitude with its unquestioned, self-confirming, and reifying perception of social structures; cf. Pels, 2002)—or if advocates of ANT (or scholars inspired by it) try to reconcile both, they run into considerable problems (as various critics have argued; cf., for example, Amsterdamska, 1990; Bloor, 1999; Schaeffer, 1991; Shapin, 1988): How can entities be active, produced, and their existence be controversial at the same time? This combination between realism and constructivism results from a blurring of the distinction between one's own and others' ontological commitments, or of the distinction between reality and representations (what we or others have to take as real in a given moment and what we refer to as a contingent descriptions). Instead, we should use such distinctions and, for example, classify the different ways social structures are enacted and their representations produced. We will then find that "representation" can have different meanings:

1. We can think of it as *description* (portrayal, depiction, demonstration). Social structures on the Internet can be shown to users or created by them to show what, according to them or the providers, already exists offline. A social networking site may, for example, ask its users to represent only their existing relationships and other facts from the offline world (real names, cultural preferences, etc.) or to report their offline activities. An important part of the literature on the Social Web has analyzed the Web's social aspect in terms of self-disclosure and truth or falsehood: Facts about a person are either represented (correctly, or possibly deceptively or euphemistically) or left unrepresented (e.g., Whitty & Joinson, 2009).

   Other sites represent structures that do not have an offline equivalent, for example, a classification of users according to the number of contributions in a forum. But still, we could see this as some sort of portrayal.

   This descriptive form of representations is already practical as it implies activities to conceptualize the structures to be represented and to produce the representation (an analysis of the details of this production would be a strength of ANT: to identify the networks of human and non-human activities). This form is also already performative, but in a particular way: It may contribute to enact an identity and norms of intelligibility and consistence (Cover, 2012), create further practical commitments, and so on. However, the structure itself is not produced (according to its constitutive rules as perceived by some actors); it is not constituted by the representation: One does not get married on Facebook but people may disclose their marital status.

2. However, to reduce representation to portrayal (or even self-disclosure) would be to commit a classical fallacy. Analytical philosophy of language has prominently criticized the tendency to regard all utterances as statements of facts (Austin, 1979; Wittgenstein, 2001). It would be almost the same mistake to count online representations only as portrayals of pre-existing social structures. According to speech act theory (Austin, 1962; Searle, 1969), certain utterances *count as* institutionalized acts that do not describe but create social facts. If, for example, to join an association is not the same as to report that one already is a member; to join a "group" on an online platform is not necessarily the same as to say that one is already member of a group. Thus, certain acts create or modify social structures. This form of representation rests upon rules that take the general form of "X counts as Y in context C," where this rule has either been declared explicitly or has become customary in a context C (Searle, 1995, also gives the following example: "The magnetic traces on computer disks in banks that record bank balances are not actually money, but they represent the amount of money you have in your account" [p. 115]. Compare also Fuller, 2003: Data and events that transfer or transform them "are not merely signifiers of an event, but integral

parts of it" [p. 31]). We tacitly or explicitly accept the interpretation that if a certain representational technical structure exists, this counts as a symbol that a social structure exists, for example, that we are members of a group if we are listed as a member. To manipulate data then means to change social structures.

There are then types of structures that are *constituted* (not only described; cf. Table 1, third column) by a more or less clear-cut act or event such as a modification of data and that can have all kinds of practical implications, but their continuity *does not rest upon further enactment*. For example, some groups allow for completely non-active membership that is then conceived of as a stable status represented by some data.

3. There are types of structures that are formally represented in data structures but that *require enactment*. For example, a person could count as an administrator in a forum but this status may be revoked if she or he does not satisfactorily fulfill the tasks associated with the role. In this case, the constitutive rule for being an administrator includes the duty to perform certain tasks. However, such constitutive formal representations are inherently static: They can usually be revoked but the instantiation of the structure counts as existent (e.g., a person *is* an administrator) as long as the data say so (in this sense, this form of representation can never be wrong). Websites tend to transform structures that are constituted by continuous enactment into static descriptions or static structures constituted by a single act: Friendship is a complex structure typically constituted by sufficiently frequent "amicable" practices and/or in a mutual classification as friends that does not necessarily require much enactment but at least a certain readiness to act according to specific expectations on given occasions. These amicable practices cannot necessarily be classified in clear-cut types of acts and may differ greatly among the individual relationships. There may or may not be declarations of friendship and explicit breakups, but formal representations on websites turn these into the constitutive and terminatory acts for the relationship. Friendship on some social networking sites do not require further enactment but, in some cases, can also be enacted by technical means: The amicable behavior of keeping each other up to date is automated.

4. The foregoing discussion has mainly shown how structures of relationship, classification, status, and so on are constituted and represented. We have already implicitly assumed that types of structures of acts can also be represented online and are then enacted by using the corresponding data structures and algorithms. We can now classify different types

of enactment that are related to different forms of representations (see Table 1, fourth column):

a. What users do in Internet platforms can count as performing a type of act if they use specific functionalities of the websites that trigger certain activities in the technical systems. Using these functionalities then represents the execution of the act (e.g., requesting friendship or voting). In contrast to data structures *describing* the performance of acts, the use of the systems' features here *constitutes* the act and not every act of this type has to be descriptively represented thereafter.

b. Data are manipulated not only by human actors but also by algorithms. What technical systems do count as, is interpreted as, acts of certain types; their technical structures represent types of acts. Within our reconstructive methodology, we focus on how their activities are interpreted instead of analyzing them on our own and following human and non-human entities (as an ANT perspective would require).

Technology only counts as such if it fulfills socially defined functions (cf. Pinch & Bijker, 1984). If it works, it can be treated as a black box for most purposes, abstracting from all other properties of its constituents (Latour, 1991), as a functioning simplification (Luhmann, 1998, p. 524). Technology can then count as a functional equivalent of human action (on such delegation, see, for example, Collins & Kusch, 1998), whether we regard it as an "extension of man" (McLuhan, 1964), or as something that fulfills the "expectations of man" (even if there is no equivalent human capability). It can then be subsumed under the abstract notion of social structure if it is an arrangement of elements such that some relations are expectable (e.g., a stable mapping of a type of input to a type of output, or the reliable creation of an output that fits some criteria) and are socially relevant. In particular, we readily describe the function of algorithms in terms of institutionalized types of acts.

For example, Web services are said to "recommend" certain items. The structure of this act consists in a number of rules and entities, for example, the item that is proposed, the addressee, and, most importantly, the expectation that the recipient will like the item or that it will fulfill another function to him or her (who should not yet know of the item or at least be unaware of its possible function). To the addressee, the output of the algorithm, if it works well, can be interpreted as a *meaningful, valid* recommendation and have the same function as a *successful* recommendation, and we readily accept the anthropomorphic description that a system "recommends," even if it cannot entertain the respective intention. We could then conclude that what the algorithm does could *count as* a recommendation, or may at least "represent" a recommendation in the sense of being a surrogate, a replacement, *by* listing items that fulfill some conditions.

The exact *modus operandi* of algorithms, what rules they follow, is unimportant to their social functions. This does not mean that they do not represent rules and norms, but their social meaning is not part of the code itself, but a matter of interpretation. If code is somehow a functional equivalent of laws and other rules (Lessig, 2006), that is because algorithms can restrict happenings in such a way that these events or their outcomes conform with certain expectations. Rules are a part of the whole structure an algorithm represents when performing operations that count as certain types of acts. For example, algorithms "allow" or "forbid" things according to some rule and do so in an expectable way.

Above, we suggested that one should collect and piece together all the possible elements of types of structures to identify them. Now, a slight qualification of this methodological principle is in place: As users obviously do, we have to abstract from the higher performance of many algorithms and from elements of acts that machines are unable to exhibit (at least according to the dominant ontology) to fit their behavior into categories of social structures. Alternatively, users could ascribe those intentional, normative, or affective elements to some producers and providers behind the algorithm (while these actors clearly do not perform other constitutive parts of an act, such as "examining" the items that are being recommended). However, most structures that are formally represented abstract from intentions and motivations anyway. Even if they are based on human action, many of them are efficient to the degree that they do not rely on tests and discussions of authenticity, truthfulness, good faith, and so on. For example, online voting is a relatively simple and efficient structure used to come to a decision or to measure the climate of opinion, but it does not establish whether the participants are serious or what their reasons are. It must be noted, however, that all types of acts, online and offline, are abstractions: Their individual performances have many properties or allow for many different descriptions that are seen as irrelevant regarding their subsumption under the type.

In sum, we may speak of "symbolic representation" as the mode of how social structures exist on the Internet, if by "symbol" we do not only mean something like "description," "depiction," or "signal," but also a proxy (by manipulating the symbol, we change the structure), a relationship of a part to a whole (the technical structure is part of a social fact), or a structure that allows for a double perspective: Some data exist or a functionality is used, and that also counts as, that can also be seen as an institutional fact (cf. Searle, 2005). Therefore, describing what happens on the Internet in a reductionist mode (it is *only* data structures and algorithms) would not be completely appropriate: Descriptions should rather contain words such as "by" or "as" instead of "only" or "merely": Data structures count *as* symbols for social structures; *by* changing data, social reality can be changed; what algorithms do can be interpreted *as* acts.

Conclusion

We have proposed a theory of social structures on the Internet that we have themed as "ontological." It is based on an analysis of symbolic representation and its relationship to constitutive acts. The approach would allow a new and integrative perspective on social structures on the Internet. It is based on the empirical, interpretive analysis of providers' and users' conceptions of the social world as manifestly and formally represented on websites.

In fact, this seemingly philosophical framework implies a methodological approach that does not require more ontological commitments than most other interpretive lines of analysis. Its first step will be to reconstruct what actors already—practically—know. We may then proceed to investigate what they do not know: latent structures and what observers claim to know: the semantics of the Internet. Actors may also be unaware how structures on Internet platforms could be internalized as social facts (Dringenberg, 2002; Fuchs, 2010) and shape our perspectives on society or at least on the social structure of the Internet, just as other forms of objectified social structures contribute to socialization (Berger & Luckmann, 1969). Representation contributes to create what it represents, even if the representing acts are not overtly performative (Bourdieu, 1981).

A comparison with other non-linguistic representations could be illuminating, for example, with architecture and other works of art, the design of objects, insignia, road signs, or maps. Finally, we should be able to start explaining what kinds of knowledge about society are represented online, how it is represented, and what parts have entered generalized descriptions of the Internet, what is left out, and why (this does not imply that one should only think in terms of right or wrong representations, but that we should analyze to what extent different possible visions of social structure are represented or have become a part of dominant semantics and what determines these selections).

We have also indicated a few transformations that structures seem to undergo when being represented online: from informal practices (including implicit and flexible classifications) that may constitute particular relationships, to formal, universal, static but sometimes enacted statuses and relationships constituted by clear-cut acts or described in formal categories.

As a next step, the examples mentioned here and elsewhere should be integrated into a more encompassing typology of structures. This inventory should be based on classical and recent typologies of social structures to be aware of the variety of possible forms and to assess their selective representation. In addition, further case studies of single platforms or types of websites should be undertaken to challenge and refine our approach.

Recognizing that social structures on the Internet are contingent representations whose meaning is ascribed by producers and users also has political implications: What degree

of freedom do unspecific data structures allow for if they are creatively used and converted to new uses? What are the respective advantages and disadvantages of free textual, visual, and audiovisual representations, and of formal data structures coupled with powerful algorithms? This type of analysis could then counteract the reification and naturalization of social structures that are represented online.

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