3

Agentic Modality

Fortunately for humanity, many ecologies are stable and munificent over time. Civilization can flourish, notwithstanding episodic disasters and disruption. Social systems evolve and human beings cooperate in purposive action. These ecologies elicit and sustain different agentic modalities, or expressions of agentic form and function. Three such configurations consistently emerge: individual persons, relational groups, and larger collectives (Bandura, 2006). All three are interconnected within agentic ecology, although, explanation of their origins and interconnection is problematic. In fact, persistent questions about the origins of agentic modality are central to human science. Scholars ask to what degree are there stable modalities of human agency, and how do such forms and functions originate, interact, and adapt? These puzzles have been deep and widespread, especially since the European Enlightenment (Giddens, 2013). During this period, scholars elevated the status of autonomous, reasoning individuals, as well as democratic institutions, and then worked to integrate these modalities with traditional forms of family and community. This clearly contrasted the premodern emphasis on patriarchal order and cultural compliance.

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Contemporary debates continue, regarding the origins and interactions of individuals, groups, and collectives. Competing answers have major implications. For example, if collective forms and functions are foundational modalities, rather than individual persons or relational groups, then collective origins take precedence. Individuals and groups will inherit many of their core characteristics from membership of cultural and social collectives. In contrast, if individual persons and their close relationships are the primitive modalities, then collectives derive from the combination or aggregation of individuals. Collectives would inherit many core characteristics from their members.

These distinctions have been major fault lines in modern thought. On the one hand, some advocate bottom-up explanations, thereby invoking methodological individualism, in which persons assemble, aggregate, or contract, into collective agentic modalities. Within theories of this kind, interpersonal comparison and negotiated consensus are frequent concerns, because they mediate a liberal approach to aggregation and combination (e.g., Arrow, 1997; Locke, 1967). On the other hand, there are those who advocate top-down explanations, thus invoking methodological collectivism, in which individuals inherit and instantiate features of the collective (e.g., Marx, 1867). Intercommunal comparison and managed consensus are now typical concerns because they mediate a cultural process of agentic devolution. Other scholars occupy the middle ground, focusing on the dynamics of relational groups, using either a sociological lens to explain how groups join into larger collectives (e.g., Simmel, 2011), or a social psychological lens to explain how group relationships shape individuals (e.g., Lewin, 1947). In almost all approaches, modern scholars accept a major role for collectives, and then debate their interaction with individuals. As March and Simon (1993, p. 13) explain, "organization members are social persons, whose knowledge, beliefs, preferences, loyalties, are all products of the social environment in which they grew up, and the environments in which they now live and work."

Agentic modalities can therefore be defined in terms of their layers of form and functional mechanisms. Notably, the hyperparameters of agentic metamodels define the same characteristics. Hence, there will be hyperparameters which specify the modalities within a metamodel of agency, including modal layers and their mechanisms of interaction, for example,

in hierarchies or networks. Moreover, hyperparameters can be immediately visible, or hidden and require discovery (Feurer & Hutter, 2019). From the "persons in context" perspective, there are both visible and hidden layers and mechanisms. Much is known, but much remains to be uncovered (Cervone, 2005). Variation is contingent on context and individual difference, and perhaps the unconscious. Sigmund Freud certainly thought so, as do many of his postmodern inheritors (Tauber, 2013). In competing theories, more is visible. Persons are conceived in terms of stable, observable traits and states. From this perspective, there are fewer hidden layers and mechanisms, and less inherent variance (e.g., McCrae & Costa, 1997). Agentic modality is more visible and predictable.

Comparable distinctions apply regarding the hyperparameters of collective modality. Some theories emphasize observable structures, routines, and norms of collectivity, with few hidden layers and mechanisms. In new institutional theory, for example, organizations exemplify the observable forms and functions of institutional fields. Isomorphism, homophily, and imprinting are then predictable, because they reflect hyperparametric transparency and stability (Scott, 2014). However, in other theories, collective modality is less transparent. There are hidden layers and mechanisms which need to be uncovered, explained, and sometimes reformed (e.g., Habermas, 1991). Thinking this way, Friedrich Engels sought to expose the "false consciousness" of capitalism (Augoustinos, 1999). Intermediate processes are possible as well, in which collective layers develop through shared action and sense-making, as iterative cycles of emergence or construction (Giddens, 1984; Weick et al., 2005). In summary, each type of agentic modality entails a debate about the hyperparameters for its fundamental layers, categories, and mechanisms. All theories of agency engage with these debates, in one way or the other.

3.1 Mediators of Agentic Modality

Whether explicitly or implicitly, therefore, theories of human agency assume patterns of modal form and function. Reflecting the problematics of modernity, most offer an explanation for the relationship between

individuals and collectives. Many posit a major role for procedural action in this regard, especially individual habit and collective routine. As William James (1890, p. 3) remarked, people can be described as "bundles of habits," implying that habit mediates personality. Leading contemporary psychologists agree (Wood & Rünger, 2016). Similarly, scholars view procedural routine as a key mediator of social collectives (Cohen, 2006; Salvato & Rerup, 2011). Indeed, at individual, group, and collective levels of modality, procedural patterns of action support the continuity of identity and organization (Albert et al., 2000). However, the origins of habit and routine remain problematic. At heart, the problem is one of mediated modality, as scholars debate the relationship between different layers of agency and their mechanisms of interaction (Latour, 2005). Many ask, does collective routine evolve bottom-up, from the aggregation of individual habit; or does procedural action originate at the collective level, and individual habit is then reflective of routine? Similarly, are habit and routine fixed in memory, as models or templates of action, and performances then instantiate the encoded procedure; or do habit and routine continually emerge as expressions of situated practice and performance (Pentland et al., 2012)?

In fact, the contextual dynamics of human psychology offers a way forward. To begin with, assume that a social ecology is relatively stable and endowed, sufficient to support patterns of recurrent action. As agents then interact, some share common goals and patterns of action. Over time, these patterns may become automatic among groups. In effect, the agents experience the same habituation process (Winter, 2013; Wood & Rünger, 2016). Each member of the group encodes the same triggers, procedures, and expectations of action. Moreover, each agent will encode similar social psychological processes, in the performance of action. They rely heavily on collective mind and memory, sensing the same signals from each other and the environment (see Cohen et al., 2014). Moreover, the process will not trigger significant individual differences. This is possible, because we assume that individual personality is inherently open and adaptive, and allows for the upregulation and downregulation of psychological processes (Nafcha et al., 2016). In the case of routine, many

personal motivations, goals, and commitments are downregulated and effectively latent. Only a limited subset of common, psychosocial processes is upregulated and active. This subset of active, upregulated processes will often include shared encodings, beliefs, goals, and competencies, while most individual differences of these kinds are downregulated (Silver et al., 2020).

This distinction is important and worth restating. In procedural patterns of action, many individual differences, such as personal values, goals, motivations, and commitments, are downregulated and latent. Whereas, shared characteristics, such as common encodings, beliefs, and competencies, are upregulated and active. In this way, shared patterns of action emerge, which are stored in individual and collective memory, and which invoke equivalent, habitual responses among groups of people, but without activating significant individual differences. As Mischel and Shoda (1998) explain, this is how cultural norms evolve, as common, recurrent psychological processes. Hence, the formation of habit and routine is neither simply bottom-up nor top-down. Rather, it is a process of related agents downregulating their individuality, while upregulating common features of sociality. Habit and routine thus coevolve, within individual and collective modalities, respectively.

Furthermore, given the downregulation of many individual differences in routine, individual persons will be less sensitive to outcome variance in routine performance, compared to more effortful, deliberate action. They are not consciously monitoring precise expectations or aspirations. Indeed, the purpose of much habit and routine is to maintain procedural control, rather than to achieve specific goals or engage in intentional action (Cohen, 2006). Although, that said, routine and habit do adapt, in response to significant contextual change, or a major shift in beliefs or goals, and more frequently, when performance fails to achieve adequate levels of control (Feldman & Pentland, 2003; Wood et al., 2005). In these situations, individual aspirations, goals, and expectations upregulate and drive adaptation. This happens naturally, when human agents—whether individual, group, or collective—are viewed as complex, open, and adaptive systems, fully situated in context.

Issues of Combination and Choice

A major consequence of this analysis is that no mechanisms of bottom-up aggregation or top-down devolution are required to explain procedural action and collective modality. Regarding collective routine, particularly, there is no need to aggregate personal motivations, values, goals, and preferences, which is what most aggregation models seek to do (see Barney & Felin, 2013). Only a common subsystem of psychosocial functioning is upregulated, and most individual differences are down-regulated. And as stated above, this naturally occurs when individuals are conceived as complex, open, adaptive systems. Different psychological subsystems may activate or not, combine or recombine, depending on the context and stimuli. At the same time, routine action is mediated by common, social-psychological mechanisms, such as social identity, collective memory, and docility. It is via these mechanisms, that collective routine emerges as a mediated pattern of action (Winter, 2013). In fact, all types of modality could activate the same pattern of action. What distinguishes them as individual habit or collective routine, is the down-regulation and upregulation of different psychosocial processes.

It is important to acknowledge, however, that not all personalities or collectives are highly organized, and not all action is habitual or routine. Even if habit serves as a scaffold for personality, and routine serves as a scaffold of collectivity, non-procedural action regularly occurs, especially when novel, complex problems arise, and agents must be creative and innovative, or when important values and interests are at stake. Automatic, procedural routine does not suffice. In these situations, individual differences often upregulate and are salient again (Madjar et al., 2011). Agents must actively seek solutions about how to think and act. To illustrate, assume that members of a collective have strong personal preferences and expectations regarding newly offered benefits, such as access to health care and education. Personal goals and preferences are likely to upregulate in this situation. Individuals will form strong personal preferences, and the collective must negotiate how to allocate benefits among its members. This will entail an effortful process of collective choice, whereby members seek to communicate, compare, and combine their diverse preferences. More often than not, any solution will require truces and trade-offs (Cyert & March, 1992). An effortful method of collective aggregation

is now required, and dilemmas of interpersonal comparison and combination quickly emerge. Ultimately, however, if this process succeeds, most members will be content, their personal differences will downregulate once again, and the outcome becomes routine. Mechanisms of routinization thereby mediate social order and organization.

In fact, this type of problem is central to social choice theory, welfare economics, and behavioral theories of organization (Arrow et al., 2010). In these fields, theories highlight the aggregation of choice, in the face of individual heterogeneity and opacity. Often, previously agreed procedures—such as voting and decision routines—allow members to reach consensus and make collective choices. Such methods enable the incomplete, but acceptable aggregation of preferences, despite contrasting interests and commitments. Scholars then debate which routine procedures should be encoded, and why (Buchanan, 2014). In practical domains, this leads to political debates about the appropriate means of collective decision-making. But importantly, most theories of this kind assume that collective modalities already exist, typically as communities and institutions.

Furthermore, once made, collective choice often becomes routine and no longer requires debate or consensus building. Indeed, as noted earlier, many natural and artificial ecologies are relatively stable and munificent over time. Communities also become accustomed to the order of things, and people value the benefits which institutional order bestows. In these contexts, many people are docile, content with procedural controls, and seek no more. Collective choice is routine, not politicized, and can be accepted with the commons (Ostrom, 1990). As a practical matter, therefore, many situations are untouched by the technical impossibility of optimal aggregation (see Arrow, 1997). Collective life proceeds fairly and effectively, without the need to debate or vote, which is good news for social cohesion and civility.

3.2 Impact of Digitalization

As preceding sections explain, artificial and human agents share numerous fundamental characteristics. Both are intelligent, goal-directed types of agent, and can be understood as complex, open, adaptive systems. Both also occur in similar patterns, as individuals, in hierarchies and

networks. These similarities mean that human and artificial agents are well suited to collaborating as augmented agents. Furthermore, just like humans, artificial agents are supervised in different ways, some more plastic and self-generative. In fact, in unsupervised forms of artificial intelligence and machine learning, modality is hidden until it emerges through processing (Shwartz-Ziv & Tishby, 2017). Some artificial systems are therefore fully emergent, using highly compositive methods (e.g., Wu et al., 2010). This already happens in virtual domains (Aydin & Perdahci, 2019; Cordeiro et al., 2016). The same will be true of digitally augmented agents. We can expect to see self-generative metamodeling more widely.

However, as the complexity of data and processing increases, so do the time and resources required. Computer scientists therefore develop techniques to reduce the processing load. One major technique is the compression of modalities, that is, reducing the distinction between layers of form and function, meaning they are easier to connect and transform (Wan et al., 2017). This entails the definition of functions, categories, and system boundaries to maximize integration and the ease of interaction. Similar techniques of modal compression and modularization are also applied in organizational settings, especially those which rely heavily on digital platforms and networks (Frenken, 2006). However, these techniques entail costs. The compression of modality often increases hidden complexity, and it then takes more effort to identify and process layers and levels. In computer science, techniques have been developed to manage these challenges, including sparse sampling and partial completion (Wang et al., 2018), plus hyperparameter pruning and tuning (Tung & Mori, 2020). The goal is to generate compressed, well-fitting metamodels, while also reducing the processing load (Choudhary et al., 2020). Resulting processes are more efficient, because they require less data and fewer steps to complete.

Persistent Limitations

By contrast, human beings are limited and constrained in this regard. Their modalities are relatively layered, distinct, and slow to adapt. Indeed, human modalities tend to be stable over time. Apart from anything else, physiological and neurological evolution are relatively glacial, and will

probably remain so, at least for the foreseeable future. It takes time for human beings to learn and adapt. Personalities and relationships also tend toward stability, and for good reasons. They anchor the self and group in community. Social and cultural adaptation are sluggish too. Collective norms, organizations, and institutions, all evolve relatively slowly, often requiring generational cycles. Therefore, human sluggishness and path dependence are likely to persist. Human modalities will be relatively layered and stable, compared to artificial agents.

In fact, some argue that moderate human sluggishness and path dependence are inherent and desirable in many contexts (Sen, 2018). These characteristics support the continuity of identity and meaning over time, for personalities, organizations, and cultures. They also elicit prosociality, because if human functioning is generally sluggish and incomplete, people must cooperate with each other to achieve shared goals. They cannot do so alone. Similarly, moderate intersubjective opacity often encourages trust and civility. When others are partially unknowable, people need to trust each other (Simon, 1990). Whereas the absence of such limits (actual or perceived) can lead to the over-activation of individual or group differences. And if people feel separately empowered and independent of others, then antisocial outcomes become more likely, including intolerance and oppression. In these situations, emboldened autonomy can lead to mistrust or worse. Hence, while human limitations are sometimes frustrating, needing each other promotes prosociality and community.

Reflecting these contrasting tendencies, dilemmas arise when human and artificial agents combine in augmented modalities. Their prior dispositions are resilient. Artificial agents tend to compress modality, thereby reducing the distinctions between layers of form and function, while human modalities tend to be layered and uncompressed. When both combine, therefore, artificial components could be highly compressed and flattened, and the human components are uncompressed and layered. For example, in massive online gaming, people compete against each other in a highly individualistic or group fashion, which evidences uncompressed human modality. At the same time, they collaborate with highly compressed artificial agents and avatars which interact and combine with ease (Yates & Kaul, 2019). The virtual world is compressed and flat, while the human players are layered and distinct, as individuals and

teams. A risk in this context is extreme modal divergence, where the human players experience strong reinforcement of layered organization and identity, even as their artificial partners further compress. Overall coordination and performance are likely to suffer.

Second, artificial agents are increasingly self-generative, while human agents are less capable in this regard. Hence, augmented modalities might emerge in which artificial components are highly self-generative, while human components are not. Online gaming is illustrative here too. Individual personalities are relatively stable and supervised over time, while artificial agents can be highly dynamic and self-generative (Castro et al., 2018). A major risk in these situations is extreme modal convergence by over-compression. For example, players may immerse themselves too deeply and become socially disengaged, lacking a clear sense of human association and control (Ferguson et al., 2020). In fact, studies suggest that addicted players do become less sensitive to others. In more extreme online situations, people may surrender to artificial supervision and forfeit autonomous self-regulation. Key aspects of their individual functioning are downregulated and latent.

Dilemmas of Agentic Modality

Novel dilemmas therefore arise for augmented modality. These dilemmas derive from different human and artificial tendencies. On the one hand, augmented modalities could be extremely divergent, by combining static human layering with dynamic artificial compression. The topography of such modality would be equivalent to a heterogeneous landscape, covered with irregular peaks and plains. Not an easy terrain to navigate, in terms of processing (Baumann et al., 2019). In such cases, metamodels would be underfitting. That is, they would admit excessive noise and variance, and thus fail accurately to distinguish potential patterns of augmented agency (Goodfellow et al., 2016). But on the other hand, augmented modalities could be extremely convergent, by allowing artificial compression to suppress human layering. This topography would be equivalent to a smooth landscape, arguably, too easy to navigate, because metamodels would be overfitting. That is, they would omit too much noise and

variance, and thus fail accurately to capture variant patterns of augmented agency. Or vice versa, augmented modalities could be extremely convergent, by allowing human layering to overwhelm and dominate modality. Now the topography would be a predictable landscape which lacks variety.

Furthermore, these effects suggest poor supervision of the entrogenous mediators discussed in the preceding chapter. Recall there are three such mediators: intelligent sensory perception, performative action generation, and contextual learning, which are critical for augmented modality. However, owing to their inherent dynamism and complexity, these mediators are difficult to supervise. They exploit rapid, intra-cyclical feedforward mechanisms, which typically elude human monitoring. They cycle quickly with high precision, and are largely inaccessible to consciousness. It is therefore difficult to involve human agents in the supervision of entrogenous mediation. Augmented modalities will easily drift toward divergence or convergence.

Ambimodality

To conceptualize this novel feature of digitally augmented modality, I import another term, "ambimodality." It comes from chemistry and refers to single processes which result in different outcome states (Yang et al., 2018). Notably, the term incorporates the prefix "ambi" once again, meaning "both." With respect to augmented agency, ambimodality refers to single processes which lead to different modal outcomes, and more specifically, processes which result in dynamic artificial compression, plus stable human layering. A system is therefore highly ambimodal when it combines both extremely compressed and uncompressed form and function. Alternatively, lowly ambimodal agents will be highly convergent, either fully compressed and dynamic in artificial terms, or fully layered and stable in human terms.

Consider the following examples. Many contemporary organizations are pursuing digital transformation. In doing so, they introduce highly compressed artificial intelligence and machine learning across the organization. However, their human employees remain uncompressed individuals and groups, layered and hierarchical. The overall result is highly

ambimodal, making the organization difficult to integrate and coordinate. People and artificial agents often struggle against each other, as humans try to maintain their social identities and commitments, in an increasingly flat and fluid, digitalized environment (Kellogg et al., 2020; Lanzolla et al., 2020). Ironically, members of the organization may be increasingly connected but feel less united. Alternatively, other organizations are becoming fully virtual and digitalized, and human actors are peripheral, perhaps contract "gig" workers. The system is highly compressed and lowly ambimodal, making the organization easier to integrate and control. However, human identities and commitments are largely expunged. In fact, studies already report these effects, albeit without labeling them as ambimodal (e.g., Kronblad, 2020).

At the same time, it must be noted that ambimodal systems are not inherently dysfunctional. Human modality, whether digitalized or not, is a consistent blending of contrasts, combining stability and change, the self and the other, the one and the many (Higgins, 2006). Indeed, moderate levels of ambimodality can be advantageous in volatile, uncertain contexts. This is because, when environments are unpredictable, variable modalities enable a wider range of potential forms and functions, thereby enhancing adaptive fitness. In this respect, moderately ambimodal agents can be more robust and adaptive (Orton & Weick, 1990). In contrast, fully non-ambimodal agents generate far fewer potentials. These systems are uniformly structured and integrated. Sometimes this is beneficial, for example, in stable, technical environments. But otherwise, non-ambimodal systems tend to be inflexible and fragile. This type of risk arises in tightly bound groups (Vespignani, 2010) and in the "iron cage" of bureaucratic institutions (Weber, 2002). A major task for augmented supervision, therefore, is to maximize ambimodal fit by combining appropriate levels of modal compression and layering.

3.3 Patterns of Ambimodality

Based on the foregoing discussion, this section summarizes and illustrates the main features of digitally augmented ambimodality, and especially systems which combine extreme forms of artificial compression and/or

human layering. To begin with, it is important to acknowledge that digital augmentation offers many potential benefits, for individuals, groups, and collectives. Augmented agents will possess unprecedented capabilities to compose and recompose new patterns of agency and action. If well supervised, ambimodality therefore increases agentic potentiality. In many task domains, significant benefits are already apparent. However, at the same time, it poses new risks. When human and artificial agents combine, their different characteristics can skew augmented modality. On the one hand, augmented agents could be overly divergent, by combining compressed artificial forms and functions, with more layered human forms and functions. On the other hand, agents could be overly convergent, fully dominated by artificial compression, or by human layering. In other words, there are risks of inappropriate, high or low ambimodality. Augmented agents of this kind will be less coherent and potentially dysfunctional. Recall the examples given above, of organizations which undergo digital transformation and either alienate or expel people in the process.

Low Ambimodality

In some augmented agents, there will be low ambimodality. The resulting system will be highly integrated and convergent. In fact, this type of augmented agent is like a closely knit group, but the relationships are internal, between human and artificial collaborators. Figure 3.1 illustrates the inner workings of such a system, assuming full digitalization and high modal compression. The figure builds on the generative metamodel of augmented agency, shown in Fig. 2.3. Shaded circles indicate digitalized processes, and unshaded circles are fully human. Adopting this approach, Fig. 3.1 shows two human agents A_3 and B_3, in the upper and lower portions of the figure respectively, each with three major phases of processing: input stimuli trigger sensory perception (SI and SP); followed by cognitive-affective processing, which leads to action generation (CA and AG); and then behavioral-performative outputs, which stimulate evaluation of performance (BP and EP), conditional on sensitivity to variance. Evaluation may subsequently trigger feedback encoding (FB), while feedforward encoding occurs intra-cyclically (FF). Both agents, A_3 and B_3, also combine in the

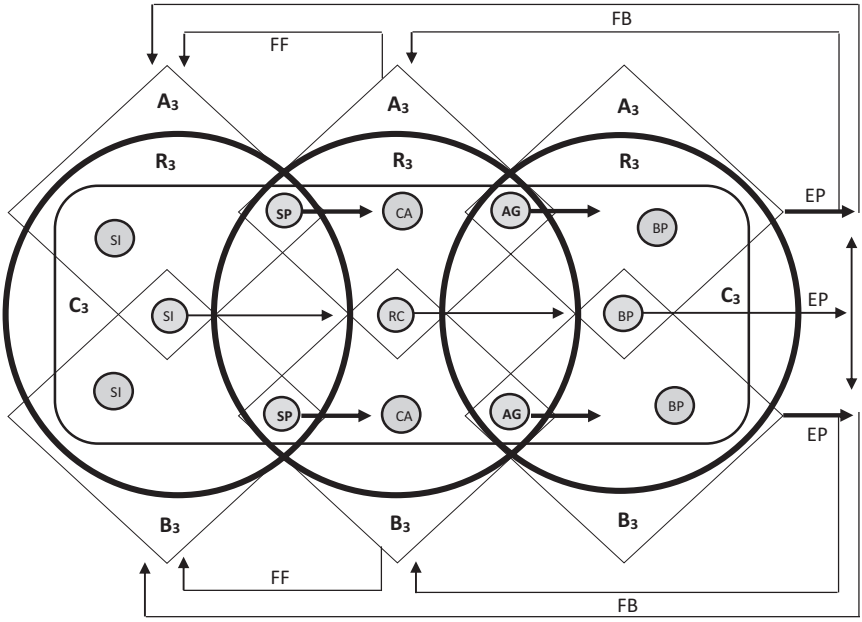

Fig. 3.1 Low agentic ambimodality

relational group R_3, which is shown by three larger, overlapping circles. Relations between phases are mediated by digitalized entrogenous mechanisms: intelligent sensory perception (SP), performative action generation (AG), and contextual learning (from FB and FF). Finally, the agents also form a collective form C_3, which spans the center of the figure.

Note that all the small circles in Fig. 3.1 are shaded. Hence, digitalized processes dominate in this scenario, and purely human processes are downregulated and latent. Human modalities are therefore compressed, shown by the lighter boundaries for human agents A_3 and B_3. Human forms and functions are less distinct. Also recall that lowly ambimodal agents are like closely knit collaborative groups. This feature is shown by the heavy boundaries for the relational group R_3 which encompasses all the digitalized processes depicted by shaded circles. Moreover, the main phases of the relationship are mediated by entrogenous mechanisms, indicated by the intersection of the large diamond shapes. In

summary, Fig. 3.1 illustrates a lowly ambimodal augmented group which is highly digitalized and compressed overall.

As noted earlier, this scenario poses significant downside risks. Particularly, agentic modalities could overcompress. The downregulation of purely human functioning could go too far. Digitalized routine would overwhelm human relating and communication. Individual distinctions are effectively dissolved. If this occurs, important features of being human may be lost, or at least suppressed in this group, including the sense of autonomous agency and identity, autobiographical narratives, as well as enduring personal commitments. This type of augmented group is therefore potentially dysfunctional because many human needs and interests will be squashed by the convergent, overcompression of modality. Low ambimodality therefore presents a major challenge for the supervision of augmented agency: how to combine human layering with artificial compression, in ways which exploit and enhance the value of both while maximizing metamodel fit?

High Ambimodality

Other augmented modalities are highly ambimodal. In these scenarios, human and artificial modalities are markedly different, in terms of their compression and dynamism. Human modalities could be hierarchical and layered, while artificial modalities are compressed and flat. Forms and functions are highly distinct and divergent. Now augmented agents are like very heterogeneous groups or families, in which members are closely related but often disagree and fail to cooperate. Figure 3.2 illustrates the inner workings of this kind of system. Once again, there are two human agents labeled A_4 and B_4, each with the same three major components: input stimuli which trigger sensory perception (SI and SP); cognitive-affective processing which leads to action generation (CA and AG); and behavioral-performative outputs, which stimulate evaluation of performance (BP and EP); which may subsequently trigger feedback encoding (FB), and feedforward encoding occurs (FF). Both agents, A_4 and B_4 also combine in the relational group R_4, which is shown by the three large oval shapes. The same entrogenous mediators are central once again, indicated by the intersection of the large

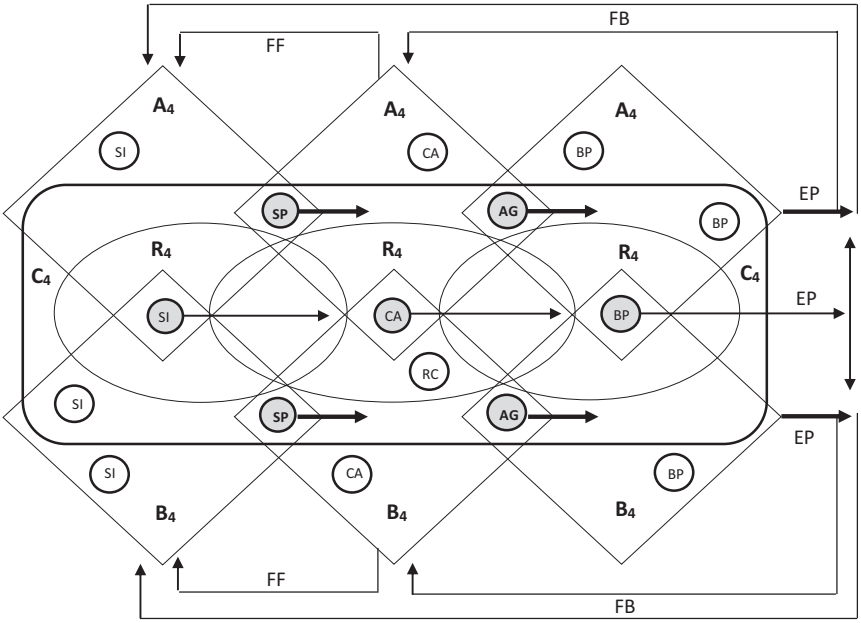

Fig. 3.2 High agentic ambimodality

diamond shapes. The agents combine in collective form C_4 which spans the center of the figure.

Digitalized processes are shaded, as before, and human are unshaded. In contrast to Fig. 3.1, however, digitalized processes do not dominate in Fig. 3.2. Human modalities are more distinct and significant. Human differences are upregulated and active. Hence, there are more unshaded circles, showing human processes, compared to the system in Fig. 3.1. Granted, the two individuals, A_4 and B_4 collaborate within relational group R_4 and collective C_4. However, individuals and groups retain greater modal distinction, compared to the system in Fig. 3.1. But in consequence, new risks appear. Human components may be highly layered, while artificial partners are highly compressed, requiring extra processing to integrate and coordinate them. At the same time, artificial agents will be highly compressed and require little effort to integrate across layers. Therefore, the combined system will exhibit different forms

and functions, between human and artificial components. Overall supervision is divergent and potentially dysfunctional. In fact, as noted above, many contemporary organizations report this type of problem. They are digitally transforming many processes and systems, but their human members remain layered and cannot easily adapt (Lanzolla et al., 2020). Organizational integration and coordination are increasingly difficult to achieve. Individual differences are active, routines are fragile, and the system is harder to control. Once again, important features of being human are at risk, but now for different reasons. The persistent layering of human modality could squander the potential benefits of digital augmentation by reinforcing limiting priors. Augmentation results in ambimodal misfit and dysfunction.

3.4 Wider Implications

Throughout the modern period, scholars have assumed stable agentic forms and functions, and especially individual, group, and collective modalities. There are obvious biological and ecological reasons for doing so. Individuals, familial groups, and populations are the key organizing modalities of mammalian life (Mayr, 2002). Many theories of economics, politics, and institutions also focus on these modal distinctions, often drawing from psychology and sociology to do so. In most of these disciplines, scholars continue to debate how collectivities relate to groups and individuals. Questions remain about bottom-up versus top-down processes, and hence between methodological individualism versus collectivism, although a growing number inhabit the middle ground, theorizing about the coevolution of agentic modalities, often highlighting the role of groups and networks (e.g., Giddens, 1984; Latour, 2005).

Framing all these efforts is the modern, post-Enlightenment elevation of autonomous, rational agency. Reasoning persons took center stage, freed from the premodern strictures of superstition and autocratic order. Against this historical backdrop, the central thesis of this chapter is that mass digitalization is transforming agentic modality yet again. By exploiting digitally augmented capabilities, humanity will compose more variable forms of agentic expression and organization. Augmented modalities

will be increasingly compositive and self-generative. It will also be possible to compare, contrast, and adapt modalities in a precise, dynamic fashion (Cavaliere et al., 2019). Apart from anything else, these developments challenge deeply held assumptions about the inherent opacity of reasons, preferences, and commitments (Sen, 1985). Thanks to digitalization, modality will be more transparent and composable, thereby mitigating the risk of agentic opacity for social organization.

However, as earlier sections of this chapter explain, if augmented agency is poorly supervised, modality could skew, either toward extremely convergent low ambimodality, making agents too homogeneous and lacking diversity, or toward extremely divergent high ambimodality, and agents would be too heterogeneous and lack coordination. In either scenario, digital augmentation impacts negatively on modality and degrades the efficacy of persons, groups, and collectives. Hence, the problematics of agentic modality expand from modern concerns about reductive individualism versus holistic collectivism, to include (a) concerns about artificial overcompression, combined with human overexpansion, or (b) the potential suppression of modal diversity and plasticity, and (c) the implications of these distortions for human identity, efficacy, and coherence.

Agentic Ambimodality

Among the top priorities for future research, therefore, is digitally augmented, agentic ambimodality. Recall the definition again. Ambimodality refers to single processes which result in different outcome states. With respect to augmented agency, it refers to the combination of dynamic artificial compression of form and function, with stable human layering and distinction, although, as previously noted, ambimodality is not fundamentally new, even if known by other names. But the property has not been explicitly conceptualized before, probably because its effects have been largely stable and moderate. Indeed, as noted earlier, moderate levels of ambimodality can be advantageous. For example, in highly volatile contexts and uncertain task domains, diverse modalities produce a wider range of agentic potentialities, which enhances adaptive fitness. Likewise, moderate ambimodality strengthens the resilience of personalities

(Cervone, 2005) and institutions (Kirman & Sethi, 2016), and most agents benefit from an optimal level of distinctiveness (Leonardelli et al., 2010). If anything, modern scholars explore how to encourage moderate ambimodality by developing loosely coupled, modular systems (Westerman et al., 2006).

Fresh challenges now arise because digital augmentation greatly amplifies these effects. Ambimodal extremes are more likely, as well as the dynamic composition of alternative agentic forms and functions. The full range of options was earlier shown in Fig. 2.6, which shows alternative combinations of human and artificial supervision in augmented agency. A major task, therefore, is the specification of hyperparameters for modal compression and layering, the goal being to determine the appropriate level of ambimodality in any context, and thereby to maximize metamodel fit. Otherwise, agents' inherent tendencies could lead to inappropriate extremes. These should be key topics of future research. Scholars can look to computer science for guidance, where similar topics are already major foci of research (Sangiovanni-Vincentelli et al., 2009). Management scholars are exploring these topics also, in the digital transformation of organizations (e.g., Lanzolla et al., 2020; Ransbotham et al., 2020). Some research how to embed values and commitments into the supervision of digital augmentation, for example, by clearly articulating the human purpose of systems design.

Problems of Aggregation

In numerous fields, theories posit routine as a key mediator of group and collective modalities. But questions remain about the origin and functioning of routine: does it emerge via bottom-up aggregation of habit, or does routine develop holistically and then devolve top-down, or perhaps both processes occur? These are central questions for behavioral and evolutionary theories of organizations and markets (Nelson & Winter, 1982; Walsh et al., 2006). Furthermore, many scholars in these fields argue that individuals' cognitive and empathic limitations—especially bounded rationality and intersubjective opacity—aggregate to collective limitations, compromises, and constraints. And hence, just like individuals,

collectives employ procedural routine in decision-making, problem-solving, and the reading of group mind (Cyert & March, 1992). But exactly how aggregation occurs in these situations also remains a contentious puzzle (see Barney & Felin, 2013; Winter, 2013). Similar questions persist in other fields. For example, in microeconomics, scholars investigate the limits of interpersonal comparison and aggregation in collective choice (Sen, 1997). In legal theory and ethics, scholars analyze how empathic limitation shapes the organization and aggregation of commitments in contractual consensus (Sen, 2009). However, aggregation is typically imputed and not yet adequately explained.

This chapter proposes a solution, by viewing human agents as complex, open, and adaptive systems, which respond to variable contexts. From this perspective, humans naturally experience the downregulation of individual differences, in the recurrent, predictable pursuit of common goals. In parallel, they experience the upregulation of collective characteristics including social norms and control procedures. In this way, it is possible to explain the origin and functioning of individual habit and collective routine, without aggregating full personalities, personal preferences, beliefs, goals, and motivations. A common subset of mediating mechanisms does most of the work (Brinol & DeMarree, 2012). And to repeat, no special process of bottom-up aggregation or top-down devolution is required. Rather, many individual differences are downregulated and latent, while common characteristics are upregulated and active. Thus, habit and routine coevolve in procedural action.

These processes warrant deeper investigation, partly because habit and routine are prime targets for digital augmentation, but also because digital augmentation implies more dynamic processes of habit and routine (Bandura, 2007; Davis, 2015). Procedures will need to adapt and recompose, in a dynamic fashion, and adjust levels of modal compression and layering. The variable upregulation and downregulation of cognitive-affective processes will be a key to these dynamics. In these respects, habituation and routinization will require more deliberate supervision. Recent investigations into the adaptation of habit and routine offer relevant insight (Winter et al., 2012). Part of the solution will lie in identifying and managing the core components of any procedural action, and then upregulating or downregulating other factors, depending on the

situation and context, to maximize metamodel fit. Digitally augmented processes will undoubtedly assist (see Murray et al., 2020). However, many questions remain unanswered.

Implications for Institutions

This analysis of routine has additional implications for social and economic institutions. For example, markets and businesses are supported by routines of production, consumption, and transaction; political institutions by routines of representation, deliberation, and decision-making; and legal institutions rely on routines of examination, judgment, and sanction. However, as this chapter explains, collective augmented agents could skew toward extreme divergence or convergence. If artificial and human components overly diverge, collectives will be internally conflicted and lack coherence. Whereas if they overly converge, they could be overdetermined by artificial agents, or dominated by inflexible human hierarchy and priors. In the meantime, social networks and virtual power are growing rapidly, but governance and trust are lagging. We see these effects already, for example, where digitalization is destabilizing the administration of politics and justice (Hasselberger, 2019; Zuboff, 2019).

In a highly augmented world, therefore, historic sources of collective coherence and consistency—such as negotiated truces, voting procedures, and routine docility—may be less effective, at least in the digitally augmented world. More will be known, transparent, and communicable, reducing the need for truces, voting, and docility. Entrogenous mediators will play a critical role here. New forms of intelligent sensory perception, performative action generation, and contextual learning, will mediate greater transparency and dynamism. Augmented agents will compose and recompose by design, rather than by imitation and other traditional means. In this respect, they will be generative and near composability, not only adaptive and near decomposability (see Simon, 1996). This contrasts prior assumptions that collective agency and choice emerge gradually, often through iterative processes of incomplete comparison and negotiation.

Viewed positively, these changes will support more agile organizations and institutions. On the downside, however, augmented collectives could over-compress and squash valued features of human experience. Alternatively, human and artificial agents might diverge and conflict, even as they collaborate more closely. In contrast, for most of human history, agentic modalities have been viewed as layered, stable forms. During premodernity, the dominant layers were communal and patriarchal, whereas, in the modern period, the most important modal layers are individual persons and social collectives. Digital augmentation problematizes these assumptions. Old stabilities and constraints are relaxing. Newer, compositive methods are now feasible, leveraging highly digitalized capabilities and networks. At the same time, fixed modal layers are giving way to more hybrid, self-generative forms. The universe of agentic modality is becoming more pluralistic and this trend is likely to accelerate. It offers genuine promise but also brings new risks. Effective supervision will be critical.

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