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Materiality in Management Studies

Development of the Theoretical Frontier

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Preface

This book carries out the critical examination of the concept of materiality noticed in various research areas in recent management studies by tracing back to the meta theories referred to there. The concept of materiality, the latest meta theories in the humanities and social sciences, tries to overcome the dogma that postmodern studies have fallen into, which looks for the beginning of the organizing process into subjective interpretation. However, what does the implication of these meta theories bring to management studies?

In order to inquire into this question, a total of nine members participated in writing this book. These nine members are up-and-coming researchers in Japan and have been working on the concept of materiality, which had begun to be discussed in various research areas in management studies.

But as this book soon makes clear, the concept of materiality has been under intense debate in management studies. Of course, new concepts do not converge and spread so readily. It is more usual for there to be controversy over its implications. The latest concepts in their budding stages show more than a few such tendencies, but the concept of materiality seems to be particularly strong and somewhat uncontrollable in its degree.

What has particularly confused us is the controversy within the meta theories referenced in discussing the concept of materiality. It becomes unclear whether the reason for the controversy lies in the way we use the concept of materiality or in the meta theory itself. Furthermore, to sort out the theoretical confusion of meta theories, the relationships between them should also be taken into account.

Therefore, confronting the concept of materiality can be a reckless challenge, covering the entire discipline. Such a difficult problem cannot be solved by a single researcher. On the other hand, it is not enough to simply gather the knowledge of the members who have already accumulated research in their respective fields. This is because taking into account the relationships between research areas and even between meta theories requires a very thorough discussion. Hence, we have spent at least five years deepening our discussions.

Here is how we came to write this book. At least the interest of this research is traced back to Matsushima, N. (2015) Genba no Jyōhōka [The Informatics Embedded

in Workplace Practice], Yuhikaku (in Japanese). One of the subjects of this research is the concept of sociomateriality in information management research (see Chaps. 1, 7). However, the information management research, which is a multidisciplinary field in management studies and applied science, was spreading to management studies in general. This book became the base camp for subsequent joint research.

After that, researchers who are interested in the concept of materiality in various fields of management studies, such as actor network theory (Chap. 2), organizational institutionalism (Chap. 3), organizational routine (Chap. 4), social constructionism and organizational wrongdoing (Chap. 5), critical management studies (Chap. 6), new realism and science based innovation (Chap. 7), the theoretical history of organization development (Chap. 8), and full-scale joint research started. The results of joint research in each research area are too numerous to mention here, but please refer to the research results cited in each chapter.

Furthermore, as an output that directly leads to this book, we published a paper titled "Shakaibusshitsusei no Meta Riron [A Note of Meta-Theories in Sociomateriality]" at Nihon Jōhō Keiei Gakkaishi [The Journal of Information and Management] (Vol. 39, No. 3) in 2019. Much of the theoretical discussion in this book is revised of it. Our manuscript has a size of 38 pages in Japanese, more than three times that of the 6–12-page limit. The editorial committee discussed whether such an unconventional size of a paper should be published. Although cutting it to regular size was considered, the editorial committee made allowance for it to include our discussions that illuminated the connection between concepts.

In October 2019, a theme session entitled "Keieigaku wo Torimodosu Kouchikushugi [Management Studies Regained by Constructivism]" was held at the 60th Anniversary Annual Meeting of Soshiki Gakkai [the Academic Association for Organizational Science of Japan] in 2020 (Fukuoka, Japan). The meeting was based on the theme of social constructivism, and professor Kenneth Gagen, a renowned social constructivist in social psychology, was invited as a guest speaker. Our research has positioned social constructionism as one of the meta theories that discuss the concept of materiality, but it is quite different from the generally understood subjective social constructivism. As a result, our session came into conflict with many sessions. (Of course, they were willing to listen). However, we believe that the intervention methodology emphasized in social constructivism by professor Gergen does not conflict with our claims (see Chaps. 5, 8).

Furthermore, joint research with accountants and economists has begun, which goes beyond management studies. It is known as the valuation studies based on the device concept sophisticated in actor network theory and new realism, which is also well known as meta theories of materiality (see Chaps. 2, 7). Although this is an area that is attracting attention, we have also found that Kokubu, K., Sawabe, N. and Matsushima, N. (2017) Keisan to Keiei Jissen [Calculation and Organizing Practices], Yuhikaku. In October 2018, we invited professor Peter Miller from the London School of Economics and held international workshops "The Interaction between Calculation and Management Practice: Towards Valuation Studies" in Kobe and Tokyo, Japan.

This book is the result of such collaborative research. The assumed readers cover all researchers who are interested in the concept of materiality. In particular, it aims to dispel the fears of young researchers who are puzzled by the meta theories cited in the concept of materiality and who have doubts about its implication. We also hope they do not have to get lost in the maze in the first place. And, we entrust them to propel empirical researches based on the concept of materiality further and enrich management studies.

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Contents

Chapter 1
Prelude: The Sociomateriality and the Legacy of Structuration Theory

Noboru Matsushima

Abstract What has the concept of materiality, the latest meta theories in the humanities and social sciences, brought to management studies? Recent management studies, which focus on materiality, try to overcome the dogma that postmodern management studies have fallen into, which looks for the beginning of the organizing process into subjective interpretation. Institutional organization theory focuses on the materiality on which the symbolism of institutions is inscribed. Organizational routine research seeks to unravel the material dimension of organizational performative practices. Organizational wrongdoing research critiques material measurement practice based on social constructionism. Critical management studies focus the material space as a way to counter the humanistic concept of time. Science based innovation challenges sociomaterialistic practices that originate from devices for MOTs that have not been able to penetrate into the workings of science and technology actually. In order to understand this issue systematically, it is necessary to understand how the studies referring to structuration theory, which had much significant impact on management studies as a whole around the 1980s–1990s, have each solved endogenously generated issues. Up-and-coming researchers in Japanese management studies conduct empirical researches that draw out the implications of the concept of materiality.

Keywords Sociomateriality · Structuration theory · Management studies

The concept of sociomateriality has recently become an object of dispute among researchers of information management research. In this chapter, we examine the meta theories to which proponents of the concept have referred in this debate. These meta theories must be examined because of the highly controversial nature of sociomateriality. Kautz and Jensen [8], taking on the role of court jesters, expressed criticism of the controversy that "newcomer organizations" were carrying on in the courts, where the doctrine of the relationship between technology and organization has been stated.

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The idea of sociomateriality[1] is alleged to have been created by "Queen" Orlikowski [18, 21]. Orlikowski presented this concept in order to overcome the limits of the structural model of technology [17, 20] that had been published previously. The notion of sociomateriality emphasizes that technology and organization are fundamentally inseparable and has developed a relational ontology, which can be expressed by "the image of a lightly bound knot of two pieces of rope (entanglement)" [18, p. 1438].[2] On the other hand, young "King" Leonardi [9–13] has opposed the Queen by regarding representation ontology as an "imbrication" of functionally distinct elements while mutually influencing the relationship between technology and organization [13, p. 82].

This study will not treat the details of this Queen-King dispute thoroughly (refer to 15), but it is interesting that the same concept is presented in opposing and differing positions, which illustrates both its complexity and the fact that superficially, these opposing viewpoints may be regarded as mere confusion.[3]

In this study, we will consider this confusion by examining the meta theories that have given rise to the concept of sociomateriality. This concept was originally proposed to overcome the problems inherent in adopting Anthony Giddens's structuration theory (e.g., Giddens, [3]) as a meta theory, as well as the latest meta theories, such as actor network theory, linguistic turn, social constructionism, spatial turn, and various realisms pertaining to the material turn, which have arisen in rapid succession.

It soon becomes clear that the complexity inherent in sociomateriality comes from the complications of the meta theories used; in other words, the complexity in sociomateriality is inherent in the referenced meta theories. Confusion in theories may also result in logical inconsistencies because the meta theories implanted have different assumptions; thus, the idea of sociomateriality may also have inherited the problems of the meta theories. This book examines the meta theories underlying sociomateriality. This examination will provide clues for identifying the theoretical implications in the concept of sociomateriality and for revealing any remaining problems as well.

In this book, these meta theories will be examined in order. This chapter, which provides a theoretical background to the information management research that gave rise to the sociomateriality concept, examines the research group that referred to Giddens's structuration theory as the meta theory that dominated all aspects of management studies from the 1980s to 1990s.

At the core of information management research is this question: What impact does information technology have on organizations? Theoretical doctrines derived from a consciousness of this problem are nothing but a clarification of the relationship

[1] Orlikowski advocated the concept of sociomateriality in order to unravel the "recursive interplay between people and technology in practice" [18]. To clarify this problem, she provided the concepts of "constructive engagement," "relationality," "performance," and "sociomaterial assemblages.".

[2] Orlikowski analyzed the IT industry and found materiality in the algorithms built into the program.

[3] For example, Introna and Hayes [7] introduce Orlikowki's argument on the assumption that technology and organization are presented as inseparable. Thus, if Leonardi's argument means they are divisible, what is the implication of sociomateriality?

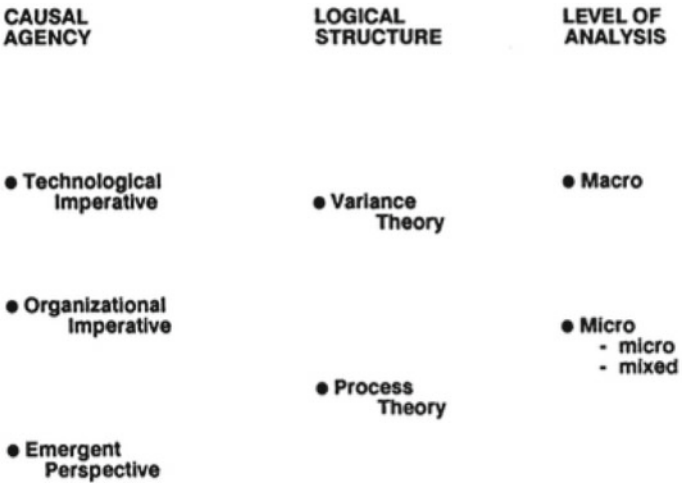

Fig. 1.1 Characteristics of an emergent perspective [14, p. 584, Fig. 1. Dimensions of causal structure]

between technology and organizations. However, we should not overlook the fact that information management research's doctrine is neither the simple technological determinism that overestimates information technology nor the pessimistic organizational imperatives which exaggerate inertia and resistance of organizations; rather, it aims for an "emergent perspective" that foresees the interaction to generate new socio technology system [14]. In other words, it is no exaggeration to say that technology—organization interaction is formed as a doctrine for information management research. Markus and Robey [14] did not always provide theoretical support for this concept but developed a concept to supplement the content of the emergent process. In this regard, structuration theory by Giddens, which was attracting attention as a social theory at that time, was applied as a meta theory (Fig. 1.1).

The "structural model" proposed by Orlikowski is cited as an application of structuration theory for information management research, and it has become a reference point for subsequent discussions [17, 20]. The essential points of the structural model proposed by Orlikowski and others are well summarized in a figure shown in Orlikowski and Robey [20]. The theoretical essence of the structural model is the interdependence between institutions and actions, to simplify it very much. The interaction itself between institutions (organization) and actions (use of technology) does not contain anything more than what Markus and Robey [14] called process theory. However, "process" in "interaction" is a conventional phrase in the argument that has no logical clarity. The important point is to notice what theoretical content has been added to this interaction process by referring to Giddens's structuration theory. It is the modalities that links between human action and institutional realm, and especially important for her was the exploration of how interpretive schemas influence the structuring process (Fig. 1.2).

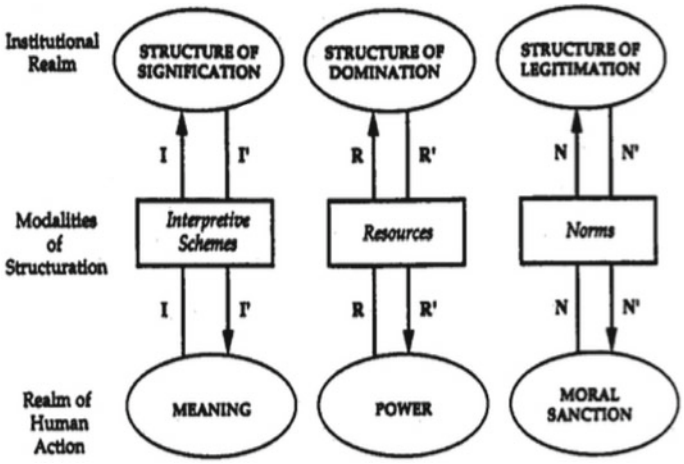

Fig. 1.2 Interaction model of institutions and actions presented in the structured model [20, p. 148, Fig. 1. The interaction of human action and institutional properties as mediated by the three modalities of structuration]

DeSanctis and Poole [2] proposed an "adaptive structuration theory" that focuses on the interdependence between institutions and actions in terms of a structural model. In their adaptive structuration theory, information technology (decision support system) is given structural characteristics that affect human actions while the structure emerges adaptively through the use of actual technology. In this explanation, the structural dimension of information technology is positioned within the different meanings of its technical and usage characteristics. However, considering the implication of the term "adaptative," it can be considered as a soft technological determinism that assumes users will adapt to the technical structural characteristics.

To avoid being subject to technological determinism, Orlikowski focused on the interaction of institutions and actions in addition to concerns about unintended consequences from the use of technology. For her, technology is nothing but a factor that influences the dimension of practice, and the unintended consequences of using technology are supported by the knowledgeability of the actors who discover its potential uses. In fact, her case analysis describes the process by which technologies have various possibilities that allow for interpretation beyond the original plan—for example, new employee education in which a database is set up and shared to record daily activities (e. g., [19]).

However, this conceptualization by Orlikowski has led to much controversy since then. The criticism is directed partly at the structuration theory by Giddens, which emphasizes the knowledgeability of the actors in the same way, and partly at her argument, which overly stresses the capabilities of the actors and fails to capture the impact of technology. On the other hand, the essential characteristics of the technology that people should interpret are smuggled by researchers, an approach that is criticized as more meta technological determinism. This also constituted an

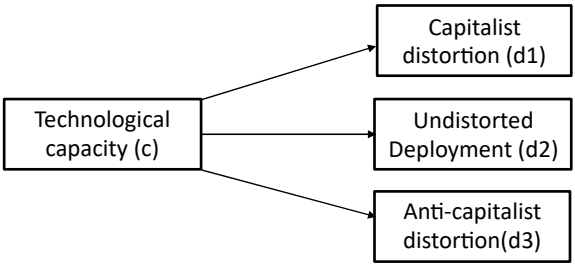

Fig. 1.3 Methodological trap of technological essentialism [6, p. 35, Fig. 1. Technological capacity and distorted deployment]

epistemological trap in which the researcher's viewpoint entered into the judgment of what is essential and what is socially distorted, when the technical ability that was considered to be a cause was distinguished [6, pp. 21–23]. These criticisms of Orlikowski's structural models have led to the incorporation of various meta theories, which have led to the creation of sociomateriality (Fig. 1.3).

Apart from information management research in a narrow sense, other management studies refer to Giddens's structuration theory as well. First, the "sequential model of the structuring process" by Barley [1], who later became Leonardi's mentor, positioned the technical concept as a script that "mediates" the interaction between institutions and actions based on extreme organizational changes (i.e., the centralization of young doctors and decentralization of radiologists) in hospitals where CT scanning was introduced. This technical concept leads to the idea of sociomateriality, which is both material and social, leading in turn to Leonardi's [9] notion of "materiality without material."[4] (Fig. 1.4).

Pentland [22] focused on the "recursiveness" of social practice contained in the structuration theory. According to Orlikowski and Robey [20], institutions and actions are placed in different dimensions from which interdependent relationships are formed. However, if we focus on the implications of structuration theory by Giddens, which conceptualized the structure as a "mind trace," human actions take a course over time that deepens from the visible or conscious level to the daily practical level and, finally, to the unconscious level. Pentland [22] described a recursively evolving reproduction process in which material, ceremonial, and even competence structures became routines such as those formed by people in a software support center when they handle telephone calls. That is, organizational routines are referred to by organizational members as abstract "grammars of action" [23, 25] (Fig. 1.5).

However, once reproduction begins, the image of recursion, which cannot be overlooked again, develops into a theory of innovation triggered by the action of following

[4] Leonardi [9] focuses on changes in the development process owing to simulation technology, which has been introduced into the crash test section of automobile development, and discusses the materiality of simulation technology, which lacks physical characteristics and consists rather of the symbol of a program. Ultimately, he regards simulation technology as an organizational representation.

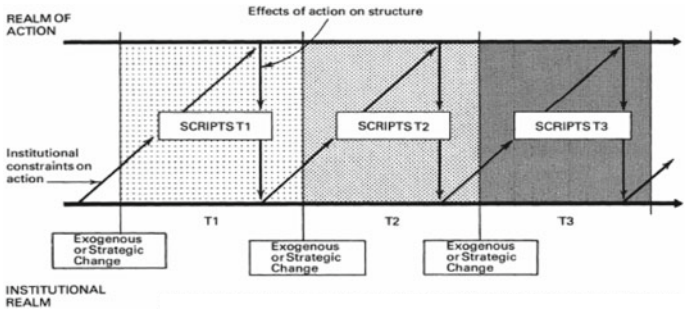

Fig. 1.4 Technology that mediates continuous structuring processes [1, p. 79, Fig. 1. Sequential model of the structuring process]

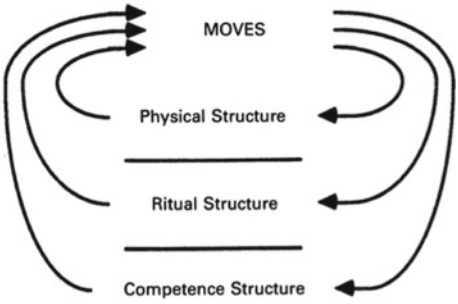

Fig. 1.5 The structured process that evolves recursively (reproduction) [22, p. 532, Fig. 1. Moves and structure]

a routine. In response to this theoretical limitation, Pentland and his colleagues shifted their research attention to performativity, which is the differentiating effect of organizational routine in concrete practice [24].

Finally, Ranson et al. [26] offered perhaps one of the earliest examples of structural theory applied in management studies. They focused on a category of institutional dimensions in schematization that had received little attention. Functional categories were derived from functional sociology, semantic categories from interpretive sociology (attended by Orlikowski and Robey [20]), and power categories from Marxist sociology. What should be noticed is that the institutional dimension of these multiple categories advances their intertwining, and there is an opportunity for organizational change to arise through the endogenous contradictions in the social system. Later, Greenwood became a leading researcher of organizational institutionalism, because it was connected to institutional change and the institutional logics concept (e. g., [4, 5]).

Not many research examples exist that apply the theoretical arrangement by Giddens and the conceptual framework of the institutional dimensions to information management research, but Negoro and Suzuki [16] have made budding attempts. Using a soft systems approach, they have attempted to visualize the context that

supports the actions and perceptions of the system implementers and the information system supplier, and to apply it as a diagnostic tool to determine an introduction strategy by the amount of the gap. Such an application of stracturation theory still provide useful tools for practitioners, and there are lessons to be learned as methodologies that apply these meta theories.

As we have seen in the foregoing discussion, as well as Orlikowski and her collogues developed the structural model into sociomateriality, Giddens's structuration theory plays a key role in the background and birth of the materiality concept in management studies. In the chapters that follow, we will examine in detail the various materiality concepts in management research, along with a review of the meta theories to which they refer.

References

1. Barley, S. R. (1986). Technology as an occasion for structuring: Evidence from observations of CT scanners and the social order of radiology departments. *Administrative Science Quarterly, 31*(1), 78–108.
2. DeSanctis, G., & Poole, M. S. (1994). Capturing the complexity in advanced technology use: Adaptive structuration theory. *Organization Science, 5*(2), 121–147.
3. Giddens, A. (1984). *The Constitution of Society: Outline of the Theory of Structuration.* Polity Press.
4. Greenwood, R., Oliver, C., Lawrence, T. B., & Meyer, R. E. (Eds.). (2017). *The sage handbook of organizational institutionalism* (2nd ed.). Sage Publications.
5. Greenwood, R., Oliver, C., Sahlin, K., & Suddaby, R. (Eds.). (2008). *The sage handbook of organizational institutionalism.* Sage Publications.
6. Grint, K., & Woolgar, S. (1997). *The machine at work: Technology, work and organization.* Polity Press.
7. Introna, L. D., & Hayes, N. (2011). On sociomaterial imbrications: What plagiarism detection systems reveal and why it matters. *Information and Organization, 21*(2), 107–122.
8. Kautz, K., & Jensen, T. B. (2013). Sociomateriality at the royal court of IS: A jester's monologue. *Information and Organization, 23*(1), 15–27.
9. Leonardi, P. M. (2010). Digital materiality? How artifacts without matter, matter. *First Monday, 15*(6). https://doi.org/10.5210/fm.v15i6.3036. Accessed 27 July 2018.
10. Leonardi, P. M. (2012). Materiality, sociomateriality, and socio-technical systems: What do these terms mean? How are they related? Do we need them? In P. M. Leonardi, B. A. Nardi, & J. Kallinikos (Eds.), *Materiality and organizing: Social interaction in a technological world* (pp. 25–48). Oxford University Press.
11. Leonardi, P. M. (2013). Theoretical foundations for the study of sociomateriality. *Information and Organization, 23*(2), 59–76.
12. Leonardi, P. M., & Barley, S. R. (2008). Materiality and change: Challenges to building better theory about technology and organizing. *Information and Organization, 18*(3), 159–176.
13. Leonardi, P. M., & Rodriguez-Lluesma, C. (2012). Sociomateriality as a lens for design: Imbrication and the construction of technology and organization. *Scandinavian Journal of Information Systems, 24*(2), 79–88.
14. Markus, M. L., & Robey, D. (1988). Information technology and organizational change: Causal structure in theory and research. *Management Science, 34*(5), 583–598.
15. Matsushima, N. (2015). *Genba no jyōhōka* [*The informatics embedded in workplace practice: Organizational approach for IT-use practice*]. Yuhikaku. (in Japanese).

16. Negoro, T., & Suzuki, S. (1998). Gyoumukaikaku to ERP [Operation reforms and ERP]. In Y. Teshima, T. Negoro, S. Sugino (Eds.), *ERP to bijinesukaikaku: Gyoumutougō pakkēji no kastuyō no gokai to shishin* [*ERP and business transformation: Misunderstandings and guidelines for using integrate operation package*] (pp. 67–100). Nikka Giren. (in Japanese).
17. Orlikowski, W. J. (1992). The duality of technology: Rethinking the concept of technology in organizations. *Organization Science, 2*(2), 398–427.
18. Orlikowski, W. J. (2007). Sociomaterial practices: Exploring technology at work. *Organization Studies, 28*(9), 1435–1448.
19. Orlikowski, W. J., & Hoffman, J. D. (1997). An improvisational model for change management: The case of groupware technologies. *Sloan Management Review, 38*(2), 11–21.
20. Orlikowski, W. J., & Robey, D. (1991). Information technology and the structuring of organizations. *Information Systems Research, 2*(2), 143–169.
21. Orlikowski, W. J., & Scott, S. V. (2008). Sociomateriality: Challenging the separation of technology, work and organization. *The Academy of Management Annals, 2*(1), 433–474.
22. Pentland, B. T. (1992). Organizing moves in software support hot lines. *Administrative Science Quarterly, 37*(4), 527–548.
23. Pentland, B. T. (1995). Grammatical models of organizational processes. *Organization Science, 6*(5), 541–556.
24. Pentland, B. T., & Feldman, M. S. (2008). Designing routines: On the folly of designing artifacts, while hoping for patterns of action. *Information and Organization, 18*(4), 235–250.
25. Pentland, B. T., & Rueter, H. H. (1994). Organizational routines as grammars of action. *Administrative Science Quarterly, 39*(3), 484–510.
26. Ranson, S., Hinings, B., & Greenwood, R. (1980). The structuring of organizational structures. *Administrative Science Quarterly, 25*, 1–17.

Chapter 2
Actor Network Theory and the Problem of Describing Heterogeneity

Akiyuki Yatera

Abstract Actor network theory (ANT) is one of the representative meta theories with discussing materiality in management studies. We reconsider the ANT, especially the concept of heterogeneity, which Orlikowski used when she tried to find out the material properties, and the concept of translation, which is the process of shaping heterogeneous networks. The Orlikowski's pursuit of finding specific properties of the object in the relations between societies and objects using the concept of "constitutive entanglement" invited criticism later, but this criticism is also a problem in describing the heterogeneity of ANT. Therefore, we confirm the direction in which ANT was originally aimed and point out problems in describing the heterogeneity. As a response to this problem, we discuss the valuation studies, which are recent research theme incorporating ANT. As an example, we describe the case of the external labor market in Japan, which is mediated by private employment services. Because of the longterm employment that is one of the Japanese employment systems, Japanese companies have internally developed firm specific capabilities that are difficult to calculate. However, the private employment services, which have expanded its scale since the deregulation in 1999, disentangle human (and its capability) that are a hybrid, make it calculable human resources, and have a function that makes human resources as job seekers, thus the constructing an external labor market in Japan.

Keywords Actor network theory (ANT) · Heterogeneity · Valuation · External labor market

2.1 Heterogeneity: A Sociomaterial Hybrid and Translation

Actor network theory (ANT) was one of the theoretical bases for analyzing objects themselves, in response to the criticism that the inherent attributes of entities had been omitted by emphasizing the humans who use objects, as mentioned above [21, 23]. A common theoretical feature of ANT is that it considers involving both human and nonhuman entities when capturing the social dimension [15]. This is also the reason ANT is used in the discussion of sociomateriality. It should be noted,

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however, that even if an object is included, there is no premise that it has already been given the attributes of an object and that it exists as such. Rather, each characteristic emerges through the relationships among these entities. In the context of ANT, this ontological premise is known as the concept of heterogeneity. In other words, this perspective offers the understanding that human and nonhuman entities, or society and technology, are not entirely distinct and divided. What we recognize as the inherent properties of an object is the result of a heterogeneous network: these properties emerge performatively in practice [16, pp. 3–4].

Orlikowski [21] conceptualizes the state in which human and nonhuman entities are fundamentally intertwined as "technology in practice," as derived from the heterogeneous network and ANT's theoretical feature of treating the human and nonhuman[1] symmetrically,[2] and uses the concept of "technological artifact" in order to find the characteristics peculiar to materials. In addition, Orlikowski [22] called this "constitutive entanglement" and tried to overcome the problem of the structural model by focusing on objects that are understood from the perspective of relational ontology. However, even if limited to analytical tools, the concept of technological artifacts leads to placing materials outside of technological practice. The "actor network" does not mean a network composed of social and material actors; rather, it considers the actors themselves as a network. Therefore, Orlikowski's attempt to grasp the role of objects individually, assuming that they are essentially divided and then entangled with each other, is not the direction in which ANT itself was originally aimed.

In view of the theoretical features of ANT, no inherent properties exist in human and nonhuman entities, so the society and technology themselves should have been understood as in a heterogeneous network. Similarly, technological artifacts as "objects" should be observed according to how their attributions are composed within the heterogeneous network,[3] rather than attributions' being made according to how they appear and prior to analysis [12, p. 118].

To amplify the original problem of ANT, the concept of heterogeneity and the symmetry of human/nonhuman or society/technology do not solve the problem of the dichotomy between determinism and interactionism; rather, the dichotomy itself is rejected. In other words, ANT was intended to reject the distinction between human and nonhuman entities by including the object in the analysis, not to overcome the problem of discussing technology from either human perception or material properties.

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[1] To be precise, it is translated as "human beings and inhuman beings," terminology that includes not only material objects but also other nonhuman things. In order to clarify the subject of this article, we will focus on material objects as distinct from other nonhuman things.

[2] As will be discussed later, the meaning of "symmetry" here is to temporarily suspend the existence of human entities and materials having certain characteristics and thus treat both of them without distinction.

[3] The expression "network results" might be interpreted as meaning that the characteristics of an entity are influenced by the underlying relationship, but this is not exactly the case. Society and materials in ANT are, as I have repeatedly stated, regarded as networks themselves. It is the reason we are regarded as "society" and "substance" in ANT is that these networks are "blackboxing".

The argument here—that there is no social or technological classification in ANT—does not mean that there are no human or object entities. What we consider to be obviously a "human" or an "object," as mentioned above, is the result of a heterogeneous network. The problem with ANT is how the resulting "human" or "object" is shaped—that is, the process of shaping.

The process that ANT analyzes is that of expanding and stabilizing its network in which one actor draws another actor into the network, and the concept used to analyze this process is "translation." Translation is defined as "the interpretation given by the fact-builders of their interests and that of the people they control" [14, p. 108], or as leading intermediaries (actors) to coexist [15, p. 108]. Thus, translation is a method of involving others in one's interests, and expanding and stabilizing the network.

Likewise, ANT focuses on the translation in which human actors relate to human/object based on the interests delegated to the existing heterogeneous network. Of course, material actors are part of the network that constitutes the interests of human actors, and they can also be the target of translation. However, it is only human actors that expand the networks. Although, it should not be noted that translation is described as a simple process in which a human actor mobilizes human/object for his or her own goals [19].

When analyzing the translation process, we must focus on the human actor as a translator with a certain intention. However, the intention of a translator can be understood on the premise that it is delegated to the network which constitutes it. In other words, translation grants that a human has the ability to interpret, but it denies the assumption that a human can interpret based on their own capability. In addition, the actor to be taken in does not have intrinsic attributions, and it does not become incorporated into the network as the translator intended. In this sense, translation is not limited to relations that are mediated by the language of a human actor, but should also include aspects of nonhuman acting on humans [24]. The term "nonhuman agency" can be understood to emphasize this. Thus, translation is not merely a successful process carried out by a human actor with a certain power.

2.2 Problems in Describing Heterogeneity

As mentioned above, ANT focuses on the translation process that expands and stabilizes a heterogeneous network. However, if we try to find a basis to explain by considering each process related by translation as causality, such an explanation will elude us infinitely, which is not the purpose of ANT. Rather, the purpose is to clarify how networks are expanded through translation and how purified categories, such as human and material or society and technology, are formed through a description of the process. Latour [15] argues that capturing networks, rather than explaining facts, consists of describing them to clarify how the explained factors are generated and recognized; in short, it is necessary to describe the network of the heterogeneous that generates the present facts.

However, even if a network is described, a methodological problem remains: how can we capture and describe the network if the concept of "heterogeneous" is thoroughly understood? For example, even if a network is described, there is the problem of who draws a line between the networks and how to draw the line [25]. Furthermore, even if the scope of a network is defined, it is impossible to describe the network if we cannot recognize its objects. In other words, a network that is heterogeneous must be described while maintaining the theoretical premise that the constructive concepts themselves cannot be divided into human and object.

Therefore, in such a description, we cannot describe the network itself without attributing humanity or materiality in advance. ANT has not always clarified how to capture and describe things analytically, assuming that they constitute a heterogeneous network.

Applying ANT analysis to economic activities is one attempt to address the above methodological issues, as discussed mainly by Callon and other researchers [5, 8]. In this analysis, the focus is shifted, in addition to having a change in the phenomena to be analyzed. If the theoretical features of ANT are applied to analyzing the market, it becomes possible to disentangle human and object, unlike in the previous analysis which emphasized the heterogeneity of the two being intertwined. At this time, the key concept is "the practice of calculations" [7, 13].

Callon and Muniesa [7] conceptualize an aggregate of abstract and social things—such as economic theory and accounting methods—and of material things— such as information and communication networks in trading rooms and shopping carts in supermarkets where transactions are actually conducted—as "market devices" (p. 1230). Market devices are assemblages of heterogeneous items, and the practice of calculation is stipulated in their specific arrangement (rightly called "agencement"; [20, pp. 2–3]).

Callon and other researchers have focused their attention on the practice of calculation, emphasizing a calculation mechanism made possible by emergent agencies that perform calculations dispersed in things and goods to be traded—that is, by the disentanglement of heterogeneous networks rather than by the entangled heterogeneity itself. For example, transactions in a financial market are made possible by calculations based on financial theory that disentangles a market in which society and technology are intricately entangled into a simple causal relationship. In other words, financial theory enables the calculation of the actor and performatively shapes the market, rather than reflecting the its state [18].

In recent years, ANT has been positioned as one of the basic theories of valuation studies. The market is a form of economization [3, 4, 9] in which the value of an object can be constituted and exchanged by enabling calculation. For example, Fourcade [11] clarifies the difference between various evaluation methods of a crude oil spill and the valuing of nature—that is, valuing based on market transactions and valuing the environment for individuals. In this way, valuation studies focus on social and technological networks and its arrangement that make things valuable, thereby clarifying the calculation mechanism, such as the function of each thing and the effect of the relationships [9, pp. 260–261].

2.3 Describing the Calculative Heterogeneous Network: Constructing the External Labor Market in Japan

In this section, as an examples of case analysis which use the concept of market device, that is the calculative heterogeneous network posed by Callon and Muniesa, we introduce to valuing human resources in the external labor market in Japan [26], which is formed through private employment services (intermediaries) as a social and technical network constituting the calculation mechanism.

2.3.1 Features of and Changes to the External Labor Market in Japan

In Japan, training within firms has been emphasized as an employment practice for acquiring firm-specific capabilities [2]. This practice has been an incentive to firms to keep employees over the long term, thus constituting an internal labor market [10]. An additional hiring practice for recruitment and selection has been the "mass hiring of new graduates" in which young people, who have little or no work experience, are hired immediately after graduating from university. This method has supplemented long term continuous employment [1]. Therefore, the external labor market in Japan, in particular, has been limited in accepting white-collar workers.

In the 1990s, however, criticism that Japanese employment practices made it difficult for companies to be flexible regarding employment needs led to calls for the mobilization of the external labor market. In 1995, the he Japan Federation of Employers' Association (Nikkeiren) proposed the use of non-regular employment as part of its "employment portfolio" and began to call for a review of these practices. Along with the deregulation of temporary workers in 1999, the fee-based employment placement business was liberalized with a revision to the Employment Security Act.

What was expected from introducing human resources here was matching to reduce the asymmetry of information, which would in turn, it was thought, activate the external labor market. However, as mentioned above, long-term continuous employment and mass recruitment of new graduates, which have been regarded as standard Japanese employment practices, are complementary to building up special abilities in companies. Human resources are not often acquired through the external labor market because it is difficult to judge the results and achievements of their previous jobs, and there is no objective standard for abilities. However, it can be said that a normative direction has been mapped out for developing human resources internally because it is impossible to calculate such abilities (e. g., [17]).

Through recruitment from private employment services in Japan, firms are acquiring human resources on the premise of long-term continuous employment, which will then be developed internally. The phenomenon of recruiting core human resources through private employment services cannot be explained by a reduction in

the asymmetry of information, given the acquisition of human resources with firm-specific capabilities, which are thought of as human resources that require internal training. It is because, in this situation, the information necessary for such capabilities is not known in the first place or is formed only after the fact. Thus, what role do private employment services play in acquiring human resources from the external labor market who have firm specific capabilities and given the premise of long-term continuous employment?

2.3.2 Japanese Private Employment Services as a Calculation Mechanism

Yatera [26] conducted a survey in 2008, about 10 years after the deregulation of the labor market in Japan, which was restructured from the perspective of valuation studies. The number of firms using private employment services through the external labor market at that time had begun to increase, and such recruitment services were on the rise as well. These services maintained a pool of job seekers. About 10 years after the deregulation, it became common for job seekers to register on a portal site operated by the recruitment service. It should be noted that job seekers who register on a portal site do not necessarily have a clear intention to change jobs; hence, people who register are not only those who need different jobs immediately but also those who are seeking different jobs only if they can obtain better employment conditions.

Job seekers registered on the portal site fill out a form with such information as their educational background and employment history. Private employment services then match the information with the requirements presented by a company, using a unique algorithm, and candidates for job placement are selected and introduced to the company. However, these job seekers are not immediately hired. First, a resume, job history, and recommendations are prepared based on a specific format to match the job requirements from the hiring company, and these documents are then submitted to the company. The private employment service and the company exchange these documents multiple times. Through this communication, the private employment service clarifies the requirements sought by the company. The reason for multiple communications between private employment services and the companies is even the latter do not clearly understand the value of the human resources they need. It is difficult to present this ability as a firm-specific ability because it is often implicit knowledge and is acquired after employment. Furthermore, because hiring is based on the premise of long-term employment, matching is based partly on subjective and sensual judgment, because the company desires someone who will fit with its organizational culture and workplace climate. Therefore, companies tend to look for employees who do not have a clear intention to leave, rather than those who have repeatedly left their workplaces (job hoppers), to avoid having the newly employed recruits leave their jobs.

The reason Japanese companies use employment services is not to obtain information about job seekers, but because it is difficult to clarify the value of the human resources they need, and it is also that the companies to hire people who are considering retirement but whose intentions are not clear. On its part, the Japanese company has no motivation to eliminate the asymmetry in information.

Through its exchange of documents with the recruiting company, the employment service is able to clarify the requirements of the human resources, the Japanese companies simultaneously collects the career history and specific job sought from the job applicant and creates a recommendation document. In other words, creating a recommendation document can be regarded as a process in which the recruiting company converts the experience and job contents of the job applicant into a calculable form, translating employee talents that were not necessarily clear to either the company or the job applicant and thus granting the company the ability to decide whether or not to hire the applicant.

In this way, the recruitment service converts the ability of the job applicant into formalized documents according to a specific format and introduces the talent to the recruiting company. The recruiter reviews the documents and considers whether to meet the candidate or not. The hiring decision process varies from company to company, but usually involves several rounds of interviews.

As described above, the external labor market in Japan has the calculation mechanism that forms the value of human resources, and it is constituted of social and technical heterogeneous network. That consists of employment services, its portal sites, registrants including job seekers who have no clear intention of changing jobs, original rules for classifying registrants, and documents created through contact with recruiting companies. Recruitment services in Japan have visualized previously unclear human resource requirements and created a large number of job seekers. In other words, they have not distributed existing human resources, but have disentangled a heterogeneous network of human resources and formed an external labor market that did not exist in Japan before. One of the theoretical implications of referring to ANT as the meta theory is that it draws attention to the changes in Japanese employment practices by focusing on such economizing process.

References

1. Aoki, M. (1988). *Information, incentives, and bargaining in the Japanese economy*. Cambridge University Press.
2. Becker, G. S. (1964). *Human capital: A theoretical and empirical analysis, with special reference to education.* Columbia University Press.
3. Çalışkan, K., & Callon, M. (2009). Economization, part 1: Shifting attention from the economy towards processes of economization. *Economy and Society, 38*(3), 369–398.
4. Çalışkan, K., & Callon, M. (2010). Economization, part 2: A research programme for the study of markets. *Economy and Society, 39*(1), 1–32.
5. Callon, M. (1998). Introduction: The embeddedness of economic markets in economics. In M. Callon (Ed.), *The lows of markets* (pp. 1–57). Blackwell.

6. Callon, M. (1999). Actor-network theory: The market test. In J. Law & J. Hassard (Eds.), *Actor network theory and after* (pp. 181–195). Blackwell.
7. Callon, M., & Muniesa, F. (2005). Economic markets as calculative collective devices. *Organization Studies, 28*(8), 1229–1250.
8. Callon, M., Millo, Y., & Muniesa, F. (Eds.). (2007). *Market devices*. Blackwell.
9. Doganova, L. (2019). What is the value of ANT research into economic valuation devices? In A. Blok, I. Farias, & C. Robert (Eds.), *The Routledge companion to actor-network theory* (pp. 256–263). Routledge.
10. Doeringer, P. B., & Piore, M. J. (1971). *Internal labor markets and manpower analysis*. Heath.
11. Fourcade, M. (2011). Cents and sensibility: Economic valuation and the nature of 'nature.' *American Journal of Sociology, 116*(6), 1721–1777.
12. Hanseth, O., Aanestad, M., & Berg, M. (2004). Guest editor's introduction: Actor-network theory and information systems. What's so special. *Information Technology and People, 17*(2), 116–123.
13. Kokubu, K., Sawabe, N., & Matsushima, N. (Eds.). (2017). *Keisan to keiei jissen: Keieigaku to kaikeigaku no kaikō,* [*Calculation and organizing practices: Connecting accounting research and organizational theory*]. Yuhikaku. (in Japanese).
14. Latour, B. (1987). *Science in action: How to follow scientists and engineers through society*. Harvard University Press.
15. Latour, B. (2005). *Reassembling the social: An introduction to actor-network theory*. Oxford University Press.
16. Law, J. (1999). After ANT: Complexity, naming and topology. In J. Law & J. Hassard (Eds.), *Actor network theory and after* (pp. 1–14). Blackwell.
17. Lepak, D. P., & Snell, S. A. (1999). The human resource architecture: Toward a theory of human capital allocation and development. *Academy of Management Review, 24*(1), 31–48.
18. MacKenzie, D. (2007). Is economics performative?: Option theory and the construction of derivatives markets. In D. MacKenzie, F. Muniesa, & L. Sui (Eds.), *Do economists make markets? On the Performativity of Economics* (pp. 54–86). Princeton University Press.
19. Matsushima, N. (1996). Kigyōka ni yoru honyaku senryaku: Akutā nettowāku riron ni okeru honyaku gainen no kakucyō [Translation strategy by entrepreneur: Extension of the concept of translation in actor-network theory]. In N. Ueno, & S. Dobashi (Eds.), *Kagaku gijutsu jissen no fīrudowāku: Haibуriddo no Dezain* [*Fieldwork of science and technology practices: The design of hybrid*] (pp. 110–127). Serica Syobo. (in Japanese).
20. Muniesa, F., Millo, Y., & Callon, M. (2007). An introduction to market devices. In M. Callon, Y. Millo, & F. Muniesa (Eds.), *Market devices* (pp. 1–12). Blackwell.
21. Orlikowski, W. J. (2000). Using technology and constituting structures: A practice lens for studying technology in organizations. *Organization Science, 11*(4), 404–428.
22. Orlikowski, W. J. (2007). Sociomaterial practices: Exploring technology at work. *Organization Studies, 28*(9), 1435–1448.
23. Orlikowski, W. J., & Scott, S. V. (2008). Sociomateriality: Challenging the separation of technology, work and organization. *The Academy of Management Annals, 2*(1), 433–474.
24. Sayes, E. (2014). Actor-network theory and methodology: Just what does it mean to say that nonhumans have agency? *Social Studies of Science, 44*(1), 134–149.
25. Strathern, M. (1996). Cutting the network. *The Journal of the Royal Anthropological Institute, 2*(3), 517–535.
26. Yatera, A. (2013). Keisan kūkan toshite no roudō shijō: Chūto saiyō ni okeru jinzai syōkai katsuyō wo chūshin ni [Labor market as calculative space: Focus on private employment services in labor market]. *Nihon Jōhō Keiei Gakkaishi [Journal of Information and Management], 33*(4), 78–89. (in Japanese).

Chapter 3
The Theoretical Positions of Institutions and Technology in Organizational Institutionalism

Mitsuhiro Urano and Noboru Matsushima

Abstract By examining the materiality of institutions based on organizational institutionalism, we overcome the dichotomy between institutions and technology. Orlikowski's structural model sought to capture the interaction between institutions and acts of using technology. In management studies, this concept of the institution has been discussed in the area of organizational institutionalism. Orlikowski and Barley (MIS Q 25(2):145–165, 2001 [25]) tried to connect information management research to organizational institutionalism and incorporate material properties of technology into organizational institutionalism. However, they emphasize the analysis of institutional changes induced by the introduction of new technology. This statement assumes uninstitutionalized technology that leads to institutional changes and overlooks the fact that technology is institutionalized itself. This problem stems from the fact that organizational institutionalism has mainly focused on the symbolism of institutions and has not sufficiently shed light on the materiality of institutions. We explore the implication of the materiality of institution with reference to the concept of institutional logics. Through these discussions, we clarify that institutions consist of symbols and objects, and introduce an empirical study of the innovation in a Japanese company implemented within institutions constituted both symbolically and materially.

Keywords Organizational institutionalism · Institutions and technology · Dichotomy · Institutional logics

3.1 Dichotomy Between Institutions and Technology

Since new institutionalism has raised in the late 1970s, organizational institutionalism has remained one of the most popular areas in management studies for a long time. Organizational institutionalism has been discussed in various ways, so it is difficult to

This chapter was written through the process described in the preface. In addition, theoretical consideration of Sects. 3.1–3.3 in this chapter is a revised version of a discussion of institutions and technology/materiality of Sects. 2–4 in Urano [34].

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give a single definition, but there is a common view that individuals or organizations are constructed under the influence of socially constructed institutional contexts. However, any trend generates a variety of arguments, and perversions crop up. One of the perversions was that institutions constrain people, thus leading to inefficiency. In management studies, which until then had been based mainly on the pursuit of technical efficiency, this idea of constraint as related to inefficiency had a great impact. It can be said that the spread of this understanding accelerated the spread of organizational institutionalism. For example, Meyer et al. [20] examined the impact of technical activities on the structure of educational organizations. They found that such technical activities as introducing new teaching methods or using new educational tools were implemented in every classroom. However, these technical activities were rarely organizationally incorporated, and the organizational structure was made to comply with the institutional environment. Therefore, in educational organizations, technical activities were decoupled from the organization, and the organizational structure was shaped to conform to the institutional environment. Besides, Scott and Meyer [29] hypothesized that the degree of influence of the technical environment, which requires technical efficiency, and of the institutional environment, which must be followed in order to obtain social support and legitimacy, varied depending on the industry. Based on this view, Scott and Meyer [30] analyzed differences in the institutional influence on educational organizations and Scott, Ruef, Mendel and Caronna [31] researched the institutional changes in the healthcare industry.

However, Meyer and Rowan [19], who triggered the current trend in organizational institutionalism, argued that the technical activities prescribed in official organizations were institutionalized, based on the discussion of modernization by Max Weber. The pursuit of efficiency through technical activities, they said, is based on a rationalized myth, by which they meant that the pursuit of technical efficiency has been legitimized and is now taken for granted. To this end, it was suggested that formal organizations, which were considered technically efficient, were ritually incorporated. Their argument was not intended to explain inefficiency but efficiency.

The leading researchers in organizational institutionalism have developed arguments to dispel the perversion of inefficient institutional constraints. A seminal treatise by DiMaggio and Powell [9] in the orange book [28], which represents new institutionalism, criticized the discussions of new institutionalism that had emphasized inefficiency.[1]

The perversion that claims institutions constrain people inefficiently has a theoretical problem: it contradicts the theoretical premise of organizational institutionalism that technical efficiency is an institutionalized criterion. Problems are not limited to the theoretical discussion. Because technology has been regarded as separate from institutions, it has been excluded from the scope of organizational institutionalism [27].

[1] As discussed in this chapter, the idea that institutions inefficiently constrain people stems from the perceived dichotomy between institutions and technology. In order to solve this problem, organizational institutionalism advocates the concept of institutional entrepreneur [8] and institutional work [16].

Orlikowski and Barley [25] attempted to resolve this problem by connecting information management research to organizational institutionalism and incorporate materiality into organizational institutionalism. Information management research attempts to explain phenomena from the material characteristics of the technology. For example, when information and communication technology is introduced into work, telecommuting increases because work can be done remotely. In reality, however, telecommuting is not especially widespread. The reason for this can be explained by organizational institutionalism, which sheds light on social factors. For example, telecommuting prevents supervisors from monitoring the work of their subordinates, or it prevents subordinates from showing their work to their supervisors. Based on organizational institutionalism, because there are social factors that are different from technology, telecommuting is not widespread. However, while organizational institutionalism focuses on social factors, it overlooks the material aspects of technology on which information management research has focused. If we look again at information and communication technology and how people use it in their work, we can see that people are working in the office but doing some work at home. Working at home does not eliminate work in the office; instead, the two are complementary. The researchers found these practices and concluded that networked computers' material properties have changed the long standing institutional boundaries of family and work in industrial capitalism. However, this explanation assumes uninstitutionalized information technology that changes traditional institutional boundaries [6]. After all, institutions and technology are seen as different things.

In response to these issues, Trevor Pinch, a sociologist of science and technology, argues that technology must also be seen as institutionalized [27]. Pinch's discussion, however, does not address how institutionalized technologies can be analyzed. The question remains for exploration here: how is institutionalized technology viewed?

3.2 The Institutional Analysis of Technology

Currently, it seems necessary to regard technology as institutionalized, but how may institutionalized technologies be analyzed? In recent organizational institutionalism, the methodology of institutional analysis is discussed with the emerging concept of institutional logics.[2]

According to Thornton and Ocasio [33], the concept of institutional logics is defined as "the socially constructed, historical pattern of material practices, assumptions, values, beliefs, and rules by which individuals produce and reproduce their material subsistence, organize time and space, and provide meaning to their social

[2] The concept of institutional logics was originally proposed by Friedland and Alford [12]. However, it was not immediately attended, the number of studies on institutional logics rapidly increased after 2011. Approximately 40 pioneering articles were published in 2011 and 2012, and over 120 articles were published annually in 2014 and 2015. Until now, more than 700 articles on institutional logics have been published [24].

reality" (p. 804). For example, contemporary Western societies have capitalism, family, bureaucratic state, democracy, and Christianity as their major institutions, and these institutions have their own logics. Institutions are often contradictory to each other because of their inherent logics, which form people's preferences and interests [12]. In this way, society is composed of various institutions, each with its unique logic. Based on this concept of institutional logics, technology can be positioned as one of the institutions.

The significance of an analysis based on institutional logics lies in the fact that it enables us to understand how people live while separating or blending various institutions existing in society [5]. In other words, by focusing on institutional logics, it is possible to grasp daily practices that are diversifying through the interaction of the contradictions and complementarities of varying institutional logics. It is essential not to use institutional logics for explaining preestablished harmony but rather to use it as a tool to capture a wide range of practices [24].

Based on this idea, Peter Berger, whose work has been one of the theoretical foundations of organizational institutionalism, has grasped the social reality of people living in a modern society accelerated by technology. According to Berger et al. [3], modern society is characterized especially by two institutions that are not necessarily compatible: industrial production and bureaucracy. On the one hand, industrial production assumes the separability of purpose and means; for example, the same gear can be used to manufacture automobiles or nuclear weapons. On the other hand, bureaucracy presupposes the indivisibility of purpose and means so that proper procedures are required for issuing passports, for instance, at government offices. Both are institutions that characterize modern times, but people live with the separability and indivisibility of purposes and means linkage.

Technology is one of the institutions that make up our lives. However, technology does not uniformly dictate practice. Various institutions that exist alongside technology are blended, and various practices are developed. Berger et al. [3] also point out that the logic of industrial production may interact with the logic of private life as well. The anonymity of industrial production affects private life beyond the workplace: people become homogenized and marginalized as workers, on the one hand, and seek psychological refuge in their private lives. On the other hand, workers may use their jobs as shelter from the difficulties of their private lives, which cannot be anonymized. Furthermore, the logic of bureaucracy is mixed with the logic of private life in practice. Bureaucracy organizes people's private lives in a bureaucratic way, such as placing a bulletin board beside a telephone stand in the kitchen to share information. On the other hand, private life is sometimes brought into bureaucracy, such as through Christmas parties at work.

The question remains, however, whether this analysis captures the technology well enough. When we look at technology, we expect it to work materially. If we do not focus on these material functions, we may lose the value of analyzing technology. To address this issue, we examine the relations between institutions and materiality in the next section.

3.3 The Materiality of Institutions

The fact that Orlikowski and Barley [25] tried to incorporate materiality into organizational institutionalism by connecting it to information management research shows that the former does not include sufficient attention to the materiality of institution. The reason for this insufficient attention is because organizational institutionalism, based on Berger and Luckamann [4] as a theoretical foundation, has emphasized that reality is socially constructed through cognition and symbols. The linguistic aspect of institutions is often emphasized (e.g., Philips et al. [26]), but the material aspect has not been given much attention.

Certainly, society is understood through language. The linguistic turn that has had a great impact on social science has clarified that objects are understood only through language. It is also true, however, that objects precede language [15]. Greater attention to the linguistic aspect does not mean that materiality has never been considered in organizational institutionalism. Actually, institutional logics were advocated as composed of material practices and symbolic constructions [11, 12]. However, organizational institutionalist has been interested in symbolic constructions rather than physical aspects of institution [10, 13].

Under these circumstances, Jones and Massa [14] have tried to bring materiality as a physical object into organizational institutionalism. They focused on Unity Temple, designed by Frank Lloyd Wright, to argue that institutions are embodied as physical objects. For example, church spires traditionally point to the existence of God. Therefore, spires have been attached to a church as a matter of course. At Unity Temple, however, no spire was built to reflect the belief that God is not sought in the sky but a community of people. Unity Temple also uses a different building material. Stone is a symbol in the Bible, and a church made of stone is figuratively thought to represent its members' spiritual unity. However, Unity Temple was the first church built of reinforced concrete.

Jones and Massa [14] focused on objects as the embodiment of institutions. However, while the church's spire is a material entity, the analysis considers only symbolic implications. Reinforced concrete was also mentioned from the aspect of cost and construction time, but the function as the material was not examined. Although the material aspects of institutions are within the scope of the analysis, they do not necessarily have to be material in this analysis. The significance of putting the material into institutional analysis lies not only in the fact that it is sufficient to place the object on the run up to analysis but also in the fact that the function performed by the material is examined. It should be noted, however, that if uninstitutionalized substances are smuggled into the analysis, the theoretical premise of organizational institutionalism will be undermined.

Bridgman and Willmott [6] attempted to overcome these problems by capturing both symbolism and materiality in institutions. They focused on the materiality of the information and communication technologies introduced by the UK Inland Revenue to reduce costs and improve service to customers. Just advocating for better service like a slogan does not necessarily lead to better service. To achieve better service,

local tax offices, for example, have installed 8500 computer terminals that allow staff access to all information, enabling each individual to respond quickly to customers and thus improving service. However, the important thing here is the computer terminal introduced at that time did not have certain essential properties as an object because the computer can be used in various ways. The expectation that computers would be able to change the conventional hierarchical system into a horizontal one solidified the evolution. In other words, material properties are affected by symbolic expectations from information and communication technology. It can be said that an institutional analysis of technology is required to pay attention to the technical characteristics that work in the overlap between symbolism and materiality.

The discussion in the previous section reveals that practice has been blended various institutions. Combining that discussion with the one in this section, we see each institution constituted both symbolically and materially, and practice is composed of a number of these institutions. Ciborra and Lanzara [7] tried to apprehend practice formed by blended institutions composed symbolically and materially by looking at a major computer company's operating system development project. In the project, the personnel department sought to introduce a flat organizational structure to promote horizontal communication. However, the information processing experts, who preferred structured methodologies, did not accept such an organic organization. A "software factory," which consists of the latest software tools to assist programmers in developing individual modules through a computer network of hundreds of workstations, was introduced to connect the experts horizontally. For the experts who preferred structured methodologies, the software factory was a structured organization, but at the same time, the software factory had the technical characteristics as a database that facilitated information sharing. On the one hand, the experts accepted the organization as being structured, while on the other hand, the software factory encouraged horizontal communication among experts. In this way, this blending of the organizational structure and the information system propelled the project forward.

3.4 Blended Practice of Technology, Personnel System, and Strategy in Sharp Co.

As we have discussed, institutions are constituted both symbolically and materially, and various institutions composed in this way are blended in practices. In this section, on the basis of Urano et al. [35], we introduce our study of Sharp Corporation's product development, focusing on practice in which these institutions, including technology, are blended.[3]

[3] While, in this section, we focus our discussion on blended institutional practice on the basis of Urano et al. [35], we originally made this case through research on Emergency Project referred to in the text. Matsushima & Urano [18] examines how emergency projects have created innovation

Sharp is one of Japan's eight major electronics manufacturers.[4] It is known for having achieved many innovations based on the spirit of its founder, who advocated that the company create products that would be copied by other companies. The company has developed and put into practical use many products that were the first in Japan, what is more in the world, including the launch and mass production of Japan's first TV, the development of the LSI calculator and the LCD calculator, and others [32].

Here, we focus on one of Sharp's innovations, the development of software for mobile phones, though it was not the first of its kind in the world. In the 1990s, Sharp's word processor business, which was underway at its Information Systems Division, was gradually shrinking. Downsizing the word processor business eliminated the need for many of the engineers who worked there. Therefore, many of the engineers who were in charge of developing software for word processors were no longer needed, and most of them were transferred to the Telecommunication Systems Division to work on developing software for mobile phones. The two require completely different programming skills because of different hardware configurations, even if the same software were to be developed for word processors and mobile phones. Even Japanese input software, which seems to have something in common, requires different programming skills. However, they were experts in software development. They developed mobile phone software and contributed to Sharp's mobile phone development by relearning programming from scratch.

The development of software for mobile phones relies on the material properties of the programming language. However, it is important to note that the mobile phone software was not developed in a separate place from other institutions. When the engineers relearned programming from scratch for a different kind of software development, the Japanese management system supported them.[5] Sharp is a company that embodies typical Japanese management and has introduced a uniform wage system, regardless of job type, on the premise of lifetime employment.[6] In addition to the software development described above, in 1998, the semiconductor business in which Sharp had invested in for many years was significantly scaled down, and the company restructured by concentrating investment in the liquid crystal business [17]. Sharp's significant downsizing of its semiconductor business, which had been its main business, was accompanied by the transfer of many engineers working in its Integrated Circuit Business Division to other divisions. However, the uniform wage structure made it possible for employees to accept such drastic restructuring. This personnel system allows personnel to be transferred according to the company's circumstances, and, at the same time, it had an impact on employees' awareness.

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on the basis of this case. In addition, on the basis of this research, a methodology is discussed in Urano et al. [36], focusing on the political relationship with research subjects.

[4] The eight major electronics manufacturers are Hitachi, Panasonic, SONY, Toshiba, Fujitsu, NEC, Mitsubishi Electric, and Sharp.

[5] The Japanese management was initially proposed by Abegglen [1], and its functions, such as the flexible use of labor discussed in this section, are detailed in Abegglen [2].

[6] Sharp has the uniform wage system not only at the head office but also at all subsidiaries, including sales companies and service companies.

Salary is guaranteed even if operational efficiency is expected to decline because of changes in job type or work. Furthermore, Sharp has never asked for early retirement to reduce its workforce since it called for voluntary retirement in 1950 [17]. In other words, employees can work at their company's convenience without worrying about their treatment. These institutions, as Japanese management, have allowed software development professionals to relearn from scratch to develop new software.

It is not only the personnel system that has supported Sharp's innovation. Sharp's position in the industry, as well, has made it an innovation oriented company. Sharp ranks at the bottom of the eight major electronics manufacturers in terms of the number of employees and sales. Besides, when it started its business as a general electronics manufacturer, there was already a giant in the industry, Matsushita Electric Industrial (currently Panasonic), nearby. Under these circumstances, when Sharp launched a new product on the market, it was immediately caught up by a major competitor with superior resources. This situation required Sharp to be ahead of other companies in its innovation [21–23]. By continuing to introduce new products to the market before others could catch up, Sharp has grown without being caught up in competition with large companies. In other words, continued innovation was Sharp's lifeblood. Thus, Sharp's strategy consisted of its physical position in the industry and the symbolic meaning of the position.

Besides, Sharp has an institution to support the creation of innovation to maintain its lifeline. This institution is named as Emergency Project[7], which is widely known in the Japanese industry. Emergency projects are launched when urgent innovation is required, such as those that will determine the fate of the company, and emergency projects bring together the experts needed from throughout the company. Because emergency projects will determine the fate of the company, experts must achieve innovation once they are assigned to an emergency project. In this way, innovation has been spurred by creating a situation wherein innovation must happen because there is an emergency [18]. The name for the institution of emergency projects is KinPro in Japanese. The Japanese word kin means "emergency," and it also has the meaning of "gold." Those selected to work on KinPro receive a gold badge as a token of their participation in the special project responsible for the company's fate. Therefore, with the gold badge on their chests, KinPro members are committed to creating innovation to ensure the project is successful. As above, KinPro is institutionalized, both symbolically and materially, for generating innovation.

References

1. Abegglen, J. C. (1958). *The Japanese factory: Aspects of its social organization*. Free Press.
2. Abegglen, J. C. (1973). *Management and worker: The Japanese solution*. Sophia University.
3. Berger, P. L., Berger, B., & Kellner, H. (1973). *The homeless mind: Modernization and consciousness*. Random House.

[7] The Emergency Project was institutionalized in 1977, and 292 projects had been launched by 2010.

4. Berger, P. L., & Luckmann, T. (1966). *The social construction of reality: A treatise in the sociology of knowledge*. Doubleday.
5. Besharov, M. L., & Smith, W. K. (2014). Multiple institutional logics in organizations: Explaining their varied nature and implications. *Academy of Management, 39*(3), 364–381.
6. Bridgman, T., & Willmott, H. (2006). Institutions and technology: Frameworks for understanding organizational change: The case of a major ICT outsourcing contract. *Journal of Applied Behavioral Science, 42*(1), 110–126.
7. Ciborra, C., & Lanzara, G. (1994). Formative contexts and information technology: Understanding the dynamics of innovation in organizations. *Accounting, Management and Information Technologies, 4*(2), 61–86.
8. DiMaggio, P. J. (1988). Interest and agency in institutional theory. In L. G. Zucker (Ed.), *Institutional patterns and organizations: Culture and environment* (pp. 3–21). Ballinger Publishing.
9. DiMaggio, P. J., & Powell, W. W. (1991). Introduction. In W. W. Powell & P. J. DiMaggio (Eds.), *The new institutionalism in organizational analysis* (pp. 1–38). University of Chicago Press.
10. Friedland, R. (2012). Book review: Patricia H. THORNTON,William OCASIO, & Michael LOUNSBURY 2012 The institutional logics perspective: A new approach to culture, structure, and process, *M@n@gement, 15*(5), 582–595.
11. Friedland, R. (2013). God, love and other good reasons for practice: Thinking through institutional logics. In M. Lounsbury, & E. Boxenbaum (Eds.), *Institutional logics in action, part A (research in the sociology of organizations)* (Vol. 39A, pp. 25–50). Emerald Group Publishing.
12. Friedland, R., & Alford, R. (1991). Bringing society back in: Symbols, practices, and institutional contradictions. In W. W. Powell, & P. J. DiMaggio (Eds.), *The new institutionalism in organizational analysis* (pp. 232–263). University of Chicago Press.
13. Jones, C., Boxenbaum, E., & Anthony, C. (2013). The immateriality of material practices in institutional logics. In M. Lounsbury, & E. Boxenbaum (Eds.), *Institutional logics in action, part A (research in the sociology of organizations)* (Vol. 39A, pp. 51–75). Emerald Group Publishing.
14. Jones, C., & Massa, F. G. (2013). From novel practice to consecrated exemplar: Unity temple as a case of institutional evangelizing. *Organization Studies, 34*(8), 1099–1136.
15. Jones, C., Meyer, R., Jancsary, D., & Höllerer, M. A. (2017). The material and visual basis of institutions. In R. Greenwood, C. Oliver, T. B. Lawrence, & R. E. Meyer (Eds.), *The sage handbook of organizational institutionalism* (2nd ed., pp. 621–646). Sage Publications.
16. Lawrence, T. B., & Suddaby, R. (2006). Institutions and institutional work. In S. R. Clegg, C. Hardy, T. B. Lawrence, & W. R. Nord (Eds.), *Handbook of organization studies* (2nd ed., pp. 215–254). Sage Publications.
17. Machida, K. (2008). *Onrīwan wa soui da aru [Only one is creativity]*. Bungeishyunzū. (in Japanese).
18. Matsushima, N., & Urano, M. (2013) Inobēshon wo soushutsu suru seido no hataraki [Insitution works on innovation]. *Kokumin Keizai Zasshi [Journal of Economics and Business Administration]*, *207*(6), 93–116. (in japanese).
19. Meyer, J. W., & Rowan, B. (1977). Institutionalized organizations: Formal structure as myth and ceremony. *American Journal of Sociology, 83*(2), 340–363.
20. Meyer, J. W., Scott, W. R., & Deal, T. E. (1981). Institutional and technical source of organizational structure: Explaining the structure of educational organizations. In H. D. Stein (Ed.), *Organization and the human services: Cross-disciplinary reflections* (pp. 151–178). Temple University Press.
21. *Nikkei Business* (1991). "Syōhinryoku de syōbu" ga syukumei: Dokutoku no kaihatsu sisutemu de fukakachi wo tetteitsuikyū ["Compete on the strength of product" is destiny: Thoroughly pursuing added value with the unique development system]. *August 19*, 11–15. (in Japanese).
22. *Nikkei Business* (2009). Tokusyu syāpu ishin: "Tomareba hissui" no kotowari [Special issue on Sharp restoration: If Sharp stops, it will inevitably fail]. *July 6*, 30–31. (in Japanese).

23. Noda, T. (1995). Sharp Corporation: Technology strategy. Harvard Business School Publishing, 9–793–064.
24. Ocasio, W., Thornton, P. H., & Lounsbury, M. (2017). Advances to the institutional logics perspective. In R. Greenwood, C. Oliver, T. B. Lawrence, & R. E. Meyer (Eds.), *The Sage handbook of organizational institutionalism* (2nd ed., pp. 509–531). Sage Publications.
25. Orlikowski, W. J., & Barley, S. R. (2001). Technology and institutions: What can research on information technology and research on organizations learn from each other? *MIS Quarterly, 25*(2), 145–165.
26. Philips, N., Lawrence, T. B., & Hardy, C. (2004). Discourse and institutions. *Academy of Management Review, 29*(4), 635–652.
27. Pinch, T. (2008). Technology and institutions: Living in a material world. *Theory and Society, 37*(5), 461–483.
28. Powell, W. W., & DiMaggio, P. J. (Eds.). (1991). *The new institutionalism in organizational analysis*. University of Chicago Press.
29. Scott, W. R., & Meyer, J. W. (1991). The organization of societal sectors: Propositions and early evidence. In W. W. Powell & P. J. DiMaggio (Eds.), *The new institutionalism in organizational analysis* (pp. 108–140). University of Chicago Press.
30. Scott, W. R., & Meyer, J. W. (1994). Environmental linkages and organizational complexity: Public and private schools. In W. R. Scott, J. W. Meyer, & Associates (Eds.), *Institutional environments and organizations: Structural complexity and individualism* (pp. 137–159). Sage Publications.
31. Scott, W. R., Ruef, M., Mendel, P. J., & Caronna, C. A. (2000). *Institutional change and healthcare organizations: From professional domination to managed care*. University of Chicago Press.
32. Sharp Corporation (2012). *Sharp 100th anniversary: A century of sincerity and creativity*. http://global.sharp/100th/pdf/all.pdf. Accessd January 18, 2022.
33. Thornton, P. H., & Ocasio, W. (1999). Institutional logics and the historical contingency of power in organizations: Executive succession in the higher education publishing industry, 1958–1990. *American Journal of Sociology, 105*(3), 801–843.
34. Urano, M. (2019). Seido to busshitsusei: Kūkan manejimento wo toraeru pāsupekuteibu no tankyū ni mukete [Institutions and materiality: Towards an exploration of space management perspective]. *Syōgaku Ronkyū [Journal of Business Administration of Kwansei Gakuin University], 66*(3), 401–414. (in Japanese).
35. Urano, M., Matsushima, N., & Kanai, T. (2011). Institutionalization of the innovation initiative and implementation: 'KinPro' for Sharp Corporation. *Kobe University Graduate School of Business Administration Discussion Paper Series*, 2011–4.
36. Urano, M., Matsushima, N., & Kanai, T. (2011). "Kinpro" no shakaitekikousei ni setsuzoku sareta chishikiseisan: Shakaikouseishugi saihou [The knowledge production embedded within the social construction of the urgent project in Sharp Co.: Social constructionism revisited]. *Nihon Jōhō Keiei Gakkaishi [Journal of Information and Management], 31*(3), 66–80 (in Japanese).

Chapter 4
The Materiality of Artifacts in Performing Organizational Routines: How Patterns of Action Are Created and Maintained

Naoto Yoshino and Shunsuke Hazui

Abstract Although organizational routines have often been misunderstood as recurrent interaction patterns, recent studies have shown that the actual meaning is closer to abstract patterns of an action generalized from an interaction. This implies that practices involved in performing a routine are not always reproduced, or if they are reproduced, they are not mindless but effortful accomplishments, which has not been fully discussed in management studies applying Giddens's structuration theory. Therefore, the studies of organizational routines have attempted to describe the variety in practices of performing routines and specific abstract patterns of action from the variety. However, the following issue remains unresolved: "Why can we recognize certain patterns in various practices?" or "Why are various practices routinized?" In light of this, we review the history of the discourse on the concept of organizational routines, look at the significance of focusing on the materiality that forms organizational routines, and introduce empirical studies in Japan that revealed the materiality of artifacts in terms of affordances and framing.

Keywords Organizational routine · Artifact · Ostensive/performative/patterning · Affordance

4.1 Organizational Routines as Dualities: Background and Definitions

The theoretical genesis of the studies of organizational routines derives from the Carnegie School. Researchers there conceptualized the rules humans follow, which are limited by bounded rationality, to simplify and categorize the search processes related to decision-making as "habit" [25], "performance programs" [17], and "standard operating procedures" (SOPs; [5]). At present, these concepts are positioned at the origin of organizational routines. Their significance lies in their expression of cognitive patterns instead of actions.

However, because we think of repetitive actions when we hear the words "routine" or "pattern," the term "organizational routines" has been confused with these everyday terms and has therefore been misunderstood. Thus, routines as cognitive

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patterns were believed to lead to routinized actions, and many prior studies have taken organizational routines to be "recurrent interaction patterns" [2] or "recurrent behavior patterns" [3]. One typical example is ambidexterity research, which stresses the balance between exploration and exploitation [18]. This study problematizes the exploration exploitation trade-off because inertia acts on both kinds of learning. Excessive exploration leads to failure traps, and exploitation causes success traps [16]. However, both exploration and exploitation are decision-making rules, which does not necessarily mean that they immediately lead to routinization or inertia of action.

In order to clear up these misunderstandings, Martha S. Feldman and Brian T. Pentland reframed organizational routines as cognitive patterns. Pentland and Rueter [22] defined organizational routines as analogous to grammar. They pointed out that just as normative grammar is used to write diverse expressions, organizational routines also can create diverse practices. Feldman [9] and Feldman and Pentland [12] further developed this analogy into organizational routines as dualities. According to Feldman and Pentland [12],organizational routines can be divided into two aspects: ostensive and performative. The ostensive aspect is "the ideal or schematic form of a routine. It is the abstract, generalized idea of the routine or the routine in principle" (p. 101). From the standpoint of linguistics, the term "ostensive" means to define a word by pointing to its practical instantiation. Therefore, the ostensive aspect of the hiring routine involves attracting, screening, and choosing applicants. The performative aspects are the practices involved in performing specific routines, which consist of "specific actions, by specific people, in specific places and times" (p. 101). It is important to understand that the action pointed to by ostensive aspects is a pattern or category included in a routine, not an action to be taken in individual contexts. Therefore, the subjective understandings of diverse participants are involved in the performative aspects of routines, which can be understood as inherently improvisational or situated in a complex context.

After organizational routines as dualities were proposed, the diversity in the practices of performing routines and human agency attracted attention, but two problems were also discovered. First, researchers conducted empirical studies assuming that the actors interpret routines without any constraints. This is the criticism that was aimed at Giddens's structuration theory, which is one of the theoretical foundations of the duality argument. According to Archer [1], the problem with the structuration theory is that it merely transposes the dualism between structure and agency from the theoretical to the methodological level (p. 88). In other words, for transcending dualism, Giddens theoretically adopted 'central conflation' to view structure and agency as fundamentally inseparable in social practice; but methodologically, he returned to Methodological Individualism to explain the reproduction or transformation of structure through the reflexive knowledge and behavior of actors. However, because he does not consider in detail the origins of the desires and knowledge that lead to reproduction or transformation, he seems to assume implicitly that these are inherent in the actors (pp. 130–132). Similarly, the duality argument also explains the stability and variations in the ostensive aspects (structure) as the actor's interpretation and practice (agency), but the argument unfolds without clarifying where

this agency comes from, nor does it actually reveal the infinite variations in actors' interpretation or practice.

Second, the two aspects are seen to have separate and independent existences and, ultimately, to be treated as dualism. Feldman and Pentland [12] explained that the ostensive aspect "may be codified as a standard operating procedure, or it may exist as a taken-for-granted norm" (p. 101), so it has been equated with rules and SOPs. In fact, Becker [2, 3] identified "rules or procedures" as part of the definition of organizational routines, in addition to recurrent behavior patterns. However, as Feldman and Pentland [12] mentioned, the ostensive aspects are embedded in the procedural knowledge of diverse participants, and it is wrong to equate them with rules and SOPs (p. 101).

In order to overcome these problems, Feldman and Pentland have been refining the duality model. Regarding the first problem, attention is now focused on "pattern-in-variety" [11, 20] or "central tendency" [21] and not diversity of action arising from the actor's interpretation. The shift was influenced by Cohen [4], who revisited organizational routines relying on John Dewey's "habit." Dewey [8] considered habit to be potential action repertoires and defined it as "an acquired predisposition to ways or modes of response" (p. 42). Considering habits as dimensions of actions, if a stable action pattern appears, a new action is also produced. The aim of Feldman and Pentland is to view tendencies (habits) through the description of action sequencing.[1]

Regarding the second problem, they reconceptualized the two aspects as having a mutually constitutive relationship [21]. Rules and SOPs which were equated with ostensive aspects were handled as artifacts [19]. Feldman [10] changed the rhetoric expressing the two aspects from "ostensive/performative" to "patterning/performing," doing away with the ostensive label, which had invited misunderstanding, and expressed the mutual constitution relationship between the two in the progressive tense.

4.2 The Material Turn in the Studies of Organizational Routines

Even though we agree on considering organizational routines as patterns of action, the following problem remains unresolved: "Why can we recognize certain patterns in various practices?" or "Why are various practices routinized?" Regarding this question, it is no doubt necessary to go back to the theoretical interests of the Carnegie School, especially those of Simon. Like Cohen [4], Simon [25] also cited Dewey's habit, but his interest was not in explaining habits. Rather, it was to shed light on

[1] Initially, they emphasized the uncertainty of the ostensive aspects that have been abstracted as language and focused on the diversity of actors' interpretations. However, it is important that these interpretations are also constructed by language. If we look at the transcendental functions of the language, it is natural to assume that the ostensive aspects are directive and that some patterns exist in practicing organizational routines.

organizational requirements for establishing habits—in other words, on methods to control the environment of decision (see Chap. 5, especially pp. 108–109). In light of this, we believe that the agenda in the studies of organizational routines is not only to describe patterns of action but also to explore the mechanisms that create and maintain specific patterns of action.

In the past, direct supervision and bureaucracy was considered the primary means of this mechanisms [7, 24], but in recent years, the materiality of artifacts has attracted attention for the following two reasons.

First is the affordance of artifacts. According to Leonardi [14, 15], the creation, maintenance, and transformation of organizational routines as patterns of action are generated by the imbrication of human agency, which are actions having human intentions and aims, and material agency, which are material acts of artifacts. Material acts as defined here are called "affordance." For example, an object affords grasping; a liquid affords pouring. Similarly, natural substances and artifacts created from them have the characteristic of controlling human actions. What is important to note here is that affordances are not the physical properties of things as now conceived by physical science, but are ecological in the sense that they are properties of the environment relative to humans.[2] Therefore, even objects that are physically identical may be perceived to have different affordances by different persons, or the same object might cause the same person to perceive it as having different affordances [23, pp. 403–405].

Second is framing using artifacts. In contrast to Feldman and Pentland, who did not reveal where the human agency came from, D'Adderio [6] pointed out that agency appears inside a configuration of diverse actors and artifacts, and she focused on artifacts in particular. Because artifacts are inscribed with action programs such as rules and knowledge, they univocally determine the course of actions. Naturally, inscribed action programs are sometimes interpreted, modified, and even fully rejected by human actors. However, when action programs are made into black boxes by artifacts, it becomes difficult for us to avoid the artifact's "power of default." This prescriptive function of artifacts is called "framing" (pp. 770–774).

Even though the two viewpoints have different focal points, they share a common emphasis on the control function of artifacts, which is to routinize practices. Based on these viewpoints, two empirical studies carried out up to now in Japan by the authors are introduced below.

4.3 Artifacts' Physical Structure Routinizes Sports Training Practices in Club Activities

In this section, as an empirical study focusing on the affordances of artifacts that routinize practices, we present a case analysis of club activities at a Japanese high school (High School A) featured in Hazui and Yoshino [13].

[2] Similarly, it is important that affordances are not phenomenal qualities of subjective experience. For example, the affordance of the knife to cut something is not lost at all if there is no human with the intention to cut something. A human may or may not perceive the affordance, but the affordance, being invariant, is always there to be perceived ([23], pp. 408–410).

In Japanese high schools, students of different grades form clubs under a coach (in most cases, a high school teacher) and engage in sports training for mental and physical health, and for participation in competitive tournaments. The training patterns is almost the same for every club. After class dismissal, the club members change into athletic wear and assemble at the prescribed location. The coach or club leaders give instructions about the practice schedule. The members then prepare the necessary equipment, do stretching and warm-up exercises, and start training. After they are done, they put away the equipment. Given this explanation of their routine, you might think that the club members would be very matter-of-fact about their daily training. However, at High School A, we observed the club members' training performance in the absence of their coaches and found that some clubs had routines according to a schedule, whereas others did not. The former included girls' volleyball club, badminton club, and track and field club, and the latter included judo club. This difference arose from the fact that the layout for the type and number of artifacts used in training differed greatly among the clubs (however, this situation excluded artifacts essential to the competition).

For example, looking at attack training in the girls' volleyball club, which used the highest number of artifacts for training, the following routines had been formed. First, the setter tosses the ball and the club members attack the ball that is tossed at two triangular cones placed in the middle of the opponent's court. Next, the other members who are waiting near the end zone pick up these balls and roll them to the member who is sitting near a basket for collecting balls placed in the center of the net. There are fences on both sides of the basket to prevent balls from getting into the court on the attack side. The member who receives the ball puts it in the basket. Then, the member who is standing next to the basket takes the balls from the basket and hands them to the setter who is standing next to her. Then the setter again tosses the balls.

The series of activities in the girls' volleyball club were based on the affordances of the artifacts and the physical structure created by their configuration. That is, the ball and triangular cones afforded "attacking the ball," the ball collection basket, and the fence; the person as the body sitting near the basket afforded "rolling the ball"; and the basket afforded "putting the ball in" to the members. These affordances created and maintained the patterns of action in the attack training.

In the badminton club, the artifacts for training also formed the coaching routines. In clubs that did not have training routines according to a schedule, the coach focused only on skill development in that particular sport. In contrast, the coach of the badminton club allocated time to teaching how to use the artifacts in training, for example, instead of teaching club members how to hit shots, he used the shuttlecock box as a target and showed the students where to place it on the court. In addition, this coach's training caused club members to perceive a new affordance of the artifact. The shuttlecock box had been afforded "putting the shuttlecocks in," but after the coach made the box into a "shuttlecock target," it also afforded "hitting the shot." In this way, the club members were not directly taught how to hit shots, but as they repeated the practice of facing the box and hitting the shuttlecock, they naturally developed the skill of hitting shots.

On the other hand, the judo club, which did not train as per the practice schedule, used almost no artifacts in their training. As artifacts are not used in judo competition, one would think that there is no need to use them in training either, but if one looks at other high schools, a surprisingly large number of judo clubs use such equipment as gymnastics mats, sandbags, and rubber tubing, for training. Likewise, in track and field club, artifacts are not used in competition, but the track and field club at High School A uses various artifacts in training, and this was one of the clubs in which the practice schedule was followed even when the coach was absent. In summary, one could say that the physical structure of artifacts in configuring training was a characteristic of the club, and not the sport.

In this way, at the clubs in which the practice schedule was followed even when the coach was absent, the patterns of action of club members were created and maintained by the affordances of the artifacts and physical structure created by their configuration. The club members perceived the affordances of these artifacts through the coach's teachings. That is to say, the club members' training practice was routinized by the imbrication of human and material agencies.

4.4 The Action Programs Inscribed in the Artifacts Induce Aircraft Maintenance Technicians to Check the Manuals

In this section, from an empirical study focusing on framing that uses artifacts to routinize practices, we present a case analysis of aircraft maintenance at a Japanese airline company (Company B) as featured in Yoshino [26].

At Company B, tasks for maintaining the aircraft were broadly classified into aircraft maintenance and heavy maintenance. Aircraft maintenance is performed during the short time between the arrival and departure of an aircraft, or at night between the arrival of the last flight of the day and the departure of the first flight the following day. Tasks include inspecting the plane's exterior, adding fuel and lubricant, changing parts, and cleaning. Heavy maintenance, which requires between several days and several months, is done every couple of years. It consists of inspecting all of a plane's electronics as well as its structure, rustproofing, and painting, and is carried out in an aircraft hangar. For both kinds of maintenance work, aircraft maintenance technicians place the utmost importance on the procedure manual, which they call the "maintenance manual." The manual, which exists for every type of aircraft, contains the technical standards created by the airline company, which are based on technical information from an aircraft's manufacturer, such as Boeing. The airline company works on the aircraft according to its manual, and its airworthiness is evaluated by a nationally authorized inspector (first or second-class aircraft maintenance technician or aircraft overhaul technician) in legally required inspections. In addition to the procedures for every task being clearly laid out, cautionary notes, evaluation criteria, and information about aircraft parts are also detailed in the manual.

However, in the past, though manuals existed, maintenance technicians performed the maintenance tasks based on their own heuristics. Because aircrafts were not as complex as they are now, airplane mechanics were better able to maintain a plane's airworthiness by relying on their skills from long experience rather than following a manual. Since that era, two factors have led to an emphasis on quality control based on manuals. First, the aircrafts have become more technically sophisticated. Some of their parts are now electronically controlled, and their operating mechanisms have become opaque. If mechanics do the maintenance work based on their own heuristics as they have done in the past, the risk of damage to the aircraft or of maintenance errors becomes higher. Second, the manuals are revised on an irregular basis. In their initial stages, manuals are not highly polished. Their level of correctness increases as they incorporate maintenance information from airlines worldwide. Because of this, unless manuals are checked daily, inconsistencies with the latest procedures and knowledge will arise, leading to unforeseen mistakes and errors.

Company B took various initiatives to routinize the referencing of manuals by maintenance technicians. The basic strategy was to make the maintenance technicians aware of the importance of manuals via classroom, practical training, e-learning, etc. The company also made a rule that before beginning the work, maintenance technicians had to print out the latest manual, bring it to where the work was to be done, and check off the procedures that were written in the manual as the work proceeded. What is most relevant here is that action programs for guiding maintenance technicians to reference the manual are inscribed in the artifacts used for each type of maintenance.

For example, in flight logs and work instructions, there is a column showing the number of pages and reference numbers in the manual. The flight log is a document for recording, inter alia, maintenance and flight history. Airlines are obligated by aviation laws to keep it in the aircraft. Work instructions are the documents used, whenever work is transferred, for sending a report of the work that one has done and giving instructions to the person taking over the work. Both types of documents are essential for performing maintenance routines, and they are used frequently. The fact that the number of pages and reference numbers in the manual are listed in the document means that the process of referencing the manual has been added as a part of performing the maintenance routine whether the technician wants to or not. If one considers only the action of writing the number of pages and reference numbers, one might think that once the maintenance technicians had memorized the number of pages and reference numbers, they would no longer need to check the manual every time. However, because the manual is updated irregularly, the mapping between the content and number of pages or reference numbers could change. Therefore, this program inscribed on a document with high frequency of use induces maintenance technicians always to check the latest manual.

The field for the signature of certifying staff on official documents fulfills a similar function. Certifying staff are maintenance technicians selected arbitrarily from first-class aircraft maintenance technicians. For aircraft maintenance, the line certifying staff, and for heavy maintenance, the aircraft confirmation certifying staff, sign official documents such as the flight log or Aircraft Statement of Conformity after the

work is completed. The purpose of the signatures is to attest that holders of national certifications performed the work, and in the unlikely event of defective maintenance causing flight troubles, these official documents are used as evidence in determining liability. This makes the certifying staff feel that their work completion signatures are significant for ensuring the safety of passengers, and they have come to reference the manual voluntarily. The action program, which is the signature inscribed on the official document, can be considered as directly inducing maintenance technicians to refer to the manual.

At Company B, when maintenance routines were executed based on the manual and not on individual's heuristics, framing by documents, such as the flight log, work instructions, and the Aircraft Statement of Conformity played a big part. We believe that programs such as the listing of the number of pages and reference numbers in the manual, or the signing after the work, which are inscribed in these documents, induce maintenance technicians to check the latest manual.

References

1. Archer, M. (1995). *Realist social theory: The morphogenetic approach*. Cambridge University Press.
2. Becker, M. C. (2004). Organizational routines: A review of the literature. *Industrial and Corporate Change, 13*(4), 643–677.
3. Becker, M. C. (2008). *Handbook of organizational routines*. Edward Elgar.
4. Cohen, M. D. (2007). Reading Dewey: Reflections on the study of routine. *Organization Studies, 28*(5), 773–786.
5. Cyert, R. M., & March, J. G. (1963). *A behavioral theory of the firm*. Prentice-Hall.
6. D'Adderio, L. (2008). The performativity of routines: Theorising the influence of artefacts and distributed agencies on routines dynamics. *Research Policy, 37*(5), 769–789.
7. Darr, A. (2018). Automatons, sales-floor control and the constitution of authority. *Human Relations, 72*(5), 889–909.
8. Dewey, J. (1922). *Human nature and conduct: An introduction to social psychology*. Modern Library.
9. Feldman, M. S. (2000). Organizational routines as a source of continuous change. *Organization Science, 11*(6), 611–629.
10. Feldman, M. S. (2016). Routines as process: Past, present, and future. In J. Howard-Grenville, C. Rerup, A. Langley, & H. Tsoukas (Eds.), *Organizational routines: How they are created, maintained, and changed* (pp. 23–46). Oxford University Press.
11. Feldman, M. S. (2017). Making process visible: Alternatives to boxes and arrows. In A. Langley & H. Tsoukas (Eds.), *The SAGE handbook of process organization studies* (pp. 623–635). Sage Publications.
12. Feldman, M. S., & Pentland, B. T. (2003). Reconceptualizing organizational routines as a source of flexibility and change. *Administrative Science Quarterly, 48*(1), 94–118.
13. Hazui, S., & Yoshino, N. (2019). Soshiki rūtein kenkyū ni okeru shakai busshitsusei no shiza: Supōtsu torēningu soshiki no hikaku bunseki [Sociomaterial approach toward organizational routine studies: Comparative analysis of sports training organizations]. *Nihon Jōhō Keiei Gakkaishi [Journal of Information and Management], 39*(3), 40–51. (in Japanese).
14. Leonardi, P. M. (2010). Digital materiality? How artifacts without matter, matter. *First Monday, 15*(6). https://doi.org/10.5210/fm.v15i6.3036. Accessed 27 July 2018.

15. Leonardi, P. M. (2012). Materiality, sociomateriality, and socio-technical systems: What do these terms mean? How are they different? Do we need them? In P. M. Leonardi, B. A. Nardi, & J. Kallinikos (Eds.), *Materiality and organizing: Social interaction in a technological world* (pp. 25–48). Oxford University Press.
16. Levinthal, D. A., & March, J. G. (1993). The myopia of learning. *Strategic Management Journal, 14*(2), 95–112.
17. March, J. G., & Simon, H. A. (1958). *Organizations.* Wiley.
18. O'Reilly, C. A., & Tushman, M. L. (2016). *Lead and disrupt: How to solve the innovator's dilemma.* Stanford Business Books.
19. Pentland, B. T., & Feldman, M. S. (2005). Organizational routines as a unit of analysis. *Industrial and Corporate Change, 14*(5), 793–815.
20. Pentland, B. T., & Feldman, M. S. (2007). Narrative networks: Patterns of technology and organization. *Organization Science, 18*(5), 781–795.
21. Pentland, B. T., & Hærem, T. (2015). Organizational routines as patterns of action: Implications for organizational behavior. *Annual Review of Organizational Psychology and Organizational Behavior, 2*(1), 465–487.
22. Pentland, B. T., & Rueter, H. H. (1994). Organizational routines as grammars of action. *Administrative Science Quarterly, 39*(3), 484–510.
23. Reed E. & Jones R. (Eds.). (1982). *Reasons for realism: Selected essays of James J. Gibson.* L. Erlbaum.
24. Rennstam, J. (2012). Object-control: A study of technologically dense knowledge work. *Organization Studies, 33*(8), 1071–1090.
25. Simon, H. A. (1947). *Administrative behavior: A study of decision-making processes in administrative organization.* Macmillan.
26. Yoshino, N. (2014). Soshiki rūtein kenkyū no aidenteitei: Shigoto jissen wo soshikika suru dezain genri no tankyū [The identity of organizational routine studies: An inquiry of design principles for organizing work practices]. *Nihon Jōhō Keiei Gakkaishi [Journal of Information and Management], 34*(2), 84–96. (in Japanese).

Chapter 5
Practical Implications of Social Construction: Turning Constructivism to Constructionism

Sho Nakahara and Noboru Matsushima

Abstract Nothing is more important and confusing than this meta theory in the study of sociomateriality. As we have seen in epilogue, "Queen" Orlikowski's structurational model focused on actors' ability to interpret the unintended consequences of using technology. "King" Leonardi insists that technology overlaps with society as an imbrication and is seen as a prerequisite to enable various actions. At the root of this controversy lies the difference between the epistemological positions of constructivism and constructionism, which are at odds within the social constructionist camp as a meta theory. To anticipate the conclusion, constructivism pays attention to the subjective composition of society, whereas constructionism pays attention to the composition of reality by a transcendent society. In this chapter, we focus on Leonardi's transcendental constructionism to sort out the confusion of social construction. We will seek implications for constructionism and analyze the consumption fuel fraud cases as organizational wrongdoing in Japan. Theoretically, there are two approaches, one based on the linguistic turn of social construction by Berger and Luckmann (The social construction of reality: a treatise in the sociology of knowledge. Doubleday, New York, 1966 [2]) and the other on intervention methodology for social practice based on Gergen (Am Psychol 40(3):266–275, 1985 [10]).

Keywords Social construction · Constructivism · Constructionism · Organizational wrongdoing · Linguistic turn

5.1 Subjective Constructivism and Transcendental Constructionism

Orlikowski's structural model, which sought opportunities for organizational change based on unintended consequences, focused on actors' ability to interpret the unintended consequences of technology use. These unintended consequences revealed by "Queen" Orlikowski were criticized by "King" Leonardi, who has been regarded as her opponent [16]. Leonardi prepared transcendental constructionism in order to overcome Orlikowski's argument. In this chapter, we demonstrate how Leonardi's

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position, which considers sociomateriality as an imbrication, avoids the controversy and derives its implications [14, 17].

However, the social construction themselves are very misleading, often becoming controversial not only in information management research but also in social science in general. So, we begin by summarizing the theoretical confusion in the social construction especially in the tradition of developmental psychology. As we have already mentioned at the beginning, the essence lies in properly understanding the two different epistemological positions of constructivism and constructionism.[1]

First, we will go back to the theoretical lineage of constructivism, which calls for a subjective perception of objective reality. Jean Piaget, who had a great influence on developmental psychology, spoke of constructivism. He assumed an objective reality and thought that this reality was recognized through an organ inherent in biological organisms. The function of this organ, according to Piaget, is the subjective recognition of a human being. Subsequently, how the objective reality is correctly recognized became an important question.

In information management research, it was Orlikowski who addressed the social construction of technology based on constructivism. Orlikowski discussed how people's interpretations of technology are common and stable when discussing its social constructivism. Therefore, she did not discuss the technology itself but rather emphasized inhuman materiality [18]. Thus, Orlikowski was criticized as a researcher who discussed interpretations, not technologies. In this way, the "Queen" continued the negative tradition of constructivism.

Secondly, constructionism based on a transcendental epistemology. Seymour Papert, a pupil of Piaget, attempted to discuss the constructed reality directly rather than the perception of reality as Piaget did (e.g., [26]). Papert thought that reality is constructed through collaboration with objects and people by focusing on the artifacts, learners, and media that existed before our perception. This understanding will be carried over to Berger and Luckmann [2], whose work is known as the classic of social construction. Their linguistic turn based on constructionism is of decisive importance in underpinning social construction in sociology, and will be discussed again in the next section.

Leonardi, who criticized Orlikowski for basing information management research on this position as constructivism (not constructionism), argued that technology is socially constructed and discussed various practices in using technology. His approach is quite different from Orlikowski's argument on the interpretation of technology, as Leonardi did not ascribe to Orlikowski's argument on the "convergence" of common perceptions about technology. He argued instead for "divergence" in technology utilization (e.g., [17, 18]). Leonardi also argued that sociomateriality based on constructionism does not deny existing society, but is an imbricated aspect

[1] According to Akagawa [1], the confusion arises from Japanese translation the concept "constructivism" and "constructionism" has been done by researchers across various research areas. However, this confusion comes not from difficulties in translating the words (constructionism or constructivism) but in how their meanings have been (mis)understood.

wherein human and artificial objects (sociality and materiality) overlap (e.g., [14, 15]).

On the other hand, there is an understanding in Leonardi's critique that contributes to the confusion between constructivism and constructionism. In order to dispel the misunderstanding of social construction, Leonardi also discussed the thought of Kenneth J. Gergen, a social psychologist. Leonardi argued that Gergen is close to a subjective constructivism and does not necessarily discuss transcendent constructionism [18]. However, Gergen was the first to give up on Piaget's argument (before Papert) and to derive the theoretical implications of rich constructionism. In fact, Gergen [10] focused on the theoretical implication of (social) constructionism, which is different from (social) constructivism, as "the social constructionist orientation." In this study, we focus on Gergen's implication later on.

To summarize the discussion up to now, the meta theoretical conflict between constructivism and constructionism was unfolding between master and disciple in developmental psychology. It was then referred to separately by Orlikowski and Leonardi. It finally emerged as a theoretical conflict in information management research—the argument between the "Queen" and the "King"—and was pointed out by the court clowns.

5.2 The First Implication of Constructionism: The Linguistic Turn

Now, we can turn to the next question: what kind of research will be developed from constructionism? As mentioned earlier, the linguistic turnover by Berger and Luckmann [2] becomes important. Their monumental achievement *The Social Construction of Reality* is often misunderstood, but it is not that society is subjectively constructed, rather that reality is constructed mediated via society. The rationale for social existence that precedes recognition is nothing less than language.

However, "social constructionism" of social problems (e.g., [12]) is originally a somewhat naïve constructivist position, and its basic ideas have been taken as that social problems are constructed by the parties concerned rather than existing in an objective state. This notion allows us to focus on the claims people make about how activities are carried out (e.g., [31]). For example, Pfohl [27] analyzed the situation in which child abuse became a social problem in U.S.A. in the paper of the 'discovery' of child abuse. According to Pfohl, abuse to child did not increase, and "child abuse" as a category became social problem. Pfohl argues that the social problem of child abuse was brought about by children's radiation therapists, who were "low-ranking expert" at that time, in order to connect their treatment with child abuse. In other words, pediatric radiological technologists' "discovery" that linking their treatment with child abuse would result in an opportunity to improve their status.

Can we say that the social problems addressed by the social scientists were really constructed by the claim filing activities of the parties? The methodological controversy over ontological gerrymandering [34] was rampant, with researchers arbitrarily delineating research subjects. The consequence of this debate was the defeat of the so-called epistemological turn, in which the parties, whether researchers or not, based on their subjectivity, could not lead to a useful analysis of social problems (e.g., [11]). Thus, the linguistic turn, which was the implication of constructionism, is brought to our attention again (e.g., [21]). In other words, a transcendental constructionist perspective was required, that the "language" that constructs the subject, rather than ascribing it to the subjectivity of the parties or the researcher, is the one that creates social problems.

We will discuss a case of organizational wrongdoing, which is becoming a social problem in Japan [24]. Donald Palmer has offered an interesting proposition: that an "institutions can simulate organizational wrongdoing" [25, pp. 742–744]. It is not that the organization produces the wrongdoing from the inside, but that the organizational wrongdoing is produced by the institution as "language". In other words, the recognition of organizational wrongdoing, a phenomenon peculiar to organizations, has shifted toward a perception that the institution as "language" generates organizational wrongdoing. Here, we look at an example of this proposition.

In 2016, a falsifying of fuel economy tests occurred in Japan. The truth was that a couple of automobile manufacturers did not adopt a fuel consumption measurement method, called the coasting method, that had been established by the Ministry of Land, Infrastructure and Transport (MLIT). In the fuel consumption test standard (JC08) originally determined in Japan, the equipment needed for the test was a chassis dynamometer, and it was to be installed in the test room. The chassis dynamometer had to be adjusted to the load condition to make it equivalent to actual road conditions, and the load condition was supposed to be measured by something called the coasting method. In this coasting method, the target running resistance is calculated based on the running resistance measured by actual running on the test road. In the actual running, the test vehicle is coasted from + 5 km/h over the specified speed, to − 5 km/h under the specified speed with the gear in neutral, based on a number of different specified speeds, such as 20, 30–90 km/h. This test is performed at least three times on each vehicle, with the coasting time calculated as an average of three times. The running resistance is calculated on the basis of the average coasting time and the weight of the test car, and in addition, the target running resistance to be set in the chassis dynamometer is obtained by multiplying the necessary coefficient.

However, Mitsubishi Motors and Suzuki allegedly committed fuel consumption fraud despite such numerical fuel consumption test standards. To begin with, in Mitsubishi Motors, the performance experiment division in charge of measurement of and experiments with running resistance continued to use a measurement method of high-speed coasting that had been employed since 1978. The method is similar to coasting; it lets the test vehicle start coasting after the speed is raised to 150 km/h (or 90% of the maximum speed of the automobile) and held there for 5 s. Although this coasting method was suitable for calculating the running resistance at high speed, it

was not suitable for calculating the running resistance in the low-speed range like the new coasting method [29, 30].

Suzuki also calculated running resistance by a different method from the required coasting method. In Suzuki, the running resistance was calculated not by any coasting method that employed actual running, but by the loading of each piece of equipment (pneumatic resistance, tire rolling resistance, brake drag resistance, etc.) as measured in a wind tunnel test room, which produces a state similar to the actual running state. Such loading was carried out in a department called the "car line" which is in charge of vehicle development in the Suzuki company. Because the "car line" did not calculate the running resistance by actual driving, the running resistance as calculated by loading was reported to technical development headquarters in the company and to the persons concerned [32, 33].

However, when this fuel consumption fraud was examined in detail, it was not simply that both companies used an illegal measuring method. Rather, certain aspects of the new quantified fuel consumption test standard made it difficult to carry out the measurement practice in the field. In the press conferences given by both companies, it was frequently mentioned that coasting was considerably susceptible to the effects of the natural environment, such as wind and temperature. In Mitsubishi Motors, the measurement was carried out in Thailand, a long distance away from the corporation. The investigation report said that the reason coasting was not used is that "it was impossible unless conditions were met" ([29]; author in parenthesis), and that "coasting is a very laborious and troublesome method for measuring running resistance" [29]. Coasting was also a very difficult measurement method in the case of Suzuki, because the test site was strongly affected by the wind on a hill near the sea. Suzuki employees did not possess the knowledge or training to use the new coasting method, so the company's method was adopted to derive an accurate measure of fuel consumption.

As described above, fuel consumption fraud cases do not necessarily reflect internal wrongdoing in an organization; rather, they are created by the institutions as quantified "language" named JC08. It was just paradoxical fuel consumption fraud cases that coasting method could not be used as much as the quantified fuel consumption test standard was tried to be thorough. This linguistic turn is also important for the practical implications of constructionism. It means that organizational wrongdoing might not be grasped in terms of a mutual action between the subjects; rather, it may be reconsidered as a function of "language," which constructs even the subjects. Then, the wrongdoing attributed to the company can be seen in a completely new light, and an linguistic turn can be attempted by way of addressing the alleged wrongdoing.

5.3 The Second Implication of Constructionism: Intervention via Language

Next implication of transcendental constructionism, is the possibility of intervention via language. Gergen's methodology, which Leonardi had criticized as constructivist focusing subjective interpretation, can be referenced. However, the exact opposite is true. With constructionism as the ideological background, Gergen intervenes in practical work through an organizational development method called "appreciative inquiry (AI)," which is a method for researchers to intervene in practical work by positively accepting negative aspects, such as human problems and shortcomings, on the premise of (transcendental) human value (e.g., [7, 8]).[2] In other words, humanistic value not only involves the parties concerned but also creates the role of intervention for the researchers themselves (e.g., [13]).

As a practical manifestation of his ideas, Gergen and his wife, Mary M., Gergen, have formed a community called "the Taos Institute" as a place of "creating promising futures through social constructionism" where practitioners and researchers meet. Here, they are implementing a program called "positive aging." This program provides older people with the opportunity to find meaning in their lives as retired elderly people could not find a place in their workplace or home. The service activities at the welfare facilities, which are part of the program, are based on the idea that retired elderly people can contribute to welfare activities by interacting with other elderly people in need of care who are staying there.[3] In other words, the Gergens' intervention in welfare facilities together with retired elderly people, with their humanistic "value" approach, makes it possible to reconsider life expectancy positively for all elderly people.

Also, in information management research, some excellent studies tend toward intervention in practices (e.g., [3, 5, 6, 20]). Claudio Ciborra mentioned intervention in practice and the importance of the social role of researchers being challenged through such intervention. It is not widely known that this paper, written by Ciborra just before his death from cancer in 2005 [4], discussed the relationship between risk and information technology as an implication of representation. When he viewed the relationship between risk and information technology as an imbrication of representation, he focused on how they function together as a representation (language) rather than as a tangible representation of risk and information technology. At the

[2] In terms of AI itself, there is a clinical intervention case by Seligman, the creator of positive psychology, the theoretical background of AI. When U.S. soldiers dispatched to the Iraq War developed post-traumatic stress disorder (PTSD) after returning home, Seligman, who visited the scene, not only described the symptoms of the soldiers, but also adopted a clinical method for creating a positive life for them through dialogue with the soldiers. Specifically, Seligman demonstrated that optimism, which is one of the values of humanism, has the effect of suppressing the recurrence of unpleasant emotions [28]. He developed a training program based on this optimism. Then, he had the soldiers take the program and rediscover their strengths while redesigning their lives around their strong points.

[3] The contents of positive aging are described in the following websites (https://www.taosinstitute.net/2018-january-march#comm: Accessed 20 June 9).

same time, it became clear that the representation of "risk" and that of "information technology" in Ciborra functioned at different times. It was concluded that the relationship was linked in the manner of "Risk" ⇔ "information technology" → "second risk" ⇔ "second information technology" …. He referred to Heidegger's methodology as Geshtell [23], because the responsibility of this chain cannot be attributed to any particular person or agency.

Based on Ciborra's argument, we can consider the practice of researchers who intentionally or accidentally intervene in practice by reviewing the context of empirical research based on constructionism as well as direct intervention methodologies such as the Gergen's. Let us consider this by going back to the fuel consumption fraud cases discussed in the previous section. We previously analyzed these actual cases of fuel consumption fraud in another article, and at that time, it was not possible to interview the employees of both companies. Perhaps other findings could have been presented if the interviews had been conducted. This constituted a "limitation" of the paper, and not a few existing organizational wrongdoing researchers offer a lack of empirical investigation as a limitation.

However, the "limitation" may make an opportunity for further empirical investigation. Nakahara [22] can be positioned as public material for the employees concerned and for researchers for the internal disclosure through research access, if interviews are conducted in future. That is to say, it is possible and sufficient to consider an empirical investigation after the paper is published, but not the paper publication after an empirical investigation. There are some reports that negative investigation topics, such as organizational wrongdoing and corporate scandals, have failed to access the relevant investigations (e.g., [9, 19]), but it is possible to access an investigation by expressing a position of support for the enterprise. Even if organizational wrongdoing or corporate scandal is involved, a researcher can arrive at a supporting or critical position by understanding the power relationship behind the scenes. Thus, new practical implications of social constructionism will be developed for researchers' interventions in society through linguistic practice, giving them the role of intervening in society rather than only micro-interventions in organizations by Gergen.

References

1. Akagawa, M. (2001). Gensetu bunseki to kōtikusyugi. [Discourse analysis and constructionism.] In C. Ueno (Ed.), *Kōchikusyugi towa nanika* [*What is constructionism?*] (pp. 63–83). Keiso Shobo. (in Japanese).
2. Berger, P. L., & Luckmann, T. (1966). *The social construction of reality: A treatise in the sociology of knowledge*. Doubleday.
3. Ciborra, C. (2002). *The labyrinths of information: Challenging the wisdom of systems*. Oxford University Press.
4. Ciborra, C. (2006). Imbrication of representations: Risk and digital technologies. *Journal of Management Studies, 43*(6), 1339–1356.
5. Ciborra, C., & Associates. (2000). *From control to drift: The dynamics of corporate information infrastructures*. Oxford University Press.

6. Ciborra, C., & Lanzara, G. (1994). Formative contexts and information technology: Understanding the dynamics of innovation in organizations. *Accounting, Management and Information Technologies, 4*(2), 61–86.
7. Cooperrider, D. L., & Whitney, D. (2001). A positive revolution in change: Appreciative inquiry. *Public Administration and Public Policy, 87*, 611–630.
8. Cooperrider, D. L., & Whitner, D. (2005). *Appreciative inquiry*. Berrett-Koehler Publications.
9. Fukuhara, Y., & Chae, I. (2011). Soshiki husyouji kenkyū ni okeru shiza to houhou: Mikuro apurōchi no saikentou [The perspective and methodology of study on organizational corruption: A review of micro approach]. *Senshu Managimento Jānaru [Senshu Management Journal], 1*(1–2), 99–113. (in Japanese).
10. Gergen, K. J. (1985). The social constructionist movement in modern psychology. *American Psychologist, 40*(3), 266–275.
11. Hacking, I. (1999). *The social construction of what?* Harvard University Press.
12. Holstein, J. A., & Miller, G. (1993). *Reconsidering social constructionism: Debates in social problems Theory*. Aldine de Gruyter.
13. Kijima, K., Sunaguchi, B., Fujii, M., Fujiki, H., Matsushita, H., & Kanai, T. (2014). Soshiki kaihatsu no aidentiti rosuto: "Soshiki kaihatsu no kaihatsu" toiu okujōoku genshō wo tegakari ni [The identity lost of organizational development: "Development of organizational development" as gritting refined gold]. *Nihon Jōhō Keiei Gakkaishi [Journal of Information and Management], 34*(4), 47–68. (in Japanese).
14. Leonardi, P. M. (2011). When flexible routines meet flexible technologies: Affordance, constraint, and the imbrication of human and material agencies. *MIS Quarterly, 35*(1), 147–167.
15. Leonardi, P. M. (2012). Materiality, sociomateriality, and socio-technical systems: What do these terms mean? How are they related? Do we need them? In P. M. Leonardi, B. A. Nardi, & J. Kallinikos (Eds.), *Materiality and organizing: Social interaction in a technological world* (pp. 25–48). Oxford University Press.
16. Leonardi, P. M. (2013). Theoretical foundations for the study of sociomateriality. *Information and Organization, 23*(2), 59–75.
17. Leonardi, P. M., & Barley, S. R. (2008). Materiality and change: Challenges to builing better theory about technology and organizing. *Information and Organization, 18*(3), 159–176.
18. Leonardi, P. M., & Barley, S. R. (2010). What's under construction here?: Social action, materiality, and power in constructivist studies of technology and organizing. *The Academy of Management Annals, 4*(1), 1–51.
19. Majima, T. (2007). *Soshiki fushōji: Soshiki bunkaron niyoru bunseki* [*Organizational scandals: An analysis based on organizational culture*]. Bunshindo. (in Japanese).
20. Matsushima, N. (2015). *Genba no jyōhōka* [*The informatics embedded in workplace practice: Organizational approach for IT-use practice*]. Yuhikaku. (in Japanese).
21. Nakagawa, N., & Akagawa, M. (Eds.). (2013). *Hōhō toshite no kōchikusyugi* [*Constructionism as a method*]. Keiso Syobo. (in Japanese).
22. Nakahara, S. (2015). Soshiki hushōji no poritikaru risāchi: Kenkyūsha to jitsumuka no taiwa wo tūjita chōsa e mukete [Political research of organizational scandal: Through research with dialogue tesearchers and practitioners]. In *Nihon Jōhō Keiei Gakkai Dai 71 Kai Zenkoku Taikai* [*The 71st annual meeting Japan society of information and managemen*t]. (in Japanese).
23. Nakahara, S. (2018). Risuku to jōhō gijyutu no inburikeishon: C. Chibora no ikō wo sanshō shite [Imbrication of risk and information technology: Through Claudio Ciborra's posthumous manuscripts]. In *Kobe CSR research workshop*. (in Japanese).
24. Nakahara, S. (2020). Sūchika sareta houteki kijyun ga yūhatsu suru soshiki fusei: Nenpi fusei no jirei kenkyu [Organizational wrongdoing stimulated by quantified legal standards: The case study of falsifying fuel economy tests in Japan]. *Nihon Jōhō Keiei Gakkaishi [Journal of Information and Management], 40*(1/2), 89–101. (in Japanese).
25. Palmer, D. (2017). Institutions, institution theory and organizational wrongdoing. In R. Greenwood, C. Oliver, T. B. Lawrence, & R. E. Meyer (Eds.), *The sage handbook of organizational institutionalism* (2nd ed., pp. 737–758). Sage Publications.

26. Papart, S. (1991). Situating constructionism. In I. Harel & S. Papart (Eds.), *Constructionism: Research reports and essays 1985–1990* (pp. 1–11). Ablex Publishing.
27. Pfohl, S. J. (1977). The 'discovery' of child abuse. *Social Problems, 24*(30), 310–323.
28. Seligman, M. E. P. (2011). Building resilience. *Harvard Business Review, 89*(4), 100–106.
29. Special Investigation Committee (2016a). *Investigation report on fuel economy irregularities.* Special Investigation Committee.
30. Special Investigation Committee (2016b). *Investigation report on fuel economy irregularities (abridged version).* Special Investigation Committee.
31. Spector, M., & Kitsuse, J. I. (1977). *Constructing social problems.* Benjamin-Cummings Publishing Company.
32. Suzuki Motor Corporation (2016a). *Report to the ministry of land, infrastructure, transport and tourism on the 'instruction to investigate inappropriate cases related to exhaust gas and fuel efficiency tests'.* Suzuki Motor Corporation. (in Japanese).
33. Suzuki Motor Corporation (2016b). *Additional report to the ministry of land, infrastructure, transport and tourism on the 'instruction to investigate inappropriate cases related to exhaust gas and fuel efficiency tests'.* Suzuki Motor Corporation. (in Japanese).
34. Woolgar, S., & Pawluch, D. (1985). Ontological gerrymandering: The anatomy of social problem explanations. *Social Problems, 32*(3), 214–227.

Chapter 6
The Spatial Turn in Social Materiality: Organizational Space in Critical Management Studies

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Abstract The purpose of this chapter is to examine the spatial turn based on the concept of 'social' materiality which is different from sociomateriality, and to obtain the prospect of empirical research based on spatial management in Japan. The concept of social materiality proposed by researchers of critical management studies (CMS), was proposed to overcome such epistemological challenges stemming from the fact that the rationale on which the researcher rests in attempting to critique existing dominant power is already embedded in the dominant structure. The meta theory which the recent CMS theorists sought the clue was human geography. In human geography, there was the critical viewpoint for historical materialism view of Marx which was the root of the CMS. In this criticism of Marx, the clue to solve the epistemological problem which the critical management research has held for many years was sought. Regarding the spaciousness which the concept of social materiality has noticed, in the management studies, the viewpoint which can be called a spatial management has been consistently latent from the classical research. On the other hand, although the approach to systematization is not so old, those studies also focus on methodological implications as a critical study of social materiality. In addition, as an empirical study of social materiality, we introduce the case analysis about recent workplace design which tries to expose the work style reform in Japan.

Keywords Social materiality · Spatial turn · Critical management studies (CMS) · Spatial management

6.1 A Stumbling Block in Critical Management Studies

In critical management studies (CMS), there is a concept named "social materiality" that is completely different from the "sociomateriality" discussed by information management researchers, as seen in the previous chapters. This concept was developed by Gibson Burrell and Karen Dale to overcome the epistemological problems that have repeatedly arisen in CMS. As a paradigm shift, they refer to the spatial turn (from founder Henri Lefebvre) in human geography. Spatial turn, which is said to be a part of the material turn, is simply a movement to grasp and reconsider social

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practice (i.e., user practices that utilize space) that is abstracted and reduced by the space as a mere vessel. In this chapter, we will focus on issues of spatial management and the possibilities from empirical research that has been conducted for office layout and building design.

The reason Burrell focused on spatiality arose from a stumbling block inside CMS. The critical discourse of CMS became eloquence to suppress the ruling class even as it disregarded for the fact that critical discourse was already contaminated by the values of researchers as their epistemological limits [15, 36].

If we take a quick look at CMS, we will see that it questions the "management" that has formed in capitalism and criticizes societies composed of management [2, 1, 21]. However, CMS has always faced the epistemological problem: how to maintain a critical perspective while being embedded in society.

Spicer et al. [46] divided CMS discourse into three generations. The first generation of CMS was influenced by labor process theory. Harry Braverman, a professor who concentrated on Marx's labor process theory regarded human freedom to surpass the laws of nature by embodying the human ideal in an object. However, in the capitalistic division of labor, such human freedom is frustrated. The problem was that when capitalists divided and rescheduled their duties to control the work, labor was systematically deskilled. During the process of deskilling, it becomes easier to replace workers, a situation that will ultimately reach a point at which workers cannot resist. Such work exclusion has been criticized for not focusing on the power and control of subtle forms.

The second generation relies on the Frankfurt School, represented by Jürgen Habermas, and domains such as neomarxism, poststructuralism, deconstructivism, feminism, and postcolonial theory based on the influence of poststructuralism. Habermas views modern times as being ruled by experts and criticizes the ideology of technocrats. Instrumental rationality is criticized as ignoring human interest in personal and social development. Communicative rationality holds that no matter how much consensus is based on communication, one cannot always escape from political processes based on particular interests. However, it has been pointed out that the second generation may have fallen into cynicism because it is merely criticizing using existing theories.

The third generation focuses on the affirmative possibilities in a capitalist society rather than criticizing its repression, and it has been discussing critical performativity, which involves active intervention into managerial discourses and practices [45, p. 538]. This generation criticizes the anti-performativity developed by Fournier and Grey [21] because in anti-performativity, ideals for the future cannot be effectively discussed, though management may always be criticized. The third generation affirmatively explores future potentialities. However, critical performativity has been criticized as being impossible in itself [8], because subjects are composed of discourse in a performative manner and, thus, cannot go beyond discourse, and the subjects include researchers. In other words, the limitation of the critical performativity approach is that it loses its orientation towards changing reality, since it presupposes the researchers themselves, who are constituted performatively through language.

Gibson Burrell, the one of pioneer of CMS, has continued to confront these epistemological problems. First, Burrell [7] questioned logical thinking by means of focusing on the format of book texts. He attempted to reject logical thinking in the composition and layout of Pandemonium: Towards a Retro-Organization Theory. The book is bizarre, with each page divided in two, the top page reading from left to right and the bottom page reading from right to left. Once readers finish reading the upper page, they go to the lower page and read from right to left. This was intended to criticize the social sciences for modern Westerners that are customarily explained through a linear process [7, p. 236].

Second, Burrell tried to regain pleasure in the organizational theories. In the process of industrialization, such illogical parts of life as pleasure and games, which were judged to be inefficient for rational organization management, were pushed into the home. To pursue such an efficient operation as a whole is thoroughly connected with the idea of abstinence in Calvinism. Focusing on the pleasure and illusion driven by industrialization, Burrell [6] criticized the way workers are immersed in work at the sacrifice of pleasure.

Third, Burrell dramatized logical thinking by addressing sexual desire, particularly phallocentric values. The huge tower of a financial company that stands in the center of London has been described by the inhabitants as an erotic gherkin because of its glazed ridgeline. In such ridicule, the symbol of the capital power of a huge financial company is linked to the value of phallocentricity, and the residents' perception of phallocentric thinking is relativized [14, p. 28].

However, Burrell began to reflect on the fact that whereas he had made logical thinking relative by changing the form of the text in a book and addressing gender values, such as pleasure and sexual desire, he had made linear thinking latent in language itself in order to reject logical thinking and had made phallocentric values inherent in addressing pleasure and sexual desire [6]. It was necessary to elaborate a method of criticizing the epistemological assumptions that had established themselves even as he was revisiting them. After meeting Dale, Burrell found a way to solve this epistemological problem in the concept of social materiality that focuses on the space as a methodological position for critical analysis, with reference to human geography as a meta theory.

6.2 The Spatial Turn in Human Geography

CMS focused on space because it provided a clue to ensure critical position without relying on the researchers' arbitrary language. Lefebvre and especially Soja [44] posited the spatial turn, in which it is essential that is supported by the criticism of the temporality based on conventional Marxism's historicism. In the past, Marxism posited a monolithic historical process in its development process, in which the existing production mode must be destroyed and denied in order for capitalism to develop to the next stage. However, on the premise of such timeliness, it is impossible to grasp the mode of the development of capitalism that characterizes the present

age [30, 44]. Rather, a critical situation in modern capitalism is that space is the very medium that drives the process of capitalism's development without denying the existing mode of production.

Soja [44], who developed substantial contents in the direction of the spatial turn, views the modern as the age of the destruction of space by time, that is, the age in which space is so mystical that it is not necessary to ask about it because it can be rearranged by any means through thoroughgoing discipline of time management. The premise of prioritizing the time have some theoretical problems. This premise leads the space is just a "vessel" that accompanied the time, and that it can be recombined to be extended in any way. The problem with space as a vessel with an extension is that it hides many things by appearing as an objective, immovable, and visible entity. What should be rescued, above all, from this veil is the practice of users' resisting and regaining solid space [30].

For example, a typical example is that of a helicopter flying over Los Angeles to examine the space of the city critically [44]. In Los Angeles's regional urbanization process, high-rise buildings were lined up in the center, and factories were spread in the suburb. The factory group in the suburb overlapped with the residential areas of migrants from the beginning, but high-class housing in an adjacent area has advanced recently. And segregation of the rich from the poor has been thorough even in the suburbs, generating a new sense of discrimination. Currently, when we look at the ground from above, we can see that there are various communities of Blacks in the center of the city, and there are warning signs on the private lands of wealthy people that they will shoot at trespassers. Despite this dangerous environment, many income groups live together comfortably. However, this coexistence is obtained only through well-protected and monitored management systems such as recreational facilities and shopping malls.

In their consideration of the workplace, Dale [13] referred to the arguments of humanistic geographers who criticize modern capitalist society by citing the monopoly of space by the rich and the oppression of the poor in modern cities. In particular, they aim to address explicitly the lived experience of users who employ space through the spatial dialectical methods of Lefebvre: spatial practice (perceived space), representation of space (conceived space), and representational space (lived space). In their analysis case, Dale [13] consider the process in which the familiar way of working is embedded in a new workplace as a nationalized enterprise is privatized [13, pp. 664–674].

First, we consider spatial practices as perceived spaces. Spatial practices are considered when looking at the obvious practices of employees. When EnergyCO (pseudonym) of the energy industry was nationalized, the layout of the department was regarded as necessary for the close communication and maintenance of expertise in related departments. It was rare that the consciousness of competition with other companies in the same industry was generated, because there was no contact with the customers [13, p. 668].

Second, in the representation of space (conceived space), the work style is examined and change is promoted through the plan of the designer. It was decided to build a new office building in the process of privatization. In the new office building, an

open workplace was adopted, and it became a glass-walled building. By designing such an open workplace, the plan was to promote cross-sectional communication across the differences in positions and departments. Then, furniture that is easy to move was adopted for the workplace and thereby a working style promoted for easy adaptation to the new situation. In the restaurant on the top floor of the building, the effort at privatization was completed by inviting outside tenants and placing a monitor displaying the company's share price [13, pp. 667–668].

Third, the representational space (lived space) refers to how the user of the space may reorganize the designer's intention. The open workplace design led to a new sectionalism. The movable furniture was used as a screen to protect the division of experts. In the place where there are no partitions, the technical terminology that symbolized the identity of the expert has been exchanged, and the communication means as sign language which did not exist in the public enterprise was developed. In addition, by making it a habit to confirm the market value information at any time by glancing at the monitor, the employee prioritizes the market value [13, pp. 673–674].

By considering workplace practices through spatial dialectic, we can explicitly address employee practices that reweave lived experiences. In the above case, in the process of organizing individualized working styles based on the expertise taken for granted at the time of nationalization (spatial practice) and in the process of designers' organizing open working styles appropriate for privatized companies (representation of space), employees as users tried to maintain their own identities by organizing individualized working styles differently in new workplaces (representational space).

6.3 Spatial Management in Management Studies

So far, we have reviewed the implications of the spatial turn in human geography, the meta theory that Burrell and Dale focused on in advocating social materiality. However, it should not be forgotten that various researches related to spatial management have been accumulated in management studies.

For example, the oldest research, such as that relating to Scientific Management, the Hawthorne Studies, and Max Weber, was also interested in space, although these studies have not necessarily been systematically accumulated [9]. An "essential reading" book or collection of papers about spatial management was published [11, 14]. Works also exist that systematize these studies [48, 49]. Relying on the works for systematization, spatial management can be broadly classified into three categories.

The first category is the functionalist approach, a group of studies that discuss mainly open office functions, starting with Oldham and Brass [37]. These studies were motivated by the development of Hackman and Oldham [23], who are famous for their job redesign theory and who introduced the open office in order to improve job feedback as one of five core job characteristics. Oldham and Brass [37] had two main hypotheses regarding the open office space design: H1—It would reduce conflict between departments and increase feedback from superiors and colleagues, provide opportunities to deepen friendship during work, and promote interaction

within and outside of the department. H2—Situated within their supervisors' reach, subordinates would be less autonomous; there would be less isolation in the tasks because employees would be able to see the rest of the work; and less feedback from the boss would be needed as more opportunities would occur for them to get to know each other during work hours because of the lack of private space.

Results of the survey done by Oldham and Brass [37], H1 was supported, but H2 was not. Other early studies found that open offices did not always work as expected. Sundstrom et al. [47] found that the physical environment and social interactions are not affected. As soon as workers move to an open office, the interactions increase, but they gradually adapt to less private environments, develop ways to regulate social contact, and revert to traditional interaction practices. Hatch [24, 25] also pointed that in a closed office, there is more communication. The open-door policy in American companies is nothing more than an expression of expectations for open communication and strong interpersonal relationships. Brennan et al. [5] discussed how open offices make more noise while restraining private conversations, requiring additional rooms to escape for private conversations, meetings, and phone calls. Despite these results, however, subsequent studies have found that more H1 tests are repeated with the analogical understanding that open offices make open communication (e.g., [17, 27, 34, 41].

The second category is the symbolic approach, in which various approaches are intermingled, and various studies related to Gagliardi [22] are summarized. However, a common idea peculiar to this approach, the viewpoint which hierarchically grasps the meaning for the artifact, refers to Schein's [43] hierarchical model of organizational culture [26]. In studying organizational culture, Schein [43] proposed the dimension of cultural artifacts, and it was thought that culture was embodied in artifacts. However, artifacts have not been well studied, partly because they have been placed at the most superficial level.

Regarding the same idea, however, the relationship between artifacts and symbols can take a different understanding. In culture studies, researchers focus on the symbolic aspect of artifacts rather than on their materiality. Elsbach [18] illustrated that enclosures and barriers enhance manager satisfaction to show status. Berg and Kreiner [4] discussed the symbolic functions of corporate buildings, such as totems of people working for the company, symbols of strategic profiles, packaging of products and services provided by the company, symbols of positions and capabilities, and historical markers.

Interestingly, it is advocates of information management research who try to focus on both the symbolic and material aspects. Ciborra and Lanzara [10] capture the practice of mixing symbolism and materiality under the bricolage concept. The ethos of programmers who prefer bureaucracy has made them accept reliance on tools, the "software factory," that force horizontal communication (instead of the traditional vertical channels) to result in decentralization. Orlikowski and Barley [40] also integrate the symbolism of institutional organization and the materiality in information management research. Needless to say, their argument will subsequently develop into the concept of sociomateriality [31, 38, 39].

The third category is the critical approach, which, as we have already discussed, includes research that refers to the meta theories of postmodern philosophy, including Dale and Burrell [14], who in turn refer to Lefebvre. As pioneering works, Kornberger and Clegg [29] have tried two concepts, including "fold" by Deleuze [16], which refers to the borderline dynamics that form simultaneously inside and outside of the organization. And "heterotopia" which have a characteristic like a mirror: some sees themselves, but is not; a place outside of all places [19, 20]. While looking at Cooper and Law [12], whose work is also based on actor network theory, we focus on heterogeneous identities. Dale [13] also refers to such meta theories as embodiment by Maurice Merleau-Ponty, and material culture studies by Daniel Miller,[1] in addition to the lived space by Lefebvre.

In contrast to the dazzling meta theories discussed above, Kornberger and Clegg [29] have summarized the postmodernist discussions focusing on spatiality as largely a part of the material turn (p. 76). We will discuss the philosophy of the material turn as realism in detail in the next chapter. By way of summarizing this chapter, the uniqueness of the spatial turn lies in the fact that it is distanced from historicism based on the timeliness that presumes evolutionary gradual processes and that theoretically engraves the lived experiences of users who live in space.[2]

6.4 Spatial Management in Japan

In recent years, the business concept of activity based working (ABW) has been widespread, along with a growing interest in time-and-location free office design. In Japan, this is the latest fashion, first introduced by "ITOKI Tokyo Xork" in December 2018. Behind ABW, as work styles and work contents become more diverse, it is necessary to prepare an environment that is suitable for each activity. However, following its origins, it can be traced back to the new office movement in the 1980s when it seeks to make offices more open.

Becker and Steele [3] had systematically studied the new office movement at the time in the school of social psychology at Cornell University. According to their study, the new office movement in the United States in the 1980s was, in fact, borrowed from Japanese offices by a US company that had been sluggish. At that time, offices in the US had private rooms assigned to managers, so they were also a symbol of authority, with the size of the private rooms being determined by the holder's position. The cost for offices was the second highest after labor costs, and there was also a problem of communication interference between managers and employees. Conversely, in Japanese companies whose business performance was

[1] Embodiment as discussed by Merleau-Ponty provides a clue to analyzing the world prior to rational thinking [33]. D. Miller, who leads material culture research in cultural anthropology, paid attention to materiality in order to focus on the process by which the distinction is made between subject and object [35].

[2] However, owing to the difficulty of such a debate, it is also an approach that has not yet been sufficiently the object of empirical research (e.g., [11, 27, 29]).

excellent at that time, managers and employees used an island-type office layout in which desks were arranged in the same space. This layout seemed to be able to solve the problem of communication interference with a corresponding cost reduction. It was after that time that a discussion arose for the opening of the office that would exceed the constraints of time and place.[3]

In this way, ABW has been reimported in spite of the fact that traditional Japanese offices were referred to as the trend of opening up the office space, which has become the mainstream today. Of course, the work styles in Japanese companies have changed a lot since the 1980s. The ABW movement centered on the openness of Western will be accepted by Japan from a new viewpoint.

Matsushima et al. [32] conducted pilot research with the cooperation of a Japanese construction company. They analyzed Japanese spatial management by observing the unique office design and work style of the Japanese. That is Japan's ABW, a reimportation of the New Office movement, from which we can take inspiration to re-export Japanese new workplace design.

As one example, we observed the transparency function of open executive spaces. As already mentioned, the flow of open offices in the US has been nominally aimed at reducing office costs and stimulating disconnected communication. However, in Japan also, executives are often given private rooms. In 2011, Pricewaterhouse Coopers Japan (PwC Japan) installed a design called a "fishbowl" in which executives are arranged in an open workspace surrounded by glazed glass. The executive in the private room arranges the desk facing outside the fishbowl. However, the cost reduction effect will not be significant, because the original private room space is left for secretaries, who prepare conference materials, etc. Communication may certainly increase in frequency, but it may not be possible to expect effects beyond board meetings.

The question remains: what kind of change has been prompted in the actions of the executive in the fishbowl? In fact, the proximity of the fishbowl has the effect of preventing fraud. When the power of executive rooms and that of closed private rooms are combined, some bad ideas are discussed. Furthermore, in a closed room, somebody may bring (ring) in bad ideas. The fishbowl, where there is no chance of physical injustice, may in some ways be more comfortable.

But how does it affect employees? Doesn't the layout of the executive facing the office from the inside of the fishbowl make it look as if he is monitoring the employees? If designers were to make the glass of the fishbowl a one-way mirror, it would become the "panopticon" that Foucault observed at a prison. However, this perception also depends on the relationship between the executive and the employee. In Japan, an executive is not an elite who goes on a career different from that of an employee, but a fellow who is selected through internal promotion. Therefore, rather than feeling as if they are being watched, employees find that it is easier for the

[3] The new office movement in the US at the time is described by journalist Zelinsky [50]. The possibility and problems of telework were also examined, and there are many useful points for the present. In other words, although the introduction of telework in Japan is still in the experimental stage, the experiment has continued for at least 30 years, throughout the new office movement in the 1980s to the ABW of today.

executive to talk to them when he is free. However, in PwC Japan, which is a foreign company, a care was taken to avoid to dispel fears that they are being monitored. The frosted glass, which was originally arranged at the foot of the executive, was rearranged at the position of the eye line.

Another example, in recent Japanese enterprises, it has become important for the design to indicate prosperity. The island office which is traditional layout in Japanese enterprise, which was noticed by the US in 1980s, was a lively space with the ringing of the telephone and exchanges in conversation. However, at present, such a space can be seen in old-style Japanese companies, but it is not always recognized as desirable as a workplace. According to Sato [42], shared offices, which feature cross-industry exchange, are often used for the purpose of avoiding office noise.

On the other hand, recent Japanese offices are rather quiet. First, communication from outside the company is mainly by e-mail, not by telephone, so conversations by telephone is not heard. Rather the quiet makes it harder to phone call in the office. In Japan, it has become common sense to leave one's seat when making a phone call, and telephone boxes have been installed in offices. There is also a room for Skype that enables personnel to speak louder through a computer. Furthermore, when an office with a free address is introduced, the person sitting nearby becomes a stranger in a different department. One must work quietly so as not to disturb others. It is now common even for people working side by side to contact each other by e-mail.

Therefore, one of the recent trends in office design in Japan has been to create the bustle that used to be present in Japanese offices but has been lost. For example, in SIGMAXYZ Inc., a coffee server is set in a magnetic space called "Marche" with fresh flowers. The abstract pictures displayed there is drawings by the executives in the "fish bowl". They are trying to communicate their personalities to their employees, while cultivating the ability to express themselves as executives in ways that convey the company's strategy.

In addition, oddly enough, it has become more popular to install outdoor tents, tables, and chairs as meeting spaces. At the Japanese mobile telecommunications company KDDI, a carpeted office has been created to imitate a farm, and family picnics are allowed on holidays.[4] These are conscious attempts to change Japanese way of thinking that somewhat deifies work, if they do not spend the cost for such challenge. The Japanese tend to make work itself their purpose. They often work long hours and staying up late to work overtime has become a testimony to heroism. It has been unthinkable to take off suits and (in particular) leather dress shoes to relax, let alone make the office a place to play.

[4] In 2017, Pasona, a major human resource dispatch company in Japan, opened the Otemachi Firm to breed real animals on the 13th floor of Job Hub Square in the city center of Tokyo. Of course, their purpose is not to add new office space for working but for human resource development in the agriculture and tourism businesses.

References

1. Alvesson, M., Bridgman, T., & Willmott, H. (2009). *The oxford handbook of critical management studies*. Oxford University Press.
2. Alvesson, M., & Willmott, H. (1992). On the idea of emancipation in management and organization studies. *Academy of Management Review, 17*(3), 432–464.
3. Becker, F. D., & Steele, F. (1995). *Workplace by design: Mapping the high-performance workspace (Jossey Bass business & management series)*. Jossey-Bass.
4. Berg, P. O., & Kreiner, K. (1990). Corporate architecture: Turning physical settings into symbolic resources. In P. Gagliardi (Ed.), *Symbols and artifacts: Views of the corporate landscape* (pp. 41–67). Aldine de Gruyter.
5. Brennan, A., Chugh, J. S., & Kline, T. (2002). Traditional versus open office design: A longitudinal study. *Environment and Behavior, 34*(3), 279–299.
6. Burrell, G. (1992). The organization of pleasure. In M. Alvesson & H. Willmott (Eds.), *Critical management studies* (pp. 65–89). Sage Publications.
7. Burrell, G. (1997). *Pandemonium: Towards a retro-organization theory*. Sage Publications.
8. Cabantous, L., Gond, J.-P., Harding, N., & Learmonth, M. (2016). Critical essay: Reconsidering critical performativity. *Human Relations, 69*(2), 197–213.
9. Chanlat, J. F. (2006). Space, organisation and management thinking: A socio-historical perspective. In S. Clegg & M. Kornberger (Eds.), *Space, organizations and management theory* (pp. 17–43). Liber & Copenhagen Business School Press.
10. Ciborra, C. U., & Lanzara, G. F. (1994). Formative contexts and information technology: Understanding the dynamics of innovation in organizations. *Accounting, Management and Information Technologies, 4*(2), 61–86.
11. Clegg, S. R., & Kornberger, M. (Eds.). (2006). *Space, organizations and management theory*. Liber & Copenhagen Business School Press.
12. Cooper, R., & Law, J. (1995). Organization: Distal and proximal views. In S. B. Bacharach & P. Gagliardi (Eds.), *Studies of organizations in the European tradition* (pp. 237–274). JAI Press.
13. Dale, K. (2005). Building a social materiality: Spatial and embodied politics in organizational control. *Organization, 12*(5), 649–678.
14. Dale, K., & Burrell, G. (2008). *The spaces of organization and the organization of space: Power, identity and materiality at work*. Palgrave Macmillian.
15. Deetz, S., & Mumby, D. K. (1990). Power, discourse, and the workplace: Reclaiming the critical tradition. *Annals of the International Communication Association, 3*(1), 18–47.
16. Deleuze, G. (1993). *The fold: Leibniz and the Baroque*. University of Minnesota Press.
17. Duffy, F., & Powell, K. (1997). *The new office*. Conran Octopus.
18. Elsbach (2003). Relating physical environment to self-categorizations: Identity threat and affirmation in a non-territorial office space. *Administrative Science Quarterly, 48*(4), 622–654.
19. Foucault, M. (1970). The archaeology of knowledge. *Information (International Social Science Council), 9*(1), 175–185.
20. Foucault, M. (1998). Different spaces. In J. D. Faubion (Ed.), *Aesthetics, method, and epistemology* (Vol. 2, pp. 175–186), The New Press.
21. Fournier, V., & Grey, C. (2000). At the critical moment: Conditions and respects for critical management studies. *Human Relations, 53*(1), 7–31.
22. Gagliardi, P. (Ed.). (1990). *Symbols and artifacts: Views of the corporate landscape*. Walter de Gruyter.
23. Hackman, J. R., & Oldham, G. R. (1974). The job diagnostic survey: An instrument for the diagnosis of jobs and the evaluation of job redesign projects, Technical Report No. 4. Department of Administrative Sciences, Yale University.
24. Hatch, M. J. (1987). Physical barriers, task characteristics, and interaction activity in research and development firms. *Administrative Science Quarterly, 32*(3), 387–399.
25. Hatch, M. J. (1990). The symbolics of office design: An empirical exploration. In P. Gagliardi (Ed.), *Symbols and artifacts: Views of the corporate landscape* (pp. 129–146). De Gruyter.

26. Hatch, M. J., & Cunliffe, A. L. (2013). *Organization theory: Modern, symbolic and postmodern perspectives* (3rd ed.). Oxford University Press.
27. Ives, R. S., & Ferdinands, R. (1974). Working in a landscaped office. *Personnel Practice Bulletin, 30*(2), 126–141.
28. Kingma, S. F., Dale, K., & Wasserman, V. (Eds.). (2018). *Organisational space and beyond: The significance of Henry Lefebvre for organisation studies*. Routledge.
29. Kornberger, M., & Clegg, S. (2003). The architecture of complexity. *Culture and Organization, 9*(2), 75–91.
30. Lefebvre, H. (1992 [1974]). *The production of space (trans. D. Nicholson-Smith)*. Willey-Brackwell.
31. Leonardi, P. M. (2012). Materiality, sociomateriality, and socio-technical systems: What do these terms mean? How are they related? Do we need them? In P. M. Leonardi, B. A. Nardi, & J. Kallinikos (Eds.), *Materiality and organizing: Social interaction in a technological world* (pp. 25–48). Oxford University Press.
32. Matsushima, N., Urano, M., & Sayers, J. (2020). The tentative argument of spatial management in Japan. *Kobe University Graduate School of Business Administration Discussion Paper Series*, 2020 11, 1–16.
33. Merleau-Ponty, M. (1962 [1945]). *Phenomenology of perception (trans. C. Smith)*. Routledge and Kegan Paul.
34. Meyerson, J., & Ross, P. (2003). *21st century office*. Rizzoli.
35. Miller, D. (Ed.). (2005). *Materiality*. Duke University Press.
36. Nord, W., & Jermier, J. (1992). Critical social science for managers? Promising and perverse possibilities. In A. Alvesson & H. Willmott (Eds.), *Critical management studies* (pp. 202–222). Sage Publications.
37. Oldham, G. R., & Brass, D. J. (1979). Employee reactions to an open-plan office: A naturally occurring quasi-experiment. *Administrative Science Quarterly, 24*(2), 267–284.
38. Orlikowski, W. J. (2007). Sociomaterial practices: Exploring technology at work. *Organization Studies, 28*(9), 1435–1448.
39. Orlikowski, W. J. (2008). Sociomateriality: Challenging the separation of technology, work and organization. *Annals of the Academy of Management, 2*(1), 433–474.
40. Orlikowski, W. J., & Barley, S. R. (2001). Technology and institutions: What can research on information technology and research on organizations learn from each other? *MIS Quarterly, 25*(2), 145–165.
41. Parke, R. D., Ornstein, P. A., Rieser, J. J., & Zahn-Waxler, C. (1994). The past as prologue: An overview of a century of developmental psychology. In R. D. Parke, P. A. Ornstein, J. J. Rieser, & C. Zahn-Waxler (Eds.), *A century of developmental psychology* (pp. 1–70). American Psychological Association.
42. Sato, T. (2018). Ofuisu no soto de hatarakuhito: Naze ofuisu kara 'hanareru' no ka [People who work outside the office: Why 'come off' from the office?]. In *Dai 85 kai kūkan kenkyū shō iinkai kenkyūkai hōkoku siryō* [*Report on the 85 meeting of the subcommittee on spatial studies*]. (in Japanese).
43. Schein, E. H. (2004). *Organizational culture and leadership* (3rd ed.). Jossey-Bass.
44. Soja, E. W. (1989). *Postmodern geographies: The reassertion of space in critical social theory*. Verso.
45. Spicer, A., Alvesson, M., & Kärreman, D. (2009). Critical performativity: The unfinished business of critical management studies. *Human Relations, 62*(4), 537–560.
46. Sproull, L., & Kiesler, S. B. (1991). *Connections: New ways of working in the networked organization*. The MIT Press.
47. Sundstrom, E., Robert, E. B., & Douglas, K. (1980). Privacy at work: Architectural correlates of job satisfaction and job performance. *Academy of Management Journal, 23*(1), 101–117.
48. Taylor, S., & Spicer, A. (2007). Time for space: A narrative review of research on organizational spaces. *International Journal of Management Reviews, 9*(4), 325–346.

49. Weinfurtner, T., & Seidl, D. (2019). Towards a spatial perspective: An integrative review of research on organisational space. *Scandinavian Journal of Management, 35*(2), 1–30.
50. Zelinsky, M. (1998). *New workplaces for new workstyles.* McGraw-Hill.

Chapter 7
The Material Turn in New Realism and the Science Based Innovation

Keitaro Kuwada and Noboru Matsushima

Abstract The material turn is the recent movement in the philosophical realism. The theorists of so-called new realism share a common tendency to rescue the existence which transcends the human experience and recognition from the dogma of humanism. In discussing the concept of sociomateriality, Orlikowski referred to Karen Barad, who had advocated agential realism in new realism. However, while Orlikowski emphasized human interpretation for the unintended consequences of technology, Barad took her position of onto-epistem-ology, which holds that human's subjective perceptions are themselves shaped by the apparatus. Based on her onto-epistem-ology, we get a much broader analytical perspective that socio-materiality scholars have not analyzed. For example, the science based innovation, which includes basic science outside the company, which has been a matter of course in the MOT (Management of Technology), will come into the field of analysis. In this chapter, we briefly present our empirical investigation of the science based innovation driven by Japanese synchrotron radiation facility, SPring-8, noting that a diametrically opposed innovation orientation has been created by device that allow smaller or bigger observations.

Keywords Material turn · Agential realism · Quantum entanglement · Apparatus · Science based innovation · Laboratory equipment

7.1 New Realism as the Research Program

In the previous chapter, we have examined social materiality based on spatial turn which is positioned as a part of "material turn". The material turn is a movement in new realism as mentioned earlier, and the concept of materiality in management studies refers to new realism as a meta theory, which is none other than socio-materiality by Orlikowski [13] uses the concept of "entanglement" espoused by physicist and philosopher Barad to overcome the dichotomy between technology and organization.

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However, according to Kautz and Jesen [10], the "entanglement" concept should not be regarded as the fundamental indivisibility or mixing of technology and organization as discussed by the advocates of sociomateriality. Barad's argument was born by reflecting her concrete experiences to face "quantum entanglement" as physicists, while her abstract and general concepts as philosopher. In other ward, the advocates of sociomateriality between King and Queen may overlook the most important implications of new realism in order to question the practice of science itself. It is necessary to look back at the discussion about the research program of new realism, which is almost missed in social science.

The research program of new realism is clearly illustrated by Bhaskar, its pioneer and advocate of transcendental realism, one of the new realisms. The philosopher Bhaskar, who has a background in physics, was an early critic of the empiricism of understanding reality through human cognition and instead argued for the need to rethink ontology [4, p. 4]. He insisted that the transcendental realism proposed from this standpoint of consciousness raises the issue of the ongoing conflict between positivism and interpretivism.

First, the conflict between positivism and interpretivism is not caused by each having a different (and appositional) ontology of reality. Rather, positivism has failed to capture reality [5]. Positivism simply assumes the existence of an object to be analyzed. However, as long as positivists attempt to approach reality based on empirical analysis, their results are based on the researchers' cognitive functions. Positivism is no different from interpretivism in that it emphasizes the interpretation of reality. In other words, the conflict between positivism and interpretivism stems from the same empirical realism that relies on human experience and perception [5].[1]

Second, transcendental realism seeks a new science that integrates natural science and social science [4]. According to Bhaskar [4], in order to capture the real world, it is necessary to assume an intransitive object[2] as the entity that governs the phenomena that are the subject of scientific inquiry. This is the ontology upon which science must rest (p. 13). The problem is that the moment we attempt to reveal this reality, we are instantly swallowed up by the world of human experience. On the other hand, Bhaskar [4] looks at physicists' experiments (for example, experiments in magnetic or gravitational fields) and concluded that the experiment was merely a practice of intervening in the object to be analyzed. According to the Bhaskar, an experiment is nothing more than a practice of intervening in an analysis object, and in order to make this experiment possible, an intransitive object must be assumed for the actual existence of the analysis object [4, p. 14]. Bhaskar [4] thus argued that "The objects of experimental activity are not events and their conjunctions, but structures, generative mechanisms and the like (forming the real basis of causal laws), which are normally out of phase with them" (p. 12). If we consider experiments as practices

[1] According to Bhaskar, science based on empirical realism, which absolves empirical phenomena, is not scientifically sufficient in the true sense. From the standpoint of transcendental realism, presenting the mechanism behind human experience is the only true scientific basis [4, p. 26].

[2] An object is a real structure or mechanism that exists and acts independently of human perception and completely independent of the circumstances of human perception [4, p. 13].

that intervene in an intransitive object, then natural science and social science are, in fact, the same science [4, p. 17].

Third, Bhaskar [4] points out that although natural science and social science may be the same science, the practice of interventions may differ between them. In natural science, it is expected that a general reproducible theory can be derived while intervening in the analysis object through experiments. In social sciences, on the other hand, researcher and analyte interdependent. In other words, social science, which changes the nature of the object to be analyzed through intervention, requires a different type of intervention from natural science in that it continues to produce provisional solutions in line with actual social activities rather than reproducible generalizations [4, p.192].[3]

This means that independent research practice is required that remain critical of real social activity (but not against the general theory of social science) through interventions in the analyte, rather than following natural science to generalize reproducible results through the analyte. Even if a general theory of social science is to be constructed, it would (either or both) center on the practice of intervention. Thus, while recognizing that scientific knowledge depends on human experience, Bhaskar's transcendental realism emphasizes the existence of independent structures, forces, and mechanisms underlying scientific knowledge [4, p. 15].

7.2 Critical Realism in Social Science

In the previous section, I have discussed Bhaskar's transcendental realism, which is a pioneer of the new realism, and have confirmed the research program of the new realism that has been attracting attention in recent years. We need to look at the arguments of Archer, who took over Bhaskar's transcendental realism as a social science and proposed a critical realism. This scholarly development cannot be overlooked when considering Orlikowski's sociomateriality, which was triggered by the limitations of structural models (e.g., [1]), because she is also known as a critic of Giddens' construction theory, which Orlikowski referred to in advocating structural models.

According to Archer [1], it is the concept of practice that best characterizes Giddens' structuring theory, and the hierarchical elements that make up society are recovered in the fluidity of this practice (p. 150). According to Schatzki et al. [16], of course, practice involves more than just the behavior of the human subject, but also material things. However, it is clearly human cognitive action that integrates them, and in this respect Giddens points out that it is subjectivist synthesism that has argued for the interpenetration of action and structure [1, p. 167].

[3] This concept is similar to entity realism as espoused by Hacking [8]. Entity real-ism takes the position that something that scientists can manipulate or intervene in exists. For example, to confirm the existence of an electron, if an experimental device can eject the electron as they want, and if the result is what they want, the electron will exist. Even a material of unobservable size exists through their intervention.

On the other hand, in critical realism, Archer thought that by referring to Bhaskar's transcendental realism, it would be possible to imagine a structure behind acts that lay beyond human recognition [1, p. 47]. This view assumes that the structure precedes the act and takes the position that the act and the structure must be situated in different classes to be consistently distinguished [1, pp. 61–62].[4] According to Archer [1], a structure defines a human act, and a structure is practically created by a prescribed act, after which the structure goes beyond the human act to define the human act (p. 133). Archer explain the following:

> If social reality is indeed made up of different strata, each with heterogeneous properties, then it becomes imperative to examine the interplay between them. Far from it sufficing to lay the foundations of theory 'at the intersection' between action and organization, that is, in social practices, an adequate social theory is one which sees this intersection as leaving far too much out of account, and bases its account on an interplay between real agents and real structures without conflating them.
>
> ([1], p. 133)

However, it is difficult to dispel the notion that Archer's argument does not escape the "tilt" for which Orlikowski was criticized. According to Archer [1], Giddens, a subjectivist synthetist, only discusses the cycle of structure forming behavior when he seeks unintended consequences on the basis that not all social conditions are understood in the course of action (p. 92), and thus Archer criticizes Giddens for falling into reductionism (pp. 60–61). While there are no alternatives to Archer's unintended consequences, a natural attitude toward situations that produce unintended consequences is required. Does this natural attitude, however, lead to an explanation that goes beyond Giddens' reductionism? It should also be remembered that criticism of structural models has pointed to the epistemic fallacy that causes a slippage in researchers' intentions in response to an unattended consequence [7]. In other words, critical realism does not fully grasp the implications of the new realism, because it is a theory that has taken over transcendental realism as a social scientific theory, but still retains humanism. As is the case with other meta theories used in sociomateriality, the meta theory itself was confused, and this confusion was brought directly into the management study.

7.3 Materiality and Agential Realism

As we have seen, assuming that Orlikowski's sociomateriality failed to overcome the problem of Giddens's construction theory, an argument of the same type as Archer's invocation of Bhaskar to critique Giddens in the social sciences, how can we conceptualize the implications of Bhaskar that Archer overlooked? This problem was solved

[4] Archer advocates analytical dualism, which means that social structures and human agencies exist in different strata, and argues that the interaction between these strata and hierarchical halls cannot be discovered in the context of social actions and human perception, but can only be discovered by means of social scientific analysis [1, p. 14].

later by Barad's agential realism, which took over the ontological implications of Bahaskar's transcendental realism. Her background as a quantum physicist allows her to critique humanism as well as transcendental realism, and she coined the term intra-action to overcome the dichotomy of material and society, ontology and epistemology [2, p. 33]. This idea is an attempt to distinguish quantum physicists from the prevailing understanding that they are interacting with material to approach a priori reality [2, p. 33]. Rather, it is the various laboratory equipment of quantum physics that separate the physicist subject from the observed object. This is what she called an agentic cut by the apparatus.

This idea does not seem to be new, and may even seem similar to the concept of quantum entanglement proposed by Niels Bohr, another quantum physicist, long before Barad proposed agential realism. Quantum entanglement is a physical phenomenon in which when a particle of light splits into two particles with opposite spins, the two particles behave completely synchronously even if separated [6]. Bohr noted that observation of this phenomenon was made possible by the development of the scanning electron microscope [2, pp. 251–254]. Therefore, all phenomenon can be recognized not by human recognition but by laboratory equipment (laboreinrichtungen) [3, p. 29]. However, according to Barad [3], Bohr separates the role of the laboratory equipment from the physicists as observer who is using it (p. 21), which is as inadequate as same as that the actor network theory that preserves humanism (see Chap. 2).

Orlikowski, who used Bohr's concept of (quantum) entanglement in the concept of sociomateriality to discuss the fundamental intertwining of society and materiality, developed a valuation study focusing on Barad's concept of apparatus. However, Orlikowski seems to understand Barad's notion of apparatus under the notion of quantum entanglement, rather than under agential realism. Specifically, Orlikowski and Scott [14] illustrate the TripAdvisor as an algorismic apparatus calculating rankings basend on the 5 star reputation by unspecified number of users, rather than by the knowledge of specific experts (p. 877). They look forward to the fact that in this age of information technology, devices like TripAdvisor, with its built-in algorithms that reflect the value assessment of an unspecified number of users, will create a freer and more open practice for us [14, p. 880]. However, as we already well known, the reputation algorism of TripAdvisor is written program by specific experts.

The apparatus on which Barad focused comprises a methodological concept for supposing existence beyond human experience and perception. However, even if an existence beyond recognition is assumed, as soon as researchers analyze this existence, it is recovered as the naive realism of humanism. The key message here is that even the most familiar physical phenomena can be understood as phenomena driven by apparatus. For example, she often refers to the cane as an apparatus [3, pp. 50–51]. When a blind person walks with a cane, the cane serves to support the body and becomes a part of the body. At this time, the cane becomes a part of the person. On the other hand, when a blind person is checking whether the cane grasps the state of the road or not, the cane becomes an observed object [3, pp. 50–51]. The same cane can become an "agent of observation" or an "object of observation", depending on the situation. In this way, Barad analyzed the apparatus that connects

existence and perception, and adopted a unique methodological position of onto-epistem-ology [2]. In view of the implication of agential realism, the concept of materiality in management studies is insufficient because it describes the state in which society and material become inseparable in recognition as "entanglement". Rather, we should pay attention to and analyze the practices in which subjects and objects are newly identified by apparatus and local causal relations are reconstructed.

7.4 Smaller World and Bigger World Driven by Large Synchrotron Radiation Facilities

In this chapter, along with the methodological implications of the apparatus concept as discussed earlier, we will focus on the large synchrotron radiation facility itself, which is today's laboratory equipment for quantum physics, as a framework for analyzing science based innovation. Kuwada and Matsushima [11, 12] and Hara and Kuwada [9] have accumulated empirical researches on a large synchrotron radiation facility SPring-8 in Japan and its science based innovation.

7.4.1 Sociomaterial Challenges in the Pharmaceutical Industry not Observed in the Smaller World

How do we understand the large synchrotron radiation facility as apparatus? It can be said to comprise an laboratory equipment that artificially produces the light of wavelengths not found in nature, but it is also described as a "giant microscope" because it can observe objects not visible by the human eye. The smallest object is the electron (0.01 nm), and the electron microscope was developed to observe an object at the same wavelength as the size of the electron. On the other hand, a Japanese large synchrotron radiation facility SPring-8 not only emits light with a wavelength as short as that of an electron, but also has a high brightness of 1 trillion times that of a conventional X-ray generator, and is leading the world with a high specification of 8 GeV energy. The need to observe smaller objects derives from the fact that the synchrotron radiation facility in Japan has been managed by physicists led by crystallographer Torahiko Terada.[5]

However, the utilization of synchrotron radiation facilities in Japan, which specialize in the observation of such smaller objects, did not progress until the mid-2000s. The pharmaceutical industry was relatively in need of observing something smaller. However, large synchrotron radiation facilities have not perceived a core

[5] Torahiko Terada, a crystallographer at the University of Tokyo, succeeded in observing the crystal structure of rock salt using X-rays at the same time as Laue, who proved that X-rays are a type of light for the first time in the world.

technology in the Japanese pharmaceutical industry. To be precise, a pharmaceutical industry beamline was built at SPring-8 in 2002, but it has been out of use since the mid-2000s. The development of new drugs, particularly small molecules, is about finding compounds that match the target protein. Conventional drug discovery requires an exploratory approach in which a myriad sample compound is combined with the pathogenic protein. The pharmaceutical industry has been undergoing a series of global mergers and acquisitions due to the huge amount of capital required to do this.

This is consistent with the structural problems that the Japanese pharmaceutical industry faces in implementing innovation. First, the pharmaceutical industry as a whole is experiencing a decline in development costs. Traditionally, the drug discovery process for small molecule drugs has required a process called High Throughput Screening (HTS), in which a myriad of compounds are screened in the first stage for compatibility with the pathogenic protein. Until the 1990s, this work was done by researchers and could take as long as 5–15 years. The work efficiency of HTS itself has improved, but this method requires a huge investment. As a result, the pharmaceutical industry was undergoing a series of global absorption mergers. The Japanese pharmaceutical industry was unable to compete with the world's major pharmaceutical companies until Takeda Pharmaceutical Company Limited acquired Shire for 7 trillion yen in 2018, and the Japanese pharma company, which is inferior in terms of the size of its investment, had to lag behind in the global competition.

Second, while the use of synchrotron radiation facilities was aimed at improving the efficiency of HTS, as Rosenberg [15] has pointed out, there were still issues to be solved as composite technical system. In addition, the HTS using a robot is only a result of speeding up human work. In 1994, Structure Based Drug Design (SBDD), an analysis using synchrotron radiation, was started. SBDD is a method to analyze the crystal structure of a target protein and screen compounds with the appropriate shape using AI. This method has been developed and the number of screenings will be significantly reduced compared to robotic HTS. In spite of it, why did Japanese pharmaceutical companies stop using SPring-8? There were still issues to be solved as a composite technical system. Specifically, even if the target proteins were analyzed by SBDD using the synchrotron radiation facility, a database of the compounds themselves was needed to screen the corresponding compounds by AI. However, it is said that the total number of the countless compounds is about 20 million, and no company has created a database that can be analyzed by AI, and the cost of creating a database is huge.

Third, the database of compounds has not developed in Japan in contrast to other countries, where it has been promoted as part of national policy. For example, in Switzerland, where drug discovery has been a strategic industry, the Swiss Light Source (SLS) has developed the database of compounds and a composite technical system that allows companies to use the database.[6] In fact, many of the Japanese

[6] In addition to renting out synchrotron radiation facilities to pharmaceutical companies, the company's business includes the preparation of compound databases, support for analysis, and analysis of the results.

pharmaceutical companies that withdrew from SPring-8 used overseas synchrotron radiation facilities such as SLS to provide such services. However, the strategic problem for Japanese pharmaceutical companies is that there is no guarantee that the analysis data entrusted to overseas synchrotron radiation facilities, such as SLS, will not be divulged to overseas pharmaceutical companies and research institutes. For this reason, Japanese pharmaceutical companies are not aggressive in using overseas synchrotron radiation facilities. In fact, as of 2020, after SPring-8 begun to provide a database of compounds to the companies, pharmaceutical companies are also returning.

7.4.2 Sumitomo Rubber Industries' Innovation Guided by Bigger World Observations

The laboratory equipment in quantum physics not only extends human visual abilities, but also makes us aware of the limitations of our visual abilities. We has been able to observe 0.01 nm by the electron micro scope developed in 1930s. The 0.01 nm is the same size as the electron, but extremely paradoxically, the larger scale, 1 μm, has been left with a "dark region" that has not yet been observed. In fact, this need for observation on a larger scale has been met to industrial needs, which has been shying away from synchrotron radiation facilities.[7]

A typical example is the development of eco-tires by Sumitomo Rubber Industries. For more than 100 years since the discovery of natural rubber by Columbus, rubber has been considered unattractive area for research and development. This is because understanding the properties of rubber requires an analysis in the bigger world, a polymer in which molecules are multiply bonded, rather than in the smaller world, but we were unable to analyze it. The material development department of Sumitomo Rubber Industries, which could not rely on the results of the existing science, joined SPring-8 as a user in 2001. However, what is important to note in this case is that the development of the eco-tire, which now becomes a national brand, was achieved through a wide range of innovations, from the development of devices that observe dark region to the research and development organization and industry-academia collaboration relationship within Sumitomo Rubber Industries, in order to realize their needs, which were not understood by the researchers in the beginning.

[7] However, in order to observe a bigger object, it is necessary to have a different specification of the emitted light than that used to observe smaller objects. This is a specification that produces a beautiful light by aligning the phase of the wavelength in a process called coherence. In fact, these specifications are more advanced at synchrotron radiation facilities in other countries than in Japan, which specializes in the observation of smaller objects. For example, foreign synchrotron radiation facilities such as NSLS-II in the United States, TPS in Taiwan, MAX IV in Sweden, and SIRIUS in Brazil tend to observe larger objects than SPring-8 by reducing the energy to 3 GeV and increasing coherence. The tendency to lower energy, increase coherence and observe larger objects is global, and SPring-8 is not necessarily the world leader in all specifications.

First, the innovation in laboratory equipment was needed to analyze the rubber material and develop new tires. Sumitomo Rubber Industries participated in SPring-8 in search of a new analysis technology, but the researchers specialized in the observation of the nano-level, did not understand Sumitomo Rubber Industries' need to observe the dark regions. The researcher in Sumitomo Rubber Industries visited the photochemistry labs outside SPring-8 in order to observe the dark region. Although this laboratory did not have the technology suitable for observation in the dark region, the observation needs of Sumitomo Rubber Industries seemed to be a challenging subject for researchers in the field of photochemistry. The Sumitomo's researcher developed a laboratory equipment for observing dark regions with a graduate student in this laboratory, and named the method as the Ultra Small-Angle X-ray Scattering.[8]

This laboratory equipment reveals that tire performance can be understood as an emergent property at various scales. Specifically, the rolling performance of the tire is affected by 100 nm–1 μm. At the 10–100 nm scale, the grip performance will be affected. Abrasion resistance is affected by 10 nm–10 μm. In the past, this kind of performance has been improved by trial and error as a whole. However, by understanding rubber as multiple properties in each scales, they were able to improve the rolling performance by 39% and the wear resistance by 51%, which is a significant improvement in tire development that has been said to be unchanged for more than 100 years. In response to this commercial success, the Frontier Soft Matter Beamline, which is dedicated to the analysis of larger objects, was established at SPring-8, and industrial use of large synchrotron radiation facilities, which had not been progressing well, began to advance.

Second, the Ultra Small-Angle X-ray Scattering developed at SPring-8 has enabled us to observe various scales that had not been analyzed before, and to develop a revolutionary eco-tire. However, not all the properties of the rubber have been revealed. Rather, the ability to observe multiple scales has revealed new technical issues that cannot be solved by the synchrotron radiation facility, such as the relationship between these multiple scales.

One of the approaches to this problem was found to be the technical feasibility of exposing networked polymers to neutrons and capturing their dynamic information. However, in 2015, there were very few researchers who had knowledge of neutron experiments, not only in SPring-8 but also in Japan. For this reason, Sumitomo Rubber Industries, in collaboration with J-PARC Center has started a fellowship program to hire researchers for a fixed term, and foster excellent young researchers. Even if young researchers are employed at universities and other research institutes after their term of office, they can train neutron engineers and form a network of researchers outside the company. By forming such a network, Sumitomo Rubber Industries is building joint research relationships that can be used when new research and development issues arise in the future.

[8] After the development of this device, graduate students became faculty members at the university, and researchers at Sumitomo Rubber Industries were awarded the society's prize at a physics conference as co-researchers.

The various innovations of Sumitomo Rubber Industries were driven by a laboratory equipment to observe the bigger world, which Sumitomo Rubber Industries itself was involved in developing of it. In other words, the development of such a laboratory equipment would lead to various companies analyzing rubber materials in the same way and creating similar products. It could be said that this has made up the national brand, but it could also be said that it has increased the possibility of imitation. Science based innovation with large synchrotron radiation facilities has led to the discovery of technological issues that need to be observed, and now made agential cuts that require new business models as strategic issues.

References

1. Archer, M. (1995). *Realist social theory: The morphogenetic approach*. Cambridge University Press.
2. Barad, K. (2007). *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning*. Duke University Press.
3. Barad, K. (2012). *Agentieller realismus: Über die bedeutung materiell-diskursiver praktiken*. Suhrkamp.
4. Bhaskar, R. (1979). *The possibility of naturalism: A philosophical critique of the contemporary human science* (3rd ed.). Routledge.
5. Bhaskar, R. (1993). *Dialectic: The pulse of freedom*. Routledge.
6. Gilder, L. (2008). *The age of entanglement: When quantum physics was reborn*. Knopf.
7. Grint, K., & Woolgar, S. (1997). *The machine at work: Technology, work and organization*. Polity Press.
8. Hacking, I. (1983). *Representing and intervening: Introductory*. Cambridge University Press.
9. Hara, T., & Kuwada, K (2020). Sōyaku bijinesu to ōgata hōsyakō shisetsu [Drug discovery business and large synchrotron radiation facility]. *Kobe Daigaku Wākingupēpā Series* [*Kobe University Graduate School of Business Administration Discussion Paper Series*], 2020–7, 1–12. (in Japanese).
10. Kautz, K., & Jensen, T. B. (2013). Sociomateriality at the royal court of IS: A jester's monologue. *Information and Organization, 23*(1), 15–27.
11. Kuwada, K., & Matsushima, N. (2017). Inobēshon no shakaibusshitusei: 'Gijyutu' to 'soshiki' kara saika shita isyukongou no jissen [The sociomateriality of innovation: The heterogeneous practices differenced from 'technology' and 'organization']. *Kobe Daigaku Dhisukassyonpēpā* [*Kobe University Graduate School of Business Administration Discussion Paper Series*], 2017–23, 1–12. (in Japanese).
12. Kuwada, K., & Matsushima, N. (2019). Inobēshon ecoshisutemu no shinka: Kagakugijyutu inobēshon no keieigaku ni mukete [Evolution of the innovation ecosystem: Toward management of science based innovation]. *Kokumin Keizai Zasshi [Journal of Economics and Business Administration], 220*(5), 23–48. (in Japanese).
13. Orlikowski, W. J. (2007). Sociomaterial practices: Exploring technology at work. *Organization Studies, 28*(9), 1435–1448.
14. Orlikowski, W., & Scott, S. V. (2013). What happens when evaluation goes online? Exploring apparatuses of valuation in the travel sector. *Organization Science, 25*(3), 868–891.
15. Rosenberg, N. (1969). The direction of technological change; Inducement mechanisms and focusing devices. *Economic Development and Cultural Change, 18*(1), 1–24.
16. Schatzki, T. R., Cetina, K. K., & Savigny, E. V. (Eds.). (2001). *The practice turn in contemporary theory*. Routledge.

Chapter 8
Epilogue: Materiality Concept in the History of Management Studies

Kohei Kijima and Noboru Matsushima

Abstract We have focused on the meta theories, which have been referred to using the concept of materiality in recent management studies. On the other hand, the doctrine of elucidating the relationship between technology and organization is not a new perspective. It was already the emergent perspective in Markus and Robey (Manage Sci 34(5):583–598, 1988 [14]). Moreover, the idea of elucidating the effect of technology on organization has been shared by management studies in general for a long time (e.g., Barley in ASQ, 31[1]: 78–108, 1986 [1]). According to Daniel Robey, recent technology research has lost sight of technology as a specific object of observation (Robey et al. in J Assoc Inf Syst 14(7):379–398, 2013 [15]). Technology research in management studies reached its peak when Eric Trist, who had been working at the Tavistock Institute, suggested socio-technical systems and Joan Woodward, who criticized socio-technical systems, conducted South Essex research. However, their researches were positioned as the primitive stage of contingency theory and were given the critical label of technological determinism. Afterwards, to avoid technological determinism, the concept of technology was abstracted and conceptualized by Charles Perrow's information processing model and James D. Thompson's technical core concept. Ironically, however, the more advanced the sophisticated abstraction, the more difficult it becomes to observe the concrete technology. In this epilogue, we revisit the classical studies executed by Trist and Woodward as meta theories within management studies.

Keywords Socio-technical system · Contingency theory · Technological determinism · Technology research · Management studies · Intervention

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8.1 Socio-technical Systems Theory Aiming at Intervention in Practice

As a first step, we revisit Eric Trist's theory of socio-technical systems, which Robey picked up as a classic studies about technology in management studies (e.g., [8, 17]).[1] Trist was a researcher specializing in psychology at the Tavistock Institute in the UK, and a series of studies known as socio-technical systems were commissioned by the government to improve work performance at coal mining sites [17]. A longwall method using a belt conveyor, which was the latest technology at that time, was introduced as an alternative to the short-wall method, which is the traditional method of coal mining. Nevertheless, at the mine site, the sense of unity was reduced, and there was an increase in activities that did not directly contribute to productivity or decreased absences [18].

With the help of a miner who was working at the coal mine site,[2] Trist worked to clarify the impact of new technology on the work site. It became clear that there had been a reduction in interaction within the working group or coordination of jobs within the group at work site where the new technology was introduced [18, pp. 111–131]. Based on these observations, Trist concluded that the introduction of the new technology had influenced the working group in terms of reducing its sense of unity and motivation. Trist and his co-researchers defined social systems that were constructed by working groups as "work organizations and their social and psychological characteristics under a certain technical system" [16, p. 25]. Trist then considered it important to create an interaction (or coupling) between social systems and technical systems, using technology that contributes to productivity. Therefore, Trist presented the central concept of joint optimization that was also inherited by contingency theory [16, p. 37].

Furthermore, Trist proposed the introduction of a semi-autonomous work group, in which the work allocation was determined autonomously within the group, and all members of the group were responsible for group productivity. Once a technical system (in this case, the long wall type) has been introduced, it cannot be easily replaced, and if its effects are not neglected, joint optimization in a form suitable for improving productivity will not be achieved. In other words, Trist intervened in the work process and attempted to redesign the social system in order to adapt to the technical system.

However, Woodward criticized Trist's proposal, pointing out that it ended up with the classical discussion that only argued for organizational design without specifying the characteristics of technology [21, pp. 35–36]. Woodward also noted that a social system with specific properties is required to solve the problem whereby the change created by technical systems is a typical theory of traditional organizational design that focuses only on the social systems, not on the technical systems.

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[1] The Tavistock Institute was frequently involved in projects aimed at increasing industrial productivity, overseen by the British government's Medical Research Council [17, p. 1].

[2] Ken Bamforth who is one of authers of Trist and Bamforth [17] was a coal miner in the Durham area where the research was conducted.

On the other hand, Woodward's criticism did not capture Trist's real intention. In order to assemble his true intentions, the key is to deepen the understanding of the joint optimization that Trist prepared as a key concept. Joint optimization refers to maintaining a relationship between each element that works well in accordance with its respective rules without interference from the other [18]. This may seem like equilibrium of mechanical systems; however, the point is that the concept is to be used as a 'device' to lead a coupling between technical and social systems based on improving productivity. In other words, the concept of joint optimization is not only representation the work site, but also helps us redesign social systems in a way that improves productivity [13, pp. 40–41].

If we revisit Trist and consider his real intentions, we can see why Trist needed to introduce a semi-autonomous working group. Once introduced, technology systems such as the long-wall method becomes a material constraint that cannot be easily removed. What Trist could do was to understand the social systems that responded to the technical systems and guide the transition to a new organization design. Trist's work did not repeat the classical principles of management studies without examining concrete technology as Woodward criticized. In fact, Trist's work is also regarded as the classical studies of organizational design (OD) that intervenes at the work site [11], which may provide a clue to understand that the concept of materiality is a normative research program that includes intervention in organizational practices (see Chaps. 3 and 4).

8.2 What Was 'Technological Determinism'?

Secondly, we revisit Woodward, who criticized Trist's work. Woodward summarized Trist's research projects at the South East Essex Institute of Technology and published *Industrial Organization: Theory and Practice* in 1965 and *Industrial Organization: Behavior and Control* in 1970. She took technology as the central issue of management studies, which classified organization design that conform to production technology. She has been also positioned as the beginnings of contingency theory along with Trist's socio-technical systems. However, quite ironically, while socio-technical systems were criticized (by Woodward herself) for over-emphasizing organizational design, Woodward would also be criticized for beginnings of technological determinism that over-emphasized the technological systems. In this chapter, we do not intent to criticize Woodward, instead, reconsider why Woodward argued for technological determinism despite her understanding of its various challenges and discuss the ideals of technology management as an management studies.

We first focus on the methodological issues that Woodward faced when discussing technological determinism. Woodward, who is now regarded as a technological determinist, confronted various issues when conducting empirical research. The empirical research of contingency theory requires that the technological and organizational variables be defined independently. In her research, however, the key technological variables could not be rigorously defined. There was no previous studies, plausible

categories in practical use, and the technology itself was changing rapidly. In order to put the technological system on empirical analysis, Woodward hypothetically extracted the "salient technological characteristics" that would affect the organization (management structure and behavior of people). Through this tautological operationalization, three categories were created; single/small batch production, large batch/mass production, and equipment production. This technological typology, of course, is not a independent variable of the technological systems themself, which she excused as "we should not choose a technology taxonomy that can be expressed only in terms that are social in itself" [21, p. 20].

However, some patterns were found between the hypothetically prepared technical and organizational variables that was unrelated to the expected changes. [20, p. 51]. In particular, the trends in variables related to the organization, such as the average number of managers, the number of employees managed by terminal managers, and the percentage of college graduates (particularly in the line department), are difficult to understand. Focusing on these variables, there was a tendency to adopt organic organization at both ends of the technical scale and mechanical organization in the intermediate areas. In short, as the number of employees in an organization increases, adjustment costs increase, and bureaucracy becomes necessary.[3] To understand these results, Woodward concluded that introducing an organization's control variables would "eliminate technology as an explanatory variable" [21, p. 236] and "the differences in various characteristics may not have been based on the concept of an independent management system, but rather could have been explained by differences in technology" [20, p. 188].

That being the case, was Woodward not a technological determinist? She certainly saw much more complex phenomena than the criticism of technological determinism would suggest. This was demonstrated prominently in her book *Industrial Organization: Behavior and Control*. Production technology and organizational management systems or working groups are factors that interact with each other, despite being affected by the external environment. Woodward emphasized that individuals who sought the benefits, despite being bound by technology and organization, are not puppets or passive masses of environmental factors [21, p. 8]. Indeed, the case studies in her book presented a complicated description that could not be recovered in technological determinism. For example, Hedley [10] described the computer system that performs integrated production management, introduced in political bargaining between business units aiming for autonomy and the computer department at the head office.

[3] We explained this involuntarily, however, considering the size of the organization could ruin the explanation by technical variables. According to Donaldson [6], empirical research based on contingency theory demonstrates that organization size is certainly the most important situation variable. However, it is not necessary to explain it as such (pp. 147–158). The size of an organization can be replaced by another variable (for example, a technology variable), as Woodward has come to believe that technology cannot be separated from its management system. While the size of the organization is a convenient variable for researchers in the sense that it can be used for various explanations, it is not always the case for managers because the size of an organization, which has a significant impact on various aspects of it, cannot be easily changed.

However, how important is a case study depicting the more complex relationship between technology and organization? Behind Woodward's focus on technology variables, she had criticized socio-technical systems that emphasized classic management principles. Even in classical studies, production activities involving the use of technology have been issues, but they have not been considered as objects to be conceptualized, even though they are objects to be managed. Only the management principles of organizations have been discussed. In modern society, which has undergone drastic changes along with the evolution of production technology since the Industrial Revolution, the concept of "technology," although mostly important, has been lost. Therefore, we can see why Woodward, who faced a methodological challenge and attempted to grasp the complex phenomena, asserted technological determinism here. Furthermore, based on her methodological intention, we can positively position Woodward's works as technological determinism.

8.3 The Meta Theories of Materiality Contained in Management Studies

So far in this chapter, we have reflected on some technology research in order to explore the pioneering materiality concept in classical management studies. This reflection is in line with Robey et al. [15], who advocated the need for a reflective debate on the concept of sociomateriality in information management research, while also advocating the technology-organization interaction approach (emergent perspective) (see Chap. 1). If we take Robey's and our interests further, we can seek a meta theory of the concept of materiality in management studies as well.

It would take a much thicker book to take on this challenge. In the following, however, we would like to summarize the meta theories of materiality in management studies. Firstly, We will have to critically reflect on the methodological entrapment caused by excessive interactionism in management studies (including the interaction between technology and organization). Behind previous studies repeated point shifting, such as the interaction between technology and organization, we may glimpse the fear of falling into a harmonious understanding of the complex reality, even if neither technology nor organization is overemphasized. However, joint optimization of socio-technical systems comprised neither a drawing of a presumed harmonious relationship nor a complex understanding of complex phenomena. As Burrell and Morgan [4] noted, the concept of organization has the progressive value because it was originally conceptualized from the analogy of organisms. With this value, the concept of organization was promoted using the equilibrium model as a tool. On the other hand, once it was understood as a mechanistic description model, it often fell into "abstracted empiricism," which makes the theory as false as the reality [4, p. 147]. This is a recurring experience not only in management studies but also in social sciences. It is important to bear in mind that the doctrine of elucidating the

relationship between technology and organization in management studies has these inextricable possibilities and dangers.

Secondly, the materiality in management studies must not avoid discussing technological determinism. Of course, as Woodward has experienced, technology has both material and social aspects and is extremely difficult to define. The information processing model, the technical core concept, and the structuration theory that formulates the technology as an intermediary model, which have arisen as a result of confronting this difficulty, may have been refined as a concept for describing phenomena. However, the technology, which is the institutional object that we have embodied, constitutes our living world more simply than this. Give this perspective, technology research can only maintain its academic identity by defining materiality in a practical sense and discussing the possible consequences of that technology. Robey et al. [15] also conclude that, from the perspective of information management research, analyzing the impact of information technology on organizations (organizational impact of IT) is the academic identity of information management research that has inherited the research implications of Trist and Woodward. They state that this is the future direction that the research area should take (p. 392).

Thirdly, it is necessary to confirm that the purpose of management studies has been to develop knowledge to intervene in practices. Trist concluded with the introduction of a semi-autonomous working group, but not because he sought to make some theoretical contributions by remaining close to classical management principles. While Woodward had methodological problems, she emphasized technological determinism because she was attempting to conceptualize thus-far neglected technology as a subject of management. Donaldson, an advocate of neo-contingency theory,[4] has criticized a series of studies that emphasized the independence of managerial decision-making while ignoring determinism (e.g., [2, 3, 5]). He points out that this research can not provide any useful knowledge to management decision-making, and it is, ultimately, 'mission impossible' [6, p. 53]. In other words, because some managers are willing to adapt to environmental changes, researchers are required to develop deterministic propositions based on positivism. According to Donaldson [7], researchers misunderstand that contingency theory cannot capture managers' independence because they overlook the fact that positivism in management studies has evolved in conjunction with behavioral science (p. 57). As is well known, behavioral science in management studies adopts a methodology that avoids making an intrinsic reduction to both individuals and organizations (or technologies and organizations) and focuses on real behavior in practice. In this respect, there is no difference from the idea of sociomateriality; however, by thoroughly rejecting the essential reduction in behaviorism, behavioral science in management studies

[4] Neo-contingency theory has a meta theoretical orientation by discussing the methodological implication of contingency theory, which critics have overlooked, to assert the validity of contingency theory. Donaldson is mentioned at the beginning of Tsoukas and Knudsen [19], a handbook that edited the meta theories, and has received subsequent criticism.

judges the feasibility of the knowledge advocated by researchers from its practical usefulness, and inevitably aims at intervening in practical problem solving[5] [9, 12].

References

1. Barley, S. R. (1986). Technology as an occasion for structuring: Evidence from observations of CT scanners and the social order of radiology departments. *Administrative Science Quarterly, 31*(1), 78–108.
2. Bobbitt, H. R., & Ford, J. D. (1980). Decision-maker choice as a determinant of organizational structure. *Academy of Management Review, 5*(1), 13–23.
3. Bourgeois, L. J., III. (1984). Strategic management and determinism. *Academy of Management Review, 9*(4), 586–596.
4. Burrell, G., & Morgan, G. (1979). *Sociological paradigms and organizational analysis.* Heinemann.
5. Child, J. (1972). Organizational structure, environment and performance: The role of strategic choice. *Sociology, 6*(1), 1–22.
6. Donaldson, L. (1996). *For positivist organization theory: Proving the hard core.* Sage Publications.
7. Donaldson, L. (2003). Organization theory as a positive science. In. H. Tsoukas, & C. Knudsen (Eds.), *The oxford handbook of organization theory: Meta-theoretical perspectives* (pp. 39–62). Oxford: Oxford University Press.
8. Emery, F. E., & Trist, E. L. (1960). Socio-technical systems. In F. E. Emery (Ed.), *Systems thinking* (pp. 281–296). Penguin Books.
9. Fukumoto, T., Matsushima, N., & Koga, H. (2014). Jisshōshugi no kagaku teki yuyōsei: Kainyū wo mezasu aratana kagakushisō toshiteno akushon saiensu [The scientific relevance of the positivism: Action science as the new philosophy of science aimed at intervention into practices]. *Nihon Jōhō Keiei Gakkaishi [Journal of Information and Management], 34*(4), 59–70. (in Japanese).
10. Hedley, R. A. (1970). Oraganizational objectives and managerial controls: A study of computerization. In J. Woodward (Ed.), *Industrial organization: Behavior and control* (pp. 146–176). Oxford University Press.
11. Kijima, K. (2015). Soshiki kōdō ron ni okeru mikuro-makuro mondai no saikentō: Shakai gijyutsu sisutemu ron no gakusai teki apurōchi wo tegakari ni [Reconsideration of micro-macro gap problem in organizational behavior: Applications of interdisciplinary approach based on socio-technical systems]. *Keiei Gakushi Gakkai Nenpō [Journal of the Society for the History of Management Theories], 21*, 139–150. (in Japanese).
12. Kijima, K., Fukumoto, T., & Matsushima, N. (2017). Soshiki kōdō ron no honryū wo mikiwameru: Ningen kankeiron, soshikikaihatsu, akushon saiensu [Ascertain the main course of stream in studies of organizational behavior: Human relations, organizational development, action science]. *Kokumin Keizai Zasshi [Journal of Economics and Business Administration], 216*(2), 31–55. (in Japanese).
13. Leonardi, P. M. (2012). Materiality, sociomateriality, and socio-technical systems: What do these terms mean? How are they related? Do we need them? In P. M. Leonardi, B. A. Nardi, & J. Kallinikos (Eds.), *Materiality and organizing: Social interaction in a technological world* (pp. 25–48). Oxford University Press.
14. Markus, M. L., & Robey, D. (1988). Information technology and organizational change: Causal structure in theory and research. *Management Science, 34*(5), 583–598.

[5] On the other hand, it should be noted that the implications have been overlooked as behavioral science has matured as a science.

15. Robey, D., Anderson, C., & Raymond, B. (2013). Information technology, materiality, and organizational change: A professional odyssey. *Journal of the Association for Information Systems, 14*(7), 379–398.
16. Trist, E. L. (1981). The socio technical perspective: The evolution of sociotechnical systems as conceptual framework and as action research program. In A. H. Van de Ven & W. F. Joyce (Eds.), *Perspectives on organization design and behavior* (pp. 19–75). John Wiley and Sons.
17. Trist, E. L., & Bamforth, K. W. (1951). Some social and psychological consequences of the longwall method of coal-getting: An examination of the psychological situation and defences of a work group in relation to the social structure and technological content of the work system. *Human Relations, 4*(1), 3–38.
18. Trist, E. L., Higgin, G. W., Murry, H., & Pollock, A. B. (1963). *Organizational choice: Capabilities of groups at the coal face under changing technologies: The loss, re-discovery and transformation of a work tradition.* Tavistock Publications.
19. Tsoukas, H., & Knudsen, C. (2003). *The oxford handbook of organization theory: Meta-theoretical perspectives.* Oxford University Press.
20. Woodward, J. (1965). *Industrial organization: Theory and practice.* Oxford University Press.
21. Woodward, J. (Ed.). (1970). *Industrial organization: Behavior and control*. Oxford University Press.

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