Flexible Environments for Hybrid Collaboration: Redesigning Virtual Work Through the Four Orders of Design
John Meluso, Susan Johnson, James Bagrow

Introduction
Since the first industrial revolution, organizations have gathered workers together in common locations in a process called agglomeration.¹ This move allowed organizations to share common energy sources, tools, and goods among their employees, as well as to centralize logistics and increase worker supervision and control.² But by the 1970s, the nature of work was evolving. Expanding use of the telephone made “telecommuting” possible, meaning people could collaborate without physically being together.³ Tasks became “increasingly ‘informed,’” turning a large proportion of corporate employees at all ranks into ‘knowledge workers’ whose tasks are computer-mediated.”⁴ The need to remain competitive drove organizations to acquire the best talent wherever those workers were located, thereby guiding collaboration toward greater “virtuality.”⁵

The COVID-19 pandemic conspicuously accelerated this transition, shifting 35 percent of U.S. workers and 80 percent of global corporate remote work policies from primarily co-located and face-to-face interactions to virtual and hybrid forms of collaboration within a few weeks.⁶ Nor has this sudden transition been temporary. Nearly two-thirds (64%) of organizations report that “remote working is a permanent change they have made due to COVID-19,” with a similar proportion (69%) reporting that at least 75 percent of their workforce works effectively when remote.⁷ Such reports are consistent with long-held self-assessments showing the same.⁸ Increasingly, individuals and organizations see the “liberating” potentials of distributed work as it grants them newfound flexibility.⁹

Simultaneously, millions of people struggle with “flexible” work arrangements. Even prior to the pandemic, information and communication technology (ICT) adoption frequently yielded unintended or “dual” consequences—⁰—the mixed effects of hybrid collaboration that increasing numbers of people now experience. For example, while some people view Slack as a flexible lifeline amidst

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⁵ Chudoba et al., “How Virtual Are We?”

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remote work isolation, others find its incessant notifications insufferable. People also report experiencing “Zoom fatigue.” Although video conferencing certainly has helped people to stay connected with loved ones and colleagues (in some cases the only time people have seen others’ faces during the pandemic), spending all day in video meetings can feel particularly exhausting, probably because of increased cognitive load, self-evaluation, sensations of intimacy, and reduced mobility. Of course, both of these examples assume that people have sufficient or consistent enough internet access to collaborate remotely in the first place—a particularly challenging reality in many rural communities and developing nations.

Numerous works demonstrate that users “appropriate new technology by adapting it to meet their needs, which may or may not match designers’ goals.” Such appropriation occurs even in the realms of relationships, the roles of others, and policies. At some level, this process is both efficient and sufficient because users “make things work” for themselves. In fact, “tailoring systems to meet user requirements may prove impossible,” according to Leonardi et al.; particularly as problems become increasingly complex and as user populations grow “so diverse as to be incompletely definable,” letting those in need appropriate designs in distinct ways that work for them may prove more effective.

That said, universal, inclusive, and feminist design advocates would argue (as we do) for the necessity of at least working to include everyone to mitigate inequity—an outcome more often borne by marginalized groups. Indeed, Buchanan points out that the principle that underlies approaches like design thinking and its growing appeal to organizations is the “quality of experience for all those served by the organization.” For this reason and others, many organization scholars call for the redesign of the work systems that affect all those who work—the systems of interdependencies between tasks, processes, knowledge, skills, and technologies that organizations require to accomplish their goals. In this case, the challenges of redesigning collaboration “are not problems of action but of reaching a new understanding of the purposes and ends”—namely, of addressing the needs of all stakeholders.

Fortunately, two bodies of work hold potential for addressing the conundrum of hybrid collaboration. The first is Buchanan’s work on the four orders of design—symbols, things, actions, and environments—which describes a trend long underway of moving beyond the design of objects or tools and into the design of interactions and environments. But for hybrid work specifically, the past 10 years also have seen a consolidation of knowledge by scholars of management, organizational communication, information


15 Leonardi et al., 471.


19 Scott and Davis, Organizations and Organizing, 21.


22 Buchanan, “Wicked Problems in Design Thinking.”


The Four Orders of Design and Their Intersections

Identifying immutable foundations of design has proven challenging, and consequently, scholars have framed its means and objectives differently over time. Some scholars approach design as a science of considering “possible worlds” and selecting from among the set of alternatives, whether for objects or organizations; others see design as making sense of chaos by distilling simplicity from complexity; others have cast design as efficient communication toward behavior modification; and some see it as a means of effecting change in the world. Of course, all of these views are accurate in different ways and contexts, regardless of their somewhat disjointed perspectives.

Part of the value of denoting the four “orders” of design is in dialectically unifying these framings. Although the names have varied in subtle ways over time, their substance remains largely the same: The first order of design involves symbols, the essence of communication. Symbols take many forms: Language, images, and behaviors all convey symbolic meanings. Classically, this order describes disciplines such as graphic design, audio, video, and communication professions. The second order is the order of things or objects, whether statuary, furnishings, vehicles, electronics, software, etc. Industrial and product design certainly pervade, although the order also comprises the work of engineers and artists of all flavors, craftsperson, and marketers, among others. The first two orders clearly overlap in that objects often serve symbolic purposes, as with a child’s favorite toy or a tote bag that advertises support for a local radio station and that potentially conveys an identity the carrier seeks to project. The third order is that of action and interaction, systems (IS), and psychology about numerous aspects of remote work—from cultural preferences for technologies to classic notions of team performance. Hence, by reviewing the past decade of literature reviews on virtual collaboration through the lens of Buchanan’s four orders of design, this article proposes that designing work systems as flexible collaborative environments increases the likelihood of producing more equitable outcomes for organizations’ stakeholders. To that end, the following sections detail the four orders of design and virtual technology implementations before describing our review methodology. We then present the thematic outcomes of our analysis, discuss them through the lens of the four orders of design, and identify their implications for the future of technologies, physical and virtual workspaces, and even organizational cultures. We find that flexible collaborative environments could leverage the benefits of varying degrees of virtuality to make work systems more satisfying for all those who interact with them.
which brings us to present notions of the design of user experiences (with technologies and other people), services, and processes. We might consider a business consultant who designs new processes (or streamlines the old). Here, too, the consultant’s new process likely involves interacting with some kind of information technology on a designed device, the relevance of which would increase if, for example, the process manipulated customized manufacturing processes or open office workspaces.

Buchanan’s fourth order comprises environments or systems. Interestingly, Buchanan further specifies that these environments are “for living, working, playing, and learning,” which underscores the unity of purpose or thought that guides a particular environment’s design. This order naturally lends itself to professions of built environments—architecture, urban planning, interior design—but also to professions of designed missions that draw more from the systems metaphor—systems engineering, organization design, and public policy, among others. As with the other orders, the fourth often integrates the first three and, likewise, can be integrated into them. For example, a public health initiative may involve the development of recognizable symbols, the construction of personal protective equipment, and the administration of vaccines, all oriented toward a unified mission of community well-being—or the initiative might serve as a symbol of worthiness for re-election—or both, depending on the “possible world” each individual inhabits.

Similarly, we can apply this logic to systems of virtual work. Before we delve into this logic, we need to explain a language for discussing some attributes of virtual work.

**Terminology of Virtual Collaboration**

Whether our teams are co-located in the same office, are distributed around the globe, or involve a hybrid mix of the two varying by the day, information and communication technologies (ICTs) play substantive roles in most present-day work designs. ICTs have significantly evolved in recent years, with the addition of team chats, blogs, wikis, and, more recently, video calling, audio processing, computer vision, and natural language processing among many others. Technologies result in differing amounts of team virtuality—“the extent and value of utilizing information and communication technologies within work teams.” Here, value refers to the richness of the informational content provided by ICTs, whether through its synchronicity or asynchronicity. For example, integrating video-conferencing into team interactions tends to result in lower team virtuality because of its communication synchronicity and relatively rich content; meanwhile, email tends toward higher asynchronicity and lower informational quality. Virtuality produces mixed results

30 The “system” metaphor makes an important contribution even as it is interchangeable with the “environment” metaphor because it allows us to move beyond a grounding in material space and into a grounding in relationships between artifacts of any kind, material or not.
for team performance, learning, adaptation, satisfaction, trust, and identity, depending on factors such as team member skills, authority structure, and how long the team has been together. Furthermore, the continual evolution of teams through varying configurations of remote work yields different experiences for different teams at different times.

IS research also examines how teams accomplish outcomes with technology by understanding the interrelated contributions of the technical artifact and the social behaviors of people. This theoretical lens, known as materiality, asserts that while users of technologies exercise some discretion over how technologies affect their work, technologies both promote and constrain certain activities, based on the properties of the designed artifact. (Here, an object shapes interaction, and perhaps interactions shape interactions.) Rice and Leonardi summarize how organizations adopt, use, and benefit from ICTs: Increased adoption may arise out of “individual (e.g., innovativeness and self-efficacy), social (e.g., influence), and institutional (e.g., top management commitment) contexts.”

Materiality may resonate with many people who have found themselves working remotely during the pandemic because specific technologies, their implementations, and social uses often shape such experiences—for better and worse. In general, a team’s or organization’s network may expand from ICT use—for example, through connections made via professional social media sites; still, information overload can dampen the benefits of this outcome. As the pandemic has made clear, the flexibility of “working from anywhere” juxtaposes challenges that may result from disruption of organizational structures, work processes, differences in geography, culture, professionalism, and interaction frequency. Readers can likely recall similar tensions in their own careers.

Such mixed experiences bring us back to Buchanan. Our designed work systems do yield outcomes of both individual and collective good; neither individuals nor organizations would hail their benefits otherwise! And yet, “if the purpose of design thinking is to create the environments within which we live [and work], the purpose is also to make possible the unity of the individual with the environments that human beings create.” Many work systems do not facilitate unity: seamless alignment between each worker’s intentions and their means of fulfilling those intentions through their work environments. Whether caused by “practical,” “intellectual,” or “emotional” dissatisfaction, workers often find that “the felt unity of an experience is broken, trust and confidence are diminished, and human satisfaction in the fulfillment of reaching a goal is lost.” Hence, much of work as we know it only partially “works.” To understand why, the remainder of this piece reviews the established knowledge on virtual collaboration through the four

35 Rice and Leonardi, 430.
orders. As our review shows, hybrid work systems need to accommodate individuals and teams alike, flexibly and simultaneously, to fully facilitate unity. And in doing so, they may also create opportunities not currently afforded to existing work systems.

**Review Methodology**

For this work, we conducted a “review of reviews,” known in the IS literature as an umbrella review or an overview of reviews, following the procedure outlined by Templier and Paré.\(^{37}\) We searched all 41 databases included in ABI/INFORM on ProQuest for reviews of accepted knowledge about virtual work. In this search, we looked for explicit review articles, meaning works that self-identified as a review or meta-analysis of virtual, hybrid, distributed, or remote aspects of work, collaboration, teams, or groups.\(^{38}\)

We screened for article quality by performing this search within the Association of Information Systems’ “basket of eight” journals (i.e., *European Journal of Information Systems, Information Systems Journal, Information Systems Research, Journal of AIS, Journal of Information Technology, Journal of MIS, Journal of Strategic Information Systems, and MIS Quarterly*), in addition to eight top management journals (i.e., *Academy of Management Review, Academy of Management Journal, Organization Science, Management Science, Organizational Behavior and Human Decision Processes, Administrative Science Quarterly, Human Resource Management Review, and Journal of Management*) and two relevant organizational psychology journals (*Journal of Applied Psychology and Small Group Research*). We also limited the search to the years 2010–2020 to ensure that our findings represented the most up-to-date knowledge from the field, while allowing time for studies of different perspectives to accrue. Collectively, these searches returned 30 unique articles. We then excluded articles that did not self-identify as reviews or meta-analyses (e.g., *Human Resource Management Review* yielded several false positives because of the journal name) or that reviewed an adjacent topic.\(^{39}\) Of the 13 studies that remained (see Table 1), 8 came from a *Human Resources Management Review* special issue on virtual teams from 2017. Finally, given our interest in the design of hybrid work arrangements, we excluded any findings from purely co-located settings.\(^{40}\)

For the final sample of 13 studies, we recorded the theme identified by the authors; associated the factors of each finding as inputs, moderators, mediators, or outputs; noted their association with individuals, leaders, teams, or organizations; and identified the relationship between factors as positively related, as negatively related, as having mixed effects, or as having no effect. Many of the inductive thematic reviews cited findings for which only one study supported the finding, so we included only findings with multiple supporting studies to ensure claim validation. For instances in

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\(^{38}\) The logical expression for this search is “noft(virtual OR hybrid OR distributed OR remote) AND noft(work OR collaboration OR teams OR groups) AND noft(review)” where “noft” means no full text.


Table 1 | The 13 Review Articles Included in the Umbrella Review

<table>
<thead>
<tr>
<th>Authors</th>
<th>Year</th>
<th>Review Title</th>
<th>Publication</th>
<th>Review Type</th>
<th>Terminology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breuer, Christina; Hüffmeier,</td>
<td>2016</td>
<td>Does trust matter more in virtual teams? A meta-analysis of trust and team</td>
<td><em>Journal of Applied Psychology</em></td>
<td>Meta-analysis</td>
<td>Virtual teams</td>
</tr>
<tr>
<td>Joachim; Hertel, Guido</td>
<td></td>
<td>team effectiveness considering virtuality and documentation as moderators</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Gibbs, Jennifer L.; Sivunen,</td>
<td>2017</td>
<td>Investigating the impacts of team type and design on virtual team processes</td>
<td><em>Human Resource Management Review</em></td>
<td>Thematic inductive</td>
<td>Virtual teams</td>
</tr>
<tr>
<td>Anu; Boyraz, Maggie</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Gilson, Lucy L.; Maynard, M.</td>
<td>2015</td>
<td>Virtual teams research: 10 years, 10 themes, and 10 opportunities</td>
<td><em>Journal of Management</em></td>
<td>Thematic inductive</td>
<td>Virtual teams</td>
</tr>
<tr>
<td>Travis; Young, Nicole C. Jones;</td>
<td></td>
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<tr>
<td>Vartiainen, Matti; Hakonen, Marko</td>
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<tr>
<td>Han, Soo Jeoung; Beyerlein,</td>
<td>2016</td>
<td>Framing the effects of multinational cultural diversity on virtual team</td>
<td><em>Small Group Research</em></td>
<td>Thematic inductive</td>
<td>Multinational virtual teams</td>
</tr>
<tr>
<td>Michael</td>
<td></td>
<td>processes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handke, Lisa; Klonek, Florian E.; Parker, Sharon K.; Kauffeld, Simone</td>
<td>2020</td>
<td>Interactive effects of team virtuality and work design on team functioning</td>
<td><em>Small Group Research</em></td>
<td>Thematic inductive</td>
<td>Virtual teams</td>
</tr>
<tr>
<td>Hoch, Julia E.; Dulebohn,</td>
<td>2017</td>
<td>Team personality composition, emergent leadership and shared leadership in</td>
<td><em>Human Resource Management Review</em></td>
<td>Thematic inductive</td>
<td>Virtual teams</td>
</tr>
<tr>
<td>James H.</td>
<td></td>
<td>virtual teams: A theoretical framework</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Kramer, William S.; Shuffler,</td>
<td>2017</td>
<td>The world is not flat: Examining the interactive multidimensionality of</td>
<td><em>Human Resource Management Review</em></td>
<td>Thematic inductive</td>
<td>Virtual teams</td>
</tr>
<tr>
<td>Marissa L.; Feitosa, Jennifer</td>
<td></td>
<td>culture and virtuality in teams</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Christina N.; Salas, Eduardo</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Mesmer-Magnus, Jessica R.;</td>
<td>2011</td>
<td>A meta-analytic investigation of virtuality and information sharing in teams</td>
<td>*Organizational Behavior and Human Decision</td>
<td>Meta-analysis</td>
<td>Virtual teams</td>
</tr>
<tr>
<td>DeChurch, Leslie A.; Jimenez-</td>
<td></td>
<td></td>
<td>Processes*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rodriguez, Miliani; Wildman;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jessica; Shuffler, Marissa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roehling, Mark</td>
<td>2017</td>
<td>The important but neglected legal context of virtual teams: Research</td>
<td><em>Human Resource Management Review</em></td>
<td>Thematic inductive</td>
<td>Virtual teams</td>
</tr>
<tr>
<td></td>
<td></td>
<td>implications and opportunities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schaubroeck, John M.; Yu,</td>
<td>2017</td>
<td>When does virtuality help or hinder teams? Core team characteristics as</td>
<td><em>Human Resource Management Review</em></td>
<td>Thematic inductive</td>
<td>Virtual teams</td>
</tr>
<tr>
<td>Andrew</td>
<td></td>
<td>contingency factors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schmidtke, James M.; Cummings,</td>
<td>2017</td>
<td>The effects of virtualness on teamwork behavioral components: The role of</td>
<td><em>Human Resource Management Review</em></td>
<td>Thematic inductive</td>
<td>Virtual teams</td>
</tr>
<tr>
<td>Anne</td>
<td></td>
<td>shared mental models</td>
<td></td>
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</tr>
</tbody>
</table>

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which the object of study was not specified, the party enacting or affected by a given practice was inferred from context. Furthermore, statements about generic “effects” were designated as having “mixed effects” on a generic “outcomes” specification. Following the compilation of these findings, we inductively coded the findings from each study, partially informed by the author-identified thematic categories. Our work shows that a significant majority of the findings involve preferences and attributes that, in Buchanan’s framework, we might classify as third order and fourth order, but the findings vary significantly within most topics.

Results: Hybrid Collaborations as Environments
Following the procedure described in the previous section, we identified a total of 243 claims made across the reviews that satisfied the specified criteria. An inductive coding process distilled these findings into 14 themes, which we gathered into 4 categories, as summarized in Table 2. The number of articles and the total number of claims are displayed for each category and theme. Of course, many of these claims are redundant because different reviews frequently refer to the same articles; hence, these quantities metaphorically represent the relative attention paid to each topic (within and across disciplines) and the extent of nuance within each category, rather than the importance of each. Also, although themes can and do apply to multiple categories, we organized the themes into personality traits, task expectations, task resources, and team interaction because this sequence parallels both the progression of a project and the categories’ demonstration of the four orders. Table 2 further describes the percentage of claims in which the factors were positively or negatively related, in which there were no effects or mixed effects, and in which a factor was identified as mediating two other factors.

The findings of these studies are too numerous to recount here in full. Instead, we briefly summarize the claims that fall within each category and theme to contextualize their subsequent consideration through the four orders.

Personality Traits and Virtuality
Projects often start by constructing teams. A review by Hoch and Dulebohn provides, to the best of our knowledge, a unique synthesis of organizational psychology literature. They describe the relationships between the “big five” personality dimensions (extraversion, agreeableness, conscientiousness, openness, and emotional stability) and leadership in virtual teams.

With respect to individuals, all five traits correlate with an increased likelihood of that person emerging as a leader, and individual leadership emergence correlates with team performance.

Table 2 | A Statistical Summary of the Claims Identified in the Review Articles

<table>
<thead>
<tr>
<th>Category</th>
<th>Inductive Theme</th>
<th># of Reviews Theme Appears in</th>
<th># of Claims</th>
<th>Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Positive</td>
</tr>
<tr>
<td>Personality Traits</td>
<td>Personality Traits</td>
<td>1</td>
<td>25</td>
<td>80.0%</td>
</tr>
<tr>
<td>Personality Traits Total</td>
<td></td>
<td>1</td>
<td>25</td>
<td>80.0%</td>
</tr>
<tr>
<td>Task Expectations</td>
<td>Job Demands</td>
<td>2</td>
<td>8</td>
<td>25.0%</td>
</tr>
<tr>
<td></td>
<td>Legal Frameworks</td>
<td>1</td>
<td>8</td>
<td>100.0%</td>
</tr>
<tr>
<td>Task Expectations Total</td>
<td></td>
<td>3</td>
<td>16</td>
<td>12.5%</td>
</tr>
<tr>
<td>Task Resources</td>
<td>Information</td>
<td>2</td>
<td>4</td>
<td>50.0%</td>
</tr>
<tr>
<td></td>
<td>Technology</td>
<td>3</td>
<td>7</td>
<td>14.3%</td>
</tr>
<tr>
<td></td>
<td>Virtuality</td>
<td>1</td>
<td>6</td>
<td>50.0%</td>
</tr>
<tr>
<td>Task Resources Total</td>
<td></td>
<td>4</td>
<td>17</td>
<td>35.3%</td>
</tr>
<tr>
<td>Team Interaction</td>
<td>Communication</td>
<td>5</td>
<td>50</td>
<td>50.0%</td>
</tr>
<tr>
<td></td>
<td>Conflict</td>
<td>1</td>
<td>2</td>
<td>50.0%</td>
</tr>
<tr>
<td></td>
<td>Culture</td>
<td>6</td>
<td>67</td>
<td>70.1%</td>
</tr>
<tr>
<td></td>
<td>Leadership</td>
<td>5</td>
<td>34</td>
<td>52.9%</td>
</tr>
<tr>
<td></td>
<td>Task Interdependence</td>
<td>1</td>
<td>7</td>
<td>71.4%</td>
</tr>
<tr>
<td></td>
<td>Team Building</td>
<td>1</td>
<td>4</td>
<td>50.0%</td>
</tr>
<tr>
<td></td>
<td>Team Cognition</td>
<td>1</td>
<td>11</td>
<td>36.4%</td>
</tr>
<tr>
<td></td>
<td>Trust</td>
<td>4</td>
<td>10</td>
<td>70.0%</td>
</tr>
<tr>
<td>Team Interaction Total</td>
<td></td>
<td>13</td>
<td>185</td>
<td>58.9%</td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td>13</td>
<td>243</td>
<td>56.4%</td>
</tr>
</tbody>
</table>

With respect to team composition, relationships become more mixed. Several qualities (i.e., conscientiousness, agreeableness, and emotional stability) are positively correlated with shared leadership and team performance. Other qualities (i.e., extraversion and openness) have mixed effects on both shared leadership and team performance. For the most part, as virtuality increases, so do both the likelihoods that leaders will emerge and that the team will share leadership. That said, in cases where the team scores highly on agreeableness, shared leadership tends to emerge more often.

In designing a team, managers might approach its formation with a unifying thought of how to pursue a goal. We can assume managers and organizations may have some control over the personality composition of their teams, contingent on other constraints—but only some control. People have unique identities
with varying degrees of each quality (if people are even reducible to the five traits), so we cannot assume that every manager (or any manager) can form “optimal” team compositions. Nevertheless, the result of forming a team is the design of a human system—an environment of interacting identities. These identities contribute unique values and interests to the system, embodied in the people we work with toward goal-attainment.

Task Expectations
Gradually, teams construct both explicit and tacit expectations. In virtual teams, these expectations can include anything from roles and responsibilities, to social norms, to government regulations. The several reviews that discuss this topic tend to describe what we might call incentives or job demands and how their limitations and subsequent rewards shape outcomes. The majority of the findings relate to teams, but the reviews also consider individual well-being and organizational outcomes.

Beginning with individuals, constraints on a person’s job (e.g., time, role ambiguity) tend to somewhat decrease functioning, but they yield mixed effects depending on the kind of constraint. For example, virtuality is more constraining with short-term projects than long-term projects. Mixed effects also exist with respect to well-being and varying amounts of virtuality. In terms of team constructs, such as task non-routineness and rewards, mixed incentives (i.e., rewards at both the individual and group levels) are positively related to individual well-being and also improve team performance. Problem-solving demands (e.g., difficulty) yield mixed results for performance, especially when they are moderated by virtuality. These demands, on average, decrease both performance and trust. Perhaps a surprising finding is that the degree to which a task is unique or non-routine can decrease trust in a team.

Legal frameworks increasingly prove relevant as teams become more global, often resulting in uncertainty for virtual teams because of the relative newness of virtual collaboration compared to legal timescales. COVID-19 brought this issue to the fore as workers who previously commuted across borders began working full time in different tax jurisdictions. National and transnational laws shape labor standards, safety, compensation, freedom from discrimination, and other work aspects. Organizations also establish “private law” that can affect workers’ rights and obligations (e.g., through contracts and adoption of international standards). Such practices raise questions about the legal status of virtual and hybrid employees and employers, depending on the borders crossed. Thus far, “countries have not significantly adapted their approach to determining the legal status of a [hybrid] worker as an employee,” resulting in “significant ambiguity.”

42 Fiol and O’Connor, “Identification in Face-to-Face, Hybrid, and Pure Virtual Teams.”
45 Handke et al., “Interactive Effects of Team Virtuality.”
46 Gilson et al., “Virtual Teams Research.”
47 Handke et al., “Interactive Effects of Team Virtuality.”
48 Roehling, “The Important but Neglected Legal Context of Virtual Teams.”
49 Ibid., 625.
We can think of incentives as objects to achieve or to avoid that shape the processes (i.e., the actions and interactions) that individuals and teams design toward goal attainment. They also can serve symbolic purposes for organizations. Likewise, legal constructs serve symbolic, objective, and procedural purposes. How effectively these objects of achievement draw in—and how effectively the objects of avoidance deter—depends on the alignment between the incentive environments of teams, and also of the individuals, organizations, and governments that construct or participate in environments both internal and external to a team.

Task Resources
Teams draw on resources to perform tasks and achieve their goals. Resources are “aspects of the job that help achieve work goals, reduce demands, or promote growth from the job demands–resources model of work design.” Although materials qualify as resources, teams also make use of information, social networks, skills, and tools.

Perhaps the most (superficially) intuitive resource in virtual work is technology. Alluding back to materiality, different technologies have different effects on both individual and team outcomes, depending on the context in which the tool is used and the user’s experience with the tool. (Though, organizations sometimes supplement experience with training to address inexperience.) ICTs are related to numerous individual-level outcomes, including some improvements (e.g., reduced social loafing, increased perceptions of leader competence, and satisfaction) and some degradations (e.g., decreased perceptions of productivity, decreased extra-role activity, and increased decision time). Again, these outcomes vary widely because many other factors moderate the effects of ICTs.

Information also plays important roles, with various effects. Having access to more information can produce both positive and negative outcomes. For example, certain kinds of information, such as feedback about processes and outcomes, tend to correlate with improved team functioning; meanwhile, other information, such as a person’s knowledge-sharing abilities, correlate with decreased social network development.

In combination, resources tell increasingly nuanced tales through concepts like materiality. The choices involved in constructing a team’s virtuality extend beyond the second order; they predicate team processes through which people exchange information in a web of exchanges that leave us with a combined virtual–material, informed environment. This web encompasses all of our genres of communication in hybrid configurations, along with the tools of knowledge work.
One major resource obviously is missing here: “The team” also serves as a resource. We consider its myriad interactions next.

Team Interaction

Teams play such important roles in current work designs that we practically take their existence for granted. Unequivocally, they are incredibly complex.\(^\text{56}\) Our review identified eight themes that naturally arise in literature on virtual team interactions: communication, conflict, culture, leadership, task interdependence, team building, team cognition, and trust. Here, we address three of the themes briefly because, in most cases, each theme carries a mix of positive and negative relationships, mediators, and moderators, as demonstrated by the relationship percentages shown in Table 2.

The research on communication primarily describes relationships that connect either individual- or team-level inputs (e.g., frequency, timeliness, virtuality, skill level) to individual- or team-level outputs (e.g., performance, trust, satisfaction, innovation, identity). These relationships are often mediated (e.g., by uniqueness, openness, privacy, temporal stability, authority, virtuality) or moderated (e.g., by virtuality, task complexity, skill) by other constructs.\(^\text{57}\) In our analysis, 50% of the claims identify positive relationships between the input and output, 32% identify negative relationships, and 18% identify nuance in how relationships are mediated.

Much of the culture-related research considers diversity based on geographic dispersion or national origin.\(^\text{58}\) Kramer et al. conduct a unique review of cultural typologies, including Hofstede’s cultural dimensions, Triandis’s cultural typology, Trompenaars’s cultural differences, high–low context cultures, and tight vs. loose cultures.\(^\text{59}\) Several studies also consider topics of subgroup formation, language barriers, and workplace harassment.\(^\text{60}\) Each of these cultures are then related to greatly varied outcomes, including more pervasive constructs (e.g., team performance) as well as more culture-related outcomes (e.g., team identification, tool preference by culture, coordination difficulty, subgroup formation, conflict). Here, 70% of the findings describe positive relationships between the input and output, 18% report negative relationships, and 8% report mixed effects. Many of the positive items describe cultural preferences for high or low tool synchronicity, compliance with the authoritative figure’s choices, and reliance on virtual tools. Collectively, these findings demonstrate that a “one size fits all” work design is unlikely to prove fruitful.

Finally, we consider trust, which is one of the most widely studied topics in virtual teams and consistently results in mixed findings.\(^\text{61}\) Initially, many of the findings seem intuitive: Team trust is positively correlated with performance, as is individual trust with increased communication. However, particular communicative behaviors reveal mixed relations to team trust, thus adding nuance,
even as qualities such as building trust early, using a positive tone, and knowledge sharing are positively related to building “swift trust” in shorter term teams.

These samples from communication, culture, and trust provide a subset of the complexity imbuing team interaction. Concurrently, they call into question the notion of a singular design because team environments—human systems of interaction—necessarily involve heterogeneous identities, incentives, and information. Next, we address the challenge of advancing toward work systems that achieve unity between their environments.

Discussion

Multiple systems of work artifacts underlie virtual collaboration. Our understanding of work systems grows more complex as we frame environments of identities, incentives, information, and others as interacting, “nested within another and another, stretching all of the way from the goods and services provided to the customer to the top of organizational leadership,” says Buchanan.65 (Appropriately, Buchanan is describing organizational culture in this quote, which itself is a socially constructed environment.) In this work, we have described hybrid collaboration as overlapping, sociotechnical, co-constructed environments that collectively form a hybrid work environment in which humans shape humans, who shape technology, that shapes humans.

Work environments cannot be static, singular constructs if we seek to achieve unity between heterogeneous stakeholders. That said, adopting “plural” designs likely would expect minorities of all kinds to assimilate into dominant norms and would not create unity either. Instead, according to Nishii, “the key to moving from a plural organization to an inclusive one is to alter the sociorelational context[, the environment] within which heterogeneous individuals interact.”66 We must strive for work systems that are flexible enough to facilitate personalization, purposefully designing in ways by which workers can “appropriate” work designs. This reorientation is a logical outgrowth of various research streams on structural flexibility, digital innovation, flexible technologies, and organization design, among others.67 Therefore, we propose that work systems designed as flexible collaborative environments are more likely to approach unity among work, worker, team, and organization.

Designing flexible environments requires more than technical acumen alone. Note that all 13 review articles appeared in management journals.68 Such reviews “highlight the need for theory and research to inform organizations in designing, structuring, and managing virtual teams.”69 This vantage point clarifies that although flexible collaborative environments likely will involve technology, managers play pivotal roles as environmental designers of tasks, team interactions, and (hopefully, more inclusive) organizational.

cultures. Novel managerial designs should consider identities, incentives, information, and their interactions as organizations pursue productivity, innovation, and talent retention. Crucially, work design processes are more likely to create unity if they involve participatory co-creation with workers instead of merely designing for them. “Imposed” work designs are likely to foster dissent, rather than the unity that can be derived from co-creation with employees. Consider how the increasing pervasiveness of “gig work” tends to achieve organizational flexibility, but it comes at the expense of workers, rather than by empowering workers to substantively co-create customized work environments that benefit everyone.

To some extent, we already see organizations trending toward “unifying” environments: Products like Slack, Microsoft Teams, and GSuite tout their abilities to streamline team processes through a central hub often located “in the cloud.” But even purpose-built platforms often fail to address objectives of unity. These largely normative platforms’ singular and plural designs evidently yield mixed results and hence less unity, thereby sustaining a need for more flexible environments.

Given our review, designers and researchers can prioritize the need to identify ways in which they can construct flexibility, using the themes we identify in Table 2 as a starting point. For example, consider the intersection of communication, virtuality, and technology. Many of today’s video technologies visually and auditorily place speakers and non-speakers in ways that prioritize extraversion and likely yield Zoom fatigue. Some research explores constructing entirely virtual three-dimensional environments as solutions, although these experiences at present are bandwidth-intensive and still buggy.

Despite its relatively low virtuality, even video communication involves numerous forms of “noise” that materially shape the symbolic meanings we glean from one another. Are there ways to use computer vision, audio processing, and natural language processing to build in additional flexibility for both co-located and remote workers? Videoconferencing software has already begun to address background noise in real time, which grants more flexibility to working parents with children at home. Meanwhile, live speech synthesis may provide transcription that facilitates greater accessibility, as well as possibilities for overcoming audio and video garbling through reduced bandwidth requirements; for inferring employee satisfaction; and for collecting data that describes work patterns as social networks. These relatively novel forms of data collection could help managers identify network connections that are beneficial to individuals and teams (as social network sites do), and perhaps new organizational structures.
On a cautionary note, we are not saying that any of these features is necessarily “better.” Materiality acknowledges trade-offs, along with potential benefits; trade-offs in this case might include automating away historically devalued actions, such as recordkeeping, increased computing needs, and privacy concerns. Nevertheless, by designing work environments for flexible interaction—and in doing so, integrating symbols, objects, and actions—we still may provide workers with the customizability they need to experiment with solutions that appeal to their unique social, technical, and legal positionalities.

To be clear, this opportunity extends beyond recreating yesterday’s work systems. Instead, designers can provide the greatest value by working in interdisciplinary ways with researchers and practitioners, managers and gig workers, to understand the underlying fundamental objectives of work and by thinking broadly about how to achieve these objectives—from creating psychologically safe and inclusive cultures to promoting innovation.⁹ Pandemic lockdowns revealed that many people actually value the opportunity to build relationships with colleagues and develop shared culture. People often find fundamental value in the depths and breadths of human connection afforded by the action of doing work with others. Incorporating the situated knowledge of individuals and collectives will prove necessary for our new work systems to stand the test of time. Even better, it may capitalize on a plethora of novel hybrid capabilities toward greater flexibility for all.

Countless possibilities remain. Reading this article may have brought to mind experiences of the reader’s own that went surprisingly poorly, or surprisingly well. Growing accustomed to the challenges of hybrid work does not innately justify its perpetuation. But with all their liberations and frustrations, pandemic-necessitated changes generated an impetus to develop prototypes of flexible environments for hybrid collaboration. Informed by the pandemic, we can proceed intentionally toward a thought of unity between heterogeneous work, workers, teams, and organizations, and toward a more satisfying future for all.

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