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Breaking New Ground: Applying Complex Dynamic Systems Theory to Domestic Research on Language Attrition

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Abstract: Language attrition, the gradual decline in language proficiency over time, has been the focus of extensive study. Traditional approaches, however, often fall short in capturing the dynamic nature and interconnected complexities of this process. This paper introduces Complex Dynamic Systems Theory (CDST) as an innovative theoretical framework to enhance our understanding of how language proficiency evolves and diminishes. This paper advocates for the adoption of a time-intensive longitudinal approach, which can provide a more detailed and continuous tracking of language skills over prolonged periods. Additionally, it recommends employing network analysis to reveal the complex web of social, cognitive, and environmental factors that drive language loss. Together, these methodological suggestions aim to guide future research, demonstrating how CDST offers a comprehensive and dynamic perspective on the mechanisms underlying language attrition.

1. Introduction

Language development is a multifaceted process, encompassing not only the acquisition and enrichment of one's linguistic repertoire through learning new languages but also the potential decline of these skills, a phenomenon termed "language attrition" [1]. Exploring language attrition provides a comprehensive view of language development, shedding light on how bilingual and multilingual individuals' language abilities evolve over time. Domestic language attrition research commenced in 2003. In the decades since, the field has significantly evolved, focusing on the development and testing of various hypotheses such as the regression hypothesis, exploring the nature and characteristics of language attrition, and examining numerous factors that contribute to the degradation of language skills. This has greatly enhanced our understanding of the phenomenon.

Despite these advancements, research in language attrition faces a shortfall in a comprehensive, empirically grounded theoretical and methodological framework. This gap underscores the urgent need for innovative theoretical approaches to propel the field forward. Recently, Complex Dynamic Systems Theory (CDST) has emerged as a promising framework, offering new insights due to its flexibility and dynamic approach to understanding complex systems[2]. By integrating CDST into language attrition studies, researchers can delve further into the fluctuations of language

competencies over time, thus not only deepening our comprehension of the attrition process but also potentially revolutionizing the methodological paradigms employed in this field. This paper aims to explore how CDST can be leveraged in language attrition research, potentially leading to more refined insights into how languages are lost.

2. Complex Dynamic Systems Theory

Complex Dynamic Systems Theory (CDST) has been a trans-formative force in applied linguistics since Larsen-Freeman first introduced it in the mid-1990s[3]. Over the past three decades, CDST has provided a robust framework for understanding various aspects of language, including acquisition, attrition, bilingualism, multilingualism, and pedagogy. It offers a comprehensive lens through which the multifaceted nature of language can be examined.

Central to CDST is the conceptualization of language development as a system characterized by patterns that emerge from the interactions within and across different layers of context. These patterns are not static; they evolve as the system self-organizes in response to internal and external stimuli. This dynamic system is adaptive and open-ended, with a capacity for non-linear change. As a result, language proficiency can exhibit significant fluctuations—learners might go through periods of rapid improvement, plateaus, or even attrition.

By applying CDST, researchers can appreciate the complexity and unpredictability inherent in language development. It challenges the traditional linear models of language development, recognizing that these are not fixed states but are subject to ongoing change and adaptation.

3. CDST in Language Attrition Research

CDST posits that the reality of human and social world is one in which, first, everything changes, second, everything is connected[4]. This fundamental principle shapes our understanding of language attrition not as a mere decline in linguistic abilities but as a dynamic, interconnected phenomenon. By recognizing that no element exists in isolation, CDST offers a valuable framework for examining how language attrition occurs within a web of social, cultural, and cognitive factors. This perspective encourages us to consider the complex dynamics and the interconnectedness of influences, providing a deeper insight into how and why language abilities transform over time. The following sections will explore how the notions that “everything changes” and “everything is connected” guide us to understand the dynamic-dominant and interaction-dominant aspects of language attrition.

3.1. Dynamic Dominance in Language Attrition: Tracing Evolutionary Changes

Turning our attention to the traditional approaches in language attrition research, it is evident that the field has predominantly employed quantitative methodologies with a focus on macroscopic outcomes over defined periods. Historically, studies have used two main models: time-based comparisons and cross-sectional group comparisons.

In time-based comparisons model, the linguistic capabilities of the same group of participants are assessed at set intervals, such as immediately after completing a language course and then six months or one year later. This approach is helpful for observing macro-level changes over a specific period but may not capture the subtle, continuous shifts in language proficiency. The cross-sectional group comparisons model examines differences in language proficiency between distinct groups at a single point in time, such as current students versus graduates. For example, Ni Chuanbin compared the vocabulary test results of 30 sophomore students with 116 graduates to infer the degree of lexical attrition[5]. While effective for highlighting immediate contrasts, this model may

not adequately capture individual differences in attrition trajectories over time.

These traditional approaches, while useful for establishing broad patterns and phase-based results, often overlook the nuanced, ongoing processes that contribute to language loss. Language attrition is not a linear or static phenomenon but a complex, dynamic, and nonlinear process that is constantly in flux. In this context, CDST offers a compelling framework for understanding language attrition. CDST shifts our focus from mere outcomes to the evolving and interactive systems of language use. It emphasizes the inherent unpredictability and variability of language capabilities, moving away from a simplistic understanding of attrition as decline and toward a more nuanced appreciation of its complex nature.

To address the nuanced and ongoing processes that contribute to language loss effectively, adopting a longitudinal, time-intensive research method becomes instrumental. This approach allows researchers to track and capture the trajectories of change, self-organized processes, and emergent outcomes in language proficiency, both at the group and individual levels[6]. Implementing this method, studies can focus on the evolution of language skills through periodic assessments at shorter intervals, providing a detailed and continuous perspective on how linguistic abilities fluctuate over time. This method aligns with the dynamic-dominant approach proposed by CDST and facilitates a deeper exploration into how language proficiency is not merely lost but can also be maintained or even improved under certain conditions.

3.2. Interaction Dominance in Language Attrition: Understanding the Web of Influences

Language attrition is influenced by a myriad of factors, including age, literacy, initial proficiency, language use, and psychological aspects such as attitude and motivation.

Age is a significant variable, with research indicating that younger learners often face steeper declines in language proficiency. This is in concert with the protective role of literacy, where the ability to read and write in a language substantially enhancing retention and counteracting attrition. Moreover, initial proficiency prior to a period of diminished use is another vital consideration; higher levels of proficiency can mitigate the attrition, highlighting the importance of a strong foundational knowledge. The role of language use is pivotal in maintaining proficiency, demonstrating that active engagement with a language can significantly mitigate loss. Furthermore, the psychological aspects of attitude and motivation cannot be overlooked. A positive outlook and a strong motivational drive towards the language can catalyze engagement with the language and, consequently, slow the attrition process.

The existing body of research on these influencing factors has largely leaned on traditional methodologies, such as single-factor analyses and correlational studies, focusing primarily on identifying their direct impacts. A minority of studies have ventured into more complex analyses, employing decision tree models or structural equation modeling to trace the pathways through which these factors exert influence. However, these approaches, while insightful, tend to compartmentalize the factors affecting language attrition, potentially overlooking the dynamic interplay among these variables. This segmentation may limit our understanding of how these factors influence language attrition in a more fluid, interconnected manner. It is here that the CDST offers a compelling alternative, guiding an exploration into the intricate web of interactions among factors influencing language attrition.

CDST challenges the paradigm of linear causality, positing instead that language attrition is an emergent property of complex, dynamic interactions within a non-linear system. This paradigm calls for a reorientation of scholarly focus: from analyzing isolated factors to unraveling how these factors coalesce, dynamically interact, and collectively forge the trajectory of language attrition. Crucially, CDST recognizes that external environments, including the linguistic landscape, cultural

settings, and social contexts, interact with internal cognitive processes and psychological states, thus exerting a significant influence on language attrition. This comprehensive approach enables us to capture the full spectrum of contributing factors, offering deeper insights into the mechanisms underlying language attrition.

Within the CDST framework, network analysis stands out as a crucial exploratory tool[7], through which, variables are depicted as nodes and their interactions are edges signifying direct associations, and the thickness of these edges, or the edge weight, quantifies the strength of these associations: a thicker edge indicates a stronger relationship[8]. This visual representation helps distinguish positive from negative relationships, denoted by blue and red edges respectively, thus providing a clear visual differentiation of influences. Thus, network analysis enables a detailed mapping and visualization of the complex web of relationships among variables pertinent to language attrition.

4. Conclusion

This paper has demonstrated the trans-formative potential of CDST as a lens through which domestic language attrition research can be invigorated. CDST framework allows for time-intensive, longitudinal research approaches that can meticulously trace and capture the nuanced trajectory of language attrition, shedding light on its intricate, dynamic processes. Furthermore, by employing methods such as complex network analysis under the CDST framework, researchers can understand the interacted relationships among various factors influencing language loss. These insights not only refresh the field of language attrition studies but also expand its theoretical and empirical horizons.

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