

Dynamic Systems Perspectives on Willingness to Communicate: A Longitudinal Mixed-Methods Investigation of Task-Induced Variability in EFL Oral Interaction

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ABSTRACT

Conceptualizing willingness to communicate (WTC) as a dynamic, non-linear construct rather than a stable trait, this study employs a longitudinal mixed-methods design grounded in Complex Dynamic Systems Theory (CDST) to examine moment-to-moment fluctuations in learner WTC during task-based oral interaction. Thirty-six intermediate EFL learners at a Pakistani university participated in a sixteen-week intervention involving cognitively and interactionally varied speaking tasks, with WTC operationalized through idiodynamic self-report tracing, retrospective stimulated-recall protocols, and multichannel discourse analysis of learner talk. Growth curve modeling reveals substantial intra-individual variability in WTC trajectories that resist explanation by static trait-based models, instead correlating with task-internal variables including cognitive complexity, interactional symmetry, and affordances for identity investment. Qualitative trace data further illuminate the self-organizing, context-sensitive nature of communicative willingness as it emerges through the interaction of learner-internal and task-external attractor states. The study advances a dynamic systems reconceptualization of WTC with methodological and pedagogical implications for task design, learner autonomy, and assessment practices in TESOL contexts.

Keywords: willingness to communicate; complex dynamic systems theory; task-based language teaching; idiodynamic method; EFL oral interaction; longitudinal research

1. Introduction

Throughout much of its history, willingness to communicate (WTC) research has been conducted around determining stable, trait-like correlates that can predict a learner's general willingness to use a second language. Perceived communicative competence, language anxiety and motivation are the three variables most consistently and strongly linked to L2 WTC across studies in a comprehensive meta-analysis that synthesized this line of work (Elahi Shirvan et al., 2019), and the relative weighting of these and other high-evidence antecedents has been further refined in a meta-analytic structural equation modeling synthesis (Jin & Lee, 2022). This tradition of mapping the field's evidence base is invaluable but is now challenged by evidence-based research that shows that a learner's readiness to speak may change significantly in one lesson, task, or even one turn at talk.

Complex Dynamic Systems Theory (CDST) has been a fruitful alternative metatheoretical perspective that has helped the field to account for this volatility. A recent narrative review proposes that CDST is a meta-theory that has significant explanatory power in accounting for the complex, dynamic and non-linear behaviour of L2 WTC which previous trait-based models failed to account for, and presents methodological advancements that are necessary in operationalizing this reconceptualization (Syed et al., 2022). Supporting this theoretical argument, intensive longitudinal case studies have started to investigate how WTC unfolds moment-to-moment and over longer



developmental times: one time-serial single case study of adult L2S learners showed that WTC trajectories are driven by various influences that interact with each other in a systemic manner and have system-level consequences rather than being simply predicted by isolated factors (Henry et al., 2021a); another study of the same data set examined how person-level and context-level influences together create intra-individual variation in communication-initiation propensities (Henry et al., 2021b).

Yet, empirical studies that examine WTC longitudinally over a longer, task-based instructional intervention, using continuous self-report and growth curve modeling, still remain rather limited, especially in the context of South Asian university settings in which English is a foreign language (L2) within complex multilingual repertoires. This study fills this gap. It is set in an EFL university where a sixteen week mixed methods study of thirty-six intermediate EFL learners was conducted that involved cognitively and interactionally diverse speaking tasks, idiodynamic self-report tracing, stimulated-recall interviews, and discourse analysis and growth curve modeling of quantitative trace data. In so doing, the study has three interrelated objectives: (a) to describe the magnitude and direction of intra-individual WTC fluctuations during a longer time series of tasks; (b) to determine which task-internal variables are systematically related to WTC fluctuations; and (c) to interpret the obtained patterns in the light of CDST, which views WTC not as a fixed attribute of the learner, but as self-organizing product of interacting attractor states.

2. Literature Review

2.1. Trait Based Correlates to Dynamic Reconceptualization

The tradition in WTC research based on traits has yielded a sound and cumulative body of evidence. Elahi Shirvan et al. (2019) across a vast number of primary studies showed that the overall correlation between L2 WTC and perceived communicative competence, language anxiety and motivation were moderate, with perceived communicative competence being the strongest correlate. To further this synthesis Jin and Lee (2022) applied the meta-analytic structural equation modeling, which enabled to estimate multiple high evidence factors simultaneously in a single structural modeling. All these syntheses taken together establish that stable individual difference variables are able to explain meaningful variance in learners' general WTC, while still allowing for a large amount of variation that emerges moment to moment within a learner over tasks and time.

It is this within-person variability, which is the focus of this paper, that CDST-informed scholarship has been trying to theorize. Syed et al. (2022) suggest that the construal of WTC as a dynamic, emergent, self-organizing state of the system, rather than a static individual-difference outcome, requires research designs to be similarly dynamic and process-oriented.

2.2. Idiodynamic Method and Attractor States

The idiodynamic method has been the main methodological instrument to allow the dynamic reconceptualization of WTC, by combining continuous, fine-grained self-ratings of WTC with retrospective, video-cued explanations of the source of the observed fluctuations. Using this approach, MacIntyre and Gregersen (2022) investigated the interaction and co-variation of willingness to communicate and anxiety in real-time, revealing that the two are better thought of as mutually constitutive processes, not separately determined states. In its summary of the growing literature on idiodynamics, Lu (2022) describes the method's key contribution as its ability to uncover the two characteristics through which complex systems evolve to different attractor states over time: self-organization and feedback-sensitivity.

In his idiodynamic investigation, Nematizadeh (2021) directly operationalised the attractor-state construct by observing per-second changes in WTC during monologic speaking tasks and identified stable patterns of behaviour (attractors) emerging in association with content-related and linguistic-cognitive task factors. This work was followed by a per-second analysis which explored the interplay of the cognitive and linguistic subsystems and their co-determination in shaping WTC fluctuation in the same task episodes (Nematizadeh, 2022). In addition to this work focused on the individual, Ducker (2021) showed that idiodynamic tracing in combination with peer-to-peer strategy sharing could be used, not only to describe, but to actively protect and improve learners' WTC in the course of classroom interaction; an initial indication that dynamic assessment approaches can also be used to inform pedagogical intervention. The later attractor-state studies build on the previous empirical work by Nematizadeh and Wood (2019) that had demonstrated using a similar dynamic paradigm that WTC and second language speech fluency co-vary via interacting affective and cognitive mechanisms.

2.3. Task Based Interaction and Situational WTC

A parallel research stream has investigated the influences of task design features on situational WTC in classroom settings. Toyoda et al. (2021) concluded that L2 SWC of novice EFL learners could be systematically improved by using a well-designed, sequenced TBL, where some of the most consistent features of task-based learning that predicted higher WTC were dyadic and interlocutor-choice conditions. Taking this research one step further and considering technology-mediated, synchronous, group interaction, Nematizadeh and Cao (2024) employed both continuous self-rating and stimulated-recall interviews in six online discussion tasks and discovered that WTC in group contexts is not just an individual-level phenomenon, but also influenced by the group interactional dynamics, which calls for the use of discourse analysis in conjunction with self-report.

2.4. Growth Curve Modeling and Multilingual, Person-Context Dynamics

Latent growth curve modeling (LGCM) is the most popular method for quantifying non-linear and individual trajectories of change in dynamically conceived L2 constructs. The conceptual review of Zhang (2022) describes the technical logic of the CDST and LGCM, and its ability to capture both average trends and meaningful individual differences in initial status and rate of change. With regard to L2 speaking, Li and Zhang (2023) demonstrated that speaking accuracy and fluency and related self-efficacy variables evolve in a non-linear fashion with substantial inter-individual differences using LGCM with parallel processes, which is directly relevant to the present study's own growth curve analysis of WTC trajectories.

Finally, the two-part study conducted by Henry et al. (2021a, 2021b) on WTC among adult learners of Swedish (ALS) is the most similar existing study to the present study's longitudinal, individual-level design; the study shows that WTC trajectories in a naturalistic multilingual community context can be affected by mutually interacting person-level and context-level influences, and that change-point and moving-window correlational techniques can identify effects at system-level that are not evident from cross-sectional, group-averaged analysis.

3. Theoretical Framework

This study embraces Complex Dynamic Systems Theory (CDST) as a meta-theory in line with the CDST reconceptualization of WTC as expressed by Syed et al. (2022). In this context, WTC is considered as a soft assembled state, a temporary state that is bound to a specific context, and which self-organises from the interplay of various co-acting subsystems such as affective state, perceived competence, interlocutor relationship and task demand, instead of being the deterministic product of a predetermined set of trait variables. The analysis is structured in three CDST constructs. First, attractor states refer to recurrent, relatively stable configurations of a learner's WTC under specific task conditions. These are operationalized following the categories of content-related and linguistic-cognitive attractors found by Nematizadeh (2021, 2022). Second, intra-individual variability is not considered as measurement noise but as informative signal as per the person-context dynamics perspective, which considers intra-individual variability as an index of the sensitivity of the system to internal and contextual perturbations (Henry et al., 2021b). Third, the concept of interconnectedness recognizes that WTC is not a standalone process but co-develops with other related processes, such as anxiety, as supported by evidence of the interaction of WTC and anxiety as mutually constitutive real-time processes (MacIntyre & Gregersen, 2022). This allows for a methodological promise of dense and repeated sampling of WTC over a naturalistic instructional intervention, as well as qualitative retrospection that can elicit learners' own explanations for changes.

4. Methodology

4.1. Research Design

A longitudinal design was used, which was explanatory in nature (quantitative trace data followed by qualitative retrospective data) and extended over a sixteen-week semester at a Pakistani university. This is in line with the intensive, individual-level, longitudinal research in the WTC literature which has shown that single-case, time-series designs can uncover developmental dynamics that are missed in group-averaged, cross-sectional analyses (Henry et al., 2021a).

4.2. Participants and Context

The subjects were 36 intermediate-level EFL learners (as determined by institutional placement tests). The broad multilingual ecology in which these learners' uses of English are situated is similar in structure, if not in language, to the community multilingual contexts where recent dynamic WTC research has been located, in which learners' communicative choices are influenced by the interplay of multiple viable languages, rather than by a single target language in isolation (Henry et al., 2021a, 2021b).

4.3. Intervention: Task Design

Over 16 weeks, participants engaged in a systematic progression of speaking tasks designed to systematically manipulate two factors that are recognized in the task-based WTC literature as having important consequences: the level of cognitive complexity and the type of interactional symmetry (dyadic versus group, familiar versus unfamiliar interlocutor, teacher-fronted versus peer-led). To observe how WTC trajectories react to systematic perturbation of the task ecology, the features of the task which were shown to support situational WTC by Toyoda et al. (2021) were deliberately manipulated and not held constant.

4.4. Data Collection

WTC was implemented via three converging channels. In the first, idiodynamic self-report tracing, participants were asked to rate their moment-to-moment willingness to communicate continuously as they watched videos of their own performance of the tasks, according to the procedural logic reviewed by Lu (2022) and used to real-time WTC-anxiety interaction by MacIntyre and Gregersen (2022). Second, stimulated-recall protocols (SRPs) were employed to elicit the participants' own explanations for the salient increases and decreases in their WTC signal, based on the methods of previous idiodynamic WTC studies using group discussion tasks (Nematizadeh & Cao, 2024). Thirdly, a multichannel discourse analysis of the learner talk (turn allocation, self-repair, hedging, backchannel behaviour, and topic initiation) offered an independent, interaction-level index for triangulation with the self-reported WTC fluctuations, following the example of Ducker (2021) who used a peer-interaction strategy-sharing protocol to connect idiodynamic self-report with observable classroom behaviour.

4.5. Analytic Approach

Given the recent use of latent growth curve models for dynamic, affectively-laden L2 constructs (Zhang, 2022), quantitative WTC trace data were analyzed through growth curve modeling. Growth curve models were constructed to estimate average growth across the sixteen-week intervention period, as well as intra-individual variability in starting WTC state and rate of change, consistent with the CDST expectation that there may be significant meaningful intra-individual variability in aggregate growth despite the smoothness of the growth curve (as observed in parallel modeling of L2 speaking development by Li & Zhang (2023). Time-varying variables (cognitive complexity, interactional symmetry, identity-relevant content) were considered as task-internal variables and entered as time-varying covariates. Qualitative data in the form of stimulated-recall and discourse data were analysed thematically and coded with respect to the content-related and linguistic-cognitive attractors identified by Nematizadeh (2021, 2022) and integrated with the quantitative trajectories using a joint-display matrix.

5. Results

Growth curve models showed that while a simple linear CDST model of WTC change during the sixteen-week intervention was a poor fit for the data, models that allowed for individual differences in both the intercept and the slope were a good fit for the data, which was consistent with the findings for other CDST-informed growth-modeling studies of L2 speaking-related constructs in which the variables tracked exhibited non-linear growth with significant between-individual differences in both the level and rates of change (Li & Zhang, 2023; Zhang, 2022). Particularly, participants' WTC signals exhibited significant intra-individual variability over the course of tasks and weeks, with many individuals often oscillating between higher and lower WTC states rather than monotonically increasing, which is consistent with the mutually interacting, system-level influences reported in single case time serial WTC research (Henry et al., 2021a).

This variability was not randomly distributed. The cognitive complexity of tasks was systematically linked to the fluctuation of WTC: less cognitively demanding tasks tended to co-occur with higher and more stable WTC

signals, and cognitively demanding tasks led to greater volatility, especially prior to the establishment of an attractor state related to the topic. Interactional symmetry also proved to be an important variable: dyadic and self-selected-interlocutor conditions were associated with higher WTC than teacher-fronted and unfamiliar-interlocutor conditions, which confirmed task-based research that dyadic and interlocutor selection conditions with different levels of familiarity with the interlocutor contribute to WTC (Toyoda et al., 2021) and also aligns with the finding that interactional symmetry at group level influences WTC in synchronous discussion tasks in addition to WTC at the individual level (Nematizadeh & Cao, 2024).

The third and somewhat unexpected pattern had to do with identity investment. Stimulated-recall data showed that for tasks where learners were able to express content that was personally and/or culturally significant to them, there were sharp and frequently abrupt increases in the WTC signal, even for cognitively challenging tasks. This pattern incorporates the content-related attractor category found in previous idiodynamic studies (Nematizadeh, 2021, 2022) and proposes that content relevance to the identity of the learner can serve as a perturbation that can overcome the low-WTC attractor state created by other factors such as task difficulty or interactional asymmetry.

Discourse-analytic indices showed a general trend of longer speaking turns, less hedging, and more initiation of topic change by the learner in turns during high WTC intervals and more self-repair, shorter turns, and more use of minimal responses in turns during low-WTC intervals, confirming the idiodynamic signal. This convergence helps to validate the use of idiodynamic self-report and peer-interaction and discourse data combined in a triangulated approach as shown by Ducker (2021).

6. Discussion

This research contributes to the CDST reconceptualization of WTC in three ways. First, they offer longitudinal evidence, rather than single-session or cross-sectional evidence, that the intra-individual variability observed in previous idiodynamic and single-case time-serial studies is stable and in fact increases over a longer period of instruction, in line with the general CDST claim that WTC is a soft-assembled state, continuously re-assembled from interacting learner-internal and task-external subsystems, rather than a fixed trait (Syed et al., 2022; Henry et al., 2021a).

Second, the systematic relationship between task-internal variables and WTC volatility provides a partial answer to a question that dynamic systems accounts have sometimes been accused of being vague: what are the kinds of perturbations of the learning ecology that can push a learner between attractor states? Cognitive complexity and interactional symmetry become here tangible, manipulable levers, in line with the findings of task-based investigations reported by Toyoda et al. (2021).

Third, the identity-investment finding points to a variable of WTC that has been under-researched in current task-based models which have focussed on the structural aspects of tasks rather than the socio-affective nature of the task content to the individual learner. This finding aligns with the evidence that WTC and anxiety are mutually constitutive and content sensitive, in real time (MacIntyre & Gregersen, 2022), and is a refinement of the content-related attractor category found in previous idiodynamic work (Nematizadeh, 2021, 2022).

Overall, the findings indicate that a comprehensive model of situational WTC needs should not only consider structural features of task design but should also incorporate a socio-affective and identity-sensitive level of analysis, with the trait-level aspects identified in meta-analyses (e.g., perceived competence, anxiety, and motivation; Elahi Shirvan et al., 2019; Jin & Lee, 2022) serving as background conditions within which the moment-to-moment perturbations found here are generated.

The results of this study also have implications for the conception of L2 speaking assessment. In line with the person-context dynamics perspective proposed by Henry et al. (2021b), single-occasion oral assessments run the risk of treating a learner's response to an unfavourable task configuration as a trait, particularly in high-stakes scenarios, where WTC is likely to be dynamic and task-contingent rather than trait-like.

7. Pedagogical Implications

Regarding task design, the results suggest that it is important to consider the deliberate variation of interactional symmetry (dyadic and self-selected-interlocutor forms where possible) and the gradual increase of the cognitive complexity of the task, so that the learners' WTC can be stabilized around a topic before being raised up, as stated by the sequencing logic validated by Toyoda et al. (2021). The finding for identity-investment implies that curricula can be designed to include multiple chances for learners to shape or choose task content in relation to personally meaningful experiences in order to give the learner autonomy. One practical way to implement this recommendation is through peer mediated strategy sharing protocols like those demonstrated by Ducker (2021) to

protect and enhance WTC during classroom interaction. The findings of the study suggest that a single oral performance should not be used as a fixed indicator of a learner's communicative attitude; rather, suggest multi-occasion, multi-task assessment designs where high-stakes decisions are involved.

8. Limitations And Future Research

These conclusions are subject to several limitations. Although the sample was suitable for intensive, multi-method, longitudinal research, it was confined to one institutional context and may not be valid for other contexts of EFL where the language ecology may vary. Although the idiodynamic method was well validated in previous studies (Lu, 2022; MacIntyre & Gregersen, 2022), it is based on retrospective and continuous self-report, and may be affected by the memory reconstruction effects when stimulated recall is used. Future research could expand the design to cross-institutional comparison, add the change-point and moving-window analytic techniques employed by Henry et al., (2021a) in community multilingual contexts, and explore the generalizability of identity-investment effects to other EFL contexts.

9. Conclusion

This study has followed up on the longitudinal study of WTC in a sixteen-week task-based EFL intervention, using idiodynamic self-report, stimulated recall and discourse analysis with growth curve modeling to capture WTC as a truly dynamic, self-organizing construct. Results show that significant intra-individual variation defies a static explanation based on traits, and that cognitive complexity, interactional symmetry and identity investment are potentially relevant sources of perturbations in learners' WTC trajectories. The study offers a dynamic systems reconceptualization of WTC in an under-researched Pakistani higher-education context, based on evidence from a longitudinal, mixed-methods study, thus making a contribution to both the theoretical maturation of CDST-informed SLA research (Syed et al., 2022) and the practical redesign of task-based pedagogy, learner autonomy support and oral assessment practice in TESOL.

Declarations

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