

The Web as Ontology

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CHAPTER 3

THE WEB AS ONTOLOGY: WEB ARCHITECTURE BETWEEN REST, RESOURCES, AND RULES

ALEXANDRE MONNIN

1. Introduction

Few researchers have dared to theorize the basics of the Web. Those who did characteristically borrowed concepts from their favorite philosophers or philosophical schools. Interestingly, one can illustrate this trend from both sides of the spectrum, from deconstructionism to analytic philosophy. According to one of the most well-known hypertext theorists, Georges Landow (see Delany and Landow 1991; Landow 1991, 1994, 1997, 2006), hypertexts—the Web being assimilated to one of them—enact what was first described by "deconstruction" and French theory from the 1960s (Barthes, Foucault, Derrida, Deleuze, and so on). As both these theories and hypertexts "converge," the technical artifact somehow becomes the striking *incarnation* of a set of preexisting concepts that deeply redefined the roles of the author and the reader, writing, textuality, and so forth.

In a distant philosophical universe, Nigel Shadbolt (2007), professor of artificial intelligence (AI) at the University of Southampton and an open data advocate, adopts a very similar stance while taking inspiration from a different—even antagonistic—tradition: namely, the analytic one. According to Shadbolt, the endeavor that motivated the works of philosophers such as Frege, Wittgenstein (the "early" one), Russell, and the Vienna Circle—undisputedly the fathers of the analytic tradition—was to shed light on the very notion of meaning. Their collective endeavor is broadly taken to have led to the definition of meaning used within the field of computing. In this narrative, the Semantic Web is the latest and most grandiose episode in a long tradition that goes back to Aristotle, matured in AI, and finds its apex with the Semantic Web. Rooted in a solid realistic view of objects, it purports to represent their intrinsic qualities in the vocabularies composing them and their properties and consisting of terms whose meanings correspond to objective divisions of reality.

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Finally, other authors have explicitly tried to analyze the new digital reality (so-called cyberspace) from an ontological perspective. David Koepsell in particular, opposing the extravagant claims regarding the fundamentally different metaphysical status of the digital realm, undertakes to reassess the mundane character of "retrieving" a Web page:

> Web pages are just another form of software. Again, they consist of data in the form of bits which reside on some storage medium. Just as with my word processor, my web page resides in a specific place and occupies a certain space on a hard drvie [*sic*] in Amherst, New York. When you "point" your browser to http://wings.buffalo.edu/~koepsell, you are sending a message across the Internet which instructs my web page's host computer (a Unix machine at the university of Buffalo) to send a copy of the contents of my personal directory, specifically, a HTML file called "index.html," to your computer. That file is copied into your computer's memory and "viewed" by your browser. The version you view disappears from your computer's memory when you no longer view it, or if cached, when your cache is cleaned. You may also choose to save my web page to your hard drive in which case you will have a copy of my index.html file. My index.html file remains, throughout the browsing and afterward, intact and fixed. (Koepsell 2003, 126–27)

All (or so it seems) the bits and pieces, the concrete inner workings that make up the plumbing behind such a simple action, are analyzed against a backdrop of available notions and thus made all the less mysterious.

Yet each of the three previous cases suffers from a common mistake. By taking for granted without any justification some concepts, they commit what Brian Cantwell Smith called an "inscription error," thus designating the ontological presuppositions superimposed on a given domain (i.e., the Web). Is the Web a hypertext? There are very good reasons to doubt that it is. Is it simply the continuation of the inquiry pursued by analytic philosophy and AI on the nature of meaning? Again, if there is an ontological issue to be raised, it might not be first and foremost with regard to computer ontologies. Finally, though Koepsell's scenario certainly rings a bell with any Web user, in fact, what it describes, what we might call the default view of the Web, is by and large *wrong*.

Furthermore, behind the aforementioned inscription error lies a tendency to forget the true character of technical systems and objects. While it is extremely tempting to think of the Web as the *realization* of preexisting concepts, and the new digital environment as one that gives new technical flesh to venerable ideas, this view entirely misses the point of what it is to be a technical artifact: more than a mere speculum in which philosophical ideas get reflected. To borrow an expression from Antoine Hennion and Bruno Latour (1993), such a view betrays the signature of "antifetishism," with the risk of simply losing sight of the objects.

In order to avoid both inscription errors and antifetishism, it was decided to stick to two principles. The first comes from Smith (1998), who calls it the "principle of irreduction"—with a clear nod to Bruno Latour. According to this principle, no concept or presupposition should a priori be given preeminence. Our second viaticum comes from none other than Latour himself. It consists in *following the actors themselves*, so as to be able to map out their "experimental metaphysics." Interestingly, very few researchers have deigned to take into account the work of dozens of Web architects in standardization bodies like the Internet Engineering Task Force (IETF) or the World Wide Web Consortium (W3C) before devising their own theories; even fewer have always avoided the danger of substituting preexisting concepts for the reality at hand in a careful analysis of the Web.

2. A Tale of Two Philosophies: URIs Between Proper Names and REST

To understand the evolution of the Web from a simple project to the global platform we now know, one has to pay attention to the evolution of one of its core elements, its naming system. Only then will the portrait of what these names identify slowly start to emerge. Yet this is a troubled story going through multiple stages, from the first papers published by Tim Berners-Lee around 1992 on UDIs (Uniform Document Identifiers [Berners-Lee, Groff, and Cailliau 1992]), the drafts of the first standards published at IETF on URIs (Uniform Resource Identifiers; RFC 1630 [Berners-Lee 1994]), the first real standards, published later the same year, after the creation of the W3C as part of the first wave of standardization of the Web, when URIs where sundered in URLs (conceived as addresses of documents; RFC 1738 [Berners-Lee, Masinter, and McCahill 1994]) and URNs (names of objects; RFC 1737 [Sollins and Masinter 1994]), to the modern understanding/implementation that revolves, once again, around URIs (RFC 2396 [Berners-Lee et al. 1998] and RFC 3986 [Berners-Lee, Fielding, and Masinter 2005]).

Each of these recommendations embodies and enacts a different understanding of the Web. The usual story weaves the tale of a Web of documents, the height of hypertext technologies, which would eventually become a Web of objects, the Semantic Web or Web of Data. This is what prompted the so-called "Web identity crisis" (see Clark 2002, 2003a, 2003b), a controversy that was unleashed at the turn of the century when people began to wonder whether it would be possible to use the Web to identify not only accessible "documents" but any kinds of "objects."

2.1. The Web Identity Crisis

The most visible symptom of the crisis is without a doubt the issue called HTTP-Range 14 (see Berners-Lee 2002; Fielding 2005). The HTTP-Range

TABLE 3.1. The HTTP-Range 14 (Lewis 2007)

Code	Result	Indication
200 ("OK")	HTTP representation	Information or non-information resource
303 ("See other")	URI	Any kind of resource
4XX/5XX	Error message	Impossible to infer anything about the nature of the resource

14 issue was an attempt to derive a technical criterion meant to distinguish between URIs that identify "information resources" (digital documents) from "non-information resources" (objects). The resolution of the issue was to use the code sent by a server to its client in HTTP headers to infer the nature of the resources identified by a URI (see table 3.1).

As is apparent from table 3.1, the technical result of the HTTP-Range 14 issue is that it is impossible to devise such a criterion: a URI that identifies Tim Berners-Lee could dereference content about him just as well as a URI that identifies a *page* about Tim Berners-Lee. Technically, there would be no difference. The same goes with redirection: it is not clear whether a URI that identifies "the Bible" and then redirects to one particular edition of the Book (such as the King James Version) would identify either a retrievable document or an abstract object in the first place. That is in fact why the decision that followed the HTTP-Range 14 issue proved to be a normative one, leading to the promotion of good practices, such as the 303 redirection, stating that for "inaccessible resources," one should redirect to accessible resources through a 303 redirection, using a second URI, served by a 200 HTTP code.

The conjunction of two elements explains this decision. First, the information/non-information distinction is rooted in the opposition, found in early proposals like UDIs, between objects and documents. It explained why URIs were sundered into URLs and URNs as soon as the standardization of Web identifiers was addressed by the W3C. The other factor had to deal with the importance inference engines acquired in the context of the Semantic Web, as those were not apt to make or ignore distinctions between a thing and its "representation," which are drawn fairly easily by human beings.

2.2. The Descriptivist Versus Rigidist Controversy

Beyond these local discussions, another reason is to be found in the inscription error made by the actors themselves in relation to the theories often associated with URIs, beyond the architecture of the Web. This second controversy is tightly related to the Web identity crisis. Holding URIs to be tantamount to philosophical proper names, it opposed an

updated version of Bertrand Russell's descriptivist theory, championed by Patrick Hayes, and a position somehow akin to Saul Kripke's rigid designation. But each theory led to the same pitfall.[1] The extensionalist conception of objects drawing from model theory leaves beyond its scope the work of objectification that is necessary to deal with objects just as much as the rigidist position it opposes.

Indeed, in what seems to be the first discussion on proper names, dating back to 1962, Ruth Barcan Marcus's work in analytic philosophy on issues of identity and modality identified proper names with meaningless "tags" (Marcus 1995, 32–34). Marcus imagined that those tags would be used to pin down objects, as in a dictionary (she later admitted that this was a mistake and that what she had in mind was more encyclopedia-like, as Kripke himself noticed (Kripke 1980, 101). As if objects were "already there," just waiting for their Adam to be picked out and receive an individual tag, so that we could use this encyclopedia to determine for every object its name(s) in order to assess its (necessary) identity.

Marcus herself separated this problem from that of identifying the aforementioned objects, which is an epistemic one. In a sense, the Semantic Web, as conceived by Shadbolt, would appear to fulfill her project and truly "operationalize" philosophical ideas. Yet as evidenced by the lack of universal ontology (and without anyone taking this prospect seriously), the Semantic Web tends to experimentally demonstrate the contrary. Without this epistemic activity, there is no ontology to be found, as there is no means of determining what the ontological furniture of the world is. Only identifiers from this perspective, not objects, support relations of identity, after a world of "ready-made objects," to quote Hilary Putnam (2005), has first been hypothesized. That's the paradox of philosophical proper names, and taking them as the right tools to understand how URIs function although they were originally devised to answer questions of identity, logic, and language, whereas people on the Web are confronted by epistemic and ontological issues.

More generally, what is at stake here is the role of philosophy itself as a formal space where all the metaphysical distinctions would be already mapped, as in Jules Vuillemin's attempt (Vuillemin 2009) at formalizing philosophical systems (Vuillemin himself insisted on the importance of proper names for his perspective). Does philosophy purport to deliver concepts usable at any time and within any context because they exhaust every (logical? metaphysical?) possibility; or is it, as a discipline, capable of giving room to what Jacques Derrida (!) called "local thought events" (see Janicaud 2005, 124), thanks to which "actors themselves may locally change the metaphysics of the world," following Adrian Cussins' beautiful formula (Cussins 2001)?

[1] This is something I explore in Monnin 2013. For another pioneering account, see Halpin 2009.

After all, why would concepts from the philosophy of language constitute the best tool available to shed light on the problems that the architects of the Web are facing? Especially once these problems have been displaced from here to there? Not to mention the fact that there is barely any consensus on the very problems philosophers are supposed to solve, without even mentioning those of adjacent disciplines (such as linguistics, where philosophy's proper names are taken to be no more than mere artifacts that are nowhere to be found in ordinary language).

2.3. Back to REST

Contrary to what the focus on the Web identity crisis might indicate, the actual architectural style of the Web, known as REST (for *Re*presentational *S*tate *T*ransfer) comes up with a very different answer to the questions raised earlier. REST is the result of the work undertaken by Roy Fielding for his Ph.D. dissertation (Fielding 2000). Fielding had been tasked by Tim Berners-Lee to elaborate on the design philosophy behind HTTP and the Web. Fielding's mission, at the time, was to understand what made the Web so special, by going so far as to contrast the result of his investigation with the actual implementation of the Web. In other words, to be *faithful enough to the Web to go so far as to transcend its implementation.* That is why, in his answer to an e-mail questioning whether REST, which contains the principles behind the HTTP protocol, logically precedes it, Fielding points out that the answer to that question cannot rely on a merely "logical" chicken-and-egg distinction:

> Question: Logically, REST really had to predate HTTP 1.1 in order for HTTP 1.1 to be so RESTful.
> No?
> Answer (R.T. Fielding): No. That is more of a philosophical question than a logical one.
> HTTP/1.1 is a specific architecture that, to the extent I succeeded in applying REST-based design, allows people to deploy RESTful network-based applications in a mostly efficient way, within the constraints imposed by legacy implementations. The design principles certainly predated HTTP, most of them were already applied to the HTTP/1.0 family, and I chose which constraints to apply during the pre-proposal process of HTTP/1.1, yet HTTP/1.1 was finished long before I had the available time to write down the entire model in a form that other people could understand. All of my products are developed iteratively, so what you see as a chicken and egg problem is more like a dinosaur-to-chicken evolution than anything so cut and dried as the conceptual form pre-existing the form. HTTP as we know it today is just as dependent on the conceptual notion of REST as the definition of REST is dependent on what I wanted HTTP to be today. (Fielding 2006)

The W3C was created in 1994 in order to ensure the technical governance of the Web. Right after its creation, a first wave of standardization

was launched. Among the first standards to be written were those related to Web identifiers, known first as UDIs and later URIs. URIs, as already mentioned, were then split into URLs and URNs, each with different kinds of referents, the former's being thought of as ever-changing accessible documents and the latter's as stable objects outside the Web. Yet this didn't seem to work out, because people wanted to access contents about any kind of "object" on the Web, using HTTP instead of ad hoc protocols designed and maintained by URN scheme owners, such as library organizations, for instance. For that reason, in 1997 and 1999, major revisions were brought to the standards, which included the fusion of URLs and URNs into URIs and a new version of the HTTP protocol. Fielding was among other things the main editor of the HTTP 1.1 protocol, including the current 1999 version (Fielding et al. 1997, 1999), and URIs (in 1998 and then again in 2005), and the cocreator of the Apache Foundation (which designed the dominant server software on the Web). With REST, one can see him participating in the establishment of a coherent Web, from servers, to the transfer protocol between them and their clients, to the underlying naming system that powers the entire construct.

The work on REST began around 1995, at a time when the difficulties surrounding URLs and URNs became more obvious by the day. Fielding made his doctoral dissertation widely available online in 2000. He also published an article written with his dissertation supervisor (Fielding and Taylor 2002). These constitute all the primary sources available on REST save for a few blog posts Fielding published years later (especially Fielding [2008]).

REST is often seen as a method for building Web services competing with SOAP (Simple Object Access Protocol), CORBA, Web Services, and other RPC protocols. Viewed thus, however, its real significance is completely lost. REST is more precisely described as what Latour calls a "re-representation" (Latour 2005, 566–67), a document whose purpose is to reinterpret a number of other technical documents (RFCs) and the artifact they describe (the HTTP protocol and URIs in particular). The work on REST had an immediate impact on the way standards were rewritten in 1997 and 1998 under Fielding's guidance. Despite not being a standard, it nevertheless acted as a "meta-investment of forms," to extend Laurent Thévenot's work on the investment of forms (Thévenot 1984) one step further, in order to make standards themselves more generic, stable, and interoperable (which is already the purpose of basic standardization). It is as much a reinterpretation of a technical reality that precedes it as a way to devise, discover, and/or ascribe (the frontiers between those terms are blurred) new distinctions that proved immensely useful (see Pierre Livet's contribution in this volume and Monnin 2013, parts 3 and 4, for a more thorough discussion on *distinguishing* as an ontogonic activity).

2.4. Resources as Shadows Symbolized Through Functions in REST

REST articulates a very original view of what's "on" the Web. According to Berners-Lee, URIs were not addresses, unlike UNIX paths. The difference between the two is mainly explained with regard to two different kinds of variations that I call "synchronic" and "diachronic."

Synchronic variations originate from functionalities, such as "content negotiation" (also known as "conneg"), a feature of the HTTP protocol that forbids taking one file stored on a server as what is being referred to by a URI, since the content served can vary according to the customization of the client's request, *making it impossible to functionally relate URI with one file on a server* (an assertion that holds from the inception of the Web, *pace* Koepsell). Furthermore, even "static" Web pages (which never really existed—a good example against this very idea would be the use of counters that changed their "pages" every time they were being accessed by a client) could be considered mash-ups, as they contained external URIs of images embedded in HTML elements, thereby distributing the sources from which such "pages" were generated. Such principles date back to 1991–1993, with System 33, a Xerox system demonstrated to Tim Berners-Lee by Larry Masinter at PARC in the early 1990s (Putz 1993; Putz, Weiser, and Demers 1993).

The other kind of variations, *diachronic variations*, are more widely acknowledged than the synchronic ones. It is well known that pages "evolve." Lacking any versioning system, the Web does not self-archive those modifications by adding a new identifier every time they occur. Yet "pages" somehow remain *the same*. Such paradoxical duality explains why URIs were at some point replaced by both URLs and URNs. At the time, it was thought that content varied too much on the Web to allow for stable reference, leaving this task to URNs, though URNs were devoid of any access function, at least through the HTTP protocol.[2] The dichotomy performed was a classic "on the Web"/"outside the Web" one, which was later abandoned thanks to REST—though this is something that still hasn't always been properly assessed. Another reason has to do with the fact that URLs are not addresses, or should not be treated as such, otherwise lots of problems arise because the *local* level of the database directories when it reflects the way URLs are written and constantly rewritten is no longer distinguished from the *global* level exposed to users, where stability is paramount; a necessity that is made clear through modules such as "URL rewriting" in Apache servers that help to manage both levels.

The solution advocated in REST (in a nutshell, without exhausting REST's significance for the Web) is a very elegant one. It states that instead of files, documents, objects, and so forth, what is being referred

[2] By default, everything on the Web will either change or disappear. Everything that has been published must be tended to. The idea that the so-called Web 1.0 was a Web of long-lasting, not-dynamic documents is by and large a phantasy.

to by a URI is a "resource." Here's the definition given in REST (by Fielding and Taylor): "A resource R is a temporally varying membership function $M_R(t)$, which for time t maps to a set of entities, or values, which are equivalent. The values in the set may be resource representations and/or resource identifiers. A resource can map to the empty set, which allows references to be made to a concept before any realization of that concept exists—notion that was foreign to most hypertext systems prior to the Web" (Fielding and Taylor 2002, 125).

Resources are compared to concepts or even "shadows" insofar they are not material, unlike "representations," those encoded messages that are served when a URI is dereferenced. Whence the paradox, central to the Web and its architecture, described by Fielding and Taylor in a paragraph judiciously entitled "Manipulating Shadows":

> 7.1.2 Manipulating Shadows. Defining resource such that a URI identifies a concept rather than a document leaves us with another question: how does a user access, manipulate, or transfer a concept such that they can get something useful when a hypertext link is selected? REST answers that question by defining the things that are manipulated to be representations of the identified resource, rather than the resource itself. An origin server maintains a mapping from resource identifiers to the set of representations corresponding to each resource. A resource is therefore manipulated by transferring representations through the generic interface defined by the resource identifier. (Fielding and Taylor 2002, 135)

One interesting consequence of this paradox is that unlike other information systems, where pointers are for instance linked to memory addresses, resources are truly abstract. Hence, what is digital, the representation, is also material (as in "not virtual"). If there is anything virtual, in the philosophical sense of the word, as opposed to actual, as Deleuze reminded us, then it is *not* digital. In addition, we come to understand, thanks to REST, that the issue at stake is not so much "what there is *on* the Web" but rather "what there is," a question that is asked anew *thanks to the Web.*[3]

3. From References to Referentialization

3.1. Resources as Rules

In order to address these difficulties, one should decide against favoring philosophical concepts, such as proper names (understood as an *explanans*) to shed some light on those that were now stabilized in the

[3] Among other things, there are digital objects that have specific properties, being non-rivalrous goods, for instance (see Hui and Vafopoulos in this volume). Though ontologically challenging in their own way, they still differ from resources. A thorough analysis of the Web must account for both the latter and their representations.

current state of the architecture of the Web (resources, URIs, HTTP representations, etc.). We have already paid twice for the concepts we received from the actors we were studying: first by refusing to follow them when they appealed to the philosophy of language, then by following what they had "practically" done.

There is yet another distinction that calls for an explanation in REST: the idea that resources can be further articulated by *states* and *representations of these states* (whence the acronym REST itself: what is *Transferred* on the Web is a *REpresentational State* of a resource). We thus end up with three constitutive elements: the *resource* identified by the URI, the *state* entered at a given time, and the concrete, accessible *representation of that state*. I would like to argue that this threefold distinction leads to a comparison with Wittgenstein's concept of a rule, the resource being the equivalent of the rule; the state the result of rule following; and the representation a symbolic (or technical) representation of the latter.

The concept of a rule sheds light on a central difficulty for Web architecture. REST indeed specifies that a resource is always abstract, as opposed to its representations. Nevertheless, to argue that my resource is a chair requires associating the physical properties of a chair with the abstract properties that Web architecture attributes to the resource. As in Edward Zalta's (2003) take on fictional entities—whose relation to rules is more obvious than chairs!—where some properties are either *encoded* (being named Sherlock Holmes, having a brother named Mycroft, and so forth) or *exemplified* (initially being a creation of Conan Doyle, appearing in such and such novellas, etc.) by the fictional objects. The abstract character of resources is both upheld and denied in URI standards, especially in the RFC 2396, for instance. Far from being anecdotal, this betokens how difficult it is to overcome the received conception of objects as physical entities. It is directly from such a conception that seemingly stems the need to sunder resources into "information" and "non-information" ones, from UDIs to HTTP-Range 14 (though not REST!).

If we want to get rid of those paradoxes, we'll have to forge a conception of objects at least as subtle as what is hinted at with the concept of a resource.

3.2. Referentialization Instead of Reference

Up to now, the distinctions drawn from the architecture of the Web have been discussed in relation to the positions of three philosophers: Russell, Wittgenstein, and Kripke. According to this view, to understand the architecture of the Web one need only choose one position among the three. The problem with this view is that it deprives Web architecture of its autochthonous technical background, distinctions, and mediators; in other words, of its specificity being thus reduced to no more than an "intermediary" in Latour's sense, in other words the mere projection of conceptions drawn from the philosophy of language.

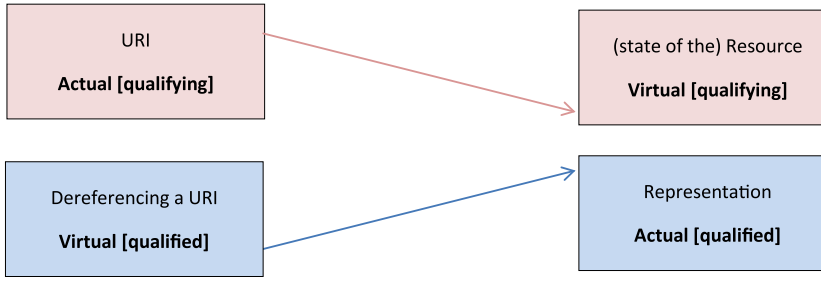


FIGURE 3.1. Referentialization of the Web.

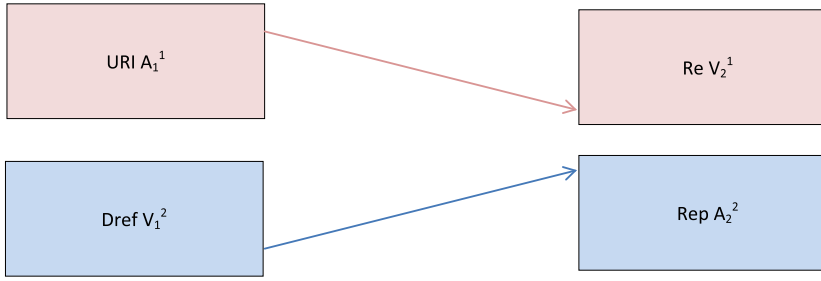


FIGURE 3.2. A process view on dereferentialization.

The work of Pierre Livet and Frédéric Nef (2009) on "social beings" (more aptly described as an attempt to "ontologize" Wittgenstein's concept of a rule) proved helpful in making sense of the architecture of the Web itself. Their "ontology of process" allows us to articulate resources and their representations according to their respective *virtual* and *actual* dimensions (the abstract resource having to do with the virtual, and its concrete representation with the actual—meaning that digital beings belong to the actual, the effective; in other words: *not* to the virtual).

In a nutshell, this analysis leads to a model where two processes converge, a qualifying process and a qualified one, as depicted in figure 3.1.

Translated into Livet and Nef's formalism,[4] the model takes the following form (depicted in figure 3.2):

[4] The arrow indicates a coupling, typical of processes, between the actual and the virtual; the characters between the parentheses refer to the aspect that is being replaced; the part in italics, to the aspect that will replace the latter; in bold, the process that is qualified; the superscript the initial (1) or final (2) aspect of a process; the subscript, whether it's process number 1 or 2; V stands for virtual, A for actual.

$$\text{URI } A_1^1 \rightarrow (Re\ V_2^1)\ \mathbf{Rep\ A_1^2}$$

$$Rep\ A_2^2 \rightarrow \text{Dref } V_1^2$$

As in a promise, in the example Livet and Nef use to illustrate their analysis, the virtual dimension *weighs* on an actual process and qualifies it (qualifying an action *as the fulfilling of a promise*, just as a resource qualifies a representation as belonging to one virtual trajectory instead of another). Two HTTP representations might indeed look identical from an actual perspective and differ with regard to their respective trajectories.

Take this canonical example of Web architecture (Jacobs and Walsh 2004): a daily report of the weather in Oaxaca, Mexico. If one dereferences the URI that identifies this resource on August 1, 2004, the report generated will naturally provide information about the weather in Oaxaca on August 1, 2004. Yet one would be wrong to infer from this representation that it represents the weather of Oaxaca on August 1, 2004, and then straightforwardly use this URI to bookmark such a resource. Indeed, there might even be an archived URI that identifies a second resource: "the weather in Oaxaca, Mexico, on August 1, 2004." Although both resources may spawn identical representations when their paths cross at a given time, they will remain different insofar as we keep in mind the heterogeneous virtual trajectories that they draw and into which, consequently, their representations are inserted: the first will change on a daily basis, while the second typically *should* remain stable over time (on the Web, remaining stable is *never* a given; it always costs a lot).

Instead of the traditional notion of reference, the gap between words and the world, words and things, signs and objects, we're led to understand the basic relation between URIs and resources and their representations as a technical (and editorial) relationship of referentialization as displayed above, a relation where various mediators (servers, browsers, URIs, algorithms, standards, and so on) play a role that is simply impossible to conceive from the traditional perspective of the philosophy of language.

It belongs to a philosophy of (the architecture of) the Web to measure the discrepancy between itself and the tradition. The very practice of "philosophical engineering," a phrase coined by Tim Berners-Lee (2003) to designate the activity of Web architects, produces new distinctions and new entities without necessarily keeping to them, sometimes even burying their specificity behind received philosophical positions, whereas to remain faithful to philosophical engineering, one has *to go so far as to critically examine the philosophies under which it is buried by the actors themselves.* To summarize, philosophy is no longer treated as the *explanans* (the relation of reference that is studied by the philosophy of language) with regard to an *explanandum* (referentialization as a working, though largely modified, relation of reference; i.e., full of mediators, standards, shadows, and so forth).

3.3. The Object as a Rule

Philosophical engineering can be understood as the result of an *ontogonic* activity through which *new beings* emerge. At the center of Web architecture, the very notion of a resource explains the distinctions drawn in philosophical engineering by adding a level of indirection between the identifier and the tangible, actual, representations accessible on the Web. Instead of a dualistic picture, torn apart between identifiers understood as tags attached to ready-made, extensional objects, what is drawn in REST is a completely renewed picture of objects conceived as *rules of individuation*, reminiscent of Roy Fielding's definition of the resource as being "the semantics of what an author intends to identify" (Fielding and Taylor 2002, 135). The very act of positing an object means becoming engaged to remain faithful to that same object by *regularly* (in both the *normative* and the *temporal* senses of the word) serving adequate content *about* it. In other words, the main innovation of Web architecture, surprising as it may sound, is not to be found in any concrete mediator, be it the server or the browser, the URI or the link, HTTP as such, and so on. It is an *ontological innovation* around which everything else revolves and whose mode of existence in turn can only be felt through a coordinated choreography of mediators.

Assimilating objects to rules points to various philosophers, including Kant (see de Coorebyter 1985), for whom objects were constructed with rules—the concepts of the understanding, a list of which is given at the end of the Transcendental Deduction. In 1910, Ernst Cassirer (Cassirer 1977) extended the idea that *concepts* were rules through his notion of "serial objects," inspired by the progress of the modern logic of his time, in particular the privilege given to a functionalist symbolism over substances (here, the similarity to the quote above from Fielding is striking). Husserl (1989) made similar remarks at exactly the same time (1910) (see Gérard 2005). In 1928, Carnap (2001), in his *Aufbau*, completed this rethinking of objects and the shift from Kantianism to neo-Kantianism, the object looking more and more like a *function* insofar as it became impossible to distinguish it from a concept. Yet, despite the "construction" metaphor so paramount in Carnap's book, except for Cassirer and the late Husserl these thinkers neglected the importance of technics—a theoretical stance that can no longer be ours.

Here's the paradox: once again, the most autochthonous (or "heterogeneous," as Bernard Stiegler would put it in his trademark Husserlian fashion) components of the Web that emerged out of philosophical engineering pave the way for a renewed understanding of objectification, and thus of ontology itself. We need to understand what kind of referents there are on the Web. Although this is made possible through a careful analysis of its architecture, our investigations also lead to another paradox, since objects are no longer *physical objects*. Actually,

they even look very much like *senses* or *meanings*. Yet we're not ready to adopt a neo-Fregean framework and abandon the focus on reference that seems to characterize the Web. Rather, it's time to think afresh what referents are. In this respect, an examination of the best system of reference humankind has ever known so far is a mandatory step.

David Kaplan's famous analysis of deictic expressions will help us to account for this little conundrum.[5] According to Kaplan, the meaning of a deictic expression is akin to a function, which doesn't vary. Kaplan distinguishes between the *content* of the indexical expression and its *character*. The character is a function or a "rule," the linguistic meaning of an expression that associates contexts as input and contents as outputs. Under such an analysis, an indexical like "I" may be analyzed this way:

	"I"
Character	The singularizing rule of being the enunciator of the expression "I"
Content	The object itself
Extension	The object itself

Kaplan's question consisted in determining whether when using deictic expressions they are being directly referred to or not. Despite his insistence on the importance of rules, objects, on this view, remain untouched. Therefore, we have to move one step further. The possibility is given by Brian Cantwell Smith's account of objects. Smith compares the aforementioned situation, with deictic expressions and rules, to the attraction exercised by a magnet. Just as with the rule of the deictic, the attraction remains constant and systematic (governed by laws, not unlike meaning itself). By contrast, the objects that fall within its attraction, its "referents," vary alongside the use of the magnet (the decisive factor being *use* more than *token*, says Smith). He contends that in both cases "the governing laws (regularity, habits) is an abstract but constant universal that maps particular occurrences—events, essentially—onto other particular occurrences or events, in a systematic way.... The crucial point of similarity, which is also the most difficult to say, has to do with the fact that the particularity of the result, referent of collected item, *spreads out through space and time*, in a kind of continuous egocentric (differential) way, until it captures the first entity that relates to the source or originating particular events in the mandated fashion" (Smith 1998, 170). Such individual entities remain beyond the grasp of physics; they are presupposed but not given. Whence this radical conclusion: "In sum, being an individual object is also not, in and of itself, an effective or even salient physical property. No physical attribute holds of an individual, for

[5] Kaplan's texts on direct reference are available in Davidson 2007.

example, except in virtue of its physical composition. If 'to be is to be the value of a bound variable,' physics will be of no help in easing the existential angst of any ordinary individuals. *For there are no physical objects*" (Smith 1998, 178; see also Livet and Nef 2009, 207).

Objects are no more given *hic et nunc* than resources are. Even more so, representations share with physical particularity the ability to spread out through space and time once they are related either to an object or to a resource accounting for their virtual trajectories. Hence, the Quinean motto that "to be is to be the value of a bound variable" (Quine 1980) may handily be turned into "to be an object is to be an individuating function" (or rule). Throughout innumerable encounters with representations, the object forever remains absent (at least *in toto*) in the background. Again, not very far from the way REST accounts for resources as intangible shadows and also reminiscent of the philosophical meaning of objects. "Objective existence" has been contrasted since the seventeenth century with "formal existence," what we would now call *concrete* existence, a trait Whitehead elaborated upon in the twentieth century, especially through his rejection of the principle of "simple location,"[6] according to which objects have a simple spatial and temporal location *hic et nunc*—a clear forerunner of our analysis if Web architecture is indeed an ontology.[7]

3.4. Frailty, Thy Name Is Resource

To impart a little more realism to this definition, one could refer to the work of Etienne Souriau, whose entire project, according to David Lapoujade, was to "save from nothingness the most frail and evanescent forms of existence" (Lapoujade 2011). We are balancing between two different worlds, to borrow a distinction made by Antoine Hennion (2007, 362): an "externalized world," shared, agreed upon, comprising autonomous entities, and an "internalized world," where nothing receives fixed properties or identity, where objects are constituted "by actively participating in constitutive operation." I would like to hint at a diplomatic mutual understanding of Wittgenstein's philosophy and Actor Network Theory by drawing a parallel between "attachments" as described by Hennion (2004) and "rules." Rules are typically in between objects and subjects, action

[6] See the analysis of Debaise (2006). Whitehead's discussion of this principle can be found in his *Science and the Modern World.*

[7] One should immediately add that the very word "ontology" appeared at the beginning of the seventeenth century, following the work of the late scholastic Francisco Suarez, in the works of Jacobus Lorhardus and Rudolph Goclenius. Contrasting with the tradition of the Aristotelian metaphysics, "ontology" was newly conceived as a "theory of objects" in the wake of Duns Scotus' concept of the univocity of being. My own work on the Web builds upon this understanding of the word "ontology" (*mutatis mutandis*).

and passion, freedom and determinism, and so forth. The parallel becomes all the more obvious when one realizes that *a rule is typically what makes someone do something*, in a very Latourian way of redefining agency, neither causally nor by sheer force. If resources are shadows, as much agent as patient of individuation, they nevertheless have their own agency, as befits objects—*and rules!* Nor are resources mere antifetishistic projections: they display a clear resistance by demanding *regular* coordination *of* their representations as well as *to* their representations—upon which they also depend. Not a small feat at all in the context of online publication.

It is easy to miss the resource and its *tentative ontology*, an ontology to be *achieved* rather than simply recorded. Forget good practices; substitute tangible mediators themselves to the *reason* why they are coordinated; or simply shift back to the world of extensional objects, "post-ontological objects" according to Smith (1998, 131)—and *voilà*! Even now discussions are going on inside the W3C to get rid of resources (see Summers 2013). Supposedly, Web developers have nothing to do with them—*in practice*; just as theoreticians stubbornly ignored them—*in theory*. To save an object from nothingness out of respect is a weird defense against a traditional ontological backdrop. Once we've moved to a completely different picture, call it the "successor metaphysics" as Smith does (1998, 87) or tentative ontologies as does Hennion, and the paradox disappears. All one needs is *to dispose oneself to be played by the rules.*

4. Conclusion: Toward Ontological Politics

There remains the task of determining how to agree on the components of a shared world. The solution doesn't come from a single person. Indeed, the idea to use Wikipedia to perform the function of "sorting propositions," which Latour identified in his *Politics of Nature*, dates back to 2006, with the birth of DBpedia, the central data repository of the entire Web of Data (as represented on the Linked Data Cloud).[8] This solution of using an encyclopedia in order to come to an agreement about the ontological furniture of the world is exactly what Ruth Barcan Marcus had in mind with her idea of a "dictionary," though this part of the philosophical problem was of no interest to her, as only the result (objects to be tagged) interested her, not the way we get there—unlike Semantic Web practitioners.

The political dimension of this ontological achievement should not be lost on us. Indeed, to produce an ontological device on a global scale

[8] Cf. http://lod-cloud.net/. See Auer et al. 2007.

cannot remain outside politics, because objects thereby acquire a political dimension, as pointed out by Noortje Marres:

> Like other forms of politics, we then say, the politics of objects is best approached as a performative politics. For no entity, whether human or non-human, institution or things, it suffices to posit on theoretical grounds that they "have" political capacities. For all entities, agential capacities depend at least in part on how these entities are equipped—on the configuration of an assemblage of entities that enable the explication of their normative capacities. This is why, somewhat paradoxically, in order to grasp the politics of objects, we must pay attention not just to objects, but also to the technologies and settings which enable them to operate. We must investigate how particular devices make possible the investment of things with political capacities. (Marres 2012, 104–5)

The Web, from the point of view of its architecture, certainly serves as a prime example of a device that "makes possible the investment of things with political capacities." Still, a lot remains to be done in order to improve the way objects and people are represented—in the political sense of the word; how the pluriverse, the many ways things both individuate themselves and are individuated, finds its adequate expression and related controversies made more visible. The latter could be achieved by making more "epistemic data" available on DBpedia regarding the state of the objectification on Wikipedia: the nature of the sources used to draw the portrait of an object (those who produce the primary sources quotable on Wikipedia in fact determine the nature of the *"porte-paroles"*—"experiments," "facts," "numbers," and so forth; others can mobilize to single out an object), the history of the articles, the discussions and controversies that they sometimes generate, and so forth.[9] As of now, these data are lost on us on DBpedia, as if no epistemic properties were involved in discriminating objects. We saw precisely the contrary.

The current philosophy of the Web, its architecture, appears not only as prosthesis for objectification. As is made obvious in the parallel with Brian Cantwell Smith's philosophy of objects, it is possible to think about it as a genuine philosophical position, despite its not being written in a book. We're no longer projecting philosophical concepts; rather, we came to recognize how the distributed agencies—rather than the actions—of "objects" (shadowy resources), "subjects" (publishers, Web architects, and so on), and mediators (standards, servers, protocols, languages, etc.) as much hold the Web as they hold thanks to the Web. Then, by extending

[9] The author is the co-initiator of the French version of DBPedia, available online at http://dbpedia.org and as part of the SemanticPedia project (http://www.semanticpedia.org/), a platform for the publication of the Wikimedia projects in French in conformity with Linked Data guidelines. This project presents an upgraded version of DBpedia, where the page history of each article is semanticized, and aims at keeping track of discussions as well both encouraging and fostering controversy analysis on Wikipedia.

the architecture of the Web, its operative philosophy or ontology, to Wikipedia (and DBpedia) understood as the institution where resources undergo various trials (what Joëlle Zask [2004] calls a process of "inter-objectification" in reference to John Dewey), we see how the Web performs something that would no longer qualify simply as an ontology (focusing on the nature objects *qua* objects) but as both a *political ontology* and an *ontological democracy* where everyone participates in determining and "making happen" what there is.

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