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Deciphering the intricate nature of learning Maltese verbs through Chaos/Complexity theory

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Abstract: Notwithstanding the considerable amount of research conducted in the field of second language acquisition (SLA) (a list of abbreviations is provided at the end of paper), our understanding of the cognitive processes that occur in the adult brain during the learning of a second language (L2) remains limited. This study investigates the potential development of a learning pattern in 35 adult learners of Maltese as a second language (ML2), specifically focusing on Maltese verbs. This research was inspired by the principles and concepts of Chaos/Complexity theory (C/CT). The subject matter revolves around the concept of a non-linear learning curve, the origins of the butterfly effect, and the presence of fractal patterns in the learning process. The study elucidates the unpredictable, chaotic, dynamic, and complicated nature of learning Maltese. This research employed a longitudinal research system and utilised a mixed-method approach with a specific focus on methodological triangulation. The study employed Timed Grammaticality Judgement Tests, verb conjugation tasks, reflective journals, and interviews to examine the progression of learning Maltese verbs at an intermediate level over a span of 15 months. Based on the findings, every participant reported a non-linear learning pattern and verified the characteristics of Chaos/Complexity theory.

Keywords: Chaos/Complexity theory (C/CT), non-linear learning curves, butterfly effect, second language acquisition (SLA)

Introduction

After Malta joined the European Union (EU) in 2004, the Maltese language was recognised as one of the official languages of the EU. Malta has the authority to demand proficiency in the Maltese language for formal European Union agreements and communication. Therefore, individuals from non-EU countries who are employed in Malta under Directive 2005/36/EU, Article 53 are expected to be able to communicate in the Maltese language (Camilleri Grima & Żammit, 2020).

This study examines the interlanguage acquisition of verbal tense and features in Maltese as a second language (ML2) by adult learners. Interlanguage is a term used to describe a type of language that is created by someone learning a second language. This language frequently includes grammatical aspects that are not present in the learner's native language or their second, third, or fourth language (Nordquist, 2020).

The study was conducted over a period of fifteen months. The participants consisted of 35 ML2 learners and 15 native speakers of Maltese/Maltese as a first language (ML1). This research is significant as it seeks to address the lack of studies on teaching and learning strategies for ML2 learners and investigate whether the Chaos/Complexity theory (C/CT) has an impact on the ML2 learning process.

Research Questions

The adoption of C/CT in ML2 learning was the primary inspiration for this research. To achieve this objective, the researcher formulated two research questions:

(1) Is it possible to detect a recognisable learning pattern over time in the acquisition of ML2?
(2) What challenges do learners encounter in acquiring ML2, particularly concerning Maltese verbs?

This analysis comprehensively examined the properties of C/CT by addressing the initial issue. The second question provides guidance on the implementation of C/CT, which can be achieved by examining the problems encountered during the acquisition process.

Literature Review

Chaos/Complexity theory (C/CT) is a scientific framework and a mathematical discipline that explores the underlying patterns and deterministic rules that govern dynamic systems (Benbya, Nan, Tanriverdi & Yoo, 2020). Significantly, they have garnered interest from the second language acquisition (SLA) research community focused on the linguistic progression of individuals learning a second language (L2) (Larsen-Freeman, 2018). The idea of C/CT facilitates comprehension of the sociocognitive factors that contribute to the development of interlanguage, while also allowing for reflection on its non-linear characteristics. The objective is to examine the structures and processes that are associated with the acquisition of an L2 (Larsen-Freeman, 1997; 2018). The C/CT approach entails the examination of twelve characteristics shown by non-linear systems, which can be categorised into three groups: dynamic, complex, or sensitive to initial

conditions (Larsen-Freeman, 1997). This study seeks to explore the use of C/CT in ML2 and its role in interpreting learners' interlanguages (Żammit, 2019; 2021).

C/CT Characteristics

According to Matsuda, Chinokul, and Sukavatee (2017), individuals who are learning an L2 may have diverse interlanguages, even if they have the same first language (L1). This is due to the possibility that their L1 acquisition may vary based on individual views (Matsuda, Chinokul & Sukavatee, 2017), in addition to other variables.

The butterfly effect is another characteristic of C/CT. The butterfly effect refers to the notion that small changes can have significant consequences in the long run. This concept has garnered endorsement from multiple researchers, including Larsen-Freeman (1997; 2018), Murphy et al. (2015), and Żammit (2024). In the field of SLA, social elements such as cultural origins also play a role (Larsen-Freeman, 1997). Over time, a learner's interlanguage might undergo changes, which is a further characteristic of C/CT (Mystkowska & Pawlak, 2017). Moreover, the development of interlanguage is shaped by self-organization mechanisms (Norris et al., 2017). Learning a new language necessitates individuals to employ distinct vocabulary or phrases compared to their usual speech in their native languages (Nordquist, 2017b).

Contrastive analysis and translational comparison studies demonstrate the ways in which different learners adapt their language usage to communicate themselves in different settings (O'Neill, 2015; Paggio & Gatt, 2018; and Saylag, 2014). According to Saylag (2014), a lack of exposure to the L2 environment results in resistance, but the presence of the environment helps learners adapt to it. Given that language is a dynamic and complex system, receiving feedback from native speakers of the target language, as well as peers and teachers, can facilitate the development of language acquisition (Peters et al., 2018). Cognitivism regards the exchange of information as a crucial aspect of research-based teaching, which is referred to as competence (Larsen-Freeman, 2000).

The use of C/CT enables educators to modify their teaching approaches in language classrooms, resulting in increased adaptability and versatility (Al-Hoorie et al., 2021). Mirski and Gut (2020) argue that the learning process, as explained by the sociocognitive viewpoint and emergentism, does not adhere to straightforward and linear learning development.

C/CT presents an unconventional approach to learning that is non-linear, chaotic and incorporates strange attractors, challenging previous notions

about SLA. Amid this chaos, patterns or fractals can emerge that resemble the complex and dynamic aspects of language acquisition (Larsen-Freeman, 2018). The viewpoints expressed by C/CT offer beneficial suggestions for the teaching and learning of Maltese.

Methodology

Longitudinal Research Design

This research employed a pragmatic epistemology and a longitudinal research methodology to investigate two research questions. Pragmatism highlights that the development of knowledge happens through an individual's introspection and real-life encounters (Bazeley, 2013). The pragmatic epistemology was used to examine the actual life experiences of 35 ML2 learners and analyse the findings related to C/CT (Bazeley, 2013).

Longitudinal research refers to the process of collecting information over a prolonged duration of time (Caruana, Roman, Hernández-Sánchez & Solli, 2015). This study was conducted on six occasions over a period of fifteen months, from March 2016 to May 2017. A longitudinal design was employed to accurately measure the impact of C/CT.

Research Design for Mixed Models

This study utilised a mixed-method methodology to collect both qualitative and quantitative data to address the research issues. The mixed-method design was effective because it comprehensively captured the dynamic nature of the research questions and provided a complete understanding of the phenomenon under investigation. The collection of quantitative data was carried out through Maltese grammar tests, while the collection of qualitative data was conducted through reflective journals and interviews.

The research was conducted in three lifelong learning centres, involving a group of 35 ML2 learners who had achieved an intermediate level of proficiency in studying the Maltese language. It is important to acknowledge that while bigger sample sizes are often desired, the limited numbers in this case were effectively handled through the use of qualitative instruments such as interviews and reflection journals. This facilitated the implementation of different data collection methods by employing the mixed-method approach.

Timed Grammaticality Judgement Tests (TGJTs) and Verb Conjugation (VCs) tasks

Timed Grammaticality Judgement Tests (TGJTs) are recognised for their ability to elicit a learner's implicit knowledge (Sorace, 1996; Zhang, 2015). TGJT is an essential psycholinguistics technique used to collect data and evaluate students' comprehension of SLA. TGJTs yield consistent outcomes

(Sorace, 1996). The participants were allotted twenty minutes to evaluate a total of forty sentences for their grammatical accuracy. In addition, verbal comprehension tasks were employed to elicit explicit information and assess the participants' grammatical proficiency (Sorace, 1996). The study employed interviews and reflective journals to get insight into the factors that influenced the participants' performance on the TGJT and verb conjugation (VC) tasks. The purpose of this triangulation technique was to improve the dependability of research findings regarding the interlanguage of ML2 learners.

Participants

The study included a total of 35 adult learners, with ages ranging from 19 to 74 years old. These learners were at the intermediate stage (B1 and B2 levels) of acquiring their ML2. The participants exhibited a wide range of first languages, nations, and different degrees of skill in both English and Maltese. Furthermore, they had a variety of occupations and marital circumstances. The only shared characteristic among these participants was their ability to understand the English language. All participants have successfully completed the Maltese as a foreign language Level 1 (MFL1) course and have been studying Maltese as a foreign language at the second level (MFL2) for a duration of two years. Everyone of them had resided in Malta for over a year.

Furthermore, a cohort of 15 proficient ML1 adults was selected to validate the process for collecting data. The ML1 speakers were chosen to ensure the reliability and precision of the TGJT and VC tasks, as well as their subsequent adjustments. All 50 participants (i.e. 35 ML2 and 15 ML1 speakers) in the research readily supplied their signature on a consent form, signifying their agreement to participate in the study. The participants were classified into the following discrete groups:

1. The ML2 study involved 35 participants who completed the TGJT and VC tasks six times each, in addition to participating in a single interview.
2. Out of the 35 participants in the ML2 programme, five individuals regularly maintained a reflective diary and recorded their views on a weekly basis.
3. In the ML1 cohort, fifteen individuals who were native Maltese speakers with different career backgrounds and marital statuses were selected to evaluate the reliability and validity of the TGJT and VC tasks.

Authorization for ethical considerations

Prior to data collection, the researcher obtained ethical approval from both the University Research Ethics Committee (UREC) and the Faculty Research Ethics Committee (FREC) at the University of Malta. The participants were thoroughly informed about the specifics of the study and their rights (Cascio & Racine, 2018). The participants were given consent forms and information sheets and were informed that they had the choice to withdraw from the study without needing to offer any justification. The researcher confirmed

that the data collection tasks were appropriate for the ML1 participants (Resnik, 2018). After conducting the interviews, the information discussed during the conversations was transcribed into written format (McKenna and Grey, 2018). The participants were guaranteed secrecy and anonymity, and fictitious names were used (McKenna & Grey, 2018).

Procedure for Collecting and Analysing Data

The data collection technique featured participants who were either physically present at their educational institutions or, if they were ML1 speakers, outside of their institutions. Some participants were missing during the data collection period. The TGJT and VC tasks were each executed six times across six separate months. Interviews with ML2 participants were conducted once.

Fifteen ML1 applicants completed a single attempt each for the TGJT and VC assignments. Interviews were carried out with speakers of ML1 to compare and ensure the authenticity, validity, and fairness of the data. To assess the accuracy of the tasks, the researcher enlisted the ML1 participants to compare their responses with those of the researcher and evaluate the degree of agreement.

Analysis

A one-way ANOVA test was used to compare the mean scores of the ML2 participants. The TGJT and VC quantitative tasks were conducted similarly. Furthermore, the researcher utilised the Least Substantial Difference (LSD) method, which is a post hoc statistical analysis, to validate the existence of substantial disparities in particular domains (Martínez-Adrián & Gallardo, 2017). The rationale behind this is because ANOVA solely detects significant disparities, but it fails to provide specific information about the precise positions of these significant alterations (Martínez-Adrián & Gallardo, 2017). Using this method, the researcher assessed the statistical significance of the mean scores for the quantitative tasks over a six-month period. The researcher employed the Pearson correlation coefficient, a statistical metric, to examine the potential relationship between variables (Schweder & Hjort, 2016) to determine if there were any connections between TGJT and VC findings.

Results and Discussion

Learning patterns

Learning patterns refer to the rate at which an individual can acquire knowledge and skills over a period of time (Aird, 2017).

Non-linear characteristic

Non-linearity refers to an attribute or behaviour that does not follow a straight or predictable pattern. The study clearly demonstrates that the learning patterns observed in the participants' scores were not linear. Over the course of 15 months, as the participants learned Maltese, they experienced periods of progress, decline, and a plateau in both the grammar tasks of the TGJT and the VC tasks. Further details can be obtained from Appendices 1-6. While the participants' scores were divided into six categories, there were variations even within the same category. For instance, in the case of learning curve 1 (refer to Appendix 1), from January to March 2017, some participants experienced an improvement in their TGJT scores, while others in the same group encountered a period of stability or a decline in their scores. The observed learning pattern provides credence for the concept of C/CT, which asserts that second language acquisition (SLA) is both non-linear and unpredictable (Larsen-Freeman, 1997, 2011, 2018).

Categorising participants according to their learning curves proved to be difficult due to the fluctuating nature of their improvements, declines, and plateau patterns. The scores of the participants were categorised into six distinct learning curves, with notable variations observed in learning curves 1 and 6, as well as in the overall learning curves depicted in Appendices 1 to 6 using GeoGebra software.

While some participants experienced minor fluctuations in their raw scores, these variations are typically not considered statistically significant. However, in this study, any observed decline or progress in the non-linear learning curve was deemed significant as evidence of one of the C/CT characteristics. Furthermore, the mean scores, which were statistically significant, revealed minor and inconsequential variations in the mean scores during the initial four months (specifically, March, May, October 2016, and January 2017) when the data was collected for the TGJT and VC tasks. However, there were significant disparities in the mean scores during the final two months (March and May 2017), as depicted in Figures 1 and 2. This demonstrates the manifestation of the butterfly effect in C/CT. According to the concept of the butterfly effect, even a minor change that is considered to have no statistical significance can lead to a significant and dramatic change, as illustrated in Figures 1 and 2. The data demonstrates that the participants' progress in learning Maltese varied, with some suffering a decline, others reaching a plateau, and others achieving higher scores during the learning periods.

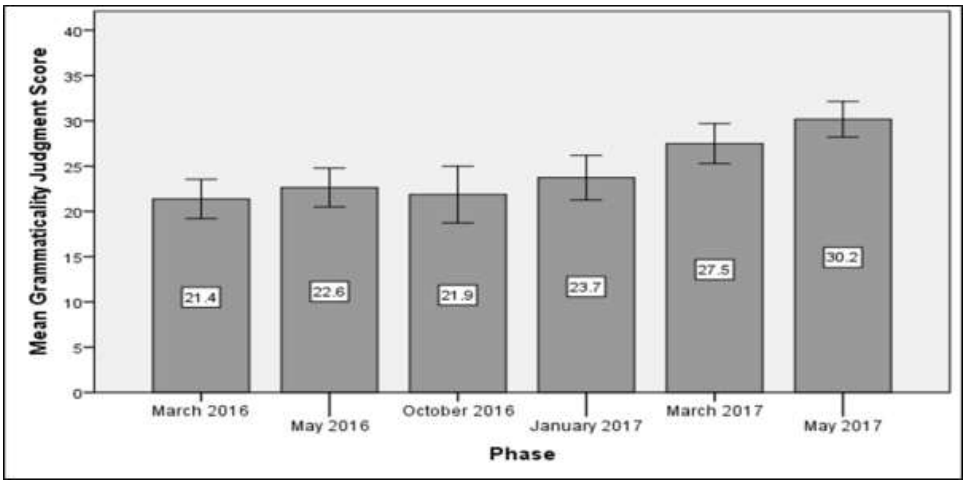

Figure 1: The Mean Scores of Timed Grammaticality Judgment Tests

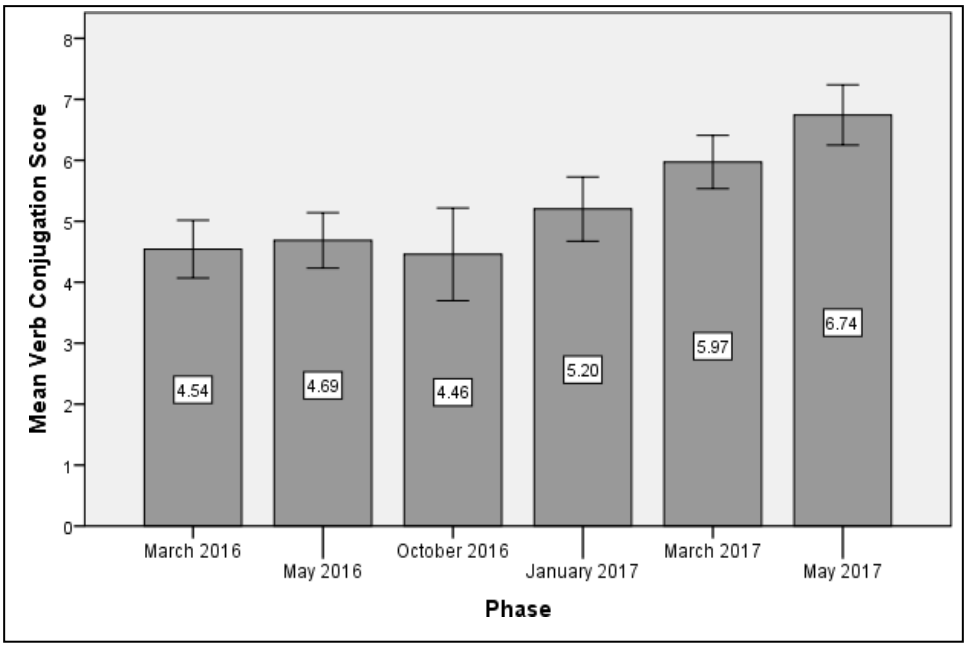

Figure 2: The Mean Scores of Verb Conjugation Tasks

The analysis of the learners' performances in this study indicates that the teacher is unable to anticipate a student's performance, as a student who has previously excelled may either exhibit improvement or experience a decline, and vice versa. This discovery challenges conventional research that proposes SLA to be a linear and foreseeable process. The consensus among scholars, including Larsen-Freeman and Safari & Rashidi, is that SLA is a non-linear process that is impacted by a range of elements, including social, cultural, environmental, and psychological characteristics. The non-linear nature of SLA cannot be exclusively ascribed to the instructional techniques or the learner's level of commitment, but rather to the learner's internal and external

circumstances. The intricate characteristics of SLA are elucidated by theories such as C/CT and cognitive, sociocognitive, and sociocultural theories. This study aims to investigate the challenges faced by the learners and establish a connection between these issues and C/CT. The objective is to gain a deeper understanding of the subjective factors that contribute to the participants' underperformance on the ML2 tests.

Challenges in acquiring ML2

Each of the 35 participants encountered a diverse range of issues, spanning from personal to environmental factors, which resulted in either a decrease, improvement, or stabilization in their performance in the TGJT and VC tasks. The presence of these issues related to ML2 learning has led to evidence that C/CT indeed dominates. The learning challenges will be examined based on the identified themes and subsequently connected with C/CT. The findings are categorised according to the prevalent developing themes that underpin this research.

Insufficient acquisition of both tacit and explicit knowledge

Some participants stated that their low scores were a result of not being exposed to the Maltese language over their four-month summer vacation period (June–October 2016), as well as their three-week Christmas holiday and two-week Easter vacation. Thirty-one participants admitted that throughout their visits to other countries, they did not engage in speaking or listening to the Maltese language. As a result, they were unable to acquire implicit knowledge of the Maltese language. Due to the absence of evening lectures during the vacations, the majority of participants were lacking clear knowledge. As a concrete example, a participant who happened to be a doctor expressed:

> *I went back to Macedonia during the summer to visit my family and for an important medical course as I needed to continuously update my knowledge in my work. I didn't have time to study or to talk to anyone in Maltese.*
>
> (Interview, 24/05/17, Danijela)

The fundamental problem of insufficient implicit and explicit knowledge is not due to a lack of exposure to the second language (L2), but rather a disruption in exposure that occurs during the vacation period. Saylag (2014) argued that when an adult learner is exposed to a particular environment, they will adapt to learning an L2. Conversely, a lack of exposure can result in resistance, and the learner may not show interest in acquiring L2. Prolonged periods without exposure to the Maltese language may have resulted in a decline in participants' proficiency in ML2.

Lack of input or response

Most of the participants who were married to Maltese partners indicated that their partners were unwilling to interact in Maltese with them. Additionally, when ML2 participants attempted to speak Maltese to their partners or ML1 speakers, the latter were uninterested in correcting their Maltese language errors and instead responded to them in English. In addition, one of the participants, an English maid, mentioned that her husband had assured her that she did not have to learn Maltese.

> *My husband keeps on asking me: Why are you learning Maltese when we talk in English, and everyone here understands English? It is not an important language at all. You can speak it only in Malta. It's just a waste of time so you won't do household chores!*
>
> (Interview, 25/05/17, Gabby)

Based on C/CT, learning is influenced by feedback (Larsen-Freeman, 1997). Therefore, it is possible that learning did not occur when ML1 speakers refrained from correcting ML2 learners due to politeness throughout their interactions. A Russian writer, who participated in the discussion, emphasised the significance of writing and its profound impact on learning ML2.

> *Many people are so wrong when thinking that you will know the foreign language better if you live in the country where this foreign language is being spoken. For instance, Maltese are so kind and polite that they always reply to me in English even if I talk to them in Maltese. So, it's not living in Malta which made me learn Maltese but my motivation and my ability to learn. I used to also have fun writing dialogues in Maltese; some of the dialogues were actual conversations that I had heard on the bus, at a shop or by the beach. During evening classes, we should be allowed to write dialogues with each other or fictional characters andthen recite them in class.*
>
> (Interview, 26/05/17, Vladimir)

Culture shock

Several participants attributed the difficulty in learning ML2 to a cultural disparity between Malta and their country of origin. A total of twenty-three participants acknowledged being affected by culture shock and expressed the necessity to acclimatise to the Maltese culture.

Gradually, Martina, an ICT assistant from the Czech Republic, developed a strong connection to Malta and became increasingly at ease with the local culture, people, cuisine, and language. She asserted:

> *I have accepted the side that the Maltese people drive. Now for me, driving on the left is fine and I got used to it. Even the hot climate in Malta*

> *especially in July and August, the lack of greenery and trees especially during summer when everything looks so dry, the Maltese food, its political system, the fireworks' noise during the morning, the fact that we cannot drink tap water, the Maltese language ... all of this is sounding familiar to me now. Now I am finding it difficult when I return to my home country for the holidays because I feel that I am getting used to the Maltese culture.*
>
> (Interview, 24/05/17, Martina)

Adapting to the environment, including the ML2 environment, is also a trait of C/CT (Larsen-Freeman, 1997). The cultural disparities between Malta and the ML2 learners' native cultures result in challenges when acquiring ML2. Cultural intelligence can mitigate the effects of culture shock by enabling the learner to develop the necessary flexibility to comprehend, attentively listen, assess, and reflect upon the second language (L2) culture (Aravind & Dhar Dwivedi, 2015). It is necessary for learners to actively reject and question their own cultural beliefs and habits, as failure to do so could hinder their learning of ML2 in this particular situation. However, according to C/CT, SLA is characterised by its unpredictability (Larsen-Freeman, 2016). Therefore, an ML2 student who tries to adapt to the Maltese culture cannot be certain of learning ML2 without encountering any difficulties. In addition, it is challenging for a teacher to assert that all ML2 learners would uniformly overcome the issue of culture shock.

Adult learners' obligations

A total of thirty-two participants indicated that they needed additional time to acquire proficiency in ML2. The participants stated that acquiring proficiency in Maltese demands a significant investment of time. However, they find it challenging to allocate time for studying ML2 owing to various responsibilities, such as familial commitments, childcare, tending to a garden, caring for pets, engaging in hobbies, or maintaining household cleanliness. Certain participants attributed their low performance in ML2 learning to factors such as age and external responsibilities associated with adulthood.

The characteristic of openness in C/CT necessitates the consideration of external elements that impact SLA during the learning process (Gonsior, Domzalski & Gątarek, 2014). The issue of inadequate performance is exacerbated by the sensitivity of C/CT to the initial conditions (Larsen-Freeman, 2016). The likelihood of adult learners' commitments and L1 transfer impacting the initial conditions has increased, resulting in the learners' inability to comprehend crucial components of ML2, ultimately leading to a decrease in ML2 exam performance.

Cognitive decline associated with the ageing process

Seventeen individuals expressed their willingness to discontinue their study of ML2 due to difficulties with memory retention. The participants' diminishing performance, particularly in VC tasks, from October 2016 to January 2017, was attributed to the effects of ageing and memory loss. Memory impairment was observed to impact both ML2 acquisition and the subjects' native language (L1). As a result, the participants experienced significant frustration when they made considerable efforts to recall a term, even in their own language.

An English teacher acknowledged that his memory is deteriorating as a result of the natural process of ageing, as he possessed excellent recall during his childhood.

> *Sometimes I just cannot remember the word or the conjugation of the verb. I know that we did it in class or that I have seen it somewhere. I also know that I know it, and then, I just cannot remember it. It is so frustrating! What's worse is that sometimes I realise that I am remembering a word in Maltese but I forgot the same word in English. Then after some time, I remembered how to say that word in English. This is quite impressive considering that I have been learning Maltese for only three years! It shows that I am getting old. This never happened to me when I was younger.*
>
> (Interview, 24/05/17, Robert)

This emphasises the critical period theory, which suggests that the processes of second SLA in adults are characterised by slower progress and lower levels of success compared to children who are younger than the age of puberty (Muñoz, 2017). The maturation process has been suggested as a simultaneous limitation on both the potential to lose a language, as demonstrated by L1 attrition and the ability to acquire L2 (Muñoz, 2017). It may be inferred that the brain's ability to change and adapt, known as brain plasticity, is influenced by age in both first-language attrition and second-language acquisition. This will result in a significant change in an individual's ability to learn (Gathercole & Baddeley, 2014).

Nevertheless, certain learners exhibited exceptional performance in ML2 exams despite being of senior age, indicating that variables other than memory loss may influence learning outcomes. The concept of fractals, as a property of C/CT, is demonstrated when SLA follows a progressive curve that both declines and achieves a plateau (Larsen-Freeman, 1997, 2016). It is necessary to thoroughly investigate all potential causes related to the decrease in performance on an L2 test before concluding that ageing is solely responsible for the low performance.

According to Table 1 and Figure 3, the majority of the participants displayed a consistent learning pattern in both the TGJT and VC tasks. This indicates the

presence of the C/CT fractal pattern, which is a pattern that is identical in appearance but occurs at different scales (Larsen-Freeman, 1997). Figure 3 illustrates a strong positive correlation between the TGJT and VC scores. According to Table 1, the correlation coefficient between TGJT and VC scores was 0.676, indicating a strong positive relationship. The P-value is 0.000, indicating a degree of statistical significance below the threshold of 0.05. Therefore, the correlation is considered statistically significant.

Table 1: The Correlation between TGJT and VC scores

	Pearson Correlation	VC score
TGJT score	Correlation Coefficient	0.676
	P-value	0.000
	Sample size	35

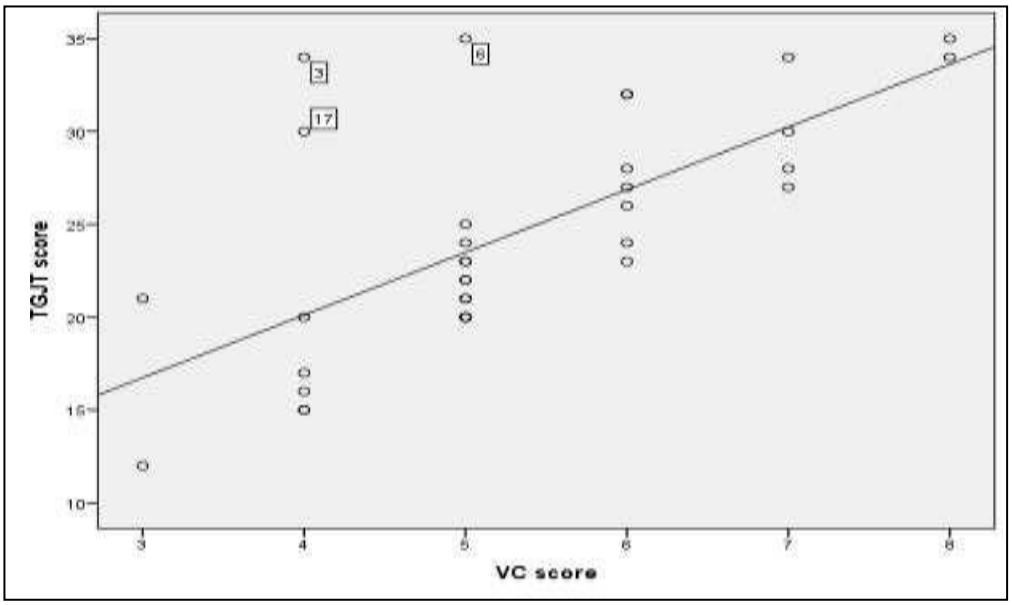

Figure 3: The Pearson Correlation between TGJT and VC scores

Challenges related to either lack of advancement or sluggishness in ML2 acquisition. Twenty-nine participants expressed their frustration with the lack of progress in their ML2 learning. The participants' unhappiness was exacerbated by the fact that they were attending evening classes and making a concerted effort to engage with ML1 speakers, but their ML2 performance remained stagnant. A Serbian individual in a position of leadership on a cruise ship remarked.

> *Even though I am an intermediate student of Maltese, I am aware that I have not achieved perfect mastery of Maltese. I feel that I am not that very competent in Maltese when I talk to Maltese in Maltese. I might know*

> *the verbs, as I have studied them by heart like a parrot, but that doesn't mean that I can use the verbs suitably when I am talking in Maltese. My nine-year-old daughter is better than me. We started learning Maltese together, but at least she can talk and play with the other Maltese children, and many times when we read a book or watch a Maltese drama on TV, she is translating from Maltese to Serbian and not the other way around.*
>
> (Interview, 24/05/17, Jasmina)

Jasmina's statement affirms the strange attractor characteristic of C/CT, as described by Larsen-Freeman (1997). This suggests that regardless of the amount of time and effort a learner invests in language acquisition, they may still get surprising outcomes. In this particular instance, the learner obtained lower scores on the same grammatical tasks compared to their previous performance. The phase in which the L2 learner encounters a plateau is said to be chaotic and unexpected because the introduction of new knowledge could lead to the deterioration of previously learned content (Safari & Rashidi, 2015). The learning process often remains stagnant until the student grasps how to integrate the newly taught concept with the previously learned ones. Therefore, it may be concluded that ML2 learners were not making progress due to being in the chaotic phase of ML2 acquisition.

Challenges in effectively utilising language transfer

All 35 participants in the ML2 programme recognised that the Maltese language was either similar to or different from their L1, and this had either a positive or negative impact on their acquisition of ML2. The majority of learners recognised that having a prior understanding of Arabic would greatly facilitate their acquisition of Maltese, particularly concerning Maltese grammar. Proficiency in Italian facilitated the acquisition of Maltese vocabulary. Positive language transfer, as documented by Shatz (2016), has been observed in cases where the participants' first language (L1) was Arabic or Italian. Alternatively, there have been instances where adverse outcomes resulting from language transfer have been documented. Positive transfer from a source language can be achieved through the helpful influence of the first language on SLA (Alonso, 2016; August & Shanahan, 2017). The majority of the learners indicated that they encountered a detrimental transfer as a result of the disparities between their L1 and Maltese.

The phenomenon of language transfer can serve as evidence for the adaptable, self-organizing, and feedback-sensitive nature of C/CT features. For SLA to be successful, the ML2 learner must not only adjust to the new surroundings but also be willing to accept and utilise criticism from ML1 speakers, teachers or peers. In addition, a learner's interlanguage is influenced by interacting elements known as self-organization (Norris, Davis & Timpe, 2017).

Constraints related to personality, particularly the traits of extroversion and introversion

Several participants ascribed their enhanced performance to their extroverted attitude, lack of fear in making mistakes, and consistent use of the Maltese language with their peers and teacher in class, as well as while interacting with ML1 speakers. Research has indicated that extroverted individuals are more likely to acquire a greater number of components of a second language compared to introverted individuals (Lightbrown & Spada, 2013). Conversely, several individuals indicated that their performance actually improved despite having an introverted disposition, contradicting the findings of numerous research.

Jasmina declared her introversion and acknowledged her shyness when interacting with ML1 speakers.

> *I come across as a very introverted person, and this could have been the reason my husband left me five years ago. I am really shy to speak in class and I do not dare speak in Maltese with a Maltese person. First of all, Maltese people are very fast when they talk to each other in Maltese, and I can barely understand them, even though I have been attending private lessons and evening classes in Maltese for three years.*
>
> (Interview, 24/05/17, Jasmina)

According to Ratner (2010), introverts do not naturally form connections with other people because they prefer to carefully select who they communicate with. Furthermore, the participant had an enhancement in her performance on the Maltese grammar examinations. She attributed this increase to her fondness for reading Maltese literature and listening to radio programmes and podcasts in the Maltese language. During the first stages of the ML2 learning process, the variation in personality can be attributed to the butterfly effect of C/CT, as being either an introvert or an extrovert will impact ML2 learning and is referred to as the learner's initial condition.

The evidence that personality may have exerted a favourable impact on ML2 further supports the notion that the characteristics of cognitive and affective processes are intricate and unpredictable in the context of SLA. Moreover, this influence is not solely determined by personality traits, such as introversion and extroversion, among adult learners. Individuals with an outgoing personality are more inclined to engage in interactions with native speakers of a language, which enhances their learning process. Research has shown that extroverts tend to acquire an L2 at a faster pace compared to introverts (Lightbrown & Spada, 2013). Contrarily, Zafar (2017) discovered that introverts exhibit faster learning and superior L2 proficiency compared to extroverts. This is attributed to their enhanced listening skills, which in turn improves their implicit understanding of L2. Therefore, it is challenging to

forecast the learner's performance based on their personality, highlighting the intricate nature of SLA as suggested by one of the features of C/CT.

The teacher's excessive reliance on conventional instructional techniques

Thirty-three participants indicated that their ML2 learning experienced a plateau phase or even resulted in lower scores due to their teacher's conventional instructional methods. These methods included the teacher remaining seated throughout the entire lesson, providing extensive lists of verb conjugations and vocabulary translations, relying on the learners to passively observe while the teacher wrote on the board, lack of active engagement in classes, failure to actively listen, and absence of positive feedback. The conventional approaches proved to be tedious and inefficient for 95% of the participants. Additional factors cited by preference for learning approaches that encompassed visual, auditory, reading, and kinaesthetic learning styles.

C/CT is defined by its responsiveness to input, which is a crucial element in SLA according to Larsen-Freeman (1997, 2018). The instructional approach should involve providing feedback to ML2 learners and actively involving them in classes to encourage reflection on areas for development.

Limitations of the Study

Various constraints emerged during the research process. One of the constraints was the withdrawal of certain participants from the research. In the academic year 2015/2016, the sample size consisted of 39 ML2 learners who were enrolled in the MFL2 intermediate-level course at three distinct lifelong learning institutions in Malta. In the following academic year of 2016/17, the number of ML2 learners decreased to 37 as two learners did not continue attending the MFL2 course. The research population size decreased to 35 participants due to one learner's refusal to participate and another participant's indefinite departure from Malta. Given the limited number of participants, the findings cannot be applied to the full population of foreign learners in Malta, which is also unknown.

Another constraint was that the researcher desired the five individuals who contributed to the reflective journal to feel comfortable and open in their writing on their journal. The researcher aimed to avoid being overly dictatorial in setting limitations on the content of their reflective diaries. Nevertheless, this had an impact on the results of the reflective journal, as some participants occasionally mentioned other factors that affected their ML2 learning, which opposed the researcher's perception of what was beneficial for the research questions. In addition, the researcher heavily relied on the material provided by the participants during their interviews or

recorded in their reflective diaries. Therefore, the researcher was obligated to record their perspectives without being able to verify their answers.

Recommendations for Further Research

Further studies could ascertain the most effective instructional methods for ML2 learners to acquire Maltese verbs, such as through the implementation of action research. An evaluation could be conducted after implementing different instructional methods about Maltese verbal tense and elements for distinct ML2 groups to measure the effectiveness of the teaching methodologies.

Research could also focus on the concept of perceived language distance, which is one of the pillars of the Crosslinguistic Influence theory. The concept of language distance refers to the degree to which the similarity or dissimilarity between two languages affects the ease or difficulty with which learners acquire and become proficient in an L2.

Conclusion

The results of this study confirm the validity of C/CT, as the acquisition of the Maltese language is described as an intricate, ever-changing, disorderly, unexpected, adaptable, open, self-regulating, and non-linear process. Furthermore, this study validates that SLA aligns with the butterfly effect, is responsive to feedback, exhibits characteristics of a strange attractor, and displays a fractal pattern. The research identified many cognitive and sociocultural factors that influence the performance, skill level, and success of second language learners. The significant areas encompass similarities and differences between ML2 and the learner's L1, absence of both implicit and explicit knowledge, culture shock, the obligations of adult learners, decline in learners' memory due to ageing, challenges faced during the initial stages of learning ML2, limitations associated with personality traits, particularly extroversion and introversion, difficulties in interacting with Maltese individuals, inadequate language-related support from Maltese partners, and the teacher's excessive reliance on conventional teaching methods. The lack of exposure to the Maltese language during holidays, as well as the lack of social connections and concerns about recall, were extremely important. Based on this research, the acquisition of the Maltese language takes place over time, even in the face of learning difficulties.

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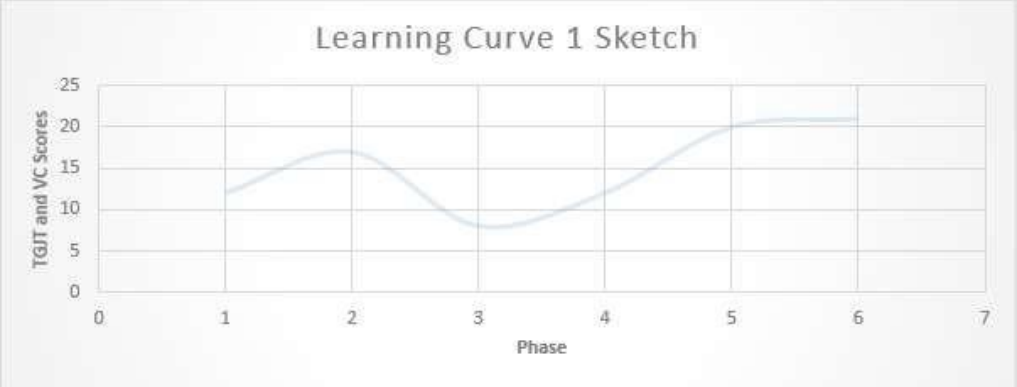
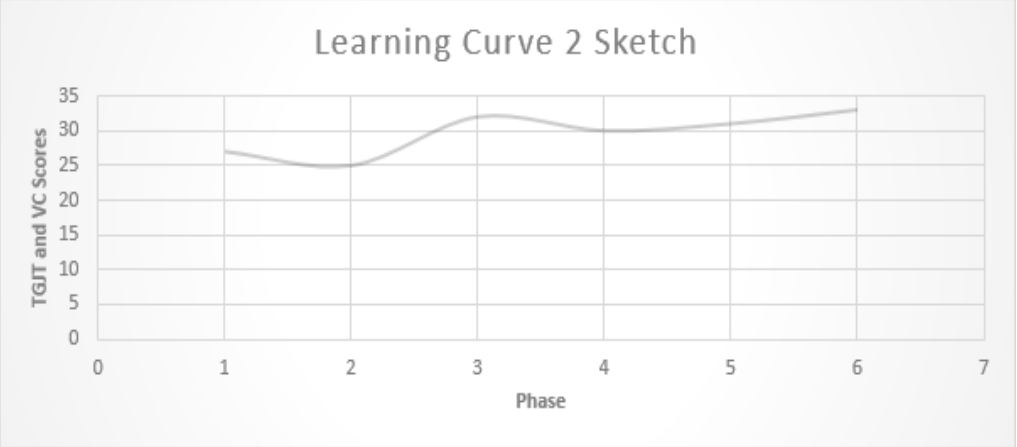
Abbreviations

C/CT – Chaos/Complexity theory
EU – European Union
L1 – first/native language
ML1 – Maltese as a first language
ML2 – Maltese as a second language
L2 – Second language
SLA – Second language acquisition
TGJT – Timed Grammaticality Judgement Test
VC – Verb Conjugation

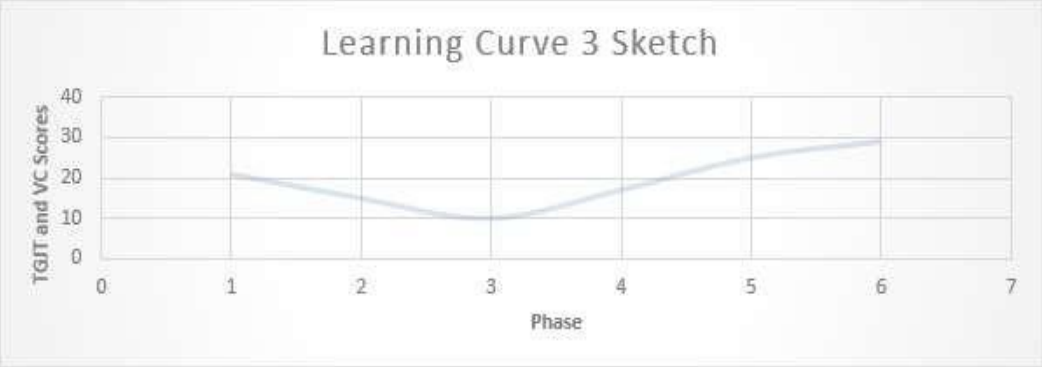
Appendix 1: The General trend of Learning Curve 1 on TGJT and VC



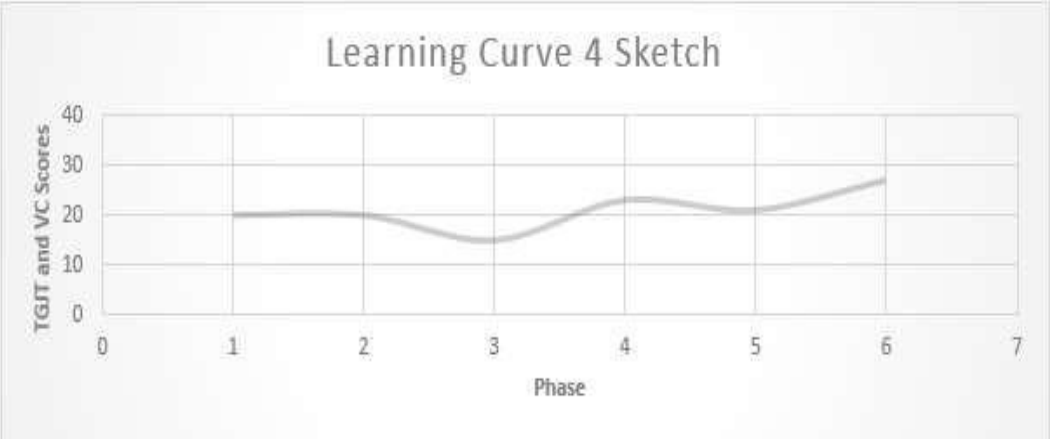
Appendix 2: The General trend of Learning Curve 2 on TGJT and VC



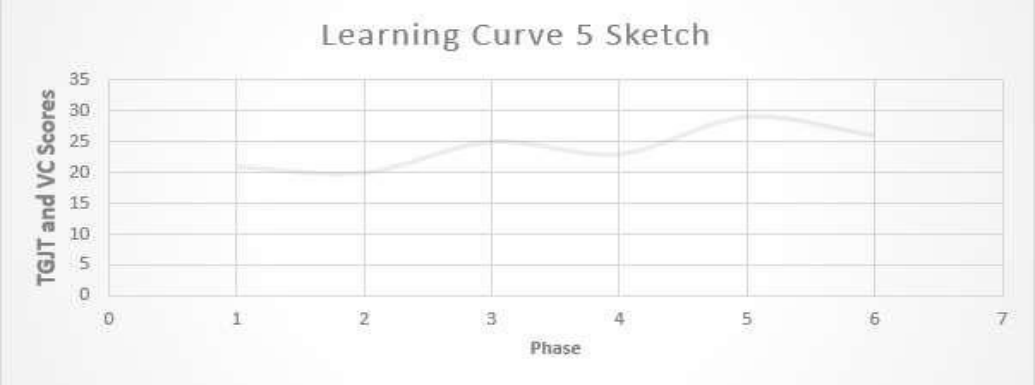
Appendix 3: The General trend of Learning Curve 3 on TGJT and VC



Appendix 4: The General trend of Learning Curve 4 on TGJT and VC



Appendix 5: The General trend of Learning Curve 5 on TGJT and VC



Appendix 6: The General trend of Learning Curve 6 on TGJT and VC