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Rethinking the Multilingual Mind Beyond the Cognitive Advantage Debate: An Ecological Affordance Perspective

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Abstract

Research on the bilingual advantage has examined whether managing multiple languages enhances cognitive functioning; however, findings remain inconsistent and theoretical consensus limited. This paper argues that the impasse partly reflects a mismatch between the categorical treatment of multilingualism and the dynamic nature of cognition. By conceptualizing multilingual experience as a person–environment relationship rather than a stable individual attribute, the paper proposes an ecological framework of multilingual cognition centered on multilingual affordance actualization. Drawing on Gibson's affordance theory, van Lier's ecological approach to language learning, Bronfenbrenner's bioecological systems theory, and Complex Dynamic Systems Theory, the framework conceptualizes multilingual cognition as an emergent and context-dependent process. Multilingual environments provide potential affordances, but their consequences depend on how individuals perceive, select, enact, and repeatedly engage with these opportunities within particular ecological conditions. Socioeconomic conditions, language-use entropy, and interactional contexts are conceptualized not simply as confounding variables but as conditions that structure the availability and complexity of multilingual affordances. The framework further calls for methodological complementarity between experimental precision and ecological validity through naturalistic, longitudinal, experience-sampling, and within-person approaches. It positions translanguaging as one context-sensitive form of affordance actualization within affordance-rich learning environments. The paper argues that research should move beyond binary comparisons of monolinguals and bilinguals toward investigating how, for whom, under what conditions, and through which mechanisms multilingual experiences become cognitively consequential.

Keywords: *bilingual advantage, multilingual cognition, ecological affordances, affordance actualization, ecological validity, translanguaging*

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1. Introduction

The search for a bilingual advantage, the proposition that managing multiple languages enhances domain-general cognitive functions, has generated one of the most enduring debates in bilingualism research. For more than six decades, researchers have investigated whether multilingual language use is associated with enhanced executive functions, particularly inhibitory control, cognitive flexibility, and attentional regulation. While numerous studies have reported cognitive benefits associated with bilingual experience (Baumgart & Billick, 2018; Bialystok, 2024), other studies have identified null, inconsistent, or context-dependent effects (Antoniou, 2019; Von Bastian et al., 2016). Meta-analytic evidence has further suggested that publication bias, methodological variation, and differences in participant characteristics have contributed to the lack of consensus regarding the existence and magnitude of bilingual cognitive advantages (Blanco-Elorrieta & Pylkkänen, 2018; De Bruin et al., 2015; Van Den Noort et al., 2019).

However, the persistence of this debate reflects not only empirical inconsistency but also a deeper conceptual challenge regarding how multilingualism and cognition have traditionally been understood (De Bruin et al., 2021). Much of the bilingual advantage literature has operationalized bilingualism as a categorical variable, comparing bilingual and monolingual groups as though language experience represented a stable and homogeneous characteristic (Gunnerud et al., 2020; Kremin & Byers-Heinlein, 2021; Luk, 2023; Salig et al., 2021). Such approaches have provided valuable insights into potential cognitive consequences of multilingual experience, but they often overlook the substantial variability within multilingual populations, including differences in proficiency, frequency and context of language use, interactional demands, socioeconomic conditions, and sociocultural environments (De Bruin et al., 2015; Gullifer & Titone, 2021; Salig et al., 2021). Thus, bilingualism itself may not be the direct source of cognitive adaptation, since the diverse experiences and ecological conditions associated with multilingual practices may shape how cognition develops.

This limitation has contributed to what may be considered a comparative fallacy: the assumption that multilingual cognition can be adequately explained through binary comparisons between monolinguals and bilinguals (Luk, 2023; Luk & Rothman, 2022). Although group comparisons remain useful for identifying broad patterns, they provide limited explanations of the mechanisms through which multilingual experiences influence cognitive development. A more productive question is therefore not whether bilingualism universally produces cognitive advantages, but how individuals engage with multilingual environments and under what ecological conditions these experiences become developmentally meaningful (Bialystok, 2024; Bialystok & Craik, 2022).

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An ecological perspective provides a theoretical foundation for addressing this limitation by shifting attention from language status to person–environment interaction. Drawing on Gibson's (1979) theory of affordances, van Lier's (2004) ecological approach to language learning, Bronfenbrenner's (1979) bioecological systems theory, and Larsen-Freeman's (1997) Complex Dynamic Systems Theory (CDST), this paper conceptualizes multilingual cognition as an emergent process shaped through continuous interactions among individuals, linguistic resources, and social environments. Within this framework, multilingual environments do not automatically generate cognitive outcomes. Instead, they provide potential affordances, opportunities for perception, action, communication, and adaptation, that individuals may recognize, negotiate, and transform according to their goals, identities, experiences, and available resources (Bialystok, 2024; van Lier, 2004). Thus, we propose the concept of multilingual affordance actualization as a mechanism linking ecological conditions (Atkinson et al., 2025; Bronfenbrenner, 1979), individual agency (Biesta & Tedder, 2007; Larsen-Freeman, 2019), and emergent adaptation (Hampel, 2024; Larsen-Freeman, 1997). It refers to the dynamic process through which multilingual individuals perceive, select, enact, and potentially transform opportunities for linguistic and communicative action within particular ecological conditions (Song & Ma, 2021; van Lier, 2004). Through repeated participation, these interactions may contribute to the emergence of cognitive, communicative, emotional, and social adaptations (Atkinson et al., 2025; van Lier, 2004). The concept provides a mechanism for explaining why multilingual experiences may have different consequences across individuals and contexts.

Moreover, this reframing also changes how contextual variables are interpreted (Bialystok, 2024; Titone & Tiv, 2023). Socioeconomic conditions, language-use entropy, institutional language policies, interactional contexts, and digital communication environments are often treated as background variables or statistical controls (Blanco-Elorrieta & Pylkkänen, 2018; Gunnerud et al., 2020; Titone & Tiv, 2023; Von Bastian et al., 2016; Wigdorowitz et al., 2023). From an ecological perspective, however, these conditions help structure the availability, accessibility, and complexity of multilingual affordances. Their influence is not deterministic, as ecological conditions shape possibilities for action, while individuals actively perceive, negotiate, and transform those possibilities (Blin, 2016; Palungtepin, 2021).

The ecological perspective does not reject experimental approaches. Controlled laboratory tasks remain essential for identifying specific cognitive mechanisms involved in language processing and executive control. However, laboratory findings represent particular cognitive processes under particular task conditions. To understand multilingual cognition as an ecological phenomenon, these findings need to be connected with evidence from naturalistic interaction, longitudinal development, everyday language

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use, and within-person variation (Atkinson et al., 2025; Bronfenbrenner, 1979; Tasker, 2017; van Lier, 2004). The paper therefore develops an ecological framework organized around three central propositions:

1. Multilingual cognition is an emergent property of person–environment interaction rather than a stable consequence of multilingual status.
2. Ecological conditions influence multilingual cognition indirectly by structuring the availability and actualization of multilingual affordances.
3. The consequences of multilingual experience are conditional on patterns of engagement across contexts and time and therefore require methodological approaches that connect experimental mechanisms with ecological validity.

2. From bilingual status to multilingual affordance actualization

The ecological framework proposed here integrates four theoretical perspectives that address different dimensions of multilingual development. These perspectives are not treated as competing theories or as interchangeable explanations. Affordance theory explains how opportunities for action arise relationally between individuals and environments (Gibson, 1979). Ecological language learning explains how such opportunities become meaningful through perception, participation, and interaction (van Lier, 2004). Bioecological systems theory explains how immediate interactions are embedded within broader social, institutional, and cultural systems (Bronfenbrenner, 1979). CDST explains how repeated interactions accumulate and change over time, producing emergent and potentially nonlinear trajectories (Larsen-Freeman, 1997). Together, they provide the theoretical basis for reconceptualizing multilingual cognition as an ecological process.

2.1. Affordances and the relational nature of multilingual cognition

Gibson's (1979) concept of affordances refers to possibilities for action that emerge through the relationship between an organism and its environment. An affordance is neither simply an objective property of the environment nor merely a subjective interpretation. It is relational; what an environment affords depends partly on the characteristics and capabilities of the individual encountering it (Sinha, 2015; Steffensen & Kramsch, 2017; van Lier, 2004). Applied to multilingual cognition, this perspective challenges the assumption that exposure to multiple languages automatically produces cognitive consequences. A multilingual environment may contain opportunities for language negotiation, switching, translanguaging, cultural exchange, perspective taking, and social coordination (Beatty-Martínez & Dussias, 2017; Blanco-Elorrieta & Pylkkänen, 2018; García & Otheguy, 2020; Kramsch, 2008; Titone & Tiv, 2023; van Lier, 2004). Therefore, the presence of these possibilities does not guarantee that individuals will perceive or use them. Their significance depends on the interaction

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between environmental conditions and individual characteristics, including proficiency, goals, identity, motivation, social relationships, and prior experience.

Van Lier's (2004) ecological approach further emphasizes that learning and development occur through active participation in meaningful environments rather than through passive exposure alone. From this perspective, multilingual experience becomes consequential when individuals engage with communicative situations that require them to coordinate linguistic, social, and cultural resources (Steffensen & Kramsch, 2017; van Lier, 2004). This distinction allows multilingual experience to be conceptualized through a sequence of related but analytically distinct processes. It begins with affordance availability, referring to the linguistic, social, cultural, technological, and material possibilities present within an environment (Gibson, 1979; van Lier, 2004). These possibilities become relevant through affordance perception, whereby individuals recognize particular possibilities as meaningful or actionable in relation to their goals and circumstances. When perceived possibilities are enacted through situated communicative and social action, affordance actualization occurs (Nguyen & Doan, 2025; Song & Ma, 2021). Through repeated engagement with such opportunities, patterns of action may become established and increasingly integrated into individuals' ways of communicating and participating. Over time, sustained engagement may also give rise to emergent adaptation, involving changes in cognitive, communicative, emotional, or social processes (Larsen-Freeman, 2019). These processes should not be interpreted as a simple linear chain; they are recursive and mutually influential (van Lier, 2004). Individuals' actions can alter their social environments, relationships, and future opportunities, while previous experiences shape what they perceive as possible in subsequent situations (Steffensen & Kramsch, 2017).

2.2. Ecological systems and the conditions of multilingual experience

Affordance theory explains the immediate person–environment relationship, but multilingual experience is embedded within broader systems (Blin, 2016; Titone & Tiv, 2023; van Lier, 2004). Bronfenbrenner's (1979) bioecological perspective provides a framework for locating multilingual interactions within nested social and institutional contexts. At the microsystem level, multilingual experiences emerge through direct interactions in families, classrooms, workplaces, peer groups, communities, and online spaces (Anderson et al., 2020; Titone & Tiv, 2023). These settings shape the opportunities available for language use and the interactional demands individuals encounter (Beatty-Martínez et al., 2020). At the mesosystem level, relationships among settings influence multilingual development (Titone & Tiv, 2023). For example, alignment or tension between family language practices and educational expectations may affect whether learners perceive their multilingual resources as valuable or problematic. At the exosystem level, institutions and infrastructures, including educational systems, workplaces, media, and digital technologies, shape multilingual opportunities indirectly

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by determining access to resources and participation (Blin, 2016; Titone & Tiv, 2023). At the macrosystem level, language ideologies, cultural values, migration policies, and societal attitudes influence the social legitimacy and accessibility of multilingual practices (Blin, 2016; Titone & Tiv, 2023). From this perspective, contextual factors should not be treated merely as external influences on an otherwise independent multilingual individual (Gkonou et al., 2020). They constitute the ecological conditions within which affordances become available and meaningful. Nevertheless, these conditions do not determine outcomes. Their developmental significance depends on how individuals perceive and engage with them.

2.3. Dynamic development and emergence

While affordance theory and bioecological systems theory explain the relational and contextual foundations of multilingual experience, CDST provides a framework for understanding change over time (Larsen-Freeman, 1997; Larsen-Freeman & Hiver, 2025). Multilingual cognition is not assumed to develop through a simple accumulation of language experience. Instead, it emerges through interactions among multiple interconnected factors, including language-use patterns, social relationships, emotional experiences, educational environments, individual goals, and changing communicative demands (Kałamała et al., 2023; van Lier, 2004). From a dynamic systems perspective, small differences in experience may accumulate and generate divergent developmental trajectories (Godwin-Jones, 2024; Larsen-Freeman, 2019; Tasker, 2017). Two individuals with similar linguistic backgrounds may develop different patterns of adaptation because they participate in different social environments or encounter different communicative demands (DeLuca et al., 2019; Luk, 2023). Conversely, individuals with different linguistic histories may develop similar adaptive capacities if they repeatedly engage with comparable ecological demands. The significance of multilingual experience therefore lies partly in its temporal organization (Blin, 2016; Gullifer & Titone, 2021; Tasker, 2017). What matters is not simply whether a person knows two or more languages, but how, when, where, and for what purposes those languages are used over time.

2.4. Multilingual affordance actualization as an integrative mechanism

The four theoretical perspectives can be integrated through the concept of multilingual affordance actualization (Fig. 1). In this framework, multilingual environments provide potential opportunities for linguistic and communicative action. Individuals encounter these opportunities within ecological systems that vary in their resources, constraints, norms, and demands. Individuals perceive some opportunities as relevant, engage with them through situated action, and potentially transform them through participation. When particular patterns of engagement recur over time, they may contribute to emergent forms of adaptation. This model is explicitly recursive rather than linear. Individuals do not simply receive environmental inputs. Through their participation, they also reshape relationships, interactional routines, social networks, and

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the affordances available to themselves and others. Multilingual affordance actualization is therefore not synonymous with agency, engagement, or translanguaging. Agency concerns the capacity and willingness to act; engagement refers to participation; affordance perception concerns recognizing a possibility for action. Affordance actualization refers specifically to the relational process through which a perceived possibility becomes enacted within situated multilingual activity and potentially consequential through repeated participation (Larsen-Freeman, 2019; van Lier, 2004).

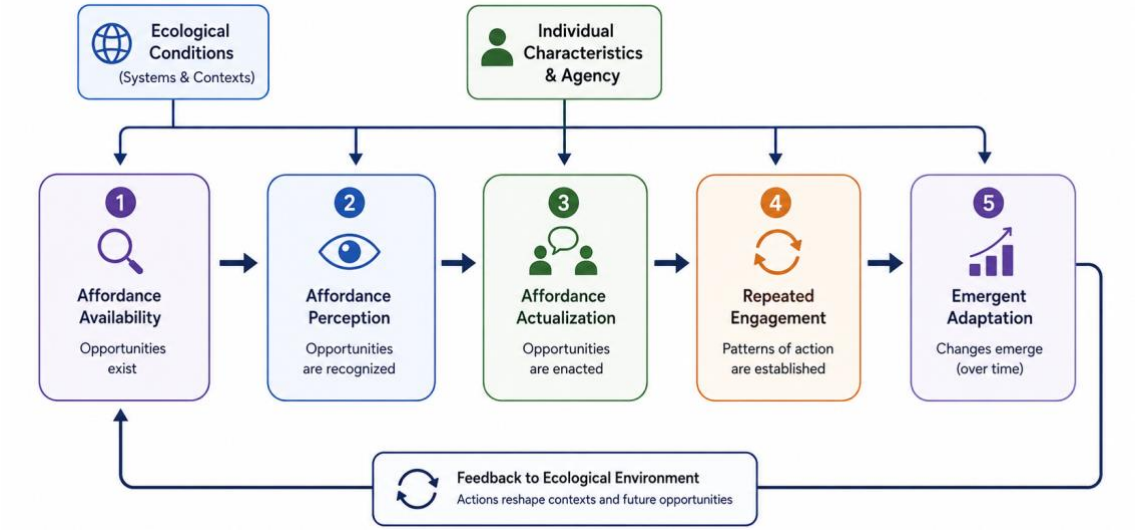


***Fig.1**. Experience of multilingual affordance*

The framework generates three propositions shifting the analytical focus from a categorical comparison between monolinguals and bilinguals toward the ecological processes through which multilingual experience becomes consequential.

Proposition 1: Emergence.

Multilingual cognition is an emergent property of recurring person–environment interactions rather than a stable cognitive consequence of multilingual status.

Proposition 2: Conditionality.

Ecological conditions influence multilingual cognition primarily by shaping the availability, accessibility, and complexity of multilingual affordances, while their consequences depend on individual perception and actualization.

Proposition 3: Temporality.

The consequences of multilingual experience emerge through repeated engagement across contexts and time and therefore may vary within and between individuals.

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3. Ecological conditions shaping affordance actualization

If multilingual cognition emerges through affordance actualization, then the ecological conditions surrounding multilingual individuals become theoretically important (Titone & Tiv, 2023; van Lier, 2004). Two conditions illustrate this argument particularly well: socioeconomic circumstances (Gunnerud et al., 2020; Poarch & Krott, 2019) and language-use entropy (Gullifer & Titone, 2020; Titone & Tiv, 2023). Additionally, interactional context provides a further link between broad ecological conditions and immediate communicative demands (Beatty-Martínez et al., 2020; Hernandez et al., 2015). These factors should not be conceptualized as direct causes of cognitive outcomes, because they shape the environments in which multilingual affordances become available and the kinds of demands individuals encounter.

3.1. Socioeconomic conditions and access to affordances

Socioeconomic status is often treated in bilingual advantage research as a confounding variable requiring statistical control (e.g. Bright & Filippi, 2019; Hernandez et al., 2015; Poarch & Krott, 2019; Von Bastian et al., 2016). From an ecological perspective, however, this framing is incomplete, as socioeconomic conditions influence access to material, educational, technological, and social resources that structure opportunities for multilingual engagement (Steffensen & Kramsch, 2017; Titone & Tiv, 2023; van Lier, 2004). Individuals from relatively advantaged contexts may encounter multilingual affordances through international education, digital resources, travel, diverse social networks, and institutional support (García & Otheguy, 2020; Kirss et al., 2021; Ramírez-Esparza et al., 2020; Van Den Noort et al., 2019). Individuals in less advantaged contexts may encounter multilingualism through different ecological demands, such as navigating multiple languages across family, community, educational, and institutional settings (Antoniou, 2019; Beatty-Martínez et al., 2020; Hernandez et al., 2015; Kiramba, 2019; Wigdorowitz et al., 2023). The key point is not that one context produces greater cognitive benefits than another, but different socioeconomic environments may provide different configurations of affordances (Steffensen & Kramsch, 2017; van Lier, 2004). Individuals may also perceive and actualize these affordances differently according to their goals, identities, social networks, and previous experiences (Larsen-Freeman, 2019; Ramírez-Esparza et al., 2020; Titone & Tiv, 2023). Reconceptualizing socioeconomic status as an ecological condition therefore changes the research question. Instead of asking whether socioeconomic status confounds the relationship between bilingualism and cognition, researchers can ask how socioeconomic conditions structure access to multilingual affordances and how individuals with different resources actualize them (Gunnerud et al., 2020; Hernandez et al., 2015; Kiramba, 2019; van Lier, 2004).

3.2. Language-use entropy and interactional complexity

Language entropy provides another example of an ecological condition that may help explain variation in multilingual experience (Bialystok, 2024; Gullifer & Titone, 2020;

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Kałamała et al., 2023). Rather than counting the number of languages an individual knows, language entropy captures the distribution and unpredictability of language use across communicative contexts (Gullifer et al., 2018; Gullifer & Titone, 2020). Individuals with relatively low language-use entropy may use different languages in relatively separated domains, whereas individuals with higher entropy may encounter greater variability in language choice across interlocutors, topics, settings, or interactions (Gullifer et al., 2018; Gullifer & Titone, 2020, 2021). However, language entropy should not be treated as equivalent to switching frequency or multilingual proficiency, as it describes the organization of language experience, but does not by itself indicate how individuals respond to that experience (Kałamała et al., 2023). From an ecological perspective, language entropy may influence the complexity and variability of available multilingual affordances. Higher variability may create more frequent opportunities to monitor contextual cues, coordinate linguistic resources, negotiate meaning, or adapt to interlocutors in uncertain environment (Gullifer et al., 2018). Yet these possibilities become consequential only when individuals perceive and actualize them (van Lier, 2004). The distinction is therefore important: Language entropy describes the structure of multilingual experience, whereas affordance actualization describes how individuals engage with the opportunities and demands created by that structure (Gullifer & Titone, 2021; van Lier, 2004). This distinction may help explain why similar levels of multilingualism can be associated with different cognitive outcomes.

3.3. Interactional context and adaptive demands

Interactional context provides the immediate link between ecological conditions and cognitive demands (Gullifer & Titone, 2020). Multilingual individuals may participate in relatively stable single-language contexts, dual-language environments, or dense code-switching communities (Anderson et al., 2020; Bialystok & Craik, 2022; Hernandez et al., 2015; Wigdorowitz et al., 2023). Each context creates different opportunities and constraints for language selection, monitoring, coordination, and social interpretation. From an ecological perspective, however, interactional contexts should not be treated as fixed environmental treatments, because their consequences depend on how individuals perceive and participate in them (Luk, 2023; van Lier, 2004). A dense code-switching environment may provide opportunities for flexible multilingual coordination for one individual while imposing unfamiliar or demanding expectations on another (Beatty-Martínez et al., 2020; Blanco-Elorrieta & Pylkkänen, 2018; De Bruin et al., 2021). Similarly, a context that requires frequent language selection may generate different adaptations depending on proficiency, identity, social relationships, and familiarity with local norms (Beatty-Martínez & Dussias, 2017; DeLuca et al., 2019). Interactional context therefore illustrates a central principle of the framework: the ecological environment does not directly determine cognitive outcomes; it structures possibilities for action that individuals actualize differently.

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4. Beyond executive control: multidimensional multilingual adaptation

The bilingual advantage debate has largely focused on executive functioning. An ecological perspective does not reject this focus but questions whether executive control should represent the entire conceptual space of multilingual cognition. Multilingual individuals participate in environments that involve not only language selection and cognitive control but also emotion, identity, cultural interpretation, social coordination, and communicative adaptation. These dimensions should not be assumed to be automatic benefits of multilingualism. Rather, they represent potential domains of adaptation that may emerge through particular forms of affordance actualization.

4.1. Emotional and cultural affordances

Multilingual environments provide opportunities for individuals to encounter different ways of expressing emotion, interpreting social relationships, and constructing meaning (Koch et al., 2024; van Lier, 2004). Languages and cultures may differ in communicative conventions, interpersonal expectations, and culturally situated meanings (Chibaka, 2018). These differences can create emotional and cultural affordances: possibilities for expressing, interpreting, and negotiating experience through multiple linguistic and cultural resources(Cenoz, 2017; Steffensen & Kramsch, 2017). However, multilingualism itself does not guarantee emotional flexibility or intercultural competence (Koch et al., 2024; Ramírez-Esparza et al., 2020). Such capacities are more plausibly related to the nature and quality of individuals' participation in multilingual environments. Repeated engagement in emotionally and culturally diverse interactions may provide opportunities for perspective taking, emotional interpretation, identity negotiation, and adaptive communication (Poarch & Krott, 2019; Titone & Tiv, 2023; van Lier, 2004). This perspective therefore shifts the question from whether multilingualism enhances emotional or cultural competence to how particular multilingual environments provide opportunities for such development and how individuals actualize them.

4.2. Identity and intercultural adaptation

Multilingual individuals may also encounter affordances for negotiating identities across linguistic and cultural contexts (Cenoz, 2017; van Lier, 2004). Through repeated participation in different communities, individuals may develop flexible ways of positioning themselves and interpreting social situations. Such processes are consistent with perspectives that conceptualize multilingual identity as dynamic rather than fixed. Individuals may draw on different linguistic, cultural, and semiotic resources according to context without necessarily experiencing these resources as separate or mutually exclusive identities (Cenoz, 2017; García & Otheguy, 2020). From an ecological perspective, identity development can therefore be understood as another form of adaptation emerging through participation (Larsen-Freeman, 2019; van Lier, 2004). Multilingual environments provide possibilities for identity negotiation, but these

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possibilities become consequential through individuals' actual engagement with social relationships and cultural practices (Kiramba, 2019).

4.3. Multidimensional adaptation

The ecological framework conceptualizes multilingual cognition broadly enough to include cognitive, communicative, emotional, cultural, and social dimensions while maintaining conceptual distinctions among them (Steffensen & Kramsch, 2017; Titone & Tiv, 2023). Within this view, executive control represents one possible domain of adaptation (Luk & Rothman, 2022). Others may include flexible communicative coordination, perspective taking, intercultural interpretation, emotional expression and regulation, identity negotiation, social coordination, and adaptive use of linguistic and semiotic resources (Gkonou et al., 2020; Gunnerud et al., 2020; Koch et al., 2024; Titone & Tiv, 2023; van Lier, 2004). These outcomes should not be treated as universal consequences of multilingualism, rather they represent possible forms of emergent adaptation associated with particular ecological conditions and patterns of affordance actualization (Kremin & Byers-Heinlein, 2021; Luk, 2023; Titone & Tiv, 2023). This broader conceptualization also suggests that multilingual cognition may be underestimated when measured exclusively through laboratory tasks of inhibitory control or switching (Blanco-Elorrieta & Pylkkänen, 2018). An ecological account does not imply that such tasks are irrelevant, instead it suggests that they capture only particular dimensions of a more complex adaptive phenomenon (Salig et al., 2021; Titone & Tiv, 2023).

5. From group comparisons to ecological validity

The ecological framework has direct implications for how multilingual cognition should be investigated. Much of the bilingual advantage literature has relied on controlled laboratory paradigms designed to isolate specific processes such as inhibitory control, attentional shifting, and conflict monitoring. These approaches remain valuable because they allow researchers to identify mechanisms under controlled conditions. The problem arises when findings from specific tasks are generalized to multilingual cognition as a whole. From an ecological perspective, cognition is inseparable from the conditions under which it is enacted. The demands associated with multilingual communication vary according to interlocutors, communicative goals, social relationships, language-use patterns, cultural expectations, and familiarity with interactional norms. The methodological challenge is therefore not to choose between laboratory precision and ecological validity. It is to establish complementarity between them.

5.1. Laboratory precision and ecological complexity

Laboratory paradigms can identify specific mechanisms involved in language processing and cognitive control. They can test causal hypotheses and provide precise measures of performance under controlled conditions (Beatty-Martínez & Dussias, 2017;

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Blanco-Elorrieta & Pylkkänen, 2018; Salig et al., 2021; Titone & Tiv, 2023). Yet the tasks themselves necessarily simplify real-world multilingual interaction, often isolating a "small slice of reality" by abstracting the object of investigation from any contextual factors that might interfere with its behavior. A laboratory language-switching task may require participants to alternate languages in response to externally imposed cues, whereas everyday language choice may be guided by interlocutor identity, discourse structure, topic, social relationship, and communicative intention. The difference does not invalidate laboratory findings. Instead, it defines their scope. A laboratory task can provide evidence about a particular cognitive mechanism under particular conditions. It cannot, by itself, establish how frequently that mechanism is recruited in everyday life or whether it contributes to broader adaptation.

5.2. Connecting mechanisms with everyday multilingual practices

An ecological approach asks how cognitive mechanisms identified experimentally operate across real communicative environments. Naturalistic interaction can reveal how multilingual speakers coordinate language resources when communication is meaningful and socially situated (Blanco-Elorrieta & Pylkkänen, 2018). Experience sampling and ecological momentary assessment can examine fluctuations in language use and cognitive demands across everyday contexts (Ramírez-Esparza et al., 2020). Longitudinal research can investigate developmental trajectories, while intensive within-person designs can examine how the same individual responds differently across situations (Luk, 2023; Salig et al., 2021). Qualitative methods can complement these approaches by examining how individuals themselves perceive and interpret multilingual affordances (Titone & Tiv, 2023). The methodological goal is thus to connect different levels of analysis rather than to privilege one. Such integration allows researchers to move from the question of whether multilingual individuals perform differently on a particular task to the broader question of when, where, why, and under what conditions particular cognitive processes become relevant.

Table 1. Research Questions and Methodological Approaches

Research question	Potential approach
What cognitive mechanism is involved?	Laboratory experiments
When and where is it recruited?	Experience sampling / EMA
How does it operate during interaction?	Naturalistic interaction analysis
How does it change over time?	Longitudinal designs
How does it vary within individuals?	Intensive within-person analysis
How do individuals perceive affordances?	Interviews / stimulated recall
How do ecological conditions structure experience?	Multilevel and contextual analysis

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5.3. A research agenda for affordance actualization

The concept of multilingual affordance actualization suggests that future research should measure multilingual experience more directly (Luk & Rothman, 2022). Relevant indicators may include language-use entropy and language distribution (Gullifer & Titone, 2020), interactional context (Wigdorowitz et al., 2023), proficiency and communicative demands (Gullifer & Titone, 2021), socioeconomic and educational conditions (Bialystok & Craik, 2022; Kirss et al., 2021), social network characteristics (Titone & Tiv, 2023), emotional engagement (Koch et al., 2024), digital language practices, institutional language policies, and opportunities for multilingual participation and translanguaging (Cenoz, 2017; García & Otheguy, 2020). These variables should not simply be entered into statistical models as additional predictors. Researchers should examine their relationships. A central methodological question is: *How do ecological conditions shape the affordances available to individuals, how do individuals perceive and actualize those affordances, and how does repeated engagement relate to emergent adaptation?*

6. Educational implications

The ecological framework also has implications for multilingual education. If multilingual cognition emerges through person–environment interaction, classrooms should be understood not simply as places where languages are transmitted but as environments in which linguistic, cultural, social, and technological affordances are made available and actualized (Steffensen & Kramsch, 2017; van Lier, 2004). This perspective does not imply that multilingual practices are universally beneficial or that all language boundaries should be removed (Cenoz, 2017). Instead, it shifts the pedagogical question from which language should be used toward which linguistic and semiotic resources enable learners to participate meaningfully in particular activities (van Lier, 2004).

6.1. Translanguaging as context-sensitive affordance actualization

Translanguaging provides one example of multilingual affordance actualization (Blin, 2016; van Lier, 2004). Learners may draw on linguistic, visual, embodied, digital, and cultural resources to accomplish communicative and learning goals (García & Otheguy, 2020). From an ecological perspective, translanguaging is not inherently beneficial simply because it involves multiple languages. Its value depends on the learning objectives, learner characteristics, classroom norms, assessment requirements, and institutional policies (Cenoz, 2017; Kiramba, 2019). The relevant question is not whether translanguaging should always be encouraged but: Under what conditions does translanguaging enable learners to perceive and actualize available affordances for

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learning and participation? This framing positions translanguaging as a context-sensitive pedagogical possibility rather than a universal instructional prescription.

6.2. Teachers as ecological designers

An affordance-rich multilingual classroom provides opportunities for learners to connect concepts across languages and cultural perspectives, negotiate meaning collaboratively, integrate linguistic, visual, embodied, and digital resources, engage with authentic multilingual texts and communities, draw on prior linguistic and cultural knowledge, reflect critically on their language practices, and make strategic linguistic choices in relation to communicative goals (Blin, 2016; Cenoz, 2017; García & Otheguy, 2020; Kiramba, 2019; van Lier, 2004). Teachers play a central role in making these affordances visible and usable (van Lier, 2004). Their role is therefore not simply to permit or prohibit particular languages but to design conditions in which learners can recognize and strategically mobilize available resources (Larsen-Freeman, 2019). This requires pedagogical flexibility (Cenoz, 2017; Kirss et al., 2021). Some activities may require target-language use to support particular learning goals, while other stages may benefit from multilingual resources. An ecological approach therefore does not advocate unrestricted language use, instead it advocates strategic alignment between linguistic resources, learning purposes, and learner agency (Cenoz, 2017; Larsen-Freeman, 2019; van Lier, 2004). Teacher education consequently needs to address more than translanguaging strategies. It should also develop teachers' capacity to recognize learners' linguistic repertoires, understand language ideologies, design inclusive environments, integrate digital and multimodal resources, and make context-sensitive decisions about language use (Blin, 2016; Cenoz, 2017; García & Otheguy, 2020; Kiramba, 2019; Kirss et al., 2021). The broader educational implication is that multilingual education should be understood as the design of environments in which learners can strategically actualize linguistic, cultural, social, embodied, and technological affordances while still pursuing clearly defined educational goals.

7. Conclusion

For more than six decades, research on multilingual cognition has been shaped by the question of whether bilingualism confers a cognitive advantage. Although this debate has generated extensive research, inconsistent findings and limited theoretical consensus suggest that the problem may lie partly in how multilingualism and cognition have been conceptualized. Treating bilingualism as a categorical characteristic and cognition as a stable individual property overlooks the ecological conditions through which multilingual experience develops.

This paper proposes an ecological framework that conceptualizes multilingual cognition as an emergent outcome of person–environment interaction. Integrating

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affordance theory, ecological approaches to language learning, bioecological systems theory, and Complex Dynamic Systems Theory, the framework shifts attention from multilingual status to the processes through which multilingual experiences become consequential. Its central concept, multilingual affordance actualization, describes how individuals perceive, select, and enact multilingual opportunities within particular ecological conditions. Through repeated engagement across contexts and time, these interactions may contribute to emergent cognitive, communicative, emotional, and social adaptations.

The framework also reframes socioeconomic conditions, language-use entropy, and interactional contexts as ecological conditions that shape the availability and complexity of multilingual affordances rather than merely as confounding variables. Methodologically, it calls for complementarity between experimental precision and ecological validity, combining laboratory tasks with naturalistic interaction, experience sampling, longitudinal research, and within-person approaches. Educationally, it positions multilingual classrooms as affordance-rich environments in which learners can strategically mobilize linguistic, cultural, embodied, and digital resources, with translanguaging understood as one context-sensitive form of affordance actualization.

Finally, the absence of a universal bilingual advantage does not imply that multilingualism is cognitively irrelevant. Rather, its consequences may be conditional, situated, dynamic, and emergent. Future research should move beyond asking whether multilingualism makes people cognitively "better" and instead examine how, for whom, under what ecological conditions, and through which mechanisms multilingual experiences become consequential.

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