Investigating the dynamics of change in second language willingness to communicate

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Abstract

For years, researchers have viewed willingness to communicate (WTC) as a personality-based, trait-like tendency and employed quantitative measures, seemingly overlooking the WTC changes during communications. A new line of inquiry, however, has taken a dynamic approach to investigating the WTC changes and the factors triggering them during communications. The present mixed-methods study incorporated an idiodynamic method with 20 Farsi-speaking English as a Second Language participants who performed three-minute speaking tasks, rated their WTC changes, and attended stimulated recall interviews. A between-subjects repeated measures analysis of variance showed a statistically significant difference in the participants' WTC from task to task. The WTC variation patterns were also clustered into seven categories that visualized the dynamics of WTC changes. In vivo coding of the stimulated recall interviews produced seven different categories of factors including possession of supporting ideas, individual, contextual, organizational, lexis-related, and grammar-related factors as well as the participants' perceptions of their performance.

Key words: dynamic WTC, idiodynamic, complex dynamic systems

Résumé

Les chercheurs ont considéré la volonté de communiquer (VDC) comme une tendance basée sur la personnalité, semblable à un trait de caractère, et ont utilisé des mesures quantitatives, semblant ignorer les changements de la VDC pendant les communications. Cependant, un nouveau courant de recherche a adopté une approche dynamique pour étudier les changements à la VDC, ainsi que les facteurs qui les déclenchent pendant la communication. La présente étude à méthode mixte a incorporé une méthode idiodynamique avec 20 participants en anglais langue seconde qui parlent farsi. Ils ont effectué des tâches d'expression orale de trois minutes, ils ont évalué leurs changements de VDC et ont participé à des entrevues de rappel stimulé. Une analyse de variance à mesures répétées entre les sujets a montré une différence statistiquement significative

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dans la VDC des participants d'une tâche à l'autre. Les tendances de variation de la VDC ont également été regroupées en sept catégories qui ont permis de visualiser la dynamique des changements de la VDC. Le codage in vivo des entrevues de rappel stimulé a produit sept catégories différentes de facteurs allant de la possession d'idées de soutien, à des facteurs individuels, contextuels, organisationnels, liés au lexique et à la grammaire, ainsi qu'à la perception qu'ont les participants de leur performance.

Mots-clés : volonté de communiquer (VDC), méthode idiodynamique, systèmes dynamiques complexes

Introduction

There has been a major shift in the ways willingness to communicate (WTC) is viewed in the past three decades. The personality-based, trait-like notion (McCroskey & Baer, 1985) instigated a large body of research that mainly used quantitative methods. Such correlational and quantitative means would only allow researchers to access "a single snapshot of the processes" (MacIntyre, 2007, p. 572) that can potentially be influenced by over 30 variables (MacIntyre et al., 1998; Nematizadeh, 2019) and thus undergo change. The pyramid-shaped heuristic model of situational WTC proposed by MacIntyre et al. (1998), triggered the shift in the ways researchers viewed WTC and provided new insights into the transient and enduring variables that underlie WTC. Later, the introduction of complex dynamic systems theory (CDST) in fields of second language acquisition (Larsen-Freeman, 1997) and L2 individual differences (IDs) (Dörnyei, 2009) encouraged a growing number of studies that viewed IDs variables, like WTC, motivation, or L2 self, as complex dynamic systems (MacIntyre & Legatto, 2011; MacIntyre & Serroul, 2015; Mercer, 2015).

Heuristic model of variables influencing WTC

The present study partly aims to investigate factors that trigger change to WTC, and the pyramid model of WTC (MacIntyre et al., 1998) provides a comprehensive account of many of these factors, a collective force of which shape WTC. The model (Figure 1) is comprised of six levels, with the three lower levels featuring the enduring and stable factors such as social and individual context (e.g., personality and intergroup climate), affective-cognitive context (e.g., intergroup attitudes, social situation and communicative competence), and motivational propensities (e.g., interpersonal motivation, intergroup and L2 self-confidence). The top three levels involve more transient and situation-specific influences, including:

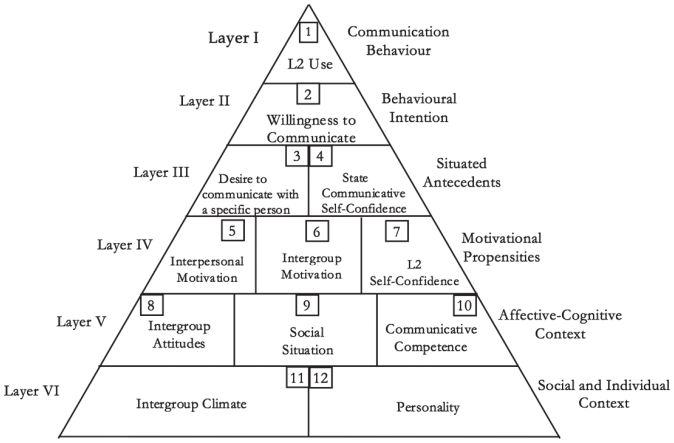

Figure 1

Heuristic models of variables influencing WTC

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1. situated antecedents (e.g., desire to communicate with a specific person and state communicative self-confidence),
2. behavioural intentions (WTC), and
3. communication behaviour (L2 use).

The pyramid shows how multiple variables could serve in shaping WTC and culminate in L2 use. The model, as MacIntyre (2020) stated, led to embracing the theory of complex dynamic systems as a framework to study WTC.

Complex dynamic systems theory

Dynamic systems are open and dynamic, comprise interacting elements and agents, and self-organize to adapt to new environments (Thelen & Smith, 1994). Dynamic systems have typically been associated with concepts such as change, dynamicity, and evolution. van Geert (1994), for instance, conceptualized them as a set of subsystems that interact and influence each other over time. These changes shape the external behaviour of the system when interacting with other systems. On the other hand, the interactions of a system with external influences/systems may also affect the states of its subsystems and alter the system's subsequent behaviour. Such internal and external interactions trigger changes that make dynamic systems nonlinear, which is a behaviour characteristic of L2 systems. The pioneering work of Larsen-Freeman (1997) pointed to the similarities between CDST and SLA,

which were later supported by other studies (de Bot et al., 2007; Larsen-Freeman & Cameron, 2008). Later, some empirical studies adopted CDST to examine ID variables, such as approach/avoidance motivation (MacIntyre & Serroul, 2015), L2 self (Irie & Ryan, 2015; Mercer, 2015), motivation, anxiety, and self-efficacy (Piniel & Csizér, 2015), or the developmental patterns of teachers' motivation (Hiver, 2014).

Change in complex dynamic systems

de Bot et al. (2007) proposed CDST as an overall theory to explain SLA, identifying four common characteristics, including:

1. sensitive dependence on initial conditions;
2. variation/change in and among individuals;
3. complete interconnectedness of subsystems; and
4. emergence of attractor states.

The following section will exclusively discuss the change property as the central focus of this article.

Dynamic systems are dynamic due to the interaction between two or more interlinked subsystems that change over time and interact with each other (Waninge et al., 2014). There is no cause-effect relationship between the subsystems and, therefore, "effect is disproportionate to the cause" (Larsen-Freeman, 1997, p. 142). Hence, the magnitude of change that each subsystem undergoes varies as does the size of the effect factors exert upon each other, making the system nonlinear. Overall, change in dynamic systems is not necessarily attributable to one single cause and there is more than one factor at play.

The pyramid model demonstrated the complex — having multiple constituents — nature of L2 WTC and the multiple factors underlying it. Assuming that these factors, subsystems of WTC, undergo change over time and that they are in constant interaction with other subsystems, it is plausible to think that such changes produce further changes in the system. In fact, it has been argued in both CDST (Larsen-Freeman, 1997) and WTC (MacIntyre & Legatto, 2011; Nematizadeh & Wood, 2021) literature that small changes within a system may bring about greater changes elsewhere in the system — what is commonly known as the *butterfly effect* (Larsen-Freeman & Cameron, 2008). This effect renders the system nonlinear as the change and its magnitude are unpredictable. As an illustration, the *desire to communicate with a specific person* (in Layer III under situated antecedent) of the pyramid model suggests that one's WTC may rise because of the presence of an interlocutor that an

L2 speaker feels more comfortable communicating with. This could also improve the *state communicative self-confidence* of the speaker, which is another factor within the same layer of the pyramid. By the same token, one may display lower WTC due to the presence of a certain interlocutor. As can be seen, the situated factors may interact and affect each other. The same applies to other factors. For instance, Nematizadeh and Wood (2019) found an interaction between WTC, vocabulary retrieval, and the linguistic performance of L2 participants who performed communicative tasks. They stated that once the participants struggled with retrieving lexical items required to communicate their points, they lost WTC as they perceived their speech as dysfluent. This explains how the interactions between cognitive lexical retrieval, WTC, and perceived linguistic performance bring about change in the WTC system.

Empirical studies such as the above look at per-second changes of WTC and are still in their infancy. Therefore, this study is one further step in that direction to gather more compelling evidence of the nature and patterns of WTC changes as well as the factors triggering them.

Literature review

Conceptualizing dynamic WTC

McCroskey and Baer (1985) conceptualized WTC as a relatively unchanging phenomenon. Later, MacIntyre et al. (1998) defined L2 WTC as "a readiness to enter into discourse at a particular time with a specific person or persons, using a L2" (p. 547), focusing on its situational changes. Kang (2005) also studied the situational fluctuations of L2 WTC qualitatively and defined WTC as "an individual's volitional inclination towards actively engaging in the act of communication in a specific situation, which can vary according to interlocutor(s), topic, and conversational context, among other potential situational variables" (p. 291). These definitions show how our understanding of WTC has evolved from a fixed to a changing variable over the past three decades, justifying the use of a dynamically-informed approach to examining WTC. Further to this, MacIntyre (2007) argues that one's motivation to communicate undergoes momentary changes, urging per-second investigations:

> At any moment a learner might feel both motivated to learn and inhibited by anxiety because of the culmination of converging, conflicting processes. Such processes lead to both approach and avoidance tendencies, operating simultaneously, waxing and waning in salience from moment to moment. (p. 572)

Given the above argument and the effect of several factors such as individual, affective, cognitive, contextual, linguistic, or their combinations on WTC (MacIntyre, 2007; Nematizadeh, 2019) as L2 communication unfolds, the

WTC research needs to focus on the nature of change and the factors triggering it.

The dynamic line of WTC research could be categorized based on the timescale used to study the variable. The first category is concerned with the qualitative studies that looked at the changes on longer timescales (class durations, weeks, etc.) and those that adopted smaller ones (seconds, minutes, etc.).

Studies adopting long timescales

One of the very first attempts to observe change in WTC was a qualitative study by Kang (2005), who collected data over an eight-week period and attributed the changes to the interactions between situational (topic, interlocutor, and context) and psychological (excitement, responsibility, and security) variables. This, from a CDST perspective, resembles the way subsystems interact with each other. Kang further argued that the situational WTC, which emerged from a given context, could interact with trait WTC and display unpredictable or nonlinear behaviour, which is also characteristic of dynamic systems. Cao and Philp's (2006) qualitative study, which examined classroom WTC using self-reported questionnaires and actual WTC behaviour using observations and interviews for a month, found that factors like group size, topic and interlocutor familiarity, medium of communication, and cultural background triggered fluctuations in WTC. In another study, Cao (2011) studied WTC in two phases for a total of 23 weeks and found that topic and task familiarity, linguistic proficiency, group size, perceived communication opportunities, personality and self-confidence, emotions, and reliance on L1 were the main factors triggering WTC changes. MacIntyre et al. (2011) focused on high school students' WTC and UnWTC using a focused essay technique for six weeks and revealed that students' WTC or UnWTC was stimulated by an interaction of linguistic development, L2 self-development, and non-linguistic factors. They also reported that factors of interlocutor and context influenced WTC. Additionally, the students were most willing to communicate within immersion classroom settings and least willing when they were unsure of the answer, afraid of making mistakes or being corrected by a friend. Other similar studies, which have observed evidence of change in WTC on long timescales (e.g., semester, months), have attributed the changes to cognitive, affective, linguistic factors, and classroom environment (Peng, 2012), individual and environmental (Cao, 2014), confidence, motivation, and personality (Cameron, 2015), and personal and group-related factors (Mystkowska-Wiertelak, 2021).

Studies adopting short timescales

Short-timescale studies of WTC have been recently making headway, pioneered by MacIntyre and Legatto (2011) who developed an idiodynamic methodology (MacIntyre, 2012) that incorporated both qualitative and quantitative data. The idiodynamic method involves video-recording a participant as he/she is completing a communicative task. The participant then views the recordings using a Windows-based application to help him/her with recalling his/her thoughts and rating a variable like WTC moment by moment by clicking 'increase' or 'decrease' on the computer screen. The application then outputs a bitmap graph illustrating per-second changes and an Excel sheet containing the corresponding numerical values of the ratings, which are used in a stimulated recall procedure to delve deep into the changes recorded by the participants. MacIntyre and Legatto (2011) had their participants complete short speaking tasks consecutively on eight topics and observed varying levels of WTC that emerged as the participants moved from one topic to another. Some participants abandoned an oral task early on upon finding the topic/task unfavorable, despite their ability to carry through when presented with different topics. The study also found that lexical retrieval failures lowered WTC. Another idiodynamic study by Mulvaney (2015), who incorporated semi-structured interviews, found evidence of WTC fluctuations and reported that WTC emerged situationally as a dynamic system that is part of "a larger context of interacting elements and systems which include micro-scale and macro-scale temporal, psychological, and socio-cultural components" (p. 71). Other studies using the idiodynamic method have observed and attributed WTC changes to cognitive, affective, and linguistic factors (Wood, 2016) and self-perceived fluency and cognitive factors like struggling with lexical retrieval and sentence constructions (Nematizadeh & Wood, 2019).

There have been a few mainly qualitative studies, mostly in Polish contexts, which adopted shorter timescales to monitor WTC changes. For instance, a study by Pawlak and Mystkowska-Wiertelak (2015), that monitored advanced learners' WTC in paired communicative tasks every thirty seconds, found that WTC was "affected by a multitude of influences that are intricately interwoven, interact in unpredictable ways, and are often themselves in a state of flux" (p. 8). Further, they reported the effect of factors like topic, speech planning time, freedom to express one's opinion, interlocutor, linguistic resources, generating appropriate ideas as well as individual differences. A partly qualitative study by Pawlak et al. (2015) investigated WTC using grids that the participants completed every five minutes in a classroom context. Through other data collection tools, like questionnaires and observations during conversation classes, the researchers found that WTC behaved like dynamic systems, mainly due to unpredictable, multi-level interactions

between the contextual and individual variables, including topic, task, and learner-related variables.

Almost all the above studies are qualitative and thus based on a small number of participants and limited data. Therefore, there is a need for larger-scale qualitative data to collect substantial evidence concerning the factors that contribute to WTC changes. It is believed that the bulk of qualitative data will not only inform pedagogical practices that will contribute to classroom WTC and student engagement but will also provide a clearer picture of what goes on inside the L2 speakers' minds when engaging in speaking tasks. In addition, there is very little to learn about the patterns of change in WTC literature, and this study sets out to bridge this gap. To this end, the present study aims to address the following research questions:

1. To what extent does WTC vary across four mainly monologic speaking tasks? What do the during-tasks WTC variations look like?
2. To what factors do the participants attribute their WTC changes (rises and declines)?

Methods

Participants

This study is part of a large project that employed a dynamic systems perspective to investigate WTC and L2 speech fluency. This article, however, focuses on the WTC variations and their corresponding properties. To this end, a homogenous group of 20 Farsi-speaking ESL participants was recruited upon obtaining the ethics clearance in two Canadian universities. A non-random purposive sampling method (Dörnyei, 2007) allowed for selecting participants that possessed certain characteristics based on the objectives of the research. This technique permitted the researcher to recruit participants who were mainly capable of communicating their experiences and opinions in a reflective, expressive, and articulate manner (Bernard, 2006; Spradley, 1979).

All participants ranged in age from 25 to 32, spoke Farsi as their first language (L1) and English as L2, had lived in Canada for a period of six months to a year, were graduate students of an engineering program, and had scored between six and seven on the IELTS speaking scale of one to nine, or an equivalent score on a different proficiency test in the year prior to the data collection.

Instruments

The two instruments used in the present study were SPSS and NVivo. SPSS is a quantitative data analysis application that was used in this study to compare

the mean dynamic WTC for each session. NVivo is a qualitative data analysis application that is used when researchers are working with mainly textual data. In this study, NVivo facilitated the creation and integration of codes/factors that influenced WTC, as indicated by the participants in the stimulated recall interviews.

Data collection

Four individual sessions were scheduled with each participant over a two-week period. During the first sessions, participants were provided with a short description of the project in Farsi to ensure consent before they read and signed the consent forms. Participants were also verbally provided with the definition of WTC proposed by MacIntyre et al. (1998) to have a clear understanding of the variable they were about to rate. Each session, the participants completed mainly monologic tasks that involved describing a set of images focused on a new topic for approximately three minutes while being video recorded. Monologic tasks have been widely used in previous WTC research (MacIntyre & Legatto, 2011; Mystkowska-Wiertelak & Pawlak, 2014; Nematizadeh, 2019; Nematizadeh & Wood, 2019). In the context of this study, these tasks lent themselves well to the idiodynamic method where participants focused on their own speech rather than being distracted by other interlocutors. Immediately after, they viewed their recorded video once or twice depending on how comfortable they were rating their WTC. All the participants were given a chance to experiment with the idiodynamic application to learn how to navigate it efficiently. Once ready, they rated their WTC while viewing the video-recording. The application generated bitmap graphs that were used along with the video-recordings to facilitate the subsequent stimulated recall tasks (Gass & Mackey, 2007), wherein the participants commented on the WTC shifts in Farsi. More specifically, the researcher would pause the recording upon spotting WTC fluctuations to allow the participants to explain the changes. Whenever participants struggled to recall their thought processes, the researcher would rewind to help them with the recall. The stimulated recall interviews were also recorded for qualitative analysis.

Data analysis

Data analysis was conducted in two stages that involved qualitative and quantitative procedures. The idiodynamic application generated Excel spreadsheets containing the participants' moment-by-moment WTC ratings, which were used to compute the mean dynamic WTC for each task. The means were used in a quantitative test to measure the WTC variation across the four tasks for each participant. The visual output, or the bitmap graphs, were analyzed qualitatively for the WTC variation patterns during the tasks.

The second stage of the analysis was partly performed during the stimulated recall interviews and partly later. Some initial coding was done and field notes, including codes concerning the factors causing shifts to WTC along with the exact timing in seconds of those WTC shifts, were taken. Another source of codes was available from a pilot study (Nematizadeh & Wood, 2019) that had produced a list of the factors triggering change to WTC. These codes included relevant educational background, discussing personal experience or interest, topic familiarity/transitions, hesitating between ideas, idea retrieval, lexical knowledge/retrieval/repetitions, inaccurate language, self-monitoring speech, perception of dysfluency, jotted-down notes, and access to picture prompts. Access to this code list significantly facilitated the final coding in NVivo. Next, the stimulated recall interviews of five randomly selected participants were transcribed verbatim, translated into English literally, and *in vivo* coded. *In vivo* coding is defined as using "the terms used by [participants] themselves" (Strauss, 1987, p. 33). Datasets of the five participants, which constituted 25% of the entire data, were coded. These were believed to represent the codes that would have emerged from the remaining datasets. At this point, with 31 factors categorized into seven categories, a point of saturation was achieved. Saturation, in the context of qualitative research, is defined as a point where "no new information seems to emerge during coding, that is, when no new properties, dimensions, conditions, actions/interactions, or consequences are seen in the data" (Strauss & Corbin, 1998, p. 136). The remaining data were assigned the corresponding codes that had already emerged.

Results

WTC variations across and during tasks

The first part of research question one aimed to examine the extent to which WTC varied during and across the four speaking tasks. In doing so, a within-subjects repeated measures ANOVA test was conducted to determine if the participants' mean dynamic WTC varied significantly from task to task. As can be seen in Table 1, the statistical analysis showed that WTC varied statistically significantly from task to task (F (3, 57) = 3.092, p <.05, partial $\eta^2 = .14$). As illustrated in Table 2, the group dynamic WTC was averaged for each task to represent the mean WTC pertaining to each task, while the standard deviation (SD) shows the magnitude of changes, with greater SD showing greater variability. The group displayed higher WTC on average in the first task (food), noticeably lower in the second (online vs. on-campus education) and third (technology) tasks, and slightly higher in the fourth (transportation problems) task. It should be noted that the topics had been piloted with

a similar group of participants (Nematizadeh, 2019) using a background knowledge questionnaire (Khabbazbashi, 2017).

Table 1
ANOVA between dynamic WTC and speaking tasks

Source		df	Mean Square	F	Sig.	Partial η^2
Topic/ task	Sphericity assumed	3	0.653	3.092	0.034	0.14

Table 2
Group average dynamic WTC and SDs

Tasks	1	2	3	4
Group mean WTC	0.66	0.3	0.27	0.34
SD (avg.)	1.48	0.78	0.68	0.55

The second part of research question one aimed to monitor and identify WTC patterns of change. To this end, WTC variations were measured using the Excel file outputs of the idiodynamic application. The Excel outputs contained the numerical values pertaining to second-by-second changes of WTC for each task. The numerical values were first averaged to calculate mean dynamic WTC, which is consistent with the method used by MacIntyre and Legatto (2011). Then an Excel formula was used to compute the magnitude of WTC changes or standard deviation (SD), which is in line with MacIntyre and Serroul (2015).

As can be seen in Table 3, a great deal of variability is observed in the idiodynamic ratings of WTC, where most of the changes are positive, suggesting a high WTC, as indicated in Figure 2, whereas a few instances display a negative trend, whereby the participants' WTC was mostly low. For instance, Niki's WTC changed for an average of 1.24 times per second during Task 1, Saba's WTC underwent very few fluctuations (0.03 times per second) in Task 3, or Sepehr's WTC did not change at all in Task 4. As per SDs, Hero's WTC changes in Task 1 showed the greatest magnitude of all (SD = 2.68), while a majority of SDs turned out to be less than 1.

Evidence of change

In addition to the dynamic WTC and SDs, the variability patterns of 80 bitmap graphs were qualitatively analysed in terms of positivity, negativity, and frequency of change, and were clustered around seven major patterns. The

Table 3

Participant-specific dynamic WTC and variability pattern by topic

	Task 1			Task 2								
Participant	*Dynamic WTC*	*Dynamic SD*	*Variability pattern*	*Dynamic WTC*	*Dynamic SD*	*Variability pattern*	*Dynamic WTC*	*Dynamic SD*	*Variability pattern*	*Dynamic WTC*	*Dynamic SD*	*Variability pattern*
Niki	1.24	1.76	GP	0.59	0.88	GP	0.54	0.77	P	0.77	0.85	P
Pouya	0.47	1.22	GP	0.00	0.43	IPN	0.03	0.43	IPN	0.05	0.37	GP
Linda	0.26	1.01	GP	0.16	0.65	GP	0.091	0.37	GP	0.00	0.00	GP
Sara	0.66	1.20	GP	0.16	0.69	GP	0.08	0.72	IPN	0.45	1.01	GP
Majid	−0.21	1.60	RC	0.00	0.13	FS	0.006	0.11	FS	−0.00	0.15	FS
Pedi	0.14	1.36	P	0.04	0.23	FS	0.01	0.12	FS	−0.06	1.36	N
Samaneh	1.46	1.78	GP	0.67	1.12	P	0.57	1.003	GP	0.43	0.88	P
Mohsen	1.45	1.80	GP	0.64	1.12	GP	0.55	0.90	P	0.27	0.58	P
Saba	0.71	1.78	GP	0.13	0.53	P	0.06	0.57	IPN	0.07	0.47	P
Lili	1.58	1.48	GP	1.06	1.32	GP	0.65	1.16	GP	0.12	0.46	GP
Mo	1.10	1.85	GP	0.14	0.56	GP	0.008	0.17	FS	0.28	0.73	GP
Sahra	0.25	1.73	GP	0.00	0.45	GP	−0.08	0.34	GN	0.16	0.40	GP
Hero	1.16	2.68	GP	1.02	1.72	GP	0.13	0.43	GP	0.23	0.56	GP
Sepehr	−0.03	0.52	IPN	0.00	0.09	FS	0.009	0.15	IPN	0.00	0.00	NR
William	1.18	1.75	GP	0.47	1.16	GP	2.00	1.94	GP	4.03	0.95	P
Anita	−0.08	0.97	IPN	0.21	0.60	GP	0.14	1.83	GP	0.05	0.36	GP
Soha	0.89	1.32	GP	0.13	0.45	P	0.00	0.20	IPN	0.05	0.23	P
Mehrzad	0.82	1.68	GP	0.02	1.19	GP	0.05	0.64	GP	0.05	0.59	RC
Akbar	0.05	1.46	RC	0.79	1.63	RC	0.37	0.92	GP	−0.08	0.58	GN
Kaami	0.23	0.65	GP	−0.15	0.76	GP	0.33	0.98	GP	0.062	0.60	IPN
Average	0.66	1.48	—	0.30	0.78	—	0.27	0.68	—	0.34	0.55	—

Roller coaster = RC, Generally positive = GP, Generally negative = GN, Infrequent positive & negative = IPN, Positive = P, Negative = N, FS = Few Shifts, No rating = NR

patterns are ranked from the least to most recurrent along with their respective frequency in Figure 2.

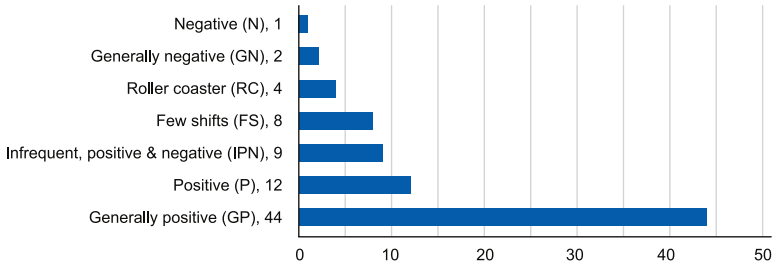

Figure 2
Patterns of WTC changes

A sample of each pattern is also provided in Figures 3 to 9. The most recurrent pattern ($N = 44$) indicated generally positive WTC throughout the tasks. The *generally positive pattern*, as illustrated below (Figure 3), involved graphs with over 90% positive rating of WTC and very few negative ratings. The *positive pattern* was the second recurrent type of pattern ($N = 12$), whereby the participants had maintained positive WTC throughout an entire task and reported no decline (Figure 4). The *infrequent, positive and negative pattern*, which ranked the third ($N = 9$), involved tasks wherein WTC fluctuated rather infrequently, but when it did, the changes were equally positive and negative (Figure 5). The next recurrent pattern of variability, called the *few shifts* pattern, was observed in eight graphs and involved very infrequent changes, in most cases once or twice (Figure 6). These changes were sometimes positive and sometimes negative. Next was the *roller-coaster* pattern ($N = 4$) and involved graphs wherein WTC fluctuated frequently both positively and negatively (Figure 7). As opposed to the *generally positive pattern*, there were two bitmap graphs, called *generally negative* (Figure 8) that represented a low WTC during the tasks. The two cases showed fluctuations with over 90% of negative ratings of WTC and very few positive ratings. As can be seen in Figure 9, in the *negative* pattern, two of the bitmap graphs showed only negative fluctuations in WTC during the tasks, and the changes were not frequent.

Factors triggering WTC variations

The second research question looked into the factors that the participants attributed to their WTC changes (rises and declines). After qualitative coding of the stimulated recall interviews, seven categories of factors (Figure 10) and a total of 31 factors emerged. The categories along with their corresponding

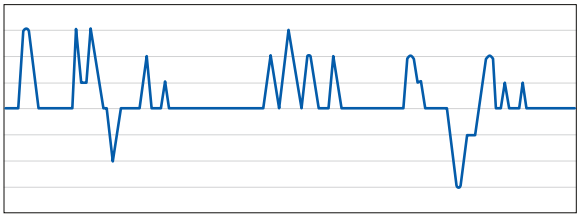

Figure 3
Generally positive pattern sample

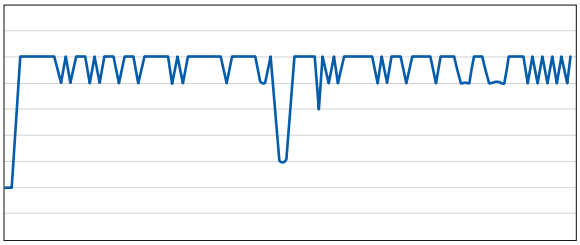

Figure 4
Positive pattern sample

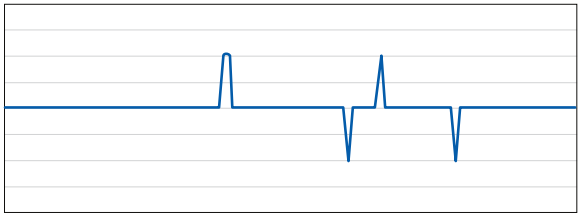

Figure 5
Infrequent, positive, and negative pattern sample

Figure 6
Few shifts pattern sample

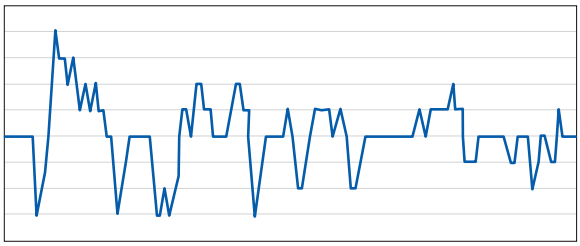

Figure 7
Roller coaster pattern sample

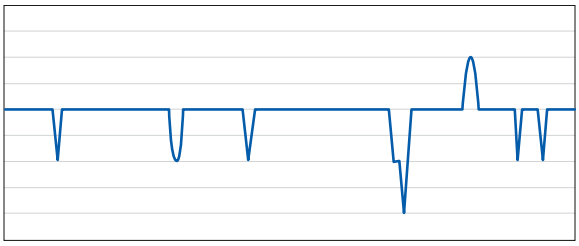

Figure 8
Generally negative pattern sample

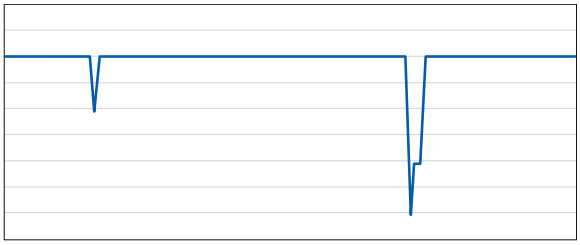

Figure 9
Negative sample Pattern

factors will be presented from the most to the least recurrent below. Due to space limitations, only one or two examples of each category will be provided. The degrees to which WTC rose or declined will be presented using numerals at the exact location where the rating was executed by the participants.

Possession or lack of supporting ideas

Of a total of 584 codes assigned, 29% involved instances where the participants' WTC fluctuated due to factors related to the content message or supporting ideas. These factors included possession or lack of supporting

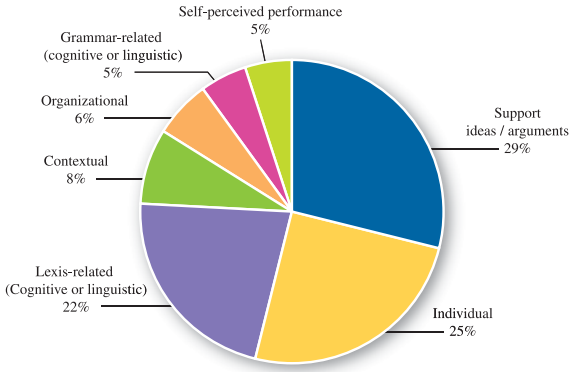

Figure 10
Factors affecting WTC

ideas or examples, impromptu discussion of ideas, perceived inappropriacy or irrelevance of idea, perceived successful argument, or unsuccessful communication of ideas. In one instance, Pedi's WTC rose when he chose to share a daily personal experience that he considered relevant to the task. He recalled his daily experience of seeing the youth glued to their electronic devices on the bus, which he found very unusual when comparing them to the youth who would typically spend more time talking to each other on public transit back home. He believed this comparison helped him generate ideas and support his argument, and improved his WTC:

> these things are the positive things of the (silence) (em) (silence) technology and the mobile phone and the other things (+2) (silence) but also it has some disadvantages[1]

In another instance, Mo's WTC went up when he managed to retrieve the idea of dining out. He explained that he loved going out to eat and had discussed dining out with someone in English, which is why he felt prepared and willing to discuss it here:

> if I wanted to have fast-food I usually go out so (+5) (silence) whenever I go out (silence) that kind of (um) (silence) fast-food or junk food might come to my mind to (silence) have it (silence) just to save time and then get full and come back to focus on my (silence) stuff

[1]Conventions:
– (positive or negative number) = participants' WTC ratings
– (silence) = silent pauses
– (um) or (em) = filled pauses

Individual factors

This category involved fluctuations of WTC due to factors unique to the participants. More specifically, in many situations where the participants ran out of supporting ideas, they tended to access their life experiences, beliefs, interests, accomplishments, memories, or daily routines/habits. As an illustration, Akbar's high WTC in the excerpt below grew out of simply casting his mind back to a conversation with his university professors, staff, and classmates for class projects or for discussing employment opportunities. He further explained that whenever he discusses personal experiences, he does not need to generate ideas because they are already available, and he only needs to sort out sentence structures and lexical items:

> I should say that when you have the chance to study on campus (+2) (silence) you can have interaction with other people such as students, (+3) staff, professor

Another example of the individual factors was when Sara discussed her personal belief concerning online education. While being a team-worker herself, as an employer, she would like to hire someone who is a self-motivated, independent individual that could complement her. She thought that those who take online courses have learned to work independently, which is why she preferred to hire those who have completed online degrees. This is how she justified her attitudes and her WTC increased as she was capable of logically expressing her belief:

Sara:	but if I want to hire someone I prefer to hire someone who did online education
Interviewer:	And why is that?
Sara:	(um) because (em) they are more self-motivated as I said before they can work by themselves (+5) (em) better than (silence) on campus students (silence) and that's it

Lexis-related factors (linguistic/cognitive)

The third group of factors that promoted or lowered WTC involved a variety of lexical issues that included lexical knowledge, retrieval, appropriacy, and repetition. Some of the participants displayed WTC if they possessed the required lexical knowledge about a topic prior to or during the task. As an example, when discussing dieting, Mo's WTC rose mainly because he felt confident as he possessed the vocabulary required for the task. To stay in shape, he had searched and read widely on the topic and thus had learned quite a few lexical items:

> for diet I always wanted to for a diet if (silence) can end up (silence) with better shape for me (+3) (silence) always wanted to be in a good shape (+1) (silence)

Another recurring category that was found to affect WTC was the cognitive demand imposed by retrieving vocabulary during the tasks. Retrieving involves searching and identifying an appropriate item for a context and articulating it. The general idea was that whenever a lexical item was smoothly retrieved, it would improve WTC mainly because the participants were able to produce fluent speech. On the other hand, when participants struggled with lexical retrieval, they ended up pausing, which not only troubled speech fluency, but also created a sense of dissatisfaction with their performance that lowered their WTC. One first example occurred when Niki, in search of some academic fields of study to help her compare which majors could benefit from online and on-campus education, lost WTC because the retrieval took her several seconds:

> and (−3) (−1) (silence) about (em) (silence) (em) I think one of the (silence) (em) (silence) fields (silence) that maybe online education (silence)

Contextual factors

This category involved situations where topical knowledge, familiarity, or transition, and the effects of the interviewer and camera influenced the participants' WTC. In an instance, Majid's WTC rose because his educational background had offered him the knowledge he needed to speak about online education. He mentioned that he had completed a master's back in Iran, and the program he was doing at the time of data collection was a hybrid; that is, it combined both online and on-campus components. Therefore, to support his arguments, he simply needed to review his educational background and experience, which explained his high WTC:

> again when you are outside of the country when you can when you can't participate in the class online helps a lot (silence) when you need (em) to use the (em) all the time of the class when you (+1) are when you want to (em) teach (silence) is in online is more useful (silence) for example here we have

In a few other instances, the participants indicated that they had lost WTC due to being video recorded. Also, speaking in front of the interviewer exerted a cognitive demand that made them more overmeticulous with their language output.

Organizational factors

The jotted-down notes and writing up a discussion plan were also identified to have an impact on the participants' WTC. In one instance, Pouya's WTC rose because of the notes he had made prior to the task. He recalled that he had jotted down the idea of flight delays and was seeking an opportunity to discuss it:

> you might think that OK if a flight delay happens (+2)

Also, writing up a discussion plan during the one-minute preparation time improved some of the participants' WTC. In one instance in Task 4, Linda had planned to categorize her ideas into international and urban transports, which had given her a feeling of security and preparedness to start the task:

> Transportation problems can be in (+1) (silence) (em) abroad or within city inside the

Grammar-related factors (linguistic/cognitive)

This category involved two subcategories: cognitive and processing issues with sentence construction slightly prior to the speech production, and perception of inaccurate speech after the utterances were produced. The first category involved instances where participants, sometimes, lost WTC when they struggled to smoothly structure a sentence. The second grammar-related category pertained to cases where inaccurate speech was produced and detected by the participants. In both cases, there were instances where WTC was affected and other instances where WTC remained intact. In one instance, Saba lost WTC as she struggled to retrieve a word after "became". She explained that she had been uncertain about the grammar structure that would best communicate her thoughts, resulting in frequent pauses and a noticeable decline of WTC:

> had more advances so it (silence) it actually (silence) (em) became (em) (silence) it became (em) like (−4) (silence) (em) a very (silence) (em (silence) it actually expanded

Self-perceived performance

This category involved instances in which participants judged the characteristics of their speech as they spoke, and depending on the quality, their WTC changed. These included perceived control over language, perceived fluent/dysfluency speech, and perceived (in)accuracy. As an example for the perceived language control and competence, Kaami's WTC rose as he was impressed with a passive structure he used:

> Online education so there there are (+2) (silence) online education and on campus education two things that (silence) *can be managed together can be done separately* (+1) (silence) so I had experience for

In another instance, Majid's WTC rose as he was able to add some humor to his discussion while being able to maintain the flow of speech. He believed that adding some humor while speaking shows one's mastery in that language, and it appeared that he was impressed with his show of proficiency:

> I wanna talk about myself because I really I really like (+5) I really like to (silence) eat a lot and especially when there is (laughter) delicious food (+2) (silence) whenever my when my wife (silence) cooks (+5) (silence) for me

Discussion

The phenomenon of change

The first research question revolved around the WTC changes across and during the speaking tasks. Statistical analyses showed that the participants' WTC differed significantly from task to task, indicating the effect of the topic, given that the other potential contextual variables (data collection procedure, interviewer, etc.) remained constant. This mirrors the results of MacIntyre and Legatto (2011). Through qualitative analysis of the patterns of change (e.g., positivity, negativity, frequency of shifts), 80 bitmap graphs were clustered around seven categories, the majority of which showed the changing nature of WTC during the tasks due to a variety of factors. Even in the few-shifts pattern, where WTC displayed little variability — known as an attractor (Nematizadeh, 2021), there were times when the participants reported change in the WTC levels at an unpredictable point. For instance, in one of the few-shifts graphs, William maintained high WTC for the better part of the task only to lose it upon perceiving one of his supporting ideas irrelevant to the topic. He further explained that despite his overall interest in the topic, his perceived smooth vocabulary retrieval, and fluent speech, noticing that his supporting idea was irrelevant lowered his WTC. This indicates how a variety of factors, such as linguistic, cognitive, contextual, which co-facilitate speech performance, are monitored by the L2 speakers and may trigger WTC changes.

Some of the bitmap graphs showed changes that occurred on a per-second basis, while there were instances where changes tended to be infrequent or spread apart, they were changes nonetheless. The findings of this study suggest that WTC changes are to be expected during L2 communications; they may occur frequently in a nonlinear fashion; they depend on one, or the collective force of several different factors. The findings are in line with previous WTC (MacIntyre & Legatto, 2011; Nematizadeh & Wood, 2019) and CDST research (Larsen-Freeman & Cameron, 2008).

WTC as a complex system with multiple sub-systems

The findings of this study suggest that, like the trait WTC with several underlying factors (MacIntyre et al.,1998), dynamic WTC, which represents one's tendency to engage in commutation "here-and now" (MacIntyre, 2020, p. 127), may be viewed as a core complex, dynamic system with several underlying sub-systems that either cooperate flawlessly and promote WTC, or fail and set the tone for low WTC. To address the second research

question, the participants attributed the WTC changes to individual, linguistic, cognitive, organizational, contextual factors, or issues relating to participants' self-perceived performance or possession of supporting ideas/arguments, many of which are consistent with previous dynamic WTC research (Kang, 2005; MacIntyre & Legatto, 2011; Mystkowska-Wiertelak & Pawlak, 2014; Nematizadeh, 2021; Pawlak & Mystkowska-Wiertelak, 2015; Pawlak, et al., 2015; Wood, 2016). The emergence of the above factors and their joint role in generating dynamic WTC highlights the multi-layered nature of WTC and very closely resembles what MacIntyre et al. (1998) proposed in their pyramid model. From a CDST perspective, these can be viewed as the sub-systems of WTC. Changes to WTC were triggered by either one central factor or some form of dynamic interaction between two or more of these factors. Whenever such sub-systems (e.g., linguistic & cognitive) functioned properly and efficiently, positive affect emerged in the form of high WTC. Conversely, once a sub-system or two malfunctioned (e.g., failure in sentence constructions or lack of lexical knowledge), the WTC system was perturbed. This closely resembles the CDST notion of butterfly effect wherein small changes somewhere in a system could bring about other change(s) elsewhere (Larsen-Freeman, 2015).

Nonlinearity and butterfly effect

One characteristic of change in dynamic systems is their nonlinearity. The magnitude of the effect may not be comparable to the cause (Larsen-Freeman, 1997), and this was evident in the findings of this study. For instance, WTC was affected by lexis-related factors; however, this effect was not always proportional to the cause. Sometimes, WTC was heavily affected by a failure to retrieve vocabulary in cases where the communication broke down, while this effect was sometimes less noticeable when the participants were able to make their point through retrieving alternative lexical items. There were also a few instances where failing to retrieve vocabulary had no impact on WTC; that is, some of the participants would not perceive this as a communication breakdown and would carry on. Determining whether a cognitive lapse like this leads to a small or huge impact (butterfly effect) is complex, and therefore, as the illustrations show, WTC changes occur in a nonlinear fashion. There were instances whereby a small change in one part led to larger changes elsewhere in the system and vice versa.

Findings of this study also showed that self-perceived performance affected WTC, which was partly in line with the findings by Nematizadeh and Wood (2019) who reported the effect of self-monitoring and participants' own perceived speech fluency. In one instance, Anita mentioned that perceiving her speech as dysfluent, as a result of a delay in lexical retrieval, had caused her stress that preoccupied her subconscious for a few seconds, affecting her

sentence construction mechanism and significantly lowering her WTC later. This study expanded this to a few more factors including, self-perceived accuracy, pronunciation, control over the tasks, and quality of supporting ideas (e.g., relevance). It was further found that attention to the qualities of already-produced speech consumed cognitive resources and troubled the planning and production of upcoming speech. This represented the so-called butterfly effect whereby a small cognitive lapse in lexical retrieval gave rise to dissatisfaction with self-perceived speech performance that led further to affective issues.

Conclusion

The present study employed an idiodynamic investigation to monitor the patterns of per-second changes of WTC and the factors triggering them. The findings showed that the participants' WTC varied significantly from task to task, and the per-second WTC changes during the tasks took on seven different patterns in terms of positivity, negativity, and frequency of change. In addition, the findings suggested that WTC changes were nonlinear and resulted from either a single factor or the interaction between multiple factors, highlighting the complex nature of the variable. Qualitative analysis of the stimulated recall interviews also produced seven categories of factors that triggered change to WTC. While many of these categories (contextual, individual, organizational, linguistic, & cognitive) had already been reported in previous dynamic WTC research, the new contribution of this study involved the effect of self-perceived performance, including perceived control over language use, perceived accuracy/fluency, which affected WTC. Since this emerged as one of the less recurrent factors, the corresponding findings should be deemed preliminary and, therefore, there is a need for future research to investigate this more closely.

While the number of participants recruited and the amount of data gathered were the strengths of this study (compared to previous examinations of per-second changes of WTC), the study comes with a few limitations: 1) the use of monologic tasks in monitoring WTC, and 2) the inauthentic environment in which the data were collected. Despite the challenges of using the idiodynamic methodology with a group of participants, it would be insightful to observe how the group dynamics function and affect L2 speakers' WTC. Therefore, future research is encouraged to use group discussion tasks in a more authentic environment (e.g., classroom).

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