

# The New Ecolinguistics: Learning as Linguaging with Digital Technologies

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**Abstract** The new ecolinguistics treats language as a part of human action. *Linguaging*, the basis for language development, co-constitutes technologically endowed environments. The result, we argue, can enhance both second language learning and aspects of human agency. Using historical and current research, we stress skillful action and, given a special stance, how expertise is generated by drawing on languages while engaging in a range of practices. A combination of linguaging, statistical learning and skillful action therefore enables technology to sustain a vast range of coordinated activities. Accordingly, we advocate for the design of technology-rich environments where people change themselves by drawing on second languages to gain skills and expertise as they use new modes of action, coordination and collaboration.

**Keywords** ecolinguistics, linguaging, translanguaging, distributed language, distributed cognition, second language learning, cognitive ethnography, design-based research

## 1 Introduction

An ecological perspective traces cognition to public events. Where language informs human action, it draws on powers arising as technologies, and ecologies co-evolve with social activity and human agency. Like Haeckel (1866), we trace *ecologies* to “interrelations between organisms and their living and nonliving surroundings—including organisms of the same and of other species” (as cited in Fill & Penz, 2017, p. 1). In relating materiality with the world, humans use social and physical constraints which, given linguistic usage, allow verbal description and control. By treating usage

as a virtual technology, we self-fabricate as persons who manage acting, attending, talking and perceiving. Whether using an axe, pen or supercomputer, we rely on skillful action. In all cases, bodily prompts influence how we attend to verbal, semantic and connotational aspects of what is said, meant and done. Material engagement thus links technology, the virtual and a history of talking. Language and digitality shape activity, norms, expertise and, thus, experience of both selves and other people. In this new ecolinguistics, practices merge three elements: human activity, material engagement and use of actual and virtual (digital) constraints (e.g., verbal patterns, alphabets, programs and linguistic usage) (Cowley, 2022 & 2024).

Language and action are part of social practices. As in the work of Li (2017), who was inspired by Chairman Mao Zedong, we focus on the interdependency of theory and practice. The basis of any theory is practice, which, in turn, generates theory that can serve practice. In the new ecolinguistics, therefore, we aim to develop theories of practice alongside practical theories. Drawing on ethnography and practice theory, a language practitioner can design learning environments to encourage and facilitate change. In this setting, learners draw on interacting bodies, culture and environmental systems to gain skills and expertise. Thus, as for Charles Darwin, language is seen as half natural and half artificial. Yet, underplaying bodies, linguists tend to highlight *phenomena* that they theorise as signs, forms, utterances, sentences, texts, discourse, etc. All too often, a mind or brain is assumed to represent linguistic “forms” that are, it is alleged, processed, produced, acquired, and used. From an ecological perspective, such theories mistakenly grant pre-theoretical existence to language. In fact, as Schmid (2020) argues, like any technology, usage relies on fictions (and beliefs). It allows living agents to

incorporate cultural powers that condition how we perceive and act as persons who draw on artifacts, institutions and languages. Ontogeny usage prompts infant bodies to develop linguistic powers as they develop actional skills. In tracing languageing to the evolution of ontogeny, like many others, we take a constructivist view: Human infant individuates as a person by engaging with other people while using languages, observations, technologies and changing environments. In terms of the new ecolinguistics, skills and expertise arise as living embodiment prompts us to gain skills and expertise as we engage in practices (Cowley, 2022 & 2024).

People use linguistic, technological and other resources in living, thinking, acting and speaking. They engage in *languageing* (Cowley, 2019) or, in Love's terms, "activities involving language: speaking, hearing (listening), writing, reading, 'signing' and interpreting sign language. [...] activities that can be united by a specific superordinate verb" (Love, 2017, p. 115). Languageing is bodily and, in literate communities, appears in other forms as eyes, hands and brains coordinate what we know of usage with visible signs, documents and screen-based material. While verbal fictions matter, languageing arises as, prompted by circumstances, people act as members of communities. First-order bodily activity is experienced within an enlanguaged world of functional and rule-based, or second-order, constraints. Rather than rely on alphabet-related units, we draw on a history of interactions between a language and its environment (Cowley, 2021; Haugen, 1972). As Steffensen and Fill (2014) emphasize, this classic ecolinguistic view sustains four diverging ecologies. First, a *symbolic ecology* enables people to talk, think and model the world as they draw on surroundings. We act in place-time and, as a multilingual species, merge linguistic, cultural and technical traditions. In a *cognitive ecology*, bodily dynamics attune people who attend, speak, feel, think and act. The resulting cooperation alters ecosystems (Newgarden et al., 2015). Like software, linguistic usage links practices to social conventions, artifacts and cultural norms. People inhabit a constructed here-and-now as languageing arises in a *local ecology* (for Fill and Steffensen, a "natural" ecology). Finally, technology and languageing use a *sociocultural ecology* or what van Lier (2004) calls social, physical and cultural affordances. Van Lier connects these to Halliday's social semiotics by tracing meaning potential (affordances) to the realization of abstract choices. Thus, in the course of coordinated activity, patterns bring coherence to practices like cooking, participation in traditional rites, or classroom learning. While we value such analytic distinctions, the new ecological perspective places practices in an enlanguaged world. Thus, living bodies draw on languageing and technology as practices nudge them to skills that enable, among other things, language learning. In this ecological view, language learners are whole persons;

they reduce to neither brains nor social actors who are separable from what happens.

## 2 A Historical Perspective

Charles Saunders Peirce and William James both appealed to evolution to unite the natural and the artificial. For Peirce, construction of experience uses semiosis and the ontology of nature; for James, we rely on pure experience and, thus, the pre-reflective (what is felt but not reportable). The view is grounded on American naturalist tradition or *strong* views of embodied cognition. While many take a *weak* view that treats cognition as embrained, embodied, embedded and extended, we prefer a strong view that prioritises meaning and values. Like James Gibson, we trace perception to bodily use of physical, relational and socially derived affordances. In an enlanguaged world, organism-environment systems self-construct as they engage with, above all, other living beings. Humans need no mental representations (e.g., of constructions or lexical items) because, by engaging in practices they become persons who use skills to entrench patterns of usage (Cowley, 2017). We adopt the main methodological moves (Chemero, 2011) of radical embodied cognitive science: (1) All capacities derive from a history of environment-organism interactions (as in system dynamic models); (2) these are to be explained without appeal to representation or linear causal relations. In applying such ideas to language, therefore, Hodges (2009) traces human dialogue to values realizing, Port (2010) shows that phonology is social and talk-rich in nonverbal meaning, and Järvillehto (2009) demonstrates the anticipative nature of reading. However, strong embodiment can also use rich distributed, dialogical and enactivist investigation of the roots of rich vocal and bodily experience. Briefly, this allows a history of brain re-use (Anderson, 2010) to sustain a symbiosis of activity, wordings and practical action. Far from relying wholly on using wordings as types, in Fuchs' (2017) terms, brains prompt people to *resonate* with events as repetition varies in ways that are conditioned by constraints. Wordings are embedded and multiscale activity which unites cognitive, local and sociocultural timescales.

Human agency is inextricable from socially organized systems. Although brains enable action and perception, as Turing saw, resources beyond the body extend intelligence (Wells, 2006). Thus, computation augments human powers, changes the world and, in time, how we construct ourselves. In the 1980s, Hutchins (1995) applied such a view, first, to navigation by Pacific islanders and, later, its counterpart in the U.S. Navy. Using cognitive ethnography, he shows how *culturally distributed systems* unite technologies, beliefs, language and practices. Having traced their embedding in action,

Hutchins (2014) came to emphasize how practices rely on the norms of *cognitive ecosystems*. In the case of navigation, networks of sailors use technology alongside how individual observations bear on usage that invokes *abstracta* such as constellations; in getting from A to B, beliefs about the stars co-function with teamwork, techniques, and technology. Cognitive ecosystems grant expertise that, at times, occurs without “*thinking*.” In one of Hutchins’ (2014) examples, people see a queue *as* a queue (by differentiating between queues/non-queues). In an enlanguaged world, *seeing* suffices to bind the sociocultural (e.g., how you get tickets), the experienced (attitudes to lining up) and the micro/pico-dynamics of attending (e.g., looking *there*). Nothing need be said because rapid bodily change (or sensibility) is prompted by microcognition. In his master’s dissertation, Blair (2003) applies such ideas to how language (or “usage”) draws on pico-scale bodily dynamics. People respond *as* they perceive and sense the orienting of others. The move has led to further investigation of how microcognition is embedded in verbal construal and, at once, strengthened the challenge to traditions that reduce the domain of linguistics to utterances, discourses, or linguistic knowledge. This distributed perspective on cognition and language eventually led some to endorse radical embodiment (Steffensen & Cowley, 2021). As a result, a traditional focus on discourse and structure is replaced by a new ecolinguistic view of how coordinative activity is integrated with wordings and, thus, how practices are extended by technology.

Nigel Love’s view of languaging applies to all uses of what people may call “words” (e.g., thinking, shouting, singing, dreaming). As human agents re-echo patterns, they draw on usage both by perceiving utterances as utterances of something and by treating alphanumeric patterns as “words.” Of course, all such doings/perceivings use coordinated bodily activity. Like scenery outside a train window, wordings are often background aspects of hearing or thinking. Yet, at times, they become objects of attention or, in Cowley’s (2011) terms, we make use of a language stance. Over times, the results grant us skills in concatenating articulatory gestures, using them ostensibly, asking questions and, indeed, asserting and alluding to many kinds of belief. By entrenching such activity, skills inform expertise and, thus, both linguistic and practical action. Thus, wordings, and usage, take on sense that transcends behavior. Even if based in articulatory history (and skills in “repeating”), languaging becomes epistemic (as wordings index aspects of coordinative activity). Hence, whether in saying things, thinking, or looking at a phone, practices bring knowing to activity. This even applies in, say, glancing at an advertisement—even if, of course, one can also treat it phenomenally later by focusing on details or, perhaps, adopting a phrasing or message.

Hellermann et al. (2017), and Zheng et al. (2017a)

often stress how languaging draws on emplacement. By contrast, Cui et al. (2023) highlight narrative and zoom screensharing where attending favours epistemically-laden action. In this work, attending brings the verbal to the fore: As parties are exposed to wordings (i.e. aspects of ambient energy/visible arrays), they make more or less extensive use of a language stance. Activity with material entities sets off neural resonance and attending to what can be repeated—usage does not reduce to pattern. The approach challenges sign-theories or what some call *orthodox linguistics*.

- In contrast to using a fixed code (or alphabetic system), we perceive talk and documents aspectually (Wittgenstein, 1958). Hence entities of usage (Schmid, 2020) reduce to neither signs nor marks.

- Language does not rely on transmission—communication is not to be seen as telementation or in terms of a conduit metaphor (Reddy, 1979).

- While functional, languaging is vocalizing/hearing, writing, looking, imagining, etc.: Its bodily basis reduces to neither speech nor writing (these evoke second-order abstracta) (Love, 2004).

- To reify verbal entities is to adopt the language myth (Harris, 1981) or take a code view of language (Kravchenko, 2007; Love, 2004).

- Microcognition enables bodies to make judgments and identify relevance as persons (or languagers) draw on languaging to act and observe (Kravchenko, 2011).

- People are dialogical (Bakhtin, 1982) to think otherwise is written language bias. Appeal to atomic units (or signifiées) blinds us to the other orientation of language.

- Understanding is fundamental (Cowley, 2019; Mulcaster, 1582); focus on the said or written merely echoes the speaker’s bias of philology (Andresen, 2013).

- The brain’s role in language is resonant (Fuchs, 2017)—bodies act and set off perceiving that serves as the basis for later brain re-use (Anderson, 2010).

- Not only is language action (Borchmann, 2019) but, in pre-historical times (e.g., 5,000, or 200,000 years ago), action must have dominated coordinative activity.

Languaging arises as we attend to events, people and things. Yet, we can also close our eyes, sit still, and simulate speaking. Covert languaging is possible because, while based on coordinative activity, repetition of wording-types evokes sensibility and meaning. Languaging arises on perceiving events (or neurally simulated events) with an aspect that hints at histories of usage. People develop what Lisina (2009) calls *communicative agency* by listening, reading, imagining and speaking. They use communicating to individuate as unique characters (who also use practical and linguistic resources). Accordingly, we each develop personal ways

of languageing or, by definition, *activity in which wordings play a part* (Cowley, 2014). As with cognition— and other biological processes—stable ways of acting co-occur with a flow of microcognitive activity: Patterns appear as people speak, listen, sign and use technologies. Like computing, languageing links cultural control systems (i.e. alphabets, hardware) with normative use of coordinative activity. While the sense of languageing has become increasingly consolidated in the last 50 years, its usage reaches back to the 1500s (Cowley, 2019). On the one hand, languageing is now used to emphasize its transcendental effects (Seiberth, 2021), the role of particulars (Becker, 1991), how we make up meaning (Swain, 2006), sociocultural uniqueness (Juffermans, 2015). On the other hand, all of these factors reflect on biocognitive roots (Kravchenko, 2007) that enable creative ways of harmonizing how practices unfold (Zheng et al., 2019) as wordings are integrated with coordinative activity. As action that includes (but does not reduce to) communication, languageing is multiscaled: Far from using an “inner” faculty, its coordinative basis in bodily activity draws on an ancient principle of neural re-use (Anderson, 2010). Since the “same” wording-types have many applications, brains enable remembering, mixing and, above all, forgetting. Statistical learning brings languageing to acting and attending and, in other scales, anchors wordings and skillful action within cognitive ecologies.

### 3 Critical Issues and Topics

As languageing augments perception, humans draw on observations that can inform attending, action and understanding. Further, given how we use communicative agency as we individuate, we also adapt our skills to networks and groups as, using organized practices (Ames, 2011), we gain expertise. Since languageing reduces to neither structures nor patterns of interaction, our acting (and perceiving) entangles the natural with the cultural in an enlanguaged world. For Hutchins (2014), therefore, all human cognition is distributed. The new ecolinguistics extends the perspective to practically oriented outcomes (Cowley, 2024) that apply in education and, indeed, in working for the future of evolution (Steffensen & Cowley, 2021). The aspiration is to build both theories of practice (our focus in Section 4) and practical theories (as described in Section 5).

Languageing is distributed in space, across artifacts and links the material with the virtual. It sustains both intrinsic and extrinsic remembering as we draw on (or simulate) perception in ways that evoke usage (and, increasingly, use programs). The results prompt us to individuate in ways that set off (measurable) behavioral change. Its statistical base uses entrenching (viz. results of *our own* actions) that, through wordings, tap into a community’s expertise (Cowley, 2011 & 2023). We adopt

reflexive ways of speaking, undertake precise repetition (comparing utterances of “one” as /wɒn/ with /wʌn/) and, above all, come to believe in *abstracta* (e.g., things, words, being a good person). In enlanguaged worlds, we rely on the *unsaid* and, in many societies, what is written (and appears in other media). Since skilled action and expertise shape what it is to be a person, neural resonances enable ways of acting and perspectives that transform our agency. Humans make creative use of re-voicing what others first learned. For example, Piirainen-Marsh and Tainio (2009) show how recurrent use of prosodic patterning aids co-players in game-play and, in so doing, helps them co-construct enjoyment of learning. Cui et al. (2023) show how a deemed failing participation due to (self-confessed) poor English skills led a person to become a skillful learner, contributor, mediator and leader through translanguaging. Briefly, they became able to help the team use a digital narrative to solve an environmental degradation problem common to all.

As applied beyond the early years, the new ecolinguistics thus faces two main research questions about the rise of linguistic skills and expertise.

- In enlanguaged worlds, how do bodies (including brains), concerted activity, linguistic usage (or second-order language) and artifacts contribute to developing as persons?
- How can one link the new ecolinguistics with e-technologies to favor skillful action that draws on a second language (including expertise in how *wordings* are applied)?

Since second language learners are already immersed in languageing or translanguaging (Zheng, 2012), they draw on their extant experience of enlanguaged worlds. They bring individual skills, beliefs and powers based on habits and culture to learning. They draw, very largely, on experience, familiarity (often with technology) and, of course, their own individuated talents, aspirations and abilities to attend to what they perceive as within social and physical reach.

### 4 Current Contributions

Many accept that language is distributed across places and in time. In sociolinguistics, sociopolitical implications are emphasized by Pennycook (2017). Equally, distribution is central to Li’s (2017) view of translanguaging. Ellis (2019) calls language the “quintessence of distributed cognition” and Hellermann et al. (2019) call teaching language in natural surroundings “distributed language in the wild” and, by so doing, link Conversation Analysis with usage-based linguistics. Accordingly, one can also link complex and dynamical systems theory with the social and bodily interdependencies of sociocultural theory. In separating how we actualize practices from utterance events (which

use types), we can also distinguish conventionalization from entrenching (Schmid, 2020). Thus, while the former characterises the doings of groups, the latter centres on persons who make (increasingly) conventional use of wordings to show what others see as expertise. While Ellis (2019) would regard our “strong” view of embodiment as extreme, we can challenge his reliance on representations on methodological grounds. Much is gained from treating languaging as—not evidence of the hidden—but as disclosed by practices, embodiment, usage and experience. Indeed, by allowing it to be both microcognitive and verbal, one avoids the narrow view that what is public is repeatable. Instead, research can build on methods as diverse as design-based models and cognitive ethnography by treating languaging as part of what we feel, think and do (together). One can address how, as observers, humans bring personal pasts to speaking and understanding (Kravchenko, 2011). One tracks how dialogicality serves to appropriate other people’s knowing (Dufva, 2013) act recursively (Maturana, 1988) and, in time, extend the sensorium (Morris, 1938). By revoicing what others have said, humans gain subjective powers: We perform as an individual in collective or organized units (e.g., a team), adopt roles (e.g., as the baby) and alter identities. For example, game plays of Zheng et al. (2009), Zheng (2012), and Zheng et al. (2017b) show how, in performance in an additional language, learners *also* identify with home language culture. In our enlanguaged worlds we draw on distributed cognitive systems in ways that are digitally, culturally and materially informed. Thus, humans individuate or, in Chinese terms, learning to be human. Even as an adult, one can draw languaging to savor the resources of many enlanguaged worlds.

Living systems self-design in evolutionary time and, of course, in other scales. Historically, this leads to a constructivism built on work by Immanuel Kant, Jean Piaget, Gregory Bateson and Humberto Maturana. For philosophical reasons, usage-based approaches often prefer a mechanistic view where, as associated with classroom use of corpus technology (Boulton & Cobb, 2017) construction reduces to dynamic, probabilistic, interactive, and patterned behaviour. By contrast, the new ecolinguistics unites with biocognitive and Russian tradition. In second language studies, the latter is familiar from Lantolf’s use (2000) of Vygotsky and the elder Leont’ev to argue that human agency is socially derived; however, weight often falls on the intra-mental (or representational) domain. While Hellermann et al. (2019) treat second language development as “situated in, and in some cases demonstrably interwoven with specific material and social contexts” (p. 193), they also separate it from how practices vary in enlanguaged worlds. In Russian tradition, by contrast, persons *incorporate* cultural values by using communicative agency (Lisina, 2009). They depend on, not the intra-mental, but ways

in which one can regulate action (Leont’ev, 2013). While Blair (2003) traces this to microcognition, Ames (2011) points to Confucian values like compassionate person/conduct, optimal appropriateness, achieving propriety, wisdom, and making good on one’s word. As a result, a person’s languaging can shape, regulate and nourish action in ways that draw on, and enable, individuation. Hence, usage is not to be explained by practices but, rather, arises as constraining what we do, ways of saying things and, together with microcognition, expert judgements. Communicative agency is central to how participating in practices informs ways of speaking and acting that bring individual growth. Languaging brings pasts to what is present in the present—life history (of self and others) is the basis for future change. While this is transparent in music and arts, the same applies to how we individuate and make judgements in using technologies. In pursuing communicative agency in World of Warcraft (WoW), Newgarden and Zheng (2016) focus on how expertise arises. They use multimodal analysis and visualization to track pivotal time-scale changes arising in a semester of WoW informed English language classes. Players increasingly developed skilled linguistic action by coordinating recurrent WoW gameplay activities (questing, planning moves, traveling, learning a skill). The results changed their agency as a result of attuning to microcognition, developing expertise and, at once, growing in confidence.

Since human agency unfolds in enlanguaged worlds, the term has (at least) two overlapping senses. First, humans rely on distributed systems and, simply, how usage informs history and culture. Yet, given emplacement, experience of entrenching enables more personal agency. Just as with WoW, linguistic and other ways of using resources bring increasing coherence to personal and expert agency. Judgements are enhanced by using the language stance to attend to aspects of usage as microcognitive nudges prompt one to change how one acts or incorporate wordings into activity. Much of the time, one speaks and acts spontaneously—or in an automatic way. Further, this also applies to how we hear as observers and, in so doing, prompt ourselves (and others) to judgements. In meeting Chappelle and Sauro’s (2017) call to strengthen research on language learning and technology, we therefore emphasise the non-spontaneous. Since much expertise uses observation-based powers, in Section 6, we focus attention on the interdependency between statistically-based learning, skillful action, and, crucially, learning by observing. Strikingly, this resonates with Turing’s view of how computation extends human powers (Wells, 2006). He was right to see it as part of practices because, when incorporated with languaging, it too extends the sensorium. Thus, e-technologies alter social agency in ways we have hardly begun to understand. While much is known about interfaces and how people manage input (for example),

many bigger questions remain unasked. For example, little is known about how a learner comes to individuate or how text-prompts impact on expertise. There may be parallels with how understanding of language (however limited) informs practices or, indeed, allows a technology to shape one's agency (as one seeks to optimize how resources are used). Reinhardt and Sykes (2012) recommend an ostensive learning mechanism that offers just-in-time scaffolding and feedback rather like a power jump in *Super Mario Brothers* (a vernacular game). Ways of encouraging willful entrenchment of this kind can be embedded in most distributed learning systems.

Much is gained from the design of distributed learning systems (Cui et al., 2021; Zheng et al., 2018) as language teaching tools. For the second language learner, their transformative power arises, quite simply, because linguistic action *is* technological practice. Accordingly, the design can aid a learner in using entrenching to automatize valued behaviour, gain expectations, skills and task specific expertise. In one of Zheng et al.'s (2018) design-based projects, for example, a mobile-enabled place-based game, *Guardians of the Mo'o*, linked locations through an iPad App that served to generate an interactive narrative. On the University of Hawai'i campus, student groups used GPS maps and virtual artifacts to follow the storyline while moving on the campus. Not only did they use extant automatisms and modes of skillful action, they also linked prompts to distributed agency as they construed the plot, identified problems, coordinated perspectives and made decisions. Hence, parties combined willful action (in a second language) with how emplaced use of mobile technology brought a narrative to life. They learned from gardeners, tea house staff, librarians and office staff. Not only did they practice framing questions but, strikingly, they gained confidence in using the tone. In one case, they used the routing of translating Hawaiian language into English. In seeking to establish the location of a mountain, they varied utterings of "Where is East Mountain" while showing pictures on an iPad. Having had little success, they asked a member of the community: He said "cause I know, west is that way, east should be that way." As he did so, he overruled the wordings by pointing, first, one way and, then, another. The students realized that the mountain could be identified by looking. There was no need to attend to what was said (or, in this case, to know its name). Their agency within a distributed system at once, encouraged them to seek relevant information as *persons*. In Section 6, therefore, we stress that agency uses more than statistical learning and entrenched routines. It also arises, gaining a new sense of how, in this emplaced moment directed by the interactive narrative accessed from their iPad, surroundings bind activity, experience and languageing.

## 5 Main Research Methods

The four ecologies can be united by eschewing mental representations. Since there is no reason to posit that people (or brains) represent "usage," we turn to how passive (or statistical) learning, skillful action, observing and entrenching ensure that, in time, expertise emerges. We stress multi-scalarity or, in other terms, how what one knows informs happenings that, at times, prompt microcognitive decisions based on, above all, tacit and explicit memory. While based on exposure, skillful action and entrenching, in distributed systems, these arise as brains resonate, people act and, at times, orient to wordings, people and/or the physical setting. Learning by doing shifts attention to observation, negotiation, noticing, repetition and feeling (Ziegler, 2016). As in all mammals, this leads to skill automatization and ways of picking up on, and attending to, how performance can be continued. However, in emplaced activity, usage takes on a specific sense. It can link observing to skillful action and, thus, how the familiar bears on concepts like linguistic form, function and meaning. The model is sketched in Figure 1.

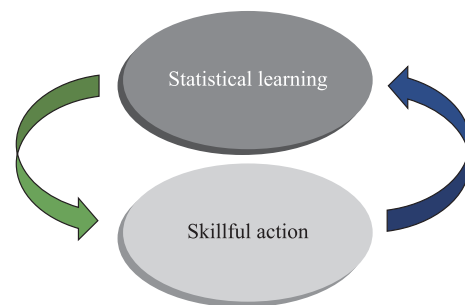


Figure 1 Multi-Scalar Language Learning Environment

The model fits work in Second Language Acquisition (SLA) that invokes complex systems, dynamical systems and learning about usage. However, in the new ecolinguistic view, we stress, not socially shared "knowledge," but how actional skills arise in practices. Skillful action develops as people co-perform and, at times, use wordings in expert ways. Indeed, this is why entrenchment—or, as we have suggested, entrenching—is so important: Over time, its functions can unite what one repeatedly attends to and what happens. As a result, people develop microcognitive prompts that bring skills in judging how others perceive them and, of course, what parties are doing and saying. Cognitive ethnography can therefore be used to reach beyond the two layers of Figure 1. Methodologically, one can pursue both recurrent regularities (as in CA) and, at once, how a history of entrenching allows a person to *actualize* practices (i. e., how the flow is judged and understood). In the microcognitive domain, this sets off subtle pico-dynamics as voices resonate and bodies move. In an emplaced

setting, these effects can prompt face-saving moves, problem-finding actions and spontaneous avoidance of errors. Thus cognitive ethnography can extend multimodal analysis by exploring how microcognition applies in environments (Fester-Seeger, in press). Equally, one can use virtual reality technology in exploring wider learning settings (Cui et al., 2021; Zheng et al., 2017b). Further, one can pursue scales of longitudinal change by coding how parties realize values (Newgarden & Zheng, 2016). Indeed, the scales can be combined with dynamical systems tools (as in cognitive event analysis, see Zheng et al., 2018), experiments, and agent-based modelling. Finally, methods can encompass symbolic, local, socio-cultural or cognitive ecologies. Yet the core remains ethnographic: Action brings experience to practices that are public, observed and, thus, reportable.

Design-based research (e.g., Brown, 1992) is just as important. Just as traditional research aimed at linking teaching and learning with the use of e-technology (Barab & Squire, 2004), newer principles apply to both computer-assisted language learning (Rodríguez, 2017) and technology-infused distributed cognitive systems (Cui et al., 2021). Thus, Zheng (2012) turn to design for caring while learning and, thus, how learners connect up statistical learning, entrenching and more sophisticated skills. The focus on interdependency is paramount in WoW where learners entrench linguistic and practical skills to gain expertise and confidence (Zheng et al., 2012). The environment offers much that is lost in both traditional classrooms and the wild: This is because, in WoW, the focus is on acting as part of a community. The game demands careful use of language stance (such as in reading “spell-tips”) and thus, viable interpretations. This involves more than use of routines and procedures in that it demands, for example, caring for others (and what, in Section 6, we call *skilled linguistic action*) (Newgarden et al., 2015). Given a sense of belonging, players engage “authentically” as they co-act, correct errors, share rewards, practice and reward each other. The lessons from gaming can apply across distributed learning environments (Cui et al., 2021 & 2023; Zheng, 2012; Zheng et al., 2017a, 2018, & 2019). The key to design lies in allowing parties to gain from flexibility, make use of abduction, and participate in varied projects. Hence, design can prompt learners to extend their powers as observers whose expertise relies, in part, on constraints imposed by practices in which they engage.

Learning not only occurs in distributed cognitive systems but, at once, can be rethought with the help of systemic ethnography. The new ecolinguistics brings thick descriptions to the practice of design and, at once, enriches our view of learning. Like its results, it is a constructivist practice where the designer is also observer. In Zheng et al.’s (2009) earlier work, Quest Atlantis (QA) was used to encourage actions quite unlike those of a traditional view of *negotiation for meaning* (viz. as

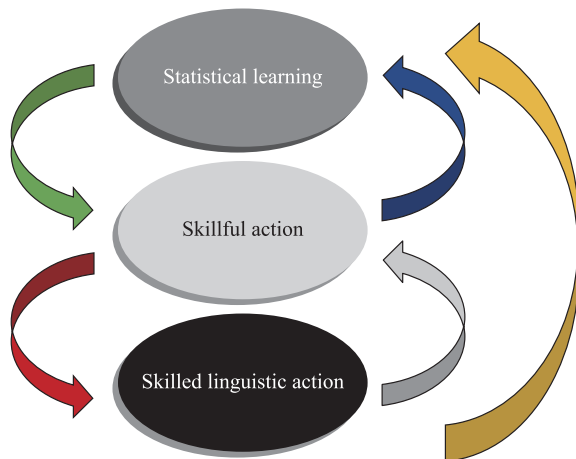
*linguistic*). In the Chinese context, learners of English drew on a language stance to take prospective action by seeking clues. In so doing, they meshed what they heard with Chinese knowledge and identity in the creative re-use of wording-types unlike those of first-language players. Such creativity allows for (1) building theories of practice that unite the four ecologies (symbolic, local, sociocultural and cognitive); and (2) using the results to enhance our grasp of how entrenching can contribute to skills in practice-based skill-building (see below), *Negotiation for Action*. QA, along with its co-questioning design, affords new actions by English language learning students who negotiate and move prospectively in seeking out new results. In so doing, they gain cultural expertise, identity, and immediate and creative re-use of wordings that attest to (but may differ from) the enlanguaged worlds of American counterparts.

The combination of cognitive ethnography and design-based research challenges the view that a language is “acquired.” In our actional view, languaging, as with using technology, occurs in the arena where practices are disclosed. As learning occurs out in the open, the relevant doings can be explored by research that explores entrenching, its consequences and, indeed, how languaging transforms skillful action, grants expertise and shapes communicative agency. This opens up how, in principle, design-based learning can change the changeable. Above all, therefore, we follow Li (2017) in developing practical theories, constituted with digital features (Zheng & Tian, 2020) that begin to throw new light on practices in enlanguaged worlds.

## 6 Practical Theories and Future Directions

A practical theory aims to alter skilled ways of acting. Thus, for example, Thibault and King (2016) describe how students use emplacement to grasp the situated sense of an  $r^2$  statistic. In so doing, they use co-action that reduces to neither statistical learning nor procedures. In getting at the emplaced relevance of a calculation, much depends on microcognition, covert languaging and usage: The sense of  $r^2$  is anchored in emplaced events (i.e., by solving a given problem). Indeed, it is in this sense that the learners gain *expertise* or develop skills beyond skill. They begin to understand why a coefficient of determination applies (or is inapplicable). In designed environments, we act as teachers, experts, co-learners, members of society who, together, refine our understanding. In illustration, we bring recursive dimension to our model of how learners use skilled modes of action in usage-informed activity (see Figure 2). Just such practices, we believe, underpin Swain’s (2006) findings. Her “meaning-making” arises in using what people do together in an emplaced setting by taking a perspective on what is said (e.g., what  $r^2$  means here). We call this *skilled*

*linguistic action*. In our view, designing environments to encourage such activity—prompting learners to change what is changeable in themselves—offers much to second language studies. As suggested by Lai et al. (2017), a multi-scalar distributed language learning environment can add much to how technology informs multifaceted language learning experiences: These provide differentiated approaches that support diverse learning experiences.



**Figure 2** Multi-Scalar Distributed Language Learning Environment

Since skilled action is ubiquitous, its linguistic extension enables many kinds of expertise. These transcend use of procedures and routines by meshing acting in the world with attending to aspects of usage. In refining the resulting skills, people change themselves and, thus, individuate as persons. Hence “representation” is replaced by appeal to expertise and observations. The view resonates with Eastern traditions where, for example, a master can correct an apprentice or demonstrate *the* right way to act. Later, as the apprentice practices, one can orient to the orientation by offering challenges. Observing is key. In important work, Wang (2016) takes this to how, in language learning, one can learn to act as one’s own master—or rely on extension. When stuck in a task, you can go back to the beginning and start over. In the West, this is called “creativity” and, often, mystified. However, in appeal to *Xu*, one highlights the recursivity of action (and languageing) and, remarkably, shows its power in even a gap filling task. This is surely a topic for future research. Finally, consider a classic case of mastering a speech; once written and memorized, one can try to forget it. Then, by going back to the start later, the substance can be rewritten, relearned and, often, enhanced. Such expertise is neither routine nor, for that matter, reducible to brain-based function. Rather, it relies on individuation to become part of a person which is applicable to future practices. Its basis lies in engaging in practices while self-observing as events unfold through second language wording-types and nonce (never repeated) wordings. As a result, observations can inform

future action that is (by definition) skilled and, at once, strictly linguistic.

E-technologies grant new potential for skilled linguistic action. Once traced to observing, design can be used to nudge learners to perceive wordings as wordings (as having relevance, etc.). In so doing, one extends traditional approaches to linguistic sensitivity based on teacher talk, historical dictionaries and grammatical descriptions by placing new weight on usage, embodiment, complexity, expertise, communicative agency, etc. However, in using distributed cognitive systems in second language studies, the designer’s main aim is that of changing environments. Hence, one can use nudging to select or foreground parts of a setting or to encourage and scaffold attending to wordings and/or aspects of usage. Further, these can aid performing that brings rewards and encourages striving for value creation, etc. (Barab et al., 2019). In other words, designers can use concepts like skilled linguistic action in building resources that prompt learners to observe, identify patterns, take perspectives, and build expertise (Cui et al., 2021 & 2023). This appears, for example, in using a site such as Reddit where, to be taken seriously, one must adopt the usage of a specific domain (Banov, 2022). Hence, as in Thorne and Hellermann’s (2022) “learning in the wild,” skilled linguistic action engages people in rich environments. However, in emphasising the microcognitive and how practices unfold, the focus falls on, not routine regularities, but actualizing what is new (for oneself). When novelties are observed an agent can entrench ways of acting/speaking and, in time, gain expertise by making the results part of communicative agency. In so doing, one makes both epistemic use of wordings and, at once, uses them in practical tasks.

In this new ecolinguistic view, second language learning draws on both languageing and its technological extensions in shaping various modes of skillful activity. By focusing on activity in which wordings play a part, one plays down language use, operationalized learning and individuals. Rather, the focus falls on how, in enlanguage worlds, co-acting (at times, with oneself) contributes to skills and expertise. Performance in distributed systems can ground coordinative agency as one both masters practices and individuates as a person. One draws, to a large extent, on skilled linguistic action and how usage brings “relevant” properties to wordings. While tracing language learning to familiarization (and statistics) as extended by entrenching, it is important to acknowledge how embodiment, affect and place bring subtlety to wordings. We use skills that reach beyond skills—practical talents, knacks, ways of coming up with hints and uses of special framings (e.g., narrative or metaphor) that allow us to incorporate expertise. By focusing on how practices are disclosed, we reunite the four ecologies—the symbolic, the local, the sociocultural and the cognitive. In order to do so, we

allow that languaging is half natural and half artificial. We maintain that the new ecolinguistics offers much to the design of technology-shaped distributed systems that set off skilled linguistic action within changing environments. Above all, however, such domains have become places for not just developing actional skills but also coming to observe and, by using wordings, gaining expertise and new kinds of communicative agency.

**Acknowledgments** In the writing process we revisited and learned literature across the fields of applied linguistics, second language studies, language sciences, learning sciences, educational technology, cognitive linguistics, ecolinguistics, and psychology. We thank Anastassia Kolmogorova of the National Research University of Higher School of Economics in St. Petersburg for her help with Russian ways of conceptualizing the social emergence of human agency. We are most appreciative of this opportunity for the three of us co-authoring this bold ensemble across disciplines and generations, which is modeled after the Confucian philosophy of “You can learn from everyone.” We are very grateful for the amount of research available for understanding language and technology. We acknowledge that many more great minds and research can enhance this dialogue. We welcome any suggestions and critiques.

**Conflict of Interest** Dongping Zheng and Stephen J. Cowley are members of the Editorial Board of *Frontiers of Digital Education*, who were excluded from the peer-review process and all editorial decisions related to the acceptance and publication of this article. Peer-review was handled independently by the other editors to minimise bias.

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