Materiality and Organizing

Social Interaction in a Technological World

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The Challenge of Materiality: Origins, Scope, and Prospects

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Return to the Material

Few people would dispute the claim that new technologies bring changes to the way people communicate, act, and organize their social relations. Technologies such as tablet computers certainly have transformative potential. Users of iPads recognize that their relationship to the office has changed now that they are perpetually connected, and users of social media have found that their private lives are now much more public than they once were. Today, although technologies such as telephones or microwaves are considered quite mundane, it does not take too much thought to envision how our daily use of these tools has changed the ways we maintain social connections, think about our diets, or even conceive of family time.

Ask the random person on the street whether new technologies bring about important social change and you are likely to hear a resounding, “yes.” But ask academics who study technology and social practice and the answer is likely to be less definitive. Although most contemporary scholars do not deny the important role that new technologies play in the reconfiguration of social practice, few are ready to admit a direct causal relationship. Instead, they tend to say things like new technologies “enable,” “occasion,” “afford,” “enact,” “make possible,” “co-construct,” or “mutually constitute” the social contexts into which they are introduced. In short, today’s scholars from fields as diverse as Communication, Information Systems, Management, Anthropology, and Informatics recognize technologies’ transformative potential, but typically stop short of saying that technologies “cause,” “shape,” “create,” or “determine” social change.
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Since the dawn of the industrial revolution, scholars and other public commentators have made grand claims about how new technologies have changed or will change the social world. From epochal accounts of riding stirrups creating medieval feudal systems (White, 1962) and the written or printed word altering humanity’s collective consciousness (Goody, 1977; Ong, 1982) to systems-level theorizing about the ways new manufacturing technologies would change the way firms organized (Woodward, 1958) and how information systems would inevitably shift a firm’s expertise and decision-making processes (Likert, 1961), scholarly work considered technology as a major agent of social change.

From the 1980s onwards, scholars working with more fine-grained levels of analysis began to challenge the assumptions made in this prior research. By charting the actual ways in which people incorporated new technologies into their work, a new set of “social constructivist” studies demonstrated that any effects that new technologies had on the way people worked were mediated by a variety of social processes (for a detailed review of these studies, see Leonardi and Barley, 2008). Consequently, many scholars concluded that the important social changes that occurred in the wake of a new technology’s implementation were as likely to be the result of people’s choices about how to design and use the technology as attributable to the artifact itself.

As social constructivist thinking has gained in popularity, at least in academic circles, scholars tended to move toward the use of ambiguous terms such as those presented above when talking about technology-induced changes in a way that does not exclude the role of human agency and social choice in shaping technologies’ effects. Use of such terminology has led many down a slippery ontological slope. At its extreme, the social constructivist position holds that technologies themselves hardly matter at all in discussions of social change (Grint and Woolgar, 1997). What matters, instead, are the ways in which those technologies are used in the context of work or other social settings. The types of empirical studies that have evolved from such thinking certainly do not trace a particular social change to a particular technology feature. Nor do they describe in any detail what features a technology has or how they are used. Instead, studies taking this rather extreme ontological position document ways in which a new technology becomes embedded in a “web of interpretation,” a “practice,” or a “cultural meaning system” and how perceptions “enact social practices” or “enable interactive shifts.” In short, technologies themselves cease to be important in studies of social change. At best, they become an occasion for studying social relationships in particular contexts of social or institutional life.

Such thinking is problematic for theoretical reasons and empirically untenable in the face of the many studies that document the profound changes
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resulting from the use of new technologies. Our own experience belies extreme forms of constructivism. Even undergraduate students often point to previous technological eras they lived through, acutely mindful of the differences new technologies sustain.

To steer away from the poles of determinism and radical constructivism, a new trend has emerged in the last five years discussing how “every organizational practice is always bound with [a technology’s] materiality” (Orlikowski, 2007: 1436) and arguing that “materiality matters for theories of technology and organizing because the material properties of artifacts are precisely those tangible resources that provide people with the ability to do old things in new ways and to do things they could not do before” (Leonardi and Barley, 2008: 161). In their efforts to reclaim the important role that technologies play in organizational life without resorting to antiquated claims of determinism, organizational researches have followed the broader “material turn” in the social sciences (for a review, see Pinch and Swedberg, 2008: 2) in arguing for a focus on the ways that technology’s materiality becomes implicated in the process of organizing and social practice in general.

Although a return to the material sounds like a viable strategy for incorporating the role of materiality into constructivist understandings of the social world, there is, at present, at least one problem with this strategy. The problem is that the term “materiality,” and other related terms that scholars have begun to use, such as “material,” “material property,” “material consequence,” “materialize,” “materialism,” “sociomaterial,” and “sociomateriality,” are neither well defined nor consistently used (see for further discussion, Leonardi’s Chapter 2, in this volume). Moreover, their relationship to concepts in regular use in the social sciences such as “technology,” “form,” “function,” “artifact,” and “socio-technical system” is not yet clear.

As Berger et al. (1972) argue, it is difficult to build meaningful theoretical research programs without concepts that are internally consistent and clearly defined in relation to other existing concepts. The goal of this book is not to reach clear definitions about the concept of materiality. Instead, we assembled the chapters included herein so that in conversation with each other, the chapters might begin to surface similarities and differences in the way leading international scholars from the fields of Anthropology, Communication Studies, Economics, Informatics, Information Systems, Philosophy, Science & Technology Studies, and Sociology are thinking about the role of materiality in the organizing process. Before previewing the book’s contents, we discuss why “materiality” has been such an elusive term and we offer some observations on what it might mean to take materiality seriously when studying technologies and their effects.
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Origins and Problems

The ideas currently conveyed by the concept of materiality may have lived an obscure life for several decades. The origins of the current use of the term (e.g., Hayles, 2002; Barad, 2003; Orlikowski, 2007; Pinch, 2008) can perhaps be traced back to French structuralism and the significance this metatheory has attributed to the material means (phonemes and marks) through which the fugitive character of meaning is captured or molded, expressed, or extracted and conveyed. On this view, ideas are transient, borderless, and evasive. By contrast, the solidity of the material means by which ideas are expressed helps fix and stabilize the transience and evasiveness of ideas, making them the cognitive currency of human communities. One of the key tenets of structuralism that descends from cultural anthropology, linguistics, and philosophy of Claude Lévi-Strauss (1963, 1966) is the derivative status of cultural content. Rather than being at the origin of human action, the primary condition that provides the orientation human communities seem to need, meaningfulness emerges out of basic distinctions, first performed upon the molten character of reality through the materiality of signs (phonemes and marks) and further organized into semantic blocks and narratives by means of a web of primary oppositions or differences (e.g., good/evil, light/dark, earth/haven, mother/father, raw/cooked). Via post-structuralists such as Barthes, Baudrillard, Derrida, Foucault, and Lacan, among others, these ideas have drifted and reached in a massive scale the Anglo-Saxon world, originally in literary theory, linguistics, and semiotics (Bolter, 1991; Jameson, 1991; Hayles, 1999) and later in social theory at large. In social theory, in particular, they have further been disseminated and occasionally popularized by the perspective known as actor-network theory (ANT; Law, 1991; Law and Mol, 1995; Latour, 2005) while their origin has become increasingly obscure.

The strong appeal that the concept of materiality has been exercising over the last few years is indicative of the rich web of associations the concept carries. And yet, what exactly materiality connotes beyond its allure is far from clear. While occasionally recognizable, the original structuralist insights have been lost or weakened and the concept has been vested with all sorts of meanings and implications. At first sight, the current reference to materiality would seem to reecho the original belief in the plenitude and enduring status of material reality. The concept seems to resonate with the power which solidity grants to physical things and the inescapable situatedness of human agents that is among other things tied to the corporeality of the human body (Arendt, 1958; Bowker and Star, 1999). Whatever humans do would seem, in some way or another, to be contingent upon these inexorable conditions and the ways material things mediate and interfere with human affairs. Thus
understood, materiality is indicative of both the embodied and embedded nature of human experience, the multiple entanglements of humans with material objects and artifacts, and the various supports these provide to human pursuits.

These appealing ideas are, however, not as unequivocal as they may seem at first glance. For, how is one to distinguish the material from the nonmaterial? Where exactly would the dividing line between material reality and whatever aspects of human living and doing that transcend that reality be drawn? Most of the material things and objects that sustain social life are cultural objects that have been invented and produced by humans to assist with their daily endeavors. Production resonates well with materiality but invention less so. To invent amounts, after all, to imagining a function or use that does not exist yet. Imagination transcends the given or immediate, and in doing so, it construes reality as different from what currently is. From this point of view, the process of inventing is akin to metaphor and thus closely associated with linguistic creativity and the faculty of imagination. Here is how Kenneth Burke captured the issue some years ago (Burke, 1978: 18–19):

The most practical form of thought that one can think of, the invention of some usable device, has been described as analogical extension, as when one makes a new machine by conceiving of some old process such as the treadle, the shuttle, the wheel, the see-saw, etc. carried over into some sets of facts to which no one had previously felt that it belonged... “Carried over” is itself as etymologically strict translation as you could get of the Greek word “metaphor.”

Invention is certainly a material or Promethean practice of “creative destruction” (Schumpeter, 1983/1934) that takes place amidst or against the background of other things, prior inventions, prevailing techniques, and new concerns or experiences. At the same time, it is a practice that is inseparable from imagination and the capacity to think of reality as different from what it is. In a fascinating and, at the same time, perplexing way, invention as social practice ties the plenitude of things to the disembodied status of imagination, and instrumentality and utility to make-believe (Bateson, 1972; March, 1976; Kallinikos, 1998, 2011). And while it might be possible to concur with Latour (1986) on the dependence of thought on material things and instruments, what he calls “thinking with eyes and hands,” lumping the two processes together may often end up glossing over important differences that obscure rather than illuminate the intricate ways through which ideas and things turn upon one another (Vygotsky, 1978; Leonardi and Barley, 2008). Imagination is certainly associated with visual supports of various kinds, plotting and measurement systems, and other techniques of “materialization” but these do not make the faculty of imagination and whatever it sustains just a material practice.
Analogous objections could be raised with respect to the evocative yet ambiguous label “material culture.” The term carries several undertones (Jameson, 1991; Miller, 2005) but it is often deployed to refer to the omnipresence of material things, that proliferating universe of consumer objects that accompanies contemporary life and is often associated with the embeddedness of capitalism and the hedonistic habits of consumer society. Implicit in the use of the term material culture is the idea of another culture, less or nonmaterial. But which culture? Capitalism is after all the most abstract and artificial (in the sense man-made) social system ever known, and its material culture is accordingly closely tied to its abstractions. Consumption itself is in many respects a semiological practice (Barthes, 1977; Baudrillard, 1988), the very mediation and using-up of impressions by means of material objects. Consumption grows at the confluence of use and status symbolization, physical needs and psychological motivations, reality, and deception, a practice which Thorstein Veblen (1899/2007) identified at the dawn of the consumer society and summarized with his much quoted phrase “conspicuous consumption.”

**Technology and Materiality: Double Binds**

Some of these intellectual puzzles recur in the use of the concept of technology which constitutes a central object of inquiry in this volume. Technology and materiality may seem intimately related to one another. One of the primary associations which tools, technical systems, and artifacts invoke is their solidity, a persisting objectness granted to them by their material or corporeal status. Yet again, upon closer scrutiny, technological objects are not distinguished on the basis of their sheer materiality but rather thanks to the functions they summon or embody, for example, a knife is used to cut, a vessel to contain, a camera to take photographs. Of course, functions are human fabrications grafted upon whatever matter fits or is able to support them, straightforwardly or through elaboration.

Function is so deeply immersed in our ordinary awareness of objects that it is only with an effort, as Searle (1995) notes, that we can transcend the perception of technological objects as functional entities and see, say, a motor vehicle, a bath tub, a screwdriver as a material bundle, a collection, as it were, of molecules. These feelings of wonderment are reinforced by reflection on the nature of software, surely one of the most interesting technological developments in the history of technology. For, ultimately, software is no other thing than a series of logical instructions, possible to execute by a machine. No matter which material supports software needs, reducing its distinctive technological profile to whatever connections it maintains with
hardware and human agents amounts to bypassing what is most interesting about the software; that is, its logical and largely immaterial nature. Failing to appreciate the ontological constitution of software and the intimate connections it maintains with logics and mathematics may end up missing the distinctive nature of its far-reaching effects on humans and their pursuits (Borgmann, 1999; Gleick, 2011).

Against the background of these intellectual puzzles and the difficulties they generate, many scholars have, wittingly or unwittingly, turned their attention away from the cardinal issue of how the functional identity of technological objects is or could be tied to social outcomes. Technology and materiality have been claimed to matter only to the degree that they produce effects of one or another kind by providing an occasion or context into which human practice unfolds (several chapters in this volume). What matters here is not the intrinsic functional identity of technological objects (if there is such a thing) but whatever consequences these objects help bring into being (i.e., materialize), with the intentional or unintentional complicity of humans, purposeful engagement, or chance. Conceived in these terms, materiality is not a causal force of social outcomes but a fundamental human condition tied to the material anchorage of human agents and what is often perceived as the inexorable reality that everything that happens cannot but happen in a “here and now” (the leitmotif of situatedness). In some way or another, materiality is in the very end equated with materialization that seems to be considered the passage through which everything that exists ultimately acquires material status.

However, puzzles expelled and not resolved are bound to recur, in some way or another. What effects exactly is such a view of materiality concerned with? How is technology tied to these effects, given the fact that ideas and immaterial conditions may also have consequences, and not infrequently serious ones? Is materiality just another name for realization? Is all that exists in a “here and now” and that comes to pass through the active or latent complicity of humans seen as materialization? Furthermore, are all effects and consequences equal? What technologies or conditions are tied to what effects? And what about unintended and propagating consequences, side effects or, as we claim below, temporally non-contingent yet connected events? How is one to grasp the distant or historically constituted forces that often transcend the confines of particular contexts and operate beyond a “here and now”? This is just a small sample of questions raised by the conception of materiality as materialization and the understanding of technologies solely in terms of the consequences they bring about.

These observations indicate that straightforward and conspicuous as materiality may originally seem, it turns out to be a rather evasive and difficult to pin down concept. Similar to the horizon, an understanding of materiality seems
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to recede as we approach it. In some way, the issues we have mentioned so far recall major divides in social thought and reprise the inherent tension that is, among other things, associated with whether the focus is on the interactive order (the situated character of human encounters) versus the structural order (the stable conditions that shape and reproduce social practices). Such epistemological and ontological differences recur through the ages and are unlikely to be resolved in any definite way, even though advances can be made in one or another frontier of social inquiry. In this regard, materiality and technology raise new challenges and provide novel avenues and conceptual tools for rethinking these recurrent and persistent questions.

It is interesting in this context to point out a certain drift that the current revival of materiality epitomizes away from the anti-subjectivism, characteristic of scholars of a post-structural bent and the critical attitude many of them have maintained vis-à-vis agency-centric explanations of social life, the making of art objects included (see, e.g., Barthes, 1977; Foucault, 1980, 1988; Hayles, 1999). For, as already indicated, key to the original understanding of materiality has been the idea that the solidity and enduring character of things and, crucially, the different relations they enter with one another (the idea of structure) counterbalance the fugitive character of ideas, and the fragility, limited perspective, and inconclusiveness of human agents, insights that are still discernible in Barad (2003). Rather than being simply constrained by structure, as the typical conventional interpretive understanding wants us to believe, human choice and agency are made originally possible through the very resources that objects and structures dispose.

Activity theory, for example, assumes that human activity is mediated by tools, that is, the relation of a human subject to reality alters through the use of tools (Vygotsky, 1978). Vygotsky proposed a notion of psychological and material tools (1978). At first glance, this scheme would appear to denote the physicality of the tools themselves, but the notion hinges instead on the “reality” they are changing. Psychological tools enable complex cognitive functions and include, for example, systems for counting, mnemonic devices, algebraic symbol systems, works of art, literary genres, schemas, diagrams, maps, technical drawings, and language (see Cole and Wertsch, 1996). Material tools act on the world and comprise what we normally think of as “tools”: knives, hammers, and so on. Critical to this formulation is the capacity of tools to make human choice and agency possible in the first place—not merely to “constrain.” For example, Fayard (Chapter 9, this volume) observes that when physical space is mentioned in organizational studies, it is usually as a constraint affecting interaction and communication (e.g., measurable physical distances that separate people) rather than a generative resource (p. 179). Activity theory holds that whether such resources and tools promote more sophisticated cognition or transform the world around us, they are not a
kind of external surround like a shell, but the very stuff of who we are, continually producing skills, identities, and culture.

These observations suggest that the mutual interpenetration of the social and the technical—the entanglement of humans with artifacts—can be approached by different routes that put the emphasis either on the interpretive nature of human agency or, alternatively, on those factors that render that agency possible in the first place. In the former case, human agency tends to remain the original explanatory medium for the constitution of social reality, the primary force, as it were, through which material conditions are appropriated to shape the social world. In the latter case, materiality, technology, and agency are not any longer exogenous to one another. Rather, they mingle in an indissoluble bundle of iterative or recursive relations that removes human agency from the center stage, making it just one more force among the dance of forces that express and govern social life.

One way of addressing some of these rather intricate issues is by inserting their understanding within a historical or evolutionary framework. There is, of course, a strong difference in focus between history (culture) and evolution (biology) but common to both is the temporal perspective they invoke and the concomitant assumption that human artifice and material conditions exhibit different constellations across time. Against these considerations, it would seem rather unlikely that materiality and technology have mattered and continue to matter equally across historical periods and contexts (Arthur, 2009; Borgmann, Chapter 17, this volume). Indeed, from such an evolutionary or historical perspective, technology could be seen as an important means through which the human relationship to the world and its materiality is reframed and reordered. Medieval techniques, for instance, epitomize a different relation to matter and the world than contemporary science-driven technologies (Mumford, 1952; Heidegger, 1977). Technological developments construct novel artifacts; discover or invent new materials (e.g., plastics); promote new skills, practices, and habits; and establish processes that alter the parameters by which matter is appropriated, used, and consumed by humans. They also generate effects or consequences of particular kinds (e.g., information search, digital records) that, despite their stochastic, non-determinist nature, are possible to trace back and associate with the cumulative and often interdependent nature of technological processes and systems and their technical lineage (here, search engines and software).

Book Structure

It appears that, while scholars have revived questions of materiality from decades past, they have, in doing so, sometimes construed materiality in
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ways foreign to, and well beyond, older conceptions of materiality as material culture, machines, physical artifacts, or things. In Part II, “Theorizing Materiality,” which follows this introductory chapter, three conceptual chapters retrace, each in their own distinct ways, the origins, scope, and prospects confronting the concept of materiality. In his chapter, entitled, “Materiality, Sociomateriality, and Socio-Technical Systems: What Do These Terms Mean? How Are They Different? Do We Need Them?”, Leonardi reviews the history of these various terms and explores ways in which they overlap and depart in meaning from one another in scholars’ writings. He concludes with a set of tentative arguments for how scholars might use these terms parsimoniously. For example, materiality might be best viewed as a concept that refers to properties of a technology that transcend space and time, while sociomateriality may be best used to refer to the collective spaces in which people come into contact with the materiality of an artifact and produce various “functions” (to use Kallinikos’s language elaborated in this volume). He argues, then, that the concept of a sociomaterial practice is akin to what socio-technical systems theorists referred to as the “technical subsystem” of an organization, or the way that people’s tasks shape and are shaped by their use of machines. This technical subsystem is recursively organized alongside the social subsystem of an organization, which is characterized by an abstract set of roles, communication patterns, and so on. The distinctions that Leonardi draws between these terms, and the conceptual apparatus that underlie them, help us to perhaps understand why authors of this book can speak to very distinct processes and outcomes while using such similar sounding words.

The second chapter in Part II, by Faulkner and Runde, takes issue with the perspective of sociomateriality, pioneered by Orlikowski a few years ago, by critically reexamining three fundamental assumptions on which such a perspective is predicated, namely the assumptions of relationality, interpenetration, and agential cuts. Relationality and interpenetration assert the constitutive bonds of entities or processes, agents and things underlying the making of our world, while the notion of agential cuts primarily refers to social agents and the ways they draw boundaries and institute relations, in a world in which humans and things are inherently entangled with one another. Faulkner and Runde question not the truthfulness of these claims, which they find reasonable, but rather their universality and the rather generic or unqualified ways by which they are made. They first note that these are arguments about ontology (not simply methodology or epistemology), that is, arguments making claims about the nature or being of the world. Then, they go on delivering with a nearly uncanny precision a number of arguments that show the basic assumptions of relationality and interpenetration to be specific instances of a much wider range of phenomena in which ontological independence is at least as tenable a position and as widespread a state as that
implied by relationality and interpenetration. They similarly question the notion of agential cuts by pointing out the agent-independent and temporarily prior nature of what, following John Searle, they call brute facts (moon, Mount Everest, Tyrannosaurus Rex). An essential and very subtle claim they make in this respect is that categories and classifications drawn out by social agents may have far-reaching social significance but they do not create new entities or things. They additionally criticize the notion of agential cuts for failing to recognize the stable, non-dramatic character of human dealings underlying the ordinary fabric of social life in which the boundaries of entities and established relations are seldom questioned.

The third chapter in Part II, by Kallinikos, “Form, Function, and Matter: Crossing the Border of Materiality,” portrays technological objects as variable assemblies of three fundamental constituents: function, form, and matter. Every technological object or set of objects has been designed or thus evolved as to accomplish a purpose or function (e.g., cut, transport, or move, rest or protect, process, contain) that is variously supported by the materials the object is made of and the ways these materials have been given specific form to assist and/or embellish that function. Kallinikos goes on to suggest that technological evolution betrays a trajectory that attests to the increasingly prevailing role function has assumed in the design of technological systems and artifacts at the expense of the other two constituents, matter and form. The pivotal role of function in the design and making of technological objects has essentially been assisted by advances in science and the discovery of new matter qualities or attributes that could be technologically extracted from nature or other primary matter, and enriched or manipulated in variety of ways. Kallinikos reads these developments as implying the progressive dematerialization of technological processes and objects and the increasing dissociation or unbundling of functional attributes from their underlying material constitution. Once perhaps a derivative of material attributes (wood, clay, or stone), an abstracted notion of function has progressively provided the primary matrix out of which technological objects and processes emerge. This shift is strongly reflected in contemporary digital technology which is essentially more logic (pre-programmed logical instructions) than techne (the art of making), and the consequent and expanding infiltration of computer hardware and other physical objects by software.

Part III, “Materiality as Performativity,” explores the relationship between the nature of artifacts and techniques, and the ways these are implicated in the making of aspects of the world we tend to confront as given. Pollock’s chapter, “Ranking Devices: The Socio-Materiality of Ratings,” deals with rankings and the effects these may have on the domains of life they subject to rating. Rankings seldom are passive recordings of a world out there. More often than not, they are constitutive of the world. They do so in the double sense
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of establishing the dimensions on the basis of which the domains they rank are conceived and perceived, and by influencing the behavior of actors within that domain, as these last seek to accommodate whatever opportunities or threats rankings offer. The idea is well known but Pollock offers a further exploration into how the effects rankings have are associated with the makeup or materiality of the devices by which rankings are achieved. He pays particular attention to visual devices and the way they structure and “economize” perception and attention. In other words, visual devices and graphs have affordances that are intimately tied to the figurative or spatial modes of perception that considerably shape how the domains to which they apply are conceived, as opposed to perceived, and mediated. These ideas are empirically explored in connection with the so-called “magic quadrant,” a particular ranking of IT (information technology) vendors, and the social, cognitive, and material process through which the magic quadrant has been constructed over time. A conclusion Pollock reaches is the very construction of markets, here the IT vendors market, through the affordances specific to the devices by which these markets are conceived as they are ranked and the rankings are mediated.

In their chapter, “Great Expectations: The Materiality of Commensurability in Social Media,” Scott and Orlikowski examine how contributors and users of the travel website TripAdvisor, along with the algorithms that the site uses to rank hotels and restaurants, together materialize particular value distinctions in the travel sector. Drawing on the concept of commensuration—the process of comparison according to a common metric—the authors examine how the rankings given by TripAdvisor are produced through the distributed reviews and ratings of thousands of user-generated postings, and transformed through filtering and weighting algorithms. Through this process of sociomaterial commensuration, the authors argue that the “truth” about hotel and lodging options given by TripAdvisor is performed through the website’s distributed and dynamic materiality, and they consider its influences for the expectations and encounters experienced by guests and hotel owners in the United Kingdom. Although commensurability may be changing the way that travelers and hoteliers experience the travel sector, Scott and Orlikowski suggest that “the processes of materialization that are core to TripAdvisor’s rating and ranking mechanisms are neither open nor subject to public scrutiny. In the past, hoteliers received private feedback from their guests on feedback forms, but through TripAdvisor’s proprietary algorithms, hoteliers are now digitally exposed” (p. 130). Consequently, when one looks at an entry about a hotel or a restaurant on the social media site, they are experiencing the process of commensuration as they are materialized through TripAdvisor’s rating and ranking mechanisms. The consequence of such materialization, of course, is that what one tends to and how one evaluates options for food and lodging
are distinct from what they would be if AAA (American Automobile Association) or Michelin provided ratings based on standard, static criteria.

The chapter by Yoo, “Digital Materiality and the Emergence of an Evolutionary Science of the Artificial,” finds its point of departure in the claim of an evolving world of artifacts that emerges out of the generative makeup of digital technologies. Such a fundamental condition is the offspring of the distinctive constitution or materiality of digital technologies. While the argument of the distinctive nature of digital technology unfolds along several paths, key to it is the contrast digital architectures offer to traditional product and industry arrangements. Digital architectures are, or can become, modular and, crucially, multilayered, thus establishing a spectrum of possibilities along which the products and services which they produce can be unbounded from specific uses, unbundled, and recombined in variety of ways that cross product- and industry-specific boundaries. Though exhibiting significant variability, the evolution of digital artifacts and services which modular and multilayered architectures enable could be explained, Yoo suggests, by exploring the lineage of digital artifacts and the similarities they share with one another at a deeper genetic, as it were, level. He accordingly draws on modern biology trying to establish an analytical framework whereby variety at the phenotypic level could be accounted for by a deeper genetic layer whereby a relatively limited number of routines and software components are thus made as to be able to enter into a large number of combinations (observable variety). His ideas of a genetics-based evolution of digital artifacts are illustrated by reference to those digital services known as APIs and Mashups. At the heart of Yoo's explanation is the idea of digital (im)materiality and the spectrum of possibilities that are established as digital artifacts or services get divested from fixed or specific and ultimately physically embedded attributes, thus turning increasingly product or service agnostic. In this respect, Yoo offers the beginnings of a theory that could be drawn upon to explain the lineage of what he calls “artificial reality," that is, the reality of manmade objects and artifacts.

Part IV, “Materiality as Assemblage,” explores the shifting imbrications of technologies and social practices. Ekbia and Nardi's chapter, “Inverse Instrumentality: How Technologies Objectify Patients and Players,” considers how bodies are materialized or dematerialized as they participate in large computational systems. They analyze two such systems—personal health records and multiplayer video games—drawing attention to the instrumental insertion of physical bodies as cognitive labor in the systems. Unlike software code which can be reproduced at almost no cost as the investment of physical matter is minimal (Faulkner and Runde, 2011), recruiting actual human persons to perform tasks in computational systems requires summoning a body that "responds, becomes skillful and increases its forces" as Foucault (1977: 136) says. For example, in multiplayer games, players write software modifications...
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to extend the gaming software, and in personal health records systems, patients interact with a variety of software programs that provide vital information to medical staff. The trained bodies functioning in these systems of “inverse instrumentality” are distinctly material, deploying their useful brains and dexterous fingers. However, a process of fragmentation may also occur that problematizes simple notions of materialization. In the case of personal health records, the cognitive labor of the patient is cleaved away from his fragile physical body, which is in need of care. To the system, he appears primarily as a set of cognitive functions. His need for a (literal) helping hand or warm touch is muted. With gaming, on the other hand, the player blossoms as she becomes transcendentally empowered as a player, gaining in new forms of identity, becoming visible in a community of players as a master of the craft, even someone who can reach out to enable others to find their own new satisfactions and rewards. Over time, in interactions with systems of inverse instrumentality, bodies “improve” as Foucault (ibid.) observes, strengthening the systems. The power of systems as regulative regimes increases (see Kallinikos, 2011), reinforcing either fragmenting or totalizing tendencies.

Fayard argues, in her chapter entitled, “Space Matters, But How? Physical Space, Virtual Space and Place,” that physical things—“rooms, walls, buildings”—are important to materiality. Fayard observes that they become “entangled” with “social practices and narratives” to produce space. She sees space as not merely a set of restrictive distances and enclosures, but a fundamental resource—locations within which we productively “engage with objects and artifacts,” and with one another. Fayard addresses the challenging domain of virtual space which is less straightforwardly composed of physical components. She maintains a conceptual distinction between physical and virtual space, but emphasizes the possibility for the emergence of “hybrid spaces” in which interaction and activity flow across physical and virtual spaces. With an artist, she designed an art installation with precisely this flow in mind, ingeniously creating a physical world space in a historic building in Brooklyn, New York, in which words projected from blog posts onto fabric panels formed a “maze” through which participants could wander. The maze nicely conceptualizes more ordinary hybrid spaces such as Internet cafes: by making the virtual “stark,” as Fayard says, the activities that generate the creation of space are rendered visible, and the space is realized as an “evocative object” (p. 188) in which we may reflect on time and space. Like Kallinikos (this volume), Fayard points to the form and function of virtual spaces as critical; their status as artifacts depends not on their substance as physical matter but on the precise functions they permit which are fundamentally virtual.

Whyte and Harty’s chapter, “Socio-material Practices of Design Coordination Across a Large Construction Project,” begins by examining Star and Griesemer’s (1989) influential work on boundary objects to understand how
interactions between people and the objects they create and use allow them to achieve particular organizational goals. In the authors’ case—a study of the design and construction of a new airport terminal, Heathrow Terminal 5, in London—members from multiple occupations collaborate to produce the final building. To enable such collaboration, the teams vowed to coordinate their work digitally via an integrated software system that linked data repositories to computer-aided design software, known as a “single model environment.” The authors show how the materiality of this single model environment proved too rigid to enable the desired coordination and how the teams employed various other media that were more malleable and plastic to achieve coordination. The plasticity of these objects had, as the authors argue, important implications for coordination: “Objects that are productive in terms of coordination of ongoing work have a dual epistemic and boundary-spanning role, allowing participants in the project to maintain conventions and legibility of objects, across different locations and times, while allowing flexibility and partiality to enable the development of new ideas and innovation” (p. 201). This analysis refocuses initial concern in Star and Greismer’s original work to the materiality of objects themselves and the way that different physical and digital artifacts can have consequences for cross-disciplinary coordination.

Part V, “Materiality as Affordance,” takes a different route by conceptualizing the role of technology through the lens of affordance. In their chapter, “Theorizing Information Technology as a Material Artifact in Information Systems Research,” Robey, Raymond, and Anderson focus specifically on IT artifacts and question how and under what conditions it makes sense to talk about these artifacts as having “material characteristics.” The authors trace the neglect of study of IT artifacts to historical decisions to define and measure technologies, broadly conceived, as abstract contingency variables predicting organizational form. They propose two major challenges to restoring theoretical attention to material artifacts. First, they suggest that novel concepts such as “affordances” must be carefully defined and adapted to a sociomaterial context. Second, they suggest that theoretical relationships among these concepts need to be articulated. They illustrate this second challenge by showing two ways that sociomaterial concepts may be positioned theoretically. The first is to extend existing theories to account for sociomateriality. Examples of adaptive structuration theory to include technology affordances, and organizational routines theory to include material agency, are presented to illustrate this strategy. A second way to position materiality is to extend theories that address substantive issues but neglect IT. The extension of work–life boundary management theory to include technology affordances are presented to illustrate this second strategy.
Like Robey et al., Faraj and Azad are concerned with theorizing the materiality of information systems and, like Robey et al., they believe that adopting an affordance lens is a good way to shed new light on the role technologies play in organizational dynamics. In their chapter, “The Materiality of Technology: An Affordance Perspective,” they suggest that IT researchers have largely accepted naming and categorization conventions developed by commercial vendors and the trade press that lump hardware and software into particular product classes and define lists of specific functionalities that warrant such classification. Although such categorization practices might not seem, at first glance, to be problematic, Faraj and Azad argue that they place attention on what a technology is, but not what it allows people to do. To overcome this problem, the authors suggest that a relational theory of affordances—where affordances exist between people and the materiality of IT artifacts—may help to explain when and how materiality becomes intertwined with human agency. As the authors note, “we see potential in the notion of affordances as a relational construct linking the capabilities afforded by technology artifacts to the actors’ purposes.”

To refine the concept of affordance, Faraj and Azad speculate about a number of scope conditions that may help researchers speak more specifically about the role of materiality in organizational life.

In their chapter, “Pencils, Legos, and Guns: A Study of Artifacts Used in Architecture,” Groleau and Demers are concerned with confronting the complexity of configurations of artifacts and resources in practice. Many studies highlight a particular technology of interest, or particular practices, but Groleau and Demers observe that sets of technologies and sets of practices mutually inform one another. If we abstract them out, disentangle them, we lose their agentic power. Groleau and Demers use activity theory as a theoretical lens. They note that the specific material enablements of artifacts are rarely considered in activity analyses but that it is critical to focus on them to understand how people accomplish work. They note that the functional attributes of artifacts generate, and are supported by, the “sensitive abilities” of practitioners. Thus, artifacts change us even as we use them in object-oriented activity. At the same time, competing artifacts that enable common practice have distinctive capabilities. People choose them according to desires to reinforce or challenge tradition, as illustrated in the authors’ comparative analysis of three different kinds of architectural firms. Artifacts are thus instruments of change or stasis.

Part VI, “Materiality as Consequence,” shifts the focus of attention from the nature of artifacts to the consequences which their social involvement engenders. On this view, what is material is what matters or is made to matter in a particular context. Perhaps the most dramatic alteration of conceiving of materiality as “that which matters” is found in Pentland and Singh’s chapter, “Materiality: What are the Consequences?,” which advocates for this position perhaps most strongly of all. The authors make the simple and provocative
claim that “Something is material insofar as it has consequences in a particular context” (p. 292). Drawing on the philosophical perspective of pragmatism, they proceed by analogy, explaining how financial auditors and IT auditors use a variety of heuristics to determine the threshold at which a transaction or a system has consequence for a particular community—in short, that it is material. In this formulation it is the consequence of the transaction, not the transaction itself, that can be said to matter. For this reason, what is seen as material to one party may be immaterial to another. As Pentland and Singh suggest in their discussion of a fictional real estate transaction, “In fact, the same transaction might be material for the buyer and immaterial for the seller” (p. 291). The conceptual work done to establish materiality as a valued consequence allows the authors to “reverse figure and ground” and argue that artifacts like information systems do not have materiality, but the actions that those technologies enable do. As the authors conclude, “Materiality is not about artifacts, people, ideas, or any thing. Or rather, it’s about all of them, but they only become material when they influence a particular course of actions or events that we value” (p. 294).

This focus on consequence is echoed in the chapter, “Why Matter Always Matters in (Organizational) Communication,” by Cooren, Fairhurst, and Huët who invoke notions of preoccupations/concerns/worries/reasons as central to their theorizing of materiality. They observe that “…we thus need to realize that materiality relates to what is relevant or pertinent to a given situation, i.e., ‘the relation [of something] to the matter at hand’ (Webster’s Dictionary)” (p. 301). This treatment of materiality is similar to Pentland and Singh’s pragmatic approach and Leonardi’s observations (2010) of how the term is used in field of law (e.g., “material witnesses” or “material facts” are those pertaining with a high degree of relevance to a case—those facts or witnesses that “matter”). Having made a bold move to broaden materiality so significantly, Cooren et al. argue that discursivity should not be left out of the equation: words matter. Therefore, analysis of interaction should be central to analysis of materiality. The authors observe: “[We] should focus on… the multiple ways by which various forms of reality (more or less material) come to do things and even express themselves in a given interaction” (p. 296). In this framing, the causal relationships assumed in older discussions of materiality (that now perhaps seem vulgarly deterministic) which tied human action directly to the specific forms and functions of artifacts, yield to more open, flexible notions of “doing things” and a variety of human and non-human agents “expressing themselves” in action (p. 296).

Burrell also speaks up for discursivity in her chapter, “The Materiality of Rumor.” She examines the agency of rumor—a non-material thing—under-scoring its capacity to generate powerful material effects. As in Cooren et al.’s discussion, contingent consequence is central. This maneuver radically
widens conceptions of materiality beyond conventional associations with artifacts, tying them to broad notions of agency at “the conceptual edges where matter or substance is not so evidently massed as an apparent ‘object’” (p. 317). Burrell’s argument continues, conveying a dual sense of materiality as, in addition to material effects, physical manifestation is also apposite: “The materiality of rumor specifically is linked to the body and the production of speech through the vocalizing organs, and the functioning of human memory. These are critical in constituting rumor’s material aspects” (p. 315). Rumor is thus material in two ways: (a) it produces material effects (in Burrell’s ethnographic study, a false rumor about an impending earthquake in Ghana generates a good deal of drama as people flee into the streets); and (b) rumor is anchored in the physical world of the brain and body. Burrell extends the physical aspect of materiality to the technological substrate of mobile phone service in Ghana that underpinned the rapid dispersal of the rumor.

The final section of this book provides a thoughtful epilogue on the idea of materiality by examining how matter has come to matter more and less at various times throughout human existence. Borgmann, a distinguished philosopher, contributes to this volume his meditation on matter and the ways our beliefs on what matter is and how the world is structured have changed from ancient times to contemporary culture. The ultimate aim of his chapter entitled “Matter Matters: Materiality in Philosophy, Physics, and Technology” is to discern or engrave a path along which the worldview of modern physics and the technological and cultural practices to which it is associated can be brought to bear upon the project of good life. Borgmann finds the current concern with materiality indicative of our troubling perceptions and feelings vis-à-vis matter as immaterial and ephemeral artifacts of all sorts increasingly populate our world, a concern that, no matter how indirectly, is reinforced by the compelling worldview of relativity and quantum theory. Both strands of contemporary physics have done much to dissolve the belief in an ultimate and absolute world, a definitive anchor into which reality can be hooked. However, the way the worldview of physics has been refracted in the perception of lay people and everyday life patterns is less clear. Borgmann discerns parallels between the two. In his own elegant prose: “As Aristotle and Plato had indicated, when we push the question of what things are made of to its deepest level, we arrive at one of two answers—structureless matter or immaterial structure. The solid and substantial world gets dematerialized either way. The cultural counterpart of structureless matter is realized in the cultural space of ever open possibilities” (p. 342). It is within this space of ever-open possibilities that Borgmann retraces the significance of matter. To quote him again: “What centers your life and lends it its identity is (significant) events. An event constitutes and occupies its own place and time. But an event could not matter if it were not material through and through. What matters needs to
have depth. It must be grounded without rupture and traceable without loss of meaning. Life is lived out in the interval between such events. That interval is the spine of your identity, and like the space-time interval between events in special relativity, it remains no matter your changing frames of reference” (p. 345).

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