Roles of Cognitive and Sociopsychological Individual Differences in Second Language Pronunciation Development in Classroom Settings: A Dynamic Systems Theory Approach

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Declaration

I, Yui Suzukida confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Abstract

Drawing on the framework of Dynamic Systems Theory that affords a holistic approach to understand the language development, the current study conducted a cross-sectional and longitudinal analyses of how 51 Japanese learners of English with various experiential, cognitive and sociopsychological profiles differentially attained two different aspects of L2 pronunciation (comprehensibility, accentedness) in foreign language classroom settings.

The participants engaged in four weeks of explicit pronunciation instruction. Their extemporaneous speech was collected via a picture description task at the beginning and end of the project. Subsequently, the pre- and post-test samples were rated for accentedness and comprehensibility, and then linked to a range of individual differences (IDs) factors including aptitude, motivation, anxiety, and English learning experience *specific* to L2 pronunciation development.

At the outset of the project, the cross-sectional results suggested (a) three types of IDs examined in the current thesis were relatively independent from each other, and (b) recent L2 learning outside the classroom and anxiety levels were the strong predictors of both comprehensibility and accentedness, whereas and phonemic coding ability was uniquely linked to accentedness. Concerning the improvement in comprehensibility and accentedness after the intervention, the result of longitudinal study demonstrated the overall effectiveness of pronunciation instruction. However, no IDs showed interaction effect on the effectiveness of pronunciation instruction.

Based on the findings, I discuss L2 pronunciation learning as a multifaceted, dynamic and ever-changing system as a result of complex interactions between *multiple* ID factors and pronunciation dimensions.

Impact statement

The current thesis explores the application of Dynamic Systems Theory (Larsen–Freeman, 1997) in understanding the roles of learner individual differences (IDs) in second language (L2) pronunciation learning. The findings of the present thesis advance the development of second language acquisition (SLA) theories, shed light on research methodology in ID studies, and provide practical implications for L2 pronunciation instruction in classroom settings.

First, the thesis offers supportive evidence for explaining the variability in the rates and outcomes of L2 acquisition through the framework of DST. Traditionally, L2 learners' IDs have been regarded as stable, monolithic and independent components that exist in isolation from each type of ID (e.g., foreign language aptitude, motivation, emotion). However, since Dörnyei's reconceptualization of IDs as parts of interdependent and dynamic systems that change depending on the time and contexts (e.g., Dörnyei, 2009a, 2010a). While the number of SLA studies that utilise the principles of DST has been increasing (e.g., Feryok, 2010; Saito et al., 2020), it has not been adapted to illustrate how various IDs influence L2 pronunciation learning. Thus, by demonstrating how L2 learners' cognitive, motivational and emotional IDs are interwoven and *dynamically* impact on different but interrelated dimensions of L2 pronunciation (i.e., comprehensibility and accentedness), the evidence reported in the present thesis underscores the theoretical value of the DST framework in understanding L2 pronunciation learning.

Secondly, by putting forward the DST approach (Larsen-Freeman, 2014), the thesis attests the necessity of analysing multiple IDs whose constructs are different from each other in the same dataset (e.g., foreign language aptitude, motivation and anxiety). The thesis used a series of mixed-effects models to showcase how and to what extent different ID variables can account for the variability between L2 learners. Such methodological choice is an advancement from the traditional methodology employed in ID research, in which a single

independent variable (i.e., an ID variable such as aptitude or motivation) is examined as a predictor of a given dependent variable (cf. Serafini, 2017).

Lastly, the findings of the current thesis generate valuable information for language teachers concerning L2 speech instruction. Focusing on the context of Japanese learners of English in an English-as-a-Foreign-Language (EFL), in particular, the thesis not only confirms the effectiveness of pronunciation-focused instruction for L2 comprehensibility and accentedness, but also identifies cognitive and emotional factors that play a crucial role in facilitating L2 oral ability in instruction settings. Hence, it offers a better understanding of the factors that influence L2 pronunciation acquisition in foreign language classrooms and can help contribute to the design of new syllabuses for effective L2 speech learning.

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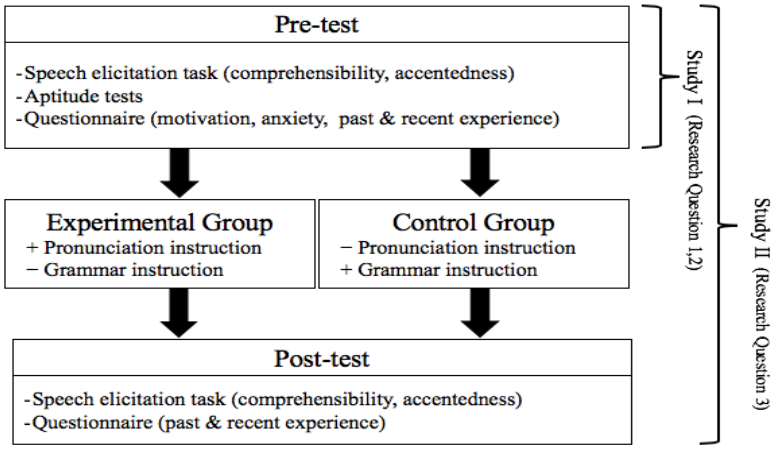


Chapter 1 Introduction

1.1 L2 Pronunciation Teaching for Speech Intelligibility

Over the past 150 years, the importance of L2 pronunciation in L2 teaching has seen considerable fluctuation. After the invention of the international phonetic alphabet (IPA) in the late 1800s, the instruction of native-like pronunciation was regarded as a crucial aspect of language teaching curricula. Subsequently, various methods such as the Direct Method, and Audio-Lingual Method were proposed to facilitate learners' mastery of native-like pronunciation (Celce-Murcia et al., 1996; Richards & Rodgers, 2001). However, these approaches were criticized due to their de-contextualised, non-communicative drills (Morley

1991). Therefore, heavily influenced by Chomsky's theory of Universal Grammar, language teaching during this period distanced itself from the form-focused pronunciation practices (Terrell, 1989). Accordingly, prioritisation of teaching pronunciation had gradually faded away and approaches that facilitate the learning of grammar and vocabulary were favoured (e.g., the cognitive approach that focuses on the mental process of learning and aims to foster inductive learning through meaningful practice). The de-emphasis of pronunciation instruction in language pedagogy had continued during the emergence of communicative language teaching (CLT) (Murphy, 2013). In fact, since CLT essentially aims to develop the communicative competence of language learners rather than their accurate use of language, the role of pronunciation was further marginalised (Richards & Schmidt, 2002).

However, after a long period of minimisation of pronunciation in L2 pedagogy, however, there was a major change in the status of pronunciation teaching in the late 1980s. Within the CLT framework, a series of scholarly work was conducted and that promoted the idea that intelligibility of pronunciation is necessary for communication (Harmer, 1991 Kenworthy, 1987; Munro & Derwing, 1995a, b). Since then, the restoration of the status of pronunciation in language teaching has drawn researchers' interest towards examining effective L2 pronunciation instruction (e.g., Derwing et al.,1997, 1998; MacDonald et al., 1994). Since the late 1980s, extensive research has been conducted to identify effective L2 pronunciation instruction. The foci of the studies were widely varied in terms of their instructional targets (segmentals, prosody), types of task (e.g., sound discrimination tasks, controlled production tasks, extemporaneous speech production tasks), the evaluation criteria (i.e., global comprehensibility, accentedness, fluency, specific aspects of pronunciation features), and the duration of the instruction (e.g., a few hours to approximately 20 hours). Overall, the studies have found the impact of pronunciation instruction to be positive (e.g., Couper, 2003, 2006; Derwing et al., 1997, 1998; Lord, 2010; McGregor & Sardegna, 2014).

Notably, observing the relative consistency in the positive influence of pronunciation instruction demonstrated in past research, Derwing & Munro (2015) have stressed the importance of incorporating the variables that affect speech production behaviour such as learners' motivation, aptitude, and their varied experience in learning L2 to determine the effectiveness or insignificance of certain instruction on the L2 pronunciation development. In fact, Kissling (2014) has pointed out that research on L2 pronunciation instruction rarely considers the influence of learner individual differences on the effectiveness of the instruction.

1.2 The Reconceptualisation of Learner Individual Differences

It is widely accepted that people vary greatly in the quality of their L2 performance. Compared to the relatively effortless nature of the L1 acquisition, which is largely reliant on implicit learning, L2 learning in adulthood is often characterised as an effortful process that requires more explicit learning. The variabilities among learners' learning outcomes attracted SLA researchers' attention towards understanding the source of such variability and theoretically accounting for the relationship between learner variability and language acquisition across multiple subsystems of the language under the framework of *individual differences* (e.g., Ortega, 2013; Ellis, 2004).

According to Ellis (2004), the early attempts to explore individual differences (IDs) can be characterised as a search for specific types of learners who were ideal for learning foreign languages. For this purpose, IDs research was mainly aiming to develop the instruments to screen learners who are likely to succeed in language learning. For instance, Carroll & Sapon's (1959) Modern Language Aptitude Test (MLAT) was popularly used as a predictive instrument to gauge learners' efficient language acquisition in formal instructional settings. Subsequently, the focus of IDs research has shifted to account for the variability in the learning success among L2 learners and, IDs have become an established line of inquiry

in SLA in the 1970s. Since the central topic of IDs research was to determine the characteristics of language learners who likely to succeed in learning foreign languages (Naiman et al, 1978; Rubin, 1975), various learner characteristics were conceptualised such as motivation, learning strategies and learning styles (e.g., Skehan, 1991). SLA in that era was heavily influenced by cognitive-interactionism (Piaget, 1974) which posits that an observed phenomenon in L2 learning is a result of the interaction between learner-internal (cognitive) and learner-external (environment) factors (Ortega, 2013). Thus, the learner characteristics focused on in IDs research were treated as stable learner-internal factors that are fully independent of the external factors, and researchers were attempting to find a universal pattern that can be generally applied to any learner of an additional language (e.g., Dörnyei, 2005). The initial wave of IDs research contributed to pinning down certain learner-internal variables as the major IDs that causes the variability in SLA. Such IDs included learning aptitude which involves the quality and capacity of learning and motivation which is a factor that controls learners' intensity, duration and choice of learning (Dörnyei & Ryan, 2015).

However, such a traditional view towards learner characteristics (conceptualising IDs as stable and monolithic variables) was challenged by socio-cognitive theorists. They posit language learning can only be understood with reference to the physical and social space the learners are in, and stress that learner factors are mostly socially constructed, and they become influential only when they interact with specific context (e.g., Murphey & Falout, 2013). As Dörnyei (2006) has described, such criticism has gradually reformed IDs researchers' views towards IDs and the nature of IDs has been accepted as context-dependent. Therefore, in line with the socio-cognitive view of language learning, Dörnyei (2009a) re-framed IDs as a the dynamic system. It regards that seemingly distinct IDs such as cognitive, affective and motivational factors are interlocked with each other and form a

"blended" operation influencing L2 learning (cf. Buck, 2005; Dörnyei, 2009a, 2009c; Lewis, 2005;). In addition, Dörnyei conceptualised the relationship between IDs and language learning as dynamic systems, such that the variables that are most significant for an individual may vary depending on the time and environment in which the learning takes place (Ellis & Larsen-Freeman, 2006).

Dynamic Systems Theory (DST) views language development as a system change in relation to its internal operation (i.e., micro view) and contextual factors (i.e., macro view). DST is an approach or a *meta-theory* that contains a set of principles for exploring the changes in complex systems (Larsen–Freeman, 2013). Changes in the systems are sensitive to its initial state, recourse-dependent, non-linear, and exhibit emergent outcomes when the system stabilizes at an attractor state (i.e., a state where the changes of the system temporally stop) (e.g., de Bot, 2008). From the micro-perspective of DST, a given system is governed by recourses (known as parameters): they characterize the interaction of elements within a system and influence a change in the system (de Bot, 2008; Morrison, 2012). Once the operating rules of parameters are identified, it is assumed to be possible to make a robust interpretation of the system's behaviour. Like other disciplines (e.g., economics, cognitive science), applied linguists have also begun to apply principles of DST to research on L2 learning because (a) it involves nonlinear changes over time at multiple levels of complexities (e.g., various dimensions of language such as syntactical, phonological, lexical aspects of a language) and (b) the initial conditions of L2 learning and other contextual, social and cognitive parameters (e.g., L1, learning context, motivation, age, L2 input, interaction, and type of instruction) may shape the rate and amount of development one can make (e.g., Hiver & Al-Hoorie, 2016; Larsen-Freeman, 1997). Therefore, the DST is considered to be a holistic approach towards the examination of what learner ID is particularly relevant to the specific learners in developing their L2s (cf. Dörnyei, 2009a).

In terms of L2 speech acquisition research, a growing number of studies have explored how learners' ID influence their speed and ultimate attainment of L2 pronunciation learning (e.g., Hansen Edwards, 2017; Pennington & Rogerson-Revell, 2019). However, while these studies have contributed to identifying canonical ID variables and demonstrated their relationship with experiential factors (e.g., Saito et al., 2018), the new conceptualisation of ID proposed by Dörnyei (2009a, 2010a) has not been reflected on L2 pronunciation research.

1.3 The Focus of the Study

In the context of L2 speech acquisition in classroom settings, over seventy studies have explored the effectiveness of instruction aimed at facilitating L2 learners' efficient development of pronunciation accuracy (Saito & Plonsky, 2019). Although the efficacy of the instruction has been found to be positive (e.g., Lee et al., 2015), what remains unclear is the *other* contributing factors to L2 pronunciation learning in the instructional context (Derwing & Munro, 2015; Kissling, 2014). Some pronunciation studies have indicated that certain learner profiles may nullify (Kennedy & Trofimovich, 2010) or facilitate and boost (Kissling, 2014) the effect of pronunciation instruction. Such interaction between learner variables and instruction is also observed in the area of aptitude-treatment-interaction (ATI) studies in L2 grammar research, suggesting that L2 learners may deploy different types of cognitive abilities to benefit from different types of instruction and to learn lexicogrammatical items (Li, 2013, 2015; Hwu & Sun, 2012; Sheen, 2007; VanPatten & Smith, 2015; VanPatten et al., 2013; Yalçin & Spada, 2016; Yilmaz, 2013; Yilmaz & Granena, 2016).

Furthermore, as Dörnyei (2009a) proposed, the influence of learner ID on L2 language learning is complex and change at over time. Therefore, it is crucial to conceptualise the relationship between them from a dynamic perspective. Importantly, Foote

and Trofimovich (2017) stressed that a dynamic approach is a good fit to explain how various dimensions of pronunciation differently develop. This is because IDs in the rate and achievement of L2 pronunciation learning can be conceptualised as continuously interacting with a number of variables. Such variables can be observed in terms of the multiple dimensions of L2 pronunciation, learners' cognitive system, and the types of contexts in which learning takes place. However, while existing IDs research on L2 pronunciation investigated the influence of various IDs and experiential factors on L2 pronunciation development has been explored (Baker Smemoe & Haslam, 2013 for cognitive factors such as foreign language learning aptitude; Muñoz, 2014 for experiential factors such as its length, quality, and quantity; Nagle, 2018a for sociopsychological factors such as quality of motivation and their relationship with the amount of effort the learner makes), the dynamic perspective has not been employed. In order to understand which learner IDs become relevant in which aspects of L2 pronunciation and in which contexts, the relationship between L2 learners' IDs and L2 speech proficiency have to be *holistically* explored (cf. Serafini, 2017). Therefore, the current thesis introduces the principles of DST and explores the roles of ID in shaping one's L2 pronunciation learning by incorporating *multiple* ID factors and to conceptualize L2 pronunciation acquisition as a multidimensional and complex phenomenon. In order to reflect recent conceptualisation of IDs as a set of multicomponential and interactive components consisting of cognitive, motivational and emotional domains (Dörnyei, 2009a), the current thesis focuses on three components of IDs– foreign language learning aptitude (as one aspect of cognition), L2 learning motivation (as one aspect of motivation) and anxiety (as one aspect of emotion) and two interrelated yet distinctive constructs of perceived L2 oral proficiency–native listeners' intuitive judgements of comprehensibility and accentedness.

Based on the recent theoretical development of IDs as a dynamic system (Dörnyei, 2010a; Dörnyei & Ryan, 2015; Ellis & Larsen-Freeman, 2006), and the growing interest in the relationship between IDs and the L2 speech learning process, the present thesis set four goals, focusing on 51 Japanese learners of English in English-as-a-Foreign Language (EFL) context. The first goal is to illustrate the complex interplay between cognitive, motivational and emotional ID factors (i.e., Research Question 1). Secondly, the thesis explores the relative contribution of cognitive, motivational and emotional IDs on learners' L2 pronunciation (measured via listeners' impressionistic judgement of comprehensibility and accentedness) (i.e., Research Question 2). Thirdly, the present thesis *longitudinally* evaluates the relative influence of cognitive, motivational, and emotional IDs on learners' L2 pronunciation development when participants engage in 3 hours of explicit pronunciation instruction (50 minutes × 4 lessons). As such, the analyses will lie in the potential interactions between particular learner ID and the effect of the instruction (i.e., Research Question 3).

By aiming for these goals, the current thesis provides one of the first attempts in the field to investigate the multifaceted roles of individual differences in L2 pronunciation learning through the lens of DST from both cross-sectional and longitudinal perspectives. In addition, to the best of my knowledge, this thesis is the first attempt to examine the relationships of L2 *pronunciation-specific* motivational and anxiety domains of learner IDs and its relationships with learners' L2 aptitude within the framework of DST. The empirical evidence obtained from this investigation could contribute to the advancements of the understanding of IDs conceptualised as a dynamic system.

Lastly, the findings of the thesis could move L2 pronunciation pedagogy forward by highlighting the learner characteristics that are relatively beneficial and detrimental to instructed L2 pronunciation learning. The thesis also shed light on the ongoing discussion of

aptitude-treatment-interaction (Snow, 1991) by exploring the interaction between ID variables and the effectiveness of pronunciation instruction. In the subsequent section, I will provide an overview of how the thesis is organised.

1.4 The Structure of the Thesis

The present thesis comprises of six chapters. Chapter 2 provides a review of the literature that discuss DST and research on learner IDs. The subsequent section focuses on the factors that affect L2 pronunciation learning. This section summarises the results from the empirical research on (a) the influence of various types of the L2 learning experience in naturalistic settings and EFL settings on L2 pronunciation acquisition, and (b) the influence of aptitude, motivation and anxiety on L2 pronunciation acquisition. This is followed by a review that deals with the current understanding of L2 pronunciation acquisition mechanisms. It explores the definition of comprehensibility and accentedness (the focus of the dissertation) and how they are related to L2 pronunciation proficiency and L2 speech proficiency and the review of its linguistic correlates. Chapter 2 concludes with the detailed explanation of the motivation of the thesis, research questions, and a brief overview of the research design. Chapter 3 describes a cross-sectional study that aims to answer Research Questions 1 and 2, and Chapter 4 reports a longitudinal study that is designed to answer Research Question 3. Each chapter contains a description of the research design, data analyses, results, and discussion. Based on the results in the studies presented in Chapter 3 and 4, Chapter 5 synthesises the findings. It starts with a brief overview of the background of the thesis, then summarises the results of the two studies in relation to the research questions. Lastly, the dynamic roles of the L2 learners' ID and experiential factors in L2 pronunciation development are discussed. Finally, Chapter 6 presents a summary of the findings, and pedagogical and methodological implications. The chapter concludes with the limitations of the two studies and suggests possible directions for future research.

Chapter 2 Review of Literature

The overall aim of this thesis is to examine the principles of DST concerning the dynamic relationship between L2 learners' IDs and L2 pronunciation learning. Accordingly, Chapter 2 reviews the past studies that were concerned with the application of DST in the field of SLA, L2 learners' IDs, and L2 pronunciation learning. The first section begins with a historical overview of the use of DST in the field of SLA, highlighting the necessity of incorporating a *dynamic* and *complex* perspective in understanding the process of L2 learning and L2 learners. It also addresses the details of the principles of DST that are crucial for describing L2 learning and L2 learners as dynamic systems. The second section reviews the past IDs

research and illustrates the crucial change in the conceptualisation of learner IDs, highlighting this recent reconceptualisation through the adaptation of DST. Subsequently, by providing past research evidence in SLA and psychology, the third section focuses on illustrating the *dynamic* and *complex* nature of L2 learners' IDs. The next section narrows down the focus to IDs studies that concerned L2 pronunciation learning, and reviews the predictors of the successful L2 pronunciation learning. Furthermore, the following section extends the scope of the review to research that explored the influence of pronunciation instruction on L2 learning in relation to learner IDs. Finally, the motivation of the present thesis and four research questions are presented.

2.1 The Application of Dynamic Systems Theory to SLA

During the 1980s and 1990s, much of the knowledge among SLA reserachers was gained using the cognitive-interactionist approach (Ortega, 2013) that was predominantly influenced by cognitivism established in psychology. The underlying assumption of the approach is that the human brain is an information-processing device which is independent from environmental factors, and that learning occurs when learners' brains (cognition) interact with input from the external environment (Atkinson, 2011; Gass, 1997). A body of work in this school of thought has been dedicated to accounting for language learning phenomena mainly through research on memory (e.g., Bialystok & Sharwood, 1985; DeKeyer, 1997; Schmitt, 2000) and attention (e.g., Doughty, 2001; Gass & Mackey, 2000). However, increasing scholarly attention towards the social science (e.g., Block, 1996; Lantolf, 1996) and cognitive science (e.g., Wilson & Keil, 2001) had led to 'the social turn' within the research of SLA (Block, 2003) and extended its interest to the understanding of social aspects of L2 learning (e.g., Atkinson, 2011; Batstone, 2010; Duff, 2012; Ellis, 2008; Norton, 2013; Swain & Deters, 2007). Around the same time, a number of cognitive-psychologists addressed the limitations of the purely cognitive explanations of human

intellectual functioning (i.e., intentional goal-oriented acts of cognitive procedures such as problem solving, decision making and reasoning) found in cognitivism. These limitations include the following two aspects. First, the cognitive account of intellectual functioning fails to account for the influence of one's emotional and motivational aspects (Dai, 2002; Oerter, 2000; Piaget, 1950, 1967; von Newmann, 1958). Dai and Sternberg (2004) have stated the following:

> Basic mental processes such as attention, perception, cognition, and memory never occur as neutral events containing raw data of whatever is registered or encoded, but rather coloured with motivational and affective overtones. (p.8)

Secondly, in relation to the first issue, the cognitivists' account of intellectual functioning neglects the subjectivity of experiences (D'Andrade, 1995). Influenced by this cognitive-psychology perspective, several SLA scholars started to advocate for the idea that (a) learners' cognition and additional language learning are bound inextricably to their social context (e.g., learners' social class, their relationship with teachers, peers, and school curriculum), and (b) the language learning behaviours are considered to be the result of learners' adaptation of motivational, emotional and cognitive mechanisms to a specific physical and social learning environment (e.g., Dörnyei, 2009a, 2010a; Semin & Caccipo, 2008; Zimmerman & Schunk, 2004).

One of the scholars that looked anew at existing cognition-centred SLA theories and introduced socio-cognitive approach to SLA research was Diane Larsen-Freeman. Inspired by the chaos/complexity theory proposed by Gleick (1987), Larsen–Freeman (1997) proposed the adaptability of DST as a conceptual framework that promotes the context-dependent and dynamic nature of SLA. The term is used almost synonymously with other approaches such as Chaos Theory, Complexity Theory, Complex Adaptive Systems, Nonlinear Systems (de Bot, 2008). Complexity theory was originally used for natural science

and assumes that observable phenomena are the emergent outcomes of the interactions among interdependent variables coming together as a whole. In particular, DST provides a conceptual framework that enables researchers to account for changes observed in a given system. According to de Bot and Larsen–Freeman (2011), systems are defined as "groups of entities or parts that work together as a whole" (p.10). A system is composed of multiple subsystems which can be further broken down into smaller components (i.e., variables), and is embedded in a larger system. The concept of a system is widely used to represent a basic unit of analysis such as the social system, the economic system, the cognitive system, the articulatory system and the language system (ibid.).

DST assumes that (a) as the components are reliant on context (i.e., systems are *adaptive* to the surroundings), they are not static entities but change over time, and (b) the change in one component in a given system may not only cause changes of other components within a given system, but also it can affect the components of the other (sub)systems that are related to the given system (e.g., Larsen-Freeman & Cameron, 2008). Therefore, identifying how a single dependent variable (a component of a system) is connected to a given system (dependent variables) is not sufficient to understand the state of the system. In order to understand the state of a given system, it is crucial to observe and illustrate how multiple dependent variables interact with each other and how the system interacts with other (sub)systems. The states of the systems are determined by when and how changes occur among the components and subsystems and *the initial condition* of the systems (e.g., de Bot, 2008; Larsen-Freeman & Cameron, 2008). Thus, changes in systems are dynamic and non-linear: its components can interact, compete with, and influence each other in certain conditions and not in others. Therefore, identifying *the initial conditions* of systems prior to a change is one of the key approaches to understand the changes the systems within the framework of DST. To summarise, DST's fundamental focus is illustrating and tracking the

patterns that emerge in systems by identifying (a) the components in the systems, (b) the relationships among the components, (c) the initial conditions of focused systems, and (d) the most prominent components that involved in changes to a system.

Following this concept, Larsen-Freeman argued that learners' language (or language system) is the outcome of interactions emerge between various variables such as learners' cognitive process, communication with interlocutors, and context. While agreeing with the importance of the psychological perspective of L2 acquisition, Larsen–Freeman pointed out that prevailing cognitive theories have a limitation in the account for the ubiquitous intra- and inter-variability among language learners, and stressed that SLA is the result of learners' adaptative use of the L2 in a given speech community, and therefore that a bottom-up learning process (i.e., learners' L2 use in interactions) is a driving force of L2 acquisition (Larsen-Freeman, 1997).

Since the first introduction of the theory to the field of applied linguistics by Larsen-Freeman, it has been utilised as a *conceptual toolbox* (Walby, 2007) to see language, learners' cognition, and language learners themselves as systems that interact and influence one another (e.g., de Bot, Lowie, & Verspoor, 2007; Ellis & Larsen–Freeman, 2006; Larsen–Freeman, 1997, 2002, 2013, 2015; Larsen–Freeman & Cameron, 2008; Verspoor, de Bot, & Lowie, 2011). Based on the principles above, Larsen-Freeman (2014) describes the application of DST to understand L2 development:

- learners' language systems are an assembly of interacting elements, and changes that emerge in language system are a result of the changes in the components within the system (Cooper, 1999),
- changes in the components in the system are a response to (a) learners' adaptation to a specific context in which they encounter a new environment or different interlocutors (e.g., teachers, peers, native speakers) and (b) the

change in learners' processing of the language patterns emerging through the iteration of instances (Larsen-Freeman, 2013),

- learners' developmental state at any given time is crucially attributed to the state that preceded the change (i.e., the system's sensitivity to the initial state),
- learners themselves are systems and are active agents that learn language through meaning-making, thus input is considered as "affordances" created through the interaction between learner and their environment (e.g., van Lier, 2000), and
- learning is motivated by the learners' perception of differences, and such awareness of contrasts can be realised by learners themselves through interaction with the environment or being intentionally prompted by others (e.g., Marton, 2006).

A crucial claim of DST is that learners are equipped with different parameters inside and outside their cognitive systems, and that those parameters influence each other and their L2 learning at varied times and in various environments, suggesting that individual learners take unique developmental paths as active agents of language learning (e.g., Feldman, 2006). In this respect, Larsen-Freeman illustrates the learner individual differences from the DST perspective as follows:

> Even our brains are different. Humans then shape their own contexts in a unique manner. The dynamism of different factors—the fact that their contribution to the learning process waxes and wanes in interaction with others—also explains why correlations between individual difference factors vary across studies (p. 57).

Such a situated and dynamic perspective towards learner characteristics has greatly influenced new conceptualisations of IDs in SLA (Dörnyei, 2009a).

2.1.1 Dynamic Systems Theory for the Reconceptualisation of Individual Differences

As Ellis (2004) observes, while the aim of traditional IDs research was to *predict* learners who are most likely to succeed in foreign language acquisition, contemporary IDs research has shifted its focus towards *explaining* the factors that influence the variability in rate and outcomes of SLA. According to Horwitz (2000), research of learner IDs can be already found in articles published between the 1910s and 1920s. The main focus of such research at that point was to explore *good* students who hold greater innate ability and motivation (e.g., Waxman, 1917) that increase their chance of success in mastering a foreign language. Seeking IDs that predict successful foreign language acquisition continued to be the mainstream approach. In particular, John Carroll and Stanley Sapon's (1959) development of the Modern Language Aptitude Test (MLAT) and Wallace Lambert's (1963a, b) *Psychological Approaches to the Study of Language, Parts I and II* served to establish aptitude as a crucial factor to predict learners' ultimate attainment in foreign language learning. IDs research had become a major area of inquiry in the field of SLA between the 1970s and 1990s (Griffiths, 2008), and various instruments have been used to measure IDs including motivation (Gardner, 1985), learning style (Reid, 1987), anxiety (Horwitz et al., 1986), personality (Eysenck & Eysenck, 1964), and learning strategies (Oxford, 1990).

Traditional view of IDs established through the research described the factors above as stable and monolithic attributes that predetermine the success of learners' language learning (Dörnyei, 2006). Therefore, Dewaele (2009) describes earlier attempts of IDs research as the quest for a holy grail. However, when the mainstream SLA research expanded its scope to the social aspect of language learning (Ortega, 2011), the traditional view of IDs was questioned by the scholars who consider learner IDs to be multicomponential, context-dependent, and change their interrelationships overtime (e.g., Dörnyei, 2010a; Lubinski &

Webb, 2003; Murphey & Falout, 2013; Schumann, 2004; Serafini, 2017). Importantly, the inclusion of social, educational and political contexts as the factors that shape L2 acquisition process contributed to the development of *socio-psychological* IDs. Traditional view towards learner IDs considered the IDs as stable and purely learner-internal components. However, a number of IDs researchers have started to consider that seemingly learner-internal characteristics such as belief, attitude, motivation are shaped by social factors (e.g., interactions with teachers and peers, educational setting, political context, school curriculum) (Dörnyei, 2006; Pavlenko, 2002). For instance, Dörnyei (2001) demonstrated that learner-external factors such as the teachers' teaching style and personality influenced L2 learners' motivation and attitude towards learning an L2. Such example suggests that certain types of learners' IDs are partially learner-internal but socially constructed and situated. According to IDs researchers, such socio-psychological IDs include motivation, attitude, belief, anxiety, and cultural empathy as they are developed through the learners' interactions with others and the educational contexts where learning takens place (e.g., Dewaele, 2009).

In order to incorporate the dynamic view of IDs, Dörnyei (2010a) stressed the importance of exploring ID and language learning through the principles of DST:

> I would suggest, individual learner variation can be better accounted for in terms of the operation of a complex dynamic system in the sense that high-level mental attributes and functions are determined by an intricate set of interconnected components that continuously evolve over time and which also interact with the environment in an ongoing manner. The value of each constituent keeps changing depending on the overall state of the system and in response to external influences, making ID factors dynamic system variables. Therefore, the logical next step of conceptualizing individual differences is to attempt to reframe them within a dynamic systems perspective. (p. 260)

Therefore, it is crucial to avoid an exclusive focus on a single independent variable. Rather, scholars are strongly encouraged to take a *holistic* approach to examining the complexity of learner IDs by including both cognitive (i.e., mainly learner-internal) and socio-psychological (i.e., mixture of learner-internal and -external factors) learner characteristics (e.g., Ackerman, 2003; Ellis, 2006; Segalowitz & Trofimovich, 2012; Serafini, 2017).

One of the assumptions that underlie the dynamic view of ID is that IDs are the components of a learner system, and those components interact with each other (rather than exist in isolation from each other). Thus, while various learner IDs have been found to contribute to L2 learning, DST sees these contributions as the results of the self-regulatory interactions between the different facets of human *intellectual functioning*. According to cognitive psychologists (e.g., Hilgard, 1980; Matthews & Zeidner, 2004), intellectual functioning consists of cognition, motivation and emotion, and these domains are recognised as *the trilogy of mind*: *Cognition* indicates the functions of the human mind that process and learn information, *motivation* refers to how a human makes decisions to execute new behaviour by using their will and freedom, and *emotion* is concerned with temperament and how a human feels towards various objects such as people, information, actions and thoughts (e.g., Ortega, 2013). Self-regulatory interactions of the three domains of mind indicate "emotions imply cognitions imply motives imply emotions, and so on" (Buck, 2005, p.198). Based on the notion of *the trilogy of mind*, therefore, a number of psychological studies have been conducted to explore the interrelationship between motivation, emotion, and cognition (Dai & Sternburg, 2004). According to DST, it is assumed that a change in one component in a given system causes another change in other components (Larsen-Freeman & Cameron, 2008). Therefore, advocates of IDs research within the DST framework (Dörnyei, 2009a, 2010a; Waninge, 2015) believe that while learner IDs can be distinguished by these three

domains (cognition, motivation and emotion) as the components of a learner system, they interact with each other and cause changes in a system over time.

While highlighting the importance of focusing on motivation, emotion (affect), and cognition, Dörnyei (2010a) stated, "it is my belief that the best way forward is to identify higher-level amalgams or constellations of *cognition, motivation and affect* [emphasis added] that are relatively stable (i.e., are governed by a strong attractor) and which act as 'wholes'" (p.263). Hence, a crucial step to test the assumptions about learner IDs within the DST framework is to describe how these three domains are interrelated to each other.

Concerning the previous literature that contribute to the understanding of the relationships between cognition, motivation and emotion, several SLA studies offer insights into these links between IDs (e.g., Gardner et al., 1997; MacIntyre & Gregersen, 2012; Sparks et al., 2000, 2009; Tóth, 2007). Therefore, the following sections provide reviews of empirical and theoretical evidence in SLA and psychology that explores these three links in the following order: the relationship between motivation and emotion, the relationship between motivation and cognition, and the relationship between emotion and cognition.

2.1.1.1 Motivation vs. Emotion in SLA. SLA scholars have long been interested in how motivation and emotion influence each other (e.g., Clément et al., 1994; Dörnyei & Ushioda, 2009; MacIntyre & Gregersen, 2012; Jackson, 2002; Kitano, 2001; Teimouri, 2016; Tóth, 2007). While the number of studies that focus on positive emotion in L2 learning has been increasing (e.g., Dewaele & MacIntyre, 2014; MacIntyre & Gregersen, 2012), the most researched factor is anxiety (Teimouri, 2016). However, since the results reported in the previous studies are mixed, the relationship between motivation and anxiety is seemingly not straight forward.

Some research on motivation and anxiety suggests a *negative* relationship between the two. Various motivation indices are found to negatively correlate with anxiety measures (e.g.,

Clément et al., 1994; Gardner et al., 1997), indicating that the L2 learners with higher level of anxiety when learning an L2 tend to have lower motivation towards learning their L2. Moreover, Gardner and McIntyre (1993) have posited that the relationship between motivation and anxiety can be reciprocal. In other words, on the one hand, a higher level of anxiety may decrease learners' motivation because they often experience frustrating and worrying moments. On the other hand, it could be also true that higher level of motivation can lead to lower anxiety since highly motivated learners tend to perform well in L2 learning and encounter positive experiences. Other research found opposite relationships: L2 learners with higher motivation tended to show a higher level of anxiety (e.g., Horwitz, 1996; Jacksons, 2001; Kitano, 2001). These studies interpret the relationship based on the learners' strict evaluation of their performance. According to Horwitz (1996), highly motivated L2 learners who have a strong desire to master an L2 may invest a considerable amount of effort, time and emotion towards practising L2 and may be inclined to feel anxious to develop their L2 to a high standard.

To summarise, the existing research has explored the relationship emotion and motivation, providing several implications. First, the degree of anxiety (a type of negative emotion) could have a reciprocal relationship with motivation. Second, anxiety can be linked to different types of L2 learners' motivational orientations. The interrelatedness of anxiety and motivation for L2 learning as indicated by SLA researchers here could, in turn, offer evidence in support of the use of the DST framework. That is, the components of L2 learners' system (i.e., ID variables) influence each other (i.e., as a self-regulating loop in the system) and operate in a blended manner. Although the research exploring the relationships among the three domains of IDs (motivation, emotion and cognition) is scarce in the field of SLA, these domains have been actively researched in Psychology. Thus, the following section overviews several key findings in psychology literature.

2.1.1.2 Evidence from Psychology Research: Motivation vs. Cognition. Based on research evidence relating to the behaviour of executive control via electrophysiological analyses (e.g., electroencephalography [EEG]), Dweck et al. (2004) observed that learners employ different types of cognitive processing depending on whether the focus of the learners' performance-oriented or learning-oriented motivation. The former type of motivation is derived from their intention to demonstrate and validate their fixed ability through a given task (i.e., motivation for performance, proving their knowledge), whereas the latter type of motivation is associated with learners' intention to improve/increase their ability to achieve their long-term goals (i.e., expansion of their knowledge, motivation for learning). When the learners who fell into the performance-oriented motivation group received feedback on their answers to the general information questions, they showed increased attention towards the feedback about the accuracy of their answers compared to the feedback that explained what the correct answer was. In other words, the performance-oriented motivation group appeared to be more interested in knowing how well they performed in the task rather than how they can improve their existing knowledge. On the other hand, the learners with learning-oriented motivation were found to equally direct their attention towards two types of feedback (i.e., performance accuracy, information about the correct answers to the questions), indicating that they attempted to capture as much available information as possible to increase their knowledge (also Butterfield & Mangels, 2003). Differences in the cognitive processes associated with performance-oriented and learning-oriented motivation were also reported in empirical research about learning behaviour (e.g., Grant & Dweck, 2003; Elliott & Dweck, 1988; Huang, 2011). Grant and Dweck (2003) examined the details of college students' learning behaviours during an introductory chemistry course. According to the students' reports of learning behaviour, they found that the students with learning-oriented motivation tended to engage in deeper processing of the

contents that they learnt. For example, the students made an effort to integrate and analyse the learning materials they received throughout the course to grasp the overall idea, and they also attempted to relate different concepts introduced in the units. By contrast, such deep learning behaviour was not observed among the students with the performance-oriented motivation. This research evidence points to the potential interaction between learning motivation and the choice of cognitive functions to employ for learning.

2.1.1.3 Evidence from Psychology Research: Emotion vs. Cognition. A body of psychology research has been dedicated to inspecting the effect of positive and negative emotion. Among them, negative emotion– anxiety– has been found to have a robust influence on the cognitive processes related to learning behaviour (Beck, 1989; Carver & Scheier, 1988; Linnenbrink & Pintrich, 2004; Matthews, 1999; Sarason & Sarason, 1990). Anxiety can be observed as a trait of a person but also arises as a dispositional vulnerability to contextualised threats such as anxieties tied to driving, taking an exam or communicating with others. Such contextualised anxiety shows certain features in one's cognitive domains. According to research on the impact of anxiety on human behaviour (e.g., Sarason et al., 1995; Matthews, 2002), arousal of anxiety in a specific context is tied to various cognitive components. For instance, the components include preoccupation with self-consciousness, irrelevant thoughts, and worry, negative self-evaluation, low self-confidence, and high level of feelings of inferiority. Matthews (1999) has also posited that anxiety may lead to the misapplication of cognitive functions for task executions. In line with Sarason et al. (1995), Matthews considers that anxiety induces various task-irrelevant thoughts, but he highlights the metacognitive aspects that involve a heightened awareness of a threat, and the planning of a compensatory effort to cope with the threat (e.g., Wells, 2000). Therefore, anxiety-breeding situations likely to induce *disruptive* thinking and such thoughts may overload the functioning of cognitive processing, resulting in production errors, showing uncertainty in

task performance, and demonstrating degraded interpersonal behaviour in social situations (e.g., Sarason et al., 1995). The role of anxiety as an obstacle to successful cognitive processing is also proposed in the resource-allocation model (Ellis & Ashrook, 1988; Ellis et al., 1995). The model focuses on the processing of information, and hypothesises that affect (especially, depressed mood) influences the function of working memory. According to the model, negative affect causes task-irrelevant processing which results in the overload and cluttering of working memory. Hence, cluttered working memory is likely to hinder the functioning of working memory in the completion of a given task (also the effect of positive affect by Bless et al., 1996).

In summary, the existing literature reviewed above has shown that a higher degree of anxiety might have a moderating role in the influence of cognitive function on task performance because learners with a high level of anxiety might have a range of task-irrelevant thoughts (e.g., negative self-evaluation, low self-confidence, concern about a threat) that occupy part of learners' capacity used to execute cognitive processing. While the past studies presented here offer insights into how anxiety can influence the quality of the cognitive function, evidence in terms of how anxiety and other emotional factors might determine the nature of cognitive function itself is fairly limited. However, some researchers (Eysenck & Calvo, 1992; Leitenberg, 1990; Smith et al., 1983) have addressed the idea that anxiety may facilitate the deployment of different cognitive functions because people who are anxious tend to generate compensatory efforts to avoid an apparent threat (Eysenck & Calvo, 1992). For instance, Meleshko & Alden (1993) stated that a socially anxious person likely employs various strategies to execute self-protective behaviour to avoid disapproval from others.

2.1.1.4 Motivation and Emotion vs. Cognition in SLA. So far, the studies introduced in this chapter demonstrated evidence showing how motivation and emotion can

be related to the cognitive process in the field of psychology. In terms of IDs research in *SLA*, a growing number of scholars have examined the interaction between motivation and emotion (e.g., Teimouri, 2016). However, relatively less attention has been paid to the nature of the role of cognitive factors in motivation and emotion. However, several factor analytic studies (e.g., Gardner et al., 1997; Sparks et al., 2011) have examined whether *foreign language learning aptitude* (i.e., a set of measurements of learners' cognitive ability relating to foreign language learning) is related to learners' motivation and anxiety towards learning a language. While various cognitive IDs have been recognised, foreign language learning aptitude is regarded as one of the most crucial *cognitive* IDs which encompass various aspects of human cognition[1] (e.g., Gardner & MacIntyre, 1992; Ortega, 2013).

Gardner et al. (1997) aimed to find an underlying relationship among multiple predictors of successful L2 acquisition. Those predictors included the composite scores of foreign language learning aptitude (measured via MLAT), motivation (integrativeness scores, a composite score of attitudes toward learning the language, desire to learn the language, and motivational intensity), language learning anxiety (French class anxiety, French use anxiety scales), attitudes (attitudes toward the teacher, attitudes toward the course), self-confidence, interest, desire to learn French, field independence/dependence, and language learning strategies elicited from Canadian learners of French in multiple universities. A factor analysis revealed that motivation and anxiety were not related to any of the foreign language aptitude measures. Another study by Sparks et al. (2011) was conducted to determine a set of learner variables that predict L2 proficiency. A variety of learner variables (L1 learning skills, foreign language learning aptitude, L2 learning motivation, and L2 learning anxiety) of 54 high school students who speak English as their L1 were investigated and linked to their

[1] Gardner & MacIntyre (1992) listed intelligence and language learning strategies are other prominent IDs that tap into cognition of L2 learners, while some researchers also discuss working memory as part of cognition (e.g., Ortega, 2013).

proficiency in German, Spanish and French. Composite scores of motivation were obtained using the motivation items from the Attitude Motivation Test Battery (AMTB) (Gardner, 1985; Gardner & Lambert, 1959), the participants' levels of anxiety were measured via the Foreign Language Classroom Anxiety Scale (Horwitz et al., 1986) and their foreign language aptitude was measured via MLAT. As a part of their data analysis, they reported that the aptitude measures were grouped separately from that of motivation and anxiety in the factor analysis. These studies suggest that foreign language aptitude may function relatively independently of the interaction between anxiety and motivation (also Li, 2016).

However, a range of studies by Sparks and his colleagues (Ganschow & Sparks, 1996; Sparks & Ganschow; 1995; Sparks et al., 2000, 2009, 2011; Sparks & Patton, 2013) suggest that learners' foreign language learning aptitude and other aspects of learners' cognitive ability may be related to motivation and emotion by shaping the state of learners' motivation and anxiety. Sparks and Ganschow (2007) examined the relationship between learners' L1 ability, L2 ability, foreign language learning aptitude, and language learning anxiety. The results implied that the learners with higher L2 learning anxiety showed lower scores not only in L1 and L2 performance but also in L2 aptitude scores. Thus, Sparks and Ganschow speculated that anxiety may be caused by learners' experience of difficulty in language learning owing to their poor language learning ability. Furthermore, they observed similar results in terms of the relationship between L2 learners' motivation and L1 and L2 ability (e.g., Sparks & Ganschow 1995). The effect of cognitive ability on affective factors as claimed by Sparks and his colleagues is corroborated by appraisal theory (e.g., Boekaerts, 1993; Scherer, 1999; Smith & Lazarus, 1990). The theory considers that one's cognitive appraisals of their situation (i.e., how well they are doing in their execution of a given task) impact on the emotional states they experience. Hence, when it comes to the influence of cognitive ID variables on learning, it is crucial to consider not only the impact of motivation

and emotion on cognition IDs, but also the influence of cognitive IDs on learners' motivation and emotion.

To summarise, while the evidence of the interaction between cognitive IDs vs. motivational and emotional IDs is very limited, several ID studies have demonstrated that foreign language aptitude (i.e., one aspect of learners' cognition that have been examined in IDs research) is related to L2 learners' motivation and emotion. On the one hand, factor analytic studies (e.g., Gardner et al., 1997) suggested that foreign language aptitude may not be related to motivation and emotion. On the other hand, several researchers (e.g., Sparks et al., 2009, 2011; Sparks & Patton, 2013) have argued that the motivation and emotional states of L2 learners with lower foreign language aptitude may consequently be negatively influenced. They believe that lower aptitude may result in more difficulty in learning an L2, and such difficulty could induce higher levels of anxiety, demotivating L2 learners.

2.1.2 Summary of the Section and Focus of the Present Thesis I.

The four sections above illustrated previous research that provide valuable evidence to support the DST view towards learner IDs, suggesting that cognitive, motivational and emotional domains can influence each other (e.g., Meleshko & Alden, 1993; Sarason et al., 1995; Sparks & Ganschow, 2007). Particularly, among the various components of emotion, negative emotions in the form of anxiety appear to be a predominant variable that could impede or facilitate cognitive processing related to learning (Beck, 1989; Carver & Scheier, 1988; Leitenberg, 1990; Linnenbrink & Pintrich, 2004; Matthews, 1999; Sarason & Sarason, 1990) and motivation for learning an L2 (e.g., Clément et al.,1994; Dörnyei & Ushioda, 2009; Kitano, 2001; MacIntyre & Gregersen, 2012; Tóth, 2007). In terms of the cognitive domain, SLA researchers have examined how foreign language aptitude is related to motivation and emotion. Such attempts include factor analytic studies of L2 learner IDs and their impact on L2 proficiency (e.g., Gardner et al., 1997; Sparks et al., 2011). Their results

suggested that foreign language learning aptitude may be not influenced by motivation and emotion, so that it might be independent of these two domains. However, a series of studies by Sparks and colleagues (Ganschow & Sparks, 1996; Sparks & Ganschow; 1995; Sparks et al., 2000, 2009, 2011; Sparks & Patton, 2013) pointed out that foreign language aptitude may influence the two domains due to their impact on L2 learners' academic performance.

Based on the above review, past SLA studies have shown that cognitive (foreign language aptitude), L2 learning motivation and emotional factors can be inter-related. While these attempts could be considered as a crucial first step towards moving IDs research forward within the DST framework, it is still unclear what aspects of motivation (e.g., prevention- or promotion-focused motivation) are tied to what types of anxiety and foreign language learning aptitude (e.g., memory, phonemic coding) in the self-regulating loop of the learner system.

Recently, Serafini (2017) took a first step to explore the dynamic relationship of three domains of IDs by drawing on the principles of DST. He longitudinally examined whether if there are any dynamic relationships between the ID variables of cognition (working memory), motivation (L2 learning motivation) and anxiety in American learners of Spanish in the U.S. (i.e., 23 beginners, 33 intermediate, and 31 advanced proficiency groups of participants) who were at the different proficiency levels of Spanish. The participants were enrolled in the non-intensive Spanish learning course, and received instruction for one semester (i.e., 2.5 months). In terms of working memory variables, executive function, and phonological working memory were measured, while the participants' motivation was measured via two questionnaires – the Attitude Motivation Test Battery (AMTB) (Gardner & Lambert, 1959) for integrativeness, composite scores from the AMTB scores, and the L2 Selves questionnaire (Dörnyei, 2010b) for Ideal L2 self (i.e., L2 learners' hopes, aspirations, and ideals for learning an L2), Ought-to L2 self (i.e., L2 learners' obligations, duties

concerning learning an L2) and the effort the participants intended to make for learning an L2. The comparison of the correlations between motivation and working memory across the three proficiency levels at the onset and the outset of the course revealed that the advanced proficiency group's executive function was correlated with their degree of Ought-to L2 self motivation and their intended effort to study Spanish at the onset, and low level of anxiety towards learning Spanish as an L2 (measured as a part of AMTB) at the outset.

Furthermore, executive function was consistently correlated with their degrees of integrativeness through the course. By contrast, the intermediate group and the beginner group showed various correlations between their phonological working memory and L2 motivation both at the onset, outset and throughout the course: the intermediate group's phonological working memory was positively correlated with their degree of Ideal L2 self motivation and integrativeness towards the Spanish-speaking community at the onset, and their intended effort and attitude towards the Spanish language (measured as a part of AMTB) both at the onset and outset, whereas the beginner group's phonological working memory was positively correlated with their Ideal L2 self motivation at the outset, and lower level of anxiety both at the onset and outset of the course. The results here provided three positive implications in support for the dynamic and complex nature of IDs. First, by illustrating that the differences between proficiency groups were associated with the interaction between working memory (cognitive IDs), and motivational and anxiety profiles (executive function for the advanced group, phonological working memory for the intermediate and beginner groups), the study demonstrates that different IDs become relevant at the different stages of SLA (e.g., Larsen-freeman, 2014). Secondly, by presenting the differences in the correlation results at the onset and the outset of the course, the study sheds light on the fluctuating nature of the relationships among cognitive, motivational and emotional IDs. Thirdly, by revealing statistically significant correlations between working

memory measures, L2 motivation measures and L2 anxiety measures, the study support the hypothesis of DST (i.e., the self-regulatory loop of the learner's system) that the cognitive, motivational and emotional IDs can influence each other and act as blended operation (Dörnyei, 2009a).

Serafini's (2017) contribution to the advancement of dynamic view towards L2 learners' ID is significant in that it provided supportive evidence that different components of *cognitive* variables (executive function and phonological working memory as components of working memory) are related differently to various aspects of motivational (integrativeness, Ideal L2 self and Ought-to L2 self towards L2 learning) and emotional (anxiety towards L2 learning) IDs. However, the author focused exclusively on the interrelationships of working memory measures (as an index of cognitive variables of L2 learners) with motivational and anxiety factors and paid much less attention to the interactions between motivation and anxiety. Since previous ID studies (i.e., Gardner et al. 1997; Li, 2016; Sparks & Ganschow, 2007; Sparks et al., 2011) also provided some mixed results on the influence of another prominent cognitive variable –foreign language learning aptitude that is particularly relevant to L2 learning in FL classrooms, it is crucial to include the scope from working memory to foreign language learning aptitude.

Furthermore, previous investigations of the relationship between motivation and anxiety have focused on learners' *general* views towards L2 learning. Recently, scholars have attempted to differentiate types and degrees of L2 learners' anxiety depending on their language skills (e.g., the Second Language Writing Anxiety Scale by Cheng, 2004, Foreign Language Listening Anxiety by Elkhafaifi, 2005, Measure of Pronunciation Anxiety in the FL Classroom by Baran-Łucarz, 2016). Such a trend has also been reflected in the domain of L2 learning motivation in terms of L2 pronunciation learning by Baran-Łucarz. She tailored Dörnyei's (2009b) L2 Motivational Self System questionnaire to tap into L2 learners'

motivation exclusively associated with L2 pronunciation learning. Thus, in order to add further evidence in terms of (a) how the self-regulatory loop of ID systems behave, and (b) extend the scholarly effort to conceptualise IDs as a dynamic learner system, the current thesis narrows the focus of the investigation to *L2 pronunciation learning* and attempts to explore how foreign language learning aptitude, pronunciation specific anxiety, and pronunciation learning motivation interact in the self-regulatory loop of learner ID systems.

The essential claim of DST is that L2 learners show considerable variability in the rate and outcomes of L2 development because learners are equipped with different components inside and outside their cognitive ecosystems, and those components influence each other and their language systems in various environments over time (e.g., Feldman, 2006). Thus, in order to conceptualise L2 learning within the framework of DST, it is essential to reveal the components within L2 learners' systems (i.e., a self-regulatory loop of ID system), how L2 learners' systems are related to their language systems (i.e., the current stable condition of the system relationships), how L2 learners' systems are related to changes in their language systems, and how L2 learners' systems interact with external environmental factors (e.g., Hiver & Al Hoorie, 2016). The present thesis attempts to address these four issues in the context of L2 pronunciation learning.

Accordingly, the first goal of the thesis is to identify the components in L2 learners' systems. By uncovering the relationships among foreign language learning aptitude, pronunciation specific anxiety, and pronunciation learning motivation, the current thesis could test the conditions which are hypothesised in DST: the multiple components of a system exist in relation to each other and create a unique structure (e.g., Larsen-Freeman & Cameron, 2008).

2.2 Dynamic Relationship between IDs and L2 Pronunciation Learning.

So far, the focus of DST principles in SLA was placed on the dynamic nature of learners' systems. However, another significant theoretical contribution from DST in the field of SLA is to help us understand L2 development as a series of changes in L2 learners' language systems (e.g., de Bot, Lowie, & Verspoor, 2007; Ellis & Larsen–Freeman, 2006; Larsen–Freeman, 1997, 2002, 2014). As Larsen-Freeman (2014) posits, L2 learners' improvement in L2 can be regarded as changes occurring in the multiple interacting elements that their language system consists of. Such changes in the elements of language systems can be induced by contact with other systems such as learners' cognitive ecosystem and social systems such as learning environment or different interlocutors (e.g., teachers, peers, native speakers of the target language) (e.g., Larsen-Freeman, 2013). Accordingly, learners' development in L2 has to be interpreted through the interaction between multiple systems and interacting elements.

In this thesis, I adopt the DST framework to illustrate L2 pronunciation development as a dynamic system that interacts with the self-regulatory loop of the ID system (i.e., the learner system that consists of cognitive, motivational and emotional domains). Focusing on the three variables selected for the examination of the self-regulatory loop of the ID above, the following sections review how these three ID factors were found to predict successful L2 *pronunciation* learning (the focus of the study).

In the context of L2 pronunciation research, a body of research has been devoted to examining the impact of various types of IDs on L2 pronunciation learning. Such research includes foreign language aptitude (e.g., Baker Smemoe & Haslam, 2013; Granena & Long, 2013; Saito & Hanzawa, 2016; Saito et al., 2019), working memory (Hu et al., 2013), anxiety and enjoyment (e.g., Saito et al., 2018), L2 motivation (Nagle, 2018a; Moyer, 2014; Smit & Dalton, 2000; Szyszka, 2015), attitude towards an L2 (e.g., Kissling, 2014; Moyer, 2007), L2

learning strategy (Derwing & Rossiter, 2002; Peterson, 2000; Rokoszewska, 2012), and personality (e.g., Dewaele & Furnham, 2000). However, to the best of my best knowledge, no attempts have been made to illustrate the dynamic relationship between, cognitive, motivational, and emotional IDs and how such dynamic interactions between IDs influences L2 pronunciation learning. Hence, following the first goal of the thesis, the investigation of the interrelationships among aptitude, motivation, and anxiety, the second of the goal of this thesis is to draw a picture of the dynamic relationship between these IDs and L2 pronunciation learning.

The following sections provide reviews of past aptitude, motivation, and anxiety research that examined their influence on L2 pronunciation learning.

2.2.1 Influence of Aptitude, Motivation and Anxiety on L2 Pronunciation Learning

2.2.1.1 Foreign Language Learning Aptitude. One of the extensively researched cognitive IDs variables in the field of SLA is aptitude (Ortega, 2013). Since early research on the roles of IDs, researchers attributed exceptionality in L2 proficiency to some kind of *talent* their subjects reported (e.g., Muñoz & Singleton, 2007). Such a talent in turn has been conceptualized as a major index of IDs – Aptitude. Aptitude is a set of specialised cognitive factors that play a facilitative role in learning language (DeKeyser, 2012). In Carroll and Sapon's (1959) Modern Language Aptitude Test (MLAT), which was an early attempt to develop a valid aptitude battery, the battery conceptualised the aptitude in terms of four components: phonemic coding ability, grammatical sensitivity, inductive learning, and associative memory (Carroll, 1962; Skehan, 1998). Phonetic coding ability is the ability that facilitates learners' noticing and analysing of the unfamiliar auditory information of the input. Language analytic ability encompasses the abilities associated with the learners' sensitivity to (a) recognise the syntactic functions of the words in a sentence (grammatical sensitivity) and (b) infer grammatical rules from detecting patterns in the sentences and apply these rules

(inductive language learning ability). Associative memory is a capacity that enable learners to form associations between verbal materials (Thompson, 2013). Since the purpose of the "traditional" aptitude batteries was to predict overall success in acquiring a second language in classroom settings (Reed & Stansfield, 2004), aptitude subsets were combined to represent an integrated score. Also, aptitude construct measured in the battery was limited to conscious learning (explicit learning abilities) (Dörnyei & Skehan, 2003). An important transition of aptitude research is its inclusion of *implicit* learning (cf. Suzuki & DeKeyser, 2015). Since the recent versions of aptitude batteries have been developed –LLAMA (Meara, 2005), the CANAL-F test[1] (Grigorenko et al., 2000), and Hi-LAB [2](Doughty et al., 2010), the constructs measured in these batteries have been at the centre of debates in terms of the domain generality/specificity and structural validity in measuring implicit and explicit learning (i.e., conscious, intentional learning) processes (cf. Skehan, 2016). For instance, focusing on LLAMA test, Granena (2013) found that sound sequence recognition (measured via LLAMA D) was implicit in nature, as opposed to the rest of the aptitude types, which considered explicit: rote and associative memory (measured via LLAMA B), phonemic coding ability (measured via LLAMA E) and grammatical inferencing (measured via LLAMA F). Although the debate over the construct validity of the LLAMA aptitude test has been ongoing (see Bokander & Bylund, 2020; Singleton, 2017), the test has been widely utilised in the realm of

[1] The CANAL-F test is paper-and-pencil based and contains inductive and deductive tasks to teach an invented language named *Ursulu* and simulate a classroom learning setting. Although the test has been recognised as a valid method of tapping into both the explicit and implicit domains of aptitude, CANAL-F has not been widely utilised in the field of SLA. (Thompson, 2013 is one of the few studies that has used CANAL-F to date.)

[2] The Hi-LAB is a computer-based aptitude test that contains 11 sub-tests (Running Memory Span, Antisaccade, Stroop, Task Switching Numbers, Letter Span, Non-Word Span, Paired Associates, Available Long-Term Memory Synonym, Serial Reaction Time, Phonemic Discrimination: Hindi, English Pseudo-Contrastive, and Phonemic Categorization). Linck et al. (2013) investigated the aptitude profiles of personnel from the U.S. government and military. Their length of foreign language learning was a long period of time (> 10 years). According to the results, those who demonstrated higher reading and listening performance (measured via the Defence Language Proficiency Tests) had high associative memory, working memory and implicit learning ability. However, like the CANAL-F test, the test requires further validation of its constructs (for exhaustive descriptions of the aptitude tests, see Li, 2016).

SLA (Bylund, Abrahamsson & Hyltenstam, 2010; Cherciov, 2011; Granena, 2013; Granena & Long, 2013; Forsberg & Sandgren, 2013; Larson-Hall & Dewey, 2012; Lundell & Sandgren, 2013; Smeds, 2012; Yalcim, 2012).

In Skehan's (2002, 2016) view, aptitude has been shown to differentially impact the initial, mid, and final stages of L2 learning (i.e., Input processing → Noticing → Patterning → Complexification → Handling feedback → Error avoidance → Automatisation → Creating a repertoire → Lexicalising). In in the early stages of L2 language learning (Input processing → Noticing → Patterning), phonemic coding ability allows the learners to process and retain auditory information in real time and facilitates noticing by analysing the information received via input processing process. According to Skehan (1998), phonemic coding plays a pivotal role at this stage because (a) it determines the amount of comprehensible input available for further analyses, and (b) it enables other aptitude components to function (Yilmaz & Koylu, 2016). Then language analytic ability (grammatical sensitivity and inductive learning) plays a role for inferring the rules of learning or making linguistic generalisations in the mid-stage of the learning (Patterning → Complexification → Handling feedback → Error avoidance). In the final stage of L2 learning (Error avoidance → Automatisation → Creating a repertoire → Lexicalising), memory contributes to retention and manipulation of the information and thus is responsible for L2 output and fluency (e.g., Artieda & Muñoz, 2016; Erlam, 2005; Linck et al., 2013; Skehan, 1998, 2002, 2016[3]). In terms of implicit learning aptitude, Granena (2013) has demonstrated that sound sequence recognition (measured via LLAMA D test) was correlated with high morphosyntactic L2 attainment of both early and later learners. Furthermore, with the inclusion of the early version of the LLAMA D test (aural memory for unfamiliar sound

[3] Importantly, Skehan (2016) stressed that working memory would involve all the stages from Input processing to Error avoidance.

sequences) in the total aptitude score, Abrahamsson and Hyltenstam (2008) found that Spanish L1 speakers who started learning their L2 after puberty had attained near native quality in their Swedish speech performance grades, which were also associated with high aptitude scores. Such evidence indicates that explicit learning aptitude is essential to each stage of L2 learning *process*, while incidental learning aptitude would serve mainly in the *attainment* of L2 (cf. for no, weak, and strong interface views of implicit vs. explicit learning, please see Skehan 2016).

In regards to L2 *pronunciation* development (the focus of the current thesis), cross-sectional and longitudinal evidence mirrors what the researchers have found in the studies of aptitude effect on L2 morphological learning: (a) different types of explicit learning aptitude work on different aspects of L2 speech development, and (b) explicit and implicit aptitude impact different stages of speech development (e.g., Baker Smemoe & Haslam, 2013; Saito, 2017; Saito & Hanzawa, 2016; Saito et al., 2019 for EFL context; Abrahamsson & Hyltenstam, 2008; Bylund et al., 2010; Cherciov, 2011; Granena & Long, 2013 for *ultimate attainment* of L2 speech in *naturalistic* context). Cherciov (2011) found that higher aptitude scores (combination of the sub-tests scores of explicit aptitude) were associated with higher L2 overall proficiency of Romanian speakers of English in Canada. Proficiency was measured via a C-test, a verbal fluency task, and a spontaneous speech production task. Granena and Long (2013) found that late learners' (16–29 year-olds) native-likeness, elicited via a set of sentence-reading tasks and judged by native listeners, were correlated with higher phonemic coding (measured via LLAMA E) and grammatical inferencing (measured via LLAMA F) than late learners without similar native-like characteristics. With the data from Japanese learners of English, Saito & Hanzawa (2016) reported that their aptitude scores (a composite of four sub-tests measured via LLAMA) showed positive correlations with better segmental, word stress, and speech rate of their speech obtained from native judges. Baker

Smemoe and Haslam (2013) found that the accurate pronunciation production, a reduced accent, and the fluency of ESL and EFL learners were best predicted by sound discrimination ability (measured via the PLAB, which is the equivalent of the phonemic coding of LLAMA E) but that was not the case with higher comprehensibility.

From a cross-sectional perspective, Saito (2017) demonstrated a strong measurement of explicit learning aptitude (phonemic coding, associative memory, and grammatical inferencing) in FL classroom contexts by investigating the link between aptitude and L2 oral performance (lexicogrammatical and phonological aspects). Drawn from spontaneous speech samples elicited from Japanese learners of English, the results illustrated the multifaceted role of explicit aptitude in L2 speech development: The learners' phonemic coding ability (LLAMA E) was associated with pronunciation and grammatical accuracy; their rote and associative memory (LLAMA B) contributed to articulation rate (speed fluency) and grammatical complexity; and their grammatical inferencing ability (LLAMA F) was correlated with vocabulary richness. However, sound sequence recognition (LLAMA D), which was assumed to measure learners' implicit learning ability, did not correlate with any linguistic variables measured in the study, indicating that while implicit learning aptitude is relevant for unintentional, incidental learning, it may not be influential in the context of intentional, explicit learning – a characteristic of the FL classroom setting. Such findings have been re-examined and extended from a longitudinal perspective by Saito et al. (2019). They reported that in the initial part of one academic year, explicit learning aptitude (associative memory and phonemic coding) appeared to have enhanced learners' global comprehensibility through the improvement of fluency and prosodic aspects of L2 speech. In the latter stage of the academic year, the learners with higher implicit learning ability (sound sequence recognition) achieved higher comprehensibility due to implicit aptitude's impact on the refinement of segmental accuracy.

2.2.1.2 Motivation towards L2 Pronunciation Learning. In addition to cognitive factors, researchers have also found that learners' motivation for learning their target languages significantly influence the diminution or retention of a foreign accent (Moyer, 2007). Although the conceptualisation of motivation differs from the study to study, motivation research has demonstrated a positive correlation between L2 learning motivation and L2 learning success (Csizér & Dörnyei, 2005a, b; Gardner, 1985; Gardner & MacIntyre, 1991; Noels et al., 1999; Schmidt & Watanabe, 2001; Tremblay & Gardner, 1995). However, when it comes to the native-like attainment in L2 pronunciation, previous research on L2 motivation yielded mixed results. Early studies of motivation (Oyama, 1976; Thompson, 1991) found no evidence of a positive correlation between a learner's motivation and his or her retention of a foreign accent. Thomson (1991) investigated how the ID profiles of Russian immigrants in the U.S. predicted the degree of their foreign accents. The results revealed that attitude and motivation factors did not correlate with reduced foreign accents, but other factors such as age at arrival did. In contrast, subsequent research found that learners' motivations–especially their concerns for pronouncing the second language accurately–was a strong predictor of reduced foreign accent (Elliott, 1995; Flege et al., 1995; Moyer, 1999, 2004; Purcell & Suter, 1980; Suter, 1976). Flege et al. (1995), who studied native Italians in Canada, found that the participants' concern for accurate L2 pronunciation and their motivation to integrate native-speakers' community accounted for small degree of the male participants' foreign accents (3 % of the variance of the foreign accentedness scores). However, these variables did not account for the female participants' foreign accentedness scores. Likewise, Moyer (1999) reported that the pronunciation accuracy of English learners of German in Germany was rated higher for learners who had higher levels of motivation towards improving the accuracy of their pronunciation.

Furthermore, recently, researchers have investigated the link between L2 pronunciation development and L2 Motivational Self System (Dörnyei, 2005, 2009b, 2010b). This recent conceptualisation of motivation was underpinned by the socio-dynamic notion that sees learners' motivation is context-sensitive and emerges out the situated activities within a given social group (e.g., language learning classroom) (e.g., Sealey & Carter, 2004). In particular, motivation researchers in the socio-dynamic phase begun to place strong emphasis on the how they see themselves as language learners (i.e., selves) in relation to their social environment and sociocultural values that underly specific language learning contexts as a source of their motivation. The introduction of *self* to the motivation research in SLA was based on the theories of social psychology (i.e., theory of regulatory focus; Higgins, 2000) that humans make decision to act in order to reduce the discrepancies between their current perceived selves and the possible selves /personal visions. By adapting theory of regulatory focus, Dörnyei (2005) further developed the concept of selves to capture language learners' promotional-focused selves (i.e., the kind of person they would like to be) and prevention-focused selves (the kind of person they think they have to be) in L2 Motivational Self System.

L2 Motivational Self System encloses three components: Ideal L2 self (i.e., motivation to maintain an ideal, possible selves that act as "forward-pointing self-guides" [Dörnyei 2010a, p.265]), the ought-to L2 self (i.e., "a belief one ought to possess to avoid possible negative outcomes [Dörnyei, 2005, p.106]"), and L2 learning experience (Csizér & Dörnyei, 2005a, 2005b; Dörnyei & Csizér, 2002). Although the counter evidence of a positive link between Self Systems and learning outcomes has been reported (Moskovsky et al., 2016), L2 motivation studies have generally yielded a positive relationship with L2 proficiency (Dörnyei & Chan, 2013 for course grade; Lamb, 2012; Yashima, Nishida, & Mizumoto, 2017 for L2 knowledge,). In their cross-sectional study with Saudi Arabian

students, Moskovsky et al. (2016) investigated the potential link between L2 motivational self-systems and the learners' L2 proficiency as measured through reading and writing tasks. Although Ideal L2 self and ought-to L2 self were found to be strong predictors of intended learning efforts (measured through perceived learning efforts and intended learning behaviour), overall proficiency was not associated with any of the motivation factors. Lamb (2012), on the other hand, reported a positive effect of motivation on L2 proficiency development. He explored various aspects of the L2 motivation factors of Indonesian learners of English in relation to their scores on a C-test (i.e., filling in missing words in five short texts). The results revealed that the higher ideal L2 self and more L2 experience in school predicted greater L2 proficiency. Yashima et al. (2017) also examined the relationship between motivation factors (Ideal L2 self, Ought-to L2, intended effort) and L2 proficiency (measured via listening and reading tasks from TOEFL-ITP). The study revealed an internal mechanism of Self System and achievement: Ideal L2 self and Ought-to L2 self were both linked to intended effort which in turn contributed to L2 proficiency.

However, evidence concerning L2 motivation's link to L2 *pronunciation* development is fairly limited (Baker-Smemoe & Haslam, 2013; Nagle, 2018a; Saito et al., 2017; Saito et al., 2018). Although the examined population contained both EFL and ESL students, Baker Smemoe and Haslam (2013) found that the learners' comprehensibility and fluency scores (measured via sentence reading and spontaneous speech tasks) were strongly correlated with their motivation scores measured as a part of the Pimsleur Language Aptitude Battery (PLAB). Furthermore, their motivation scores were also weakly correlated with the learners' fluency scores. However, no significant relationship with accentedness and motivation were found. The authors speculated that the learners who were highly motivated to learn a foreign language might not put too much emphasis on sounding target-like pronunciation. Instead, they reasoned that the learners' L2 learning motivation may have been directed towards

developing pronunciation features that are necessary for effective communication. Their study has provided an evidence that the source of learners' motivation would direct the course of pronunciation development.

Adopting various natures of motivation and metacognition, (integrativeness, instrumental motivation, aiming to become comprehensible for long-term future, and the pursuing of nativelikeness), Saito et al. (2017) also examined how different types of motivation affect the development of Japanese learners' L2 speech comprehensibility and accentedness over one academic year. Among the various motivational factors, the learners who (a) were highly motivated to study English for their future career development as a vague and long-term goal and (b) had a strong desire to improve their comprehensibility received higher comprehensibility ratings from native speakers of English. In contrast, the learners' motivation towards developing native-like pronunciation was not associated with neither accentedness nor comprehensibility.

Nagle (2018a) longitudinally investigated motivational changes in English learners of Spanish and the impact of motivational changes on the learners' comprehensibility and accentedness. Among the intended effort, Ideal L2 self, and Ought-to L2 self, only intended effort was found to be associated with the diminution of accentedness, whereas comprehensibility was not linked to any of the measures. Nagle (2018a) attributed the non-significance of Ought-to L2 self to the participants' pronunciation learning to their learning context: because they learnt Spanish in an FL classroom, they may have felt less pressure to acquire native-like pronunciation. He speculated that Ought-to L2 self may be more relevant it the immersion context where the learners have relatively frequent exposure to the native varieties of the target language. Furthermore, in terms of comprehensibility, he considered the strong influence of the communicative-oriented lessons: owing to the participants' frequent practice of L2 in the communicative lessons, such opportunity may have enabled the

learners to produce comprehensible output, and eliminated the effects of individually varied motivational variables.

Saito et al. (2018) explored links between L2 oral proficiency (i.e., comprehensibility), motivation (Ideal L2 self, Ought-to L2 self) and emotion (foreign language enjoyment, foreign language classroom anxiety) in the context of Japanese high school learners of English. While a cross-sectional investigation revealed that higher comprehensibility was associated with higher Ideal L2 self, language learning enjoyment, past learning experience at pre-school, current L2 use at the classrooms, and lower anxiety in learning English, a regression analysis showed that comprehensibility was impacted mainly by the degree of anxiety and Ideal L2 self. Through a longitudinal research design, Saito et al. (2018) examined the relationship between participants' comprehensibility scores and the amount of their current L2 experience (such as L2 learning at a cram school and conversations with native and non-native speakers) and the degree of Ideal L2 self, enjoyment, and anxiety. A regression analysis found that the participants' degree of Ideal L2 self and L2 learning enjoyment were the predictors for the improvement in their comprehensibility scores. These results suggest that learners' motivational states is strongly tied their emotional states and they may uniquely shape the outcome of L2 pronunciation learning.

2.2.1.3 Anxiety towards L2 Pronunciation Learning. Since the early 1970s, anxiety has been recognized as a factor that negatively affects the L2 learning process in the classroom (MacIntyre & Gardner, 1989, 1991; Scovel, 1978; Spielberger, 1972). Instead of treating anxiety as a general emotional state, researchers have attempted to conceptualize anxiety as a multifaceted emotional factor comprised of state anxiety, trait anxiety, and situation-specific anxiety (Horwitz, Horwitz, & Cope, 1986; MacIntyre & Gardner 1991; Spielberger, 1972). State anxiety is a temporal, transitory anxiety experienced under

particular conditions. Trait anxiety is a personality trait that stabilizes over time. Unlike state and trait anxiety, situation-specific anxiety is tied to and recurrent in a specific situation (Spielberger, 1972; Spielberger, Anton & Bedell, 1976). Situation-specific anxiety was further defined and interpreted as a factor that triggers negative emotional behaviour in foreign language learning classrooms by Horowitz and her colleagues (Horwitz, 1995, 2001; Horwitz et al., 1986; Horwitz & Young, 1991). The Foreign Language Classroom Anxiety Scale (FLCAS) was created by Horwitz et al. (1986) to investigate the emotional states of language learners in detail, and it has been widely used in subsequent anxiety research in classroom settings (Chen, 2002; Cheng et al., 1999; Kitano, 2001; Liu, 2006, 2007; MacIntyre & Gardner, 1989; Wang & Ding, 2001; Yan & Horwitz, 2008).

A few theoretical accounts of how anxiety would affect L2 learning has been proposed. According to Tobias (1986), anxiety may cause the interference in the three aspects of cognition (also Maclntyre & Gardner, 1989, 1994). First, anxiety may become a barrier to properly paying attention to the new items and initiate encoding of the items. Anxious learners thus often miss out on the input when they are exposed to the target language. Secondly, even though the learners succeed in receiving the input, anxiety may interfere with organising, assimilating and storing of the new item in the memory. Therefore, anxious learners' execution of the cognitive strategies that heavily dependent on the memory likely requires more processing time. Lastly, at the output stage, anxiety may impede item retrieval from learners' memory that is necessary for organising outputs. Insufficient memory retrieval may be detrimental to accurate and smooth language production. Furthermore, Eysenk (1979) considered the negative effects of anxiety on L2 learning to be the unbalanced attention distribution. Eysenk posited that anxious learners have a high degree of concerns related to their self-evaluation and potential errors they would make, and are sensitive to others' evaluation. Due to the amount of attention sacrificed to hold these concerns, the attention

required to carry out the cognitive tasks may not be sufficient. When compared to the learners with low anxiety who do not have to spare the attention on self-concerns, therefore, the output performance of anxious learners is less efficient. Therefore, not only the learning process itself (reception of input, processing of the input in the memory), production process (accuracy and fluency) could be hampered by the degree of anxiety (Horwitz, 2010).

In line with the theoretical accounts presented above, research has found the negative association between the level of learners' anxiety and L2 achievement (see Teimouri, Goetze, & Plonsky, 2019 for a meta-analysis). Li and Huang (2011) provided a more detailed picture of how FL classroom anxiety is linked to motivation and L2 development by using FLCAS and the English Learning Motivation Scale (ELMS). Among the FL anxiety and motivation factors, L2 performance (measured via writing, reading, listening tests) was best explained by overall FL classroom anxiety and fear of negative evaluation, intrinsic motivation, instrumental motivation, and interest in foreign languages and cultures. The study also reported strong negative correlations between FL classroom anxiety and motivation. In fact, a similar pattern was found in the other studies such as Saito et al.'s (2018) study. They found that the participants' ideal L2 self was negatively correlated with anxiety and positively correlated with a type of enjoyment. Therefore, level of anxiety may be closely related to how strongly the learners' motivation is internalised (also MacIntyre & Gregersen, 2012).

With regard to the impact of anxiety on L2 speech learning, researchers consider pronunciation to be particularly anxiety-evoking because it can trigger a specific type of anxiety since one's perceived degree of accentedness is susceptible to the level of authenticity the speaker expects/desire to achieve, and is related to his/her identity: how willing the learners are to retain the accent or reduce their accents to make them more target-like (Baran-Łucarz, 2016). In fact, Baran-Łucarz (2011) has demonstrated that the Polish learners of English who reported high level of anxiety in learning English (measured via

FLCAS) were evaluated more accented in terms of the passage reading task. The study has provided an evidence that the learners' feeling of anxiety is closely connected to their self-perception of how they sound to themselves and to some degree to the actual quality of their pronunciation production. With respect to the link between anxiety and the global development of L2 pronunciation, Saito et al. (2018) explored how emotion (enjoyment, anxiety) and motivation affected the Japanese learners' development of L2 comprehensibility over one academic term (12 weeks). They have found that the level of anxiety the learners feel in the foreign language classroom (via FLCAS) were associated with lower comprehensibility both at the onset and the end of the study.

While the major anxiety research on L2 learning adopts FLCAS to measure the participants' anxiety, some researchers attempted to isolate anxiety that is tied to pronunciation learning (Baran-Łucarz, 2016; Sardegna et al., 2014 for anxiety measures as part of attitude towards L2 pronunciation). Baran-Łucarz (2013, 2014, 2016) developed Measure of Pronunciation Anxiety in the FL Classroom (MPA-FLC) to conceptualize learners' *pronunciation-specific* anxiety based on phonetics learning anxiety. MPA-FLC consists of four main components: fear of negative evaluation, pronunciation self-efficacy and self-assessment, pronunciation self-image, and a set of beliefs related to pronunciation. According to Baran-Łucarz (2016), fear of negative evaluation concerns apprehension caused by negative responses or assessments from interlocutors/listeners (e.g., classmates, teachers, and native/non-native speakers of target language). Pronunciation self-efficacy and self-assessment measures the learners' self-perception and comparative assessments of their own prospects of learning the correct pronunciation of the target language versus those of other learners around them. Pronunciation self-image deals with learners' self-image of how they look and sound when they pronounce the target language. The learner's set of beliefs related to pronunciation measures a learner's attitude and perception of the importance of learning

the correct pronunciation of the target language. Although a validation study of the scale was conducted by Baran-Łucarz (2016), to what degree such pronunciation specific anxiety actually impedes the learning process and quality of the L2 production has not been explored.

2.2.2 Summary of the Section and Focus of the Present Thesis II.

The review above focused on studies that examined the influence of aptitude, motivation and anxiety on L2 pronunciation learning. These studies provide supportive evidence that the cognitive, motivational and emotional subsystem of L2 learners' systems (i.e., the self-regulatory loop of the IDs system) do interact with L2 learners' pronunciation components embedded in their language systems. While DST advocates, such as Serafini (2017), empirically examined the L2 system of L2 learners of Spanish (working memory measures as the indices of cognition, L2 learning motivation and, Ideal and Ought-to L2 self as the indices of motivation, and L2 anxiety as an index of emotion) interact with different proficiency groups screened via a grammar part of Spanish course placement exam, different components of L2 proficiency such as L2 pronunciation have not yet received scholarly attention within the framework of DST. Therefore, to expand the scope of IDs research from a DST perspective, the second goal of the present thesis is to conduct a cross-sectional investigation of the relationship between the self-regulatory loop of IDs and L2 learners' pronunciation performance. It is important to stress that a crucial aspect of the DST approach towards L2 learning is to holistically cover three domains of the IDs system (i.e., L2 learner systems). This is because (a) the systems behave as a self-regulatory loop of L2 learner systems, and (b) the ID components that contribute to the change in L2 learners' language systems are determined by a variety of changes occurring in the components themselves. Furthermore, identifying a prominent pattern in the learner systems that influence their language system can serve as a foundational state (i.e., the initial condition). Since the DST sees that changes in a system are related to the system's initial state, the development of

learners' systems at any given moment needs to be examined in terms of the initial or previous state of their systems (e.g., de Bot, 2008; Larsen-Freeman & Cameron, 2008). Drawing on this principle of DST (i.e., the initial state precedes the state of the system after it changes), thus, the second goal of the thesis is regarded as an attempt to find out the initial state of the relationship between L2 learners' language systems and their ID systems (i.e., the self-regulatory loop of the ID system).

So far, the literature review has focused on research evidence related to (a) how cognitive, motivational and emotional domains of human intellectual functioning (Dörnyei, 2009) operate in an interlocking manner, and (b) how IDs in these domains influence L2 learners' pronunciation learning. According to Marton (2006) and Larsen-Freeman (2014), DST sees L2 development as induced by L2 learners' noticing of L2 input and increased awareness of L1-L2 differences introduced by others (i.e., instruction, feedback) (also van Lier, 2000; Zheng & Newgarden, 2012). Hence, it is crucial to consider how L2 learners' language systems develop through interactions with systems external to L2 learners' language systems and the self-regulatory loop of L2 learner systems.

A crucial source of change in learners' language systems is instruction given in the classroom setting (i.e., the focus of the current thesis). Therefore, by focusing on L2 pronunciation learning, the following section overviews the research that has explored the influence of pronunciation instruction on learners' L2 pronunciation.

2.3 Learner ID and the Effectiveness of L2 Pronunciation Instruction

2.3.1 The Goal of L2 Pronunciation Learning

Over the last 50 years, L2 pronunciation research has experienced a significant shift in the goal of L2 pronunciation teaching. This paradigm shift is defined by Levis (2005) in terms of two principles: the nativeness principle and the intelligibility principle. The nativeness principle represent the pedagogical notion and implication that the goal of

language teaching should be to attain native-like pronunciation in the target language. By contrast, the intelligibility principle holds that the goal of foreign language learning should be to become comprehensible for successful communication. The change from targeting nativeness to targeting intelligibility proposed by Levis was motivated by the empirical evidence that the majority of adult L2 learners would retain features of their L1s in their L2 speech (e.g., Scovel, 1995) and an age-related constraint were found to be a deep-rooted factor even when other variables such as motivation were considered (Baker, 2010; Flege et al.,1999; Moyer, 1999; Oyama, 1976; Thomson, 1991). Therefore, adult L2 learners who attained native-like pronunciation are rather considered as exceptional (cf. Bongaerts et al., 2000; Moyer, 2014). In addition, another line of empirical research has provided evidence that even with the presence of foreign accent, L2 speakers can be fully intelligible to a variety of L1 and L2 listeners (e.g., Munro & Dering, 1995a; Murphy, 2014). As a result of the paradigm change, the general emphasis of the current agenda for L2 pronunciation teaching has been revised to aim for the achievement of effective and efficient communication, with a particular focus on speech intelligibility (Derwing & Munro, 2009).

Although the overall aim of L2 pronunciation teaching has been set, existing research appears to approach pronunciation from various angles– L2 pronunciation research has a specific focus in terms of the aspects of pronunciation to teach or measure (e.g., segmentals) and the types of evaluation methods (e.g., inspections of acoustic properties of the performance). Therefore, in an attempt to systematically conceptualise L2 pronunciation proficiency through the meta-analysis of seventy-seven studies, Saito and Plonsky (2019) have proposed the Framework of Pronunciation Measurement. In this model, they defined that L2 pronunciation proficiency in the context of pronunciation teaching research is "a multi-layered phenomenon" (p.5) and illustrated L2 pronunciation proficiency in terms of *specific* pronunciation features (segmentals, prosody-based suprasegmentals) and *global*

features of pronunciation (accentedness, comprehensibility, intelligibility, perceived fluency). The former can be evaluated through the objective examination of acoustic properties of the L2 utterance or the scale-based assessment by the trained experts (e.g., Saito et al., 2016), whereas the latter relies on the listeners' impressionistic and holistic judgements of *L2 speech*.

While it is crucial to examine how the acoustic properties of learners' utterance can change after the instruction, Derwing and Munro (2015) argue that it is crucial for L2 pronunciation research that follows the intelligibility principle to incorporate listeners' perception. This is precisely because the concept of intelligibility is based on the listeners' understanding of speakers' intended message. In their examination of *global pronunciation proficiency* (e.g., Munro & Derwing, 1995 a, b), while they stressed that accentedness, comprehensibility, intelligibility, and perceived fluency are inter-related (i.e., a foreign-accented speech can be difficult to understand and to identify the exact words that were produced, and an utterance with a lot of breakdowns and a slow speech can be difficult to understand), intelligibility is often operationalised as the listeners' transcription because this construct is not only about the listeners' actual understanding of the speakers' intended message but also to do with to what extent the listeners understand the exact words/utterance the speaker produced (Derwing & Munro, 2015). In this sense, intelligibility is distinguishable from comprehensibility as the latter is conceptualised as the listeners' ease of overall understanding. Degree of accentedness is also separable from the rest of the constructs as the speakers' foreign accent may not necessarily impair the listeners' understanding. Another way to see the independence of each construct is to examine the relationship between the global and the specific constructs. With respect to this line of inquiry, a body of work has been dedicated to identifying the components of accentedness

and comprehensibility (Kang, 2010; Kang et al., 2010; Munro & Derwing, 2001; Saito, Trofimovich et al., 2017; Trofimovich & Isaacs, 2012).

2.3.1.1 L2 Comprehensibility and Accentedness. Ample evidence supports the idea that segmental and prosodic errors of L2 pronunciation impact on accentedness and comprehensibility judgments. The studies found that accentedness seems to be strongly associated with segmental accuracy, temporal measures, syllable duration, stress, and pitch range (Anderson-Hsieh et al., 1992; Munro et al., 2010; Winters & O'Brien, 2013), while comprehensibility is linked with the accuracy of the segmentals in the stressed syllables (Zielinski, 2008), lexical stress (Field, 2005), primary stress in sentences (Hahn, 2004), and choice of tones (Pickering, 2001; Wennerstom, 2001).

The construct of comprehensibility and accentedness has been then, more extensively examined by Isaacs and Trofimovich (2012), and Trofimovich and Isaacs (2012), who employed various ranges of measures including pronunciation, fluency, lexis, grammar, and discourse structure for linguistic coding. For instance, Trofimovich and Isaacs (2012) found that both comprehensibility and accentedness were considerably linked to segmental and prosody-based measures such as listeners' perceptual salience of vowels and consonants errors and word stress and rhythm. However, comprehensibility was also associated with grammatical accuracy and lexical type frequency. A follow-up study by Saito et al. (2016) confirmed that accentedness is relatively strongly affected by the errors in segmental (r =.81) and prosodic accuracy (r = .7 for word stress, r = .59 for intonation) and speech rate (r = .5), whereas comprehensibility was not only related to the phonological accuracies (r =.73 for segmental accuracy, r =.64 for word stress , r = .52 for intonation) and speech rate (r = .58), but also grammatical accuracy (r = .51) and appropriate use of lexical items (r =.31). Such empirical evidence suggests that compared to accentedness, comprehensibility would be affected by phonological accuracy to a lesser extent and also hampered by the temporal

quality and the other linguistic factors such as the lexical choices and accurate grammar uses. According to the meta-analysis by Saito & Plonsky (2019), approximately 30-40 % of the variance in human intuition of comprehensibility, accentedness, and fluency is influenced by non-phonological features (e.g., lexicogrammatical errors, types of speech task, and listeners' backgrounds), suggesting that phonological accuracy takes up major variance of L2 global pronunciation proficiency (i.e., 60-70%). This means that comprehensibility, accentedness, and fluency are considered to be multi-componential concepts that play a crucial role in characterising of *L2 speech* (i.e., "listeners' holistic judgements of L2 speech (Saito & Plonsky, 2019, p.6)").

According to the L2 speech studies (e.g., De Jong et al., 2012; Iwashita et al., 2008), L2 speech proficiency is also a multi-faceted, being made up by linguistic knowledge (i.e., grammar and vocabulary) and how quickly and accurately produce speech (linguistic processing skill) (i.e., the speed of lexical retrieval and the accuracy in segmental and prosodic features). Therefore, it can be said that the constructs of L2 global pronunciation proficiency (especially comprehensibility) seems to be partially overlapped with L2 speech proficiency. However, a major difference between L2 speech proficiency and holistic measures (i.e., comprehensibility, accentedness, and fluency) is that the latter focuses on listeners' overall perception as a method for evaluation of L2 speech whilst the former mainly uses objective analyses (e.g., number of errors) for evaluation (e.g., Iwashita et al., 2008). On the one hand, such difference in operationalisation between the assessment of comprehensibility and L2 speech proficiency indicates that while comprehensibility can be one of the indicators of L2 speech proficiency, it does not represent one's L2 speech proficiency. On the other hand, in the similar vein, comprehensibility cannot be treated to be equal to L2 pronunciation proficiency. However, it is considered to be an index that shows to what degree speakers' pronunciation is clear (but not necessarily the target-form) so that

listeners' understanding of words are not hampered. Such index is distinguishable from speakers' pronunciation accuracy evaluated via accentedness, where listeners likely to pay attention to how target-like the pronunciation features are (e.g., Isaacs and Trofimovich, 2012; Saito et al., 2016). Owing to such differences in the influence of listeners' perception between comprehensibility and accentedness, these two constructs can represent two related but different nature of speakers' pronunciation in a nuanced manner: Comprehensibility represents the level of communicative sufficiency of pronunciation (i.e., how clear speakers' pronunciation is to listeners to understand words and sentences), and accentedness indicates the degree of native-likeness of pronunciation. Such subtle but crucial differences can be only obtained through the holistic judgment of speech but error analyses of word or sub-word levels (e.g., Iwashita et al., 2008).

Therefore, in order to examine L2 learners' pronunciation in the nuanced manner, the current thesis utilise comprehensibility and accentedness as the measure of learners' proficiency. At the same time, it should be clarified that L2 pronunciation proficiency is a multifaceted, and comprehensibility and accentedness are not fully equant to either L2 pronunciation proficiency or L2 speech proficiency. Rather, they are part of the dimensions of these two proficiencies.

2.3.2 The Effectiveness of L2 Pronunciation Instruction

Being in line with the rise of intelligibility principle (Levis, 2005), many scholars have explored the effective intelligibility-oriented pronunciation instruction (Bradlow et al., 1999; Couper, 2003, 2006, 2011; Champagne-Muzar et al., 1993; Derwing et al., 1997, 1998; Dlaska & Krekeler, 2013; MacDonald et al., 1994; Saito & Lyster, 2012; Thomson & Derwing, 2015; Trofimovich et al., 2009). While some studies of L2 pronunciation instruction are dedicated to investigating the improvement in the accurate production of certain features (e.g., Couper, 2011 for the changes in error ratio of epenthesis; Saito &

Lyster, 2012 for improvement in English /r/; Thomson, 2011 for computer-based training for English vowel accuracy), other studies have focused on how certain types of interventions help L2 learners improve their intelligibility, comprehensibility and accentedness (e.g., Derwing et al., 2014; Derwing et al.,1998; Sardegna, 2011).

One of the earlier attempts of exploring the effectiveness of pronunciation instruction on L2 pronunciation development was made by Champagne-Muzar et al. (1993). They provided one-hour long segmental and suprasegmental instruction with forty-eight English learners of French for twelve weeks. While the experimental groups made progress in the perception and production performance, the control group did not. Therefore, the study confirmed that L2 learners' perception and production skill can be improved through instruction. Subsequently, a number of studies have been conducted to examine the efficacy of the instruction under the various conditions. For example, two studies of Derwing and her colleagues demonstrated that the pronunciation instruction appears to be effective to the learners whose L2 pronunciation had plateaued after an extended period of L2 exposure and practice. Derwing et al. (1997) focused on the development of speech intelligibility among thirteen learners of English in Canada whose L1 backgrounds were mixed. They had lived in Canada for an average of ten years. The contents of the instruction covered broad aspects of speech (body language, volume, voice quality, speech rate, suprasegmentals, and few segmental) that were designed to facilitate the improvement of shared problematic features across learners (varied L1s). The results of the perceptual test indicated that the L2 participants made perceptual gains over the course of the 12-week study, and they found the instruction contributed significantly to the improvements in intelligibility, comprehensibility and accentedness measured via a read-aloud task.

Another study of Derwing et al. (2014) focused on six Vietnamese learners of English and one Cambodian learner of English who had lived in Canada for more than nineteen years.

The learners received thirty minutes of perception and production tasks for three days a week for over a total of seventeen hours over three months (i.e., seventeen hours of instruction in total). The learners' improvement was measured via a perception task, a free speech, and a picture description task. The results revealed that their perception and comprehensibility were found to be significantly improved, meaning that even L2 learners whose L2 accents were deeply ingrained could refine their quality of L2 production accuracy to be more comprehensible one. By contrast, the degree of accentedness in the participants' speech did not make any profound change. Derwing et al. (2014) speculated that the L2 speech features that had improved through the instruction may have been more relevant to the aspects of comprehensibility rather than accentedness. Such studies overall support the relatively robust effect of pronunciation instruction on comprehensibility.

In addition, other studies have looked at the impact of drawing learners' awareness of specific pronunciation features via the instruction. A study by Couper (2003) for example has examined how the participants' awareness towards the pronunciation features they have learnt through the instruction. Fifteen participants with varied L1 backgrounds and LOR (three months to six years). The instruction was provided for sixteen weeks (a total of eighteen hours of instruction) and they included to (a) explicit explanation of pronunciation features, (b) controlled and less controlled production practice, (c) analysing of different aspects of pronunciation, and (d) analysis of their own pronunciation. The results indicated that the learners' general awareness towards their pronunciation was improved and the learners' error ratio was significantly decreased in the controlled and free speech production tasks, pointing to the general effectiveness of perceptual and production training. Another study by Sardegna and MacGregor (2013) also focused on learners' awareness by providing learner-centred instruction. In addition to the explicit instruction of the target features (vowel reduction, linking, primary stress, and intonation), the instructor provided a set of strategies

the participants could practice the target features by themselves inside and outside the classroom. In addition, the participants were asked to record their speech, complete the self-assessment, and record their self-reflection of the progress on the blog. The results revealed significant improvements in all aspects of the target features.

In the framework of DST, a fundamental focus is on illustrating and tracking the patterns that emerge in the systems by identifying the most prominent components involved in the system changes. According to the studies reviewed above, research has confirmed that pronunciation-focused instruction would be beneficial for improving various aspects of L2 speech, including comprehensibility and particular pronunciation features. Therefore, pronunciation instruction can be considered as a factor likely to contribute to the changes in L2 learners' language systems. However, none of the L2 pronunciation instruction research has not yet explored the role of the instruction within the DST framework. Especially, it is unclear how the instruction contributes to the changes in L2 learners' language system in relation to the multicomponential L2 learner systems. Importantly, Kissling (2014) has pointed out that despite the considerable inter-learner variability in the rates and outcomes of pronunciation learning have been observed, research on the effectiveness of pronunciation instruction rarely considers (a) to what extent the differences in the amount of improvement can be observed and (b) the factors that influence the amount of gain from the instruction except for a few laboratory studies (Perrachione et al., 2011). Furthermore, by overviewing the past pronunciation teaching studies, Derwing and Munro (2015) also pointed when the instructional outcome is evaluated, it is crucial to consider not only the nature of the instruction itself but also the influence of multiple learner-internal variables including participants' motivation, aptitude, differences in their L2 learning experience, and their age.

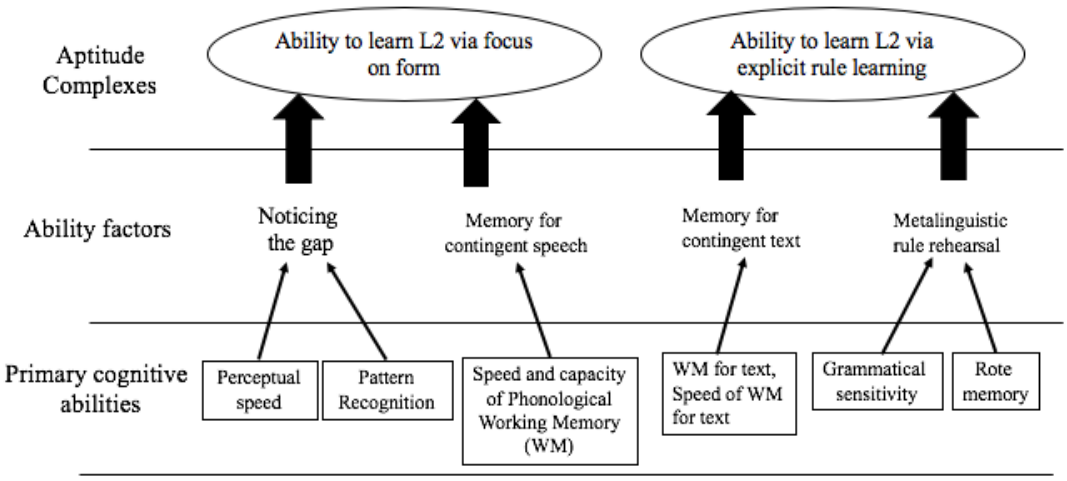
2.3.4 Interactions between Learner IDs and L2 Instruction

In the field of instructed SLA (especially trlating to research of L2 grammar teaching), research has indicated that some L2 learners' IDs may allow them to benefit more from instruction and corrective feedback (Erlam, 2005; Li, 2013, 2015; Hwu & Sun, 2012; Sheen, 2007; VanPatten et al., 2013; VanPatten & Smith, 2015; Wesche, 1981; Yalçin & Spada, 2016; Yilmaz, 2013; Yilmaz & Granena, 2016). Such interest is motivated by Robinson's (2005, 2007, 2012) Aptitude Complexes Hypothesis. Based on Snow's (1987, 1994) concept of aptitude complexes, he claimed that the relevant components of aptitude are different depending on the content of learning or instructional conditions. This hypothesis assumes that learners' aptitude is multi-componential and consists of various abilities that affect different types of learning. As shown in Figure 2.1, "primary cognitive abilities" in the lowest row underlie "ability factors" that are directly associated with the L2 learning process (e.g., noticing the gap; see Figure 2.1). Then these factors are integrated into each aptitude factor (see Figure 2.1). For instance, in the case of aptitude for focus on form via collective feedback (recasts) (i.e., the left side of the table in Figure 2.1), Robinson states that noticing and memory are crucial because when L2 learners receive recasts, they have to hold the sound information received from the interlocutors in memory, compare it with their own previous utterance, and notice the differences between them. Such ability factors are based on learners' primary abilities in perceptual speed and sound-symbol pattern recognition (for noticing), and the speed and capacity of their phonological working memory (for memory). Similarly, aptitude for explicit rule learning requires the processing of written text on a classroom board (i.e., memory for remembering text information) and analysing and applying the rules that were stored in memory (i.e., rule rehearsal) (see Figure 2.1). In order to operate these abilities, Robinson proposed that working memory, grammatical sensitivity and rote memory are relevant (Robinson, 1997, 2007).

Accordingly, the role of different explicit learning aptitude was examined in relation to different types of instruction. For instance, White and Ranta (2002) examined the impact of different types of instruction on the acquisition of third-person singular possessive determiners among the French learners of English in an ESL setting. They reported that there was a positive relationship between greater language analytic ability and the communicative lessons (i.e., no explicit rule explanation).

Figure 2.1

Robinson's Model of Aptitude Complexes



Apart from the comparisons between different types of instruction and their interaction with specific types of aptitude, other researchers focused on specific treatment type (e.g., explicit instruction) and examined how learners' aptitude would affect the acquisition of different linguistic items.

For instance, Yalçin and Spada (2016) demonstrated that Turkish learners of English who had greater grammatical inference ability and phonemic coding performed better on the grammatical judgement task of the passive (a difficult structure) than that of the past progressive (easy structure) after four hours of instruction. Crucially, this line of research has

defined the degree of difficulty in terms of (a) the linguistic features' objective structural complexity, (b) the degree of salience in input and (c) the connection between its form and meaning (e.g., Goldschneider & DeKeyser, 2001; Housen, 2014). Thus, such acquisitionally difficult features make the learners deploy more cognitive resources and effort to process (Housen, 2014). Drawing on the results of their study, Yalçin and Spada (2016) observed that in order to learn the new linguistic features that are acquisitionally difficult for learners, their attention has to be explicitly drawn to the target features by explicit instruction, then they have to resort to the explicit learning aptitude (phonemic coding, and grammatical inferencing) to fully process it in their cognitive system (Robinson, 2002). However, in some cases such as Erlam's (2005) study, which found no aptitude effect in the explicit rule learning group, explicit instruction may mitigate the differences in the learners' aptitude profiles (cf. Caroll, 1963; Skehan, 1989). Such differences in the benefit of aptitude in explicit instruction setting (e.g., Erlam, 2005 vs. Yalçin & Spada, 2016) appear to be attributed to the interaction between the type of instruction and the structure of the target items.

In terms of the interactions between pronunciation instruction and learner characteristics, the number of studies is extremely limited. However, they offer evidence that learners with greater cognitive ability may benefit more from instruction (Kennedy & Trofimovich, 2010; Kissling, 2014; Helmke & Wu, 1980; Trofimovich et al., 2013). For instance, Trofimovich et al. (2013) explored the effect of two types of L2 instruction (comprehension-based vs. traditional instruction) in order to investigate aptitude treatment interaction on L2 speech learning of francophone speakers of English in Canada (i.e., ESL setting). The contents of the traditional instruction included question-and-answer activities, practising of dialogue, and reading and writing training. For the comprehension-based programme, the participants were asked to independently engage in listening and reading

training with no specific instruction or feedback from the instructors. The learner factors they focused on included L1 literacy skills, general academic ability and contact with the target language. Although both types of intervention helped the learners improve pronunciation accuracy and comprehensibility, they found that the students who had more experience (i.e., L2 contact) and cognitive ability (i.e., L1 literacy skills, and general academic ability) benefited more from the comprehension-based instruction than the traditional, aural-oral instruction especially in terms of comprehensibility. The study showed that in the condition with limited production opportunity, the learners who demonstrated stronger learning profiles (i.e., having extensive linguistic knowledge and target language experience, and advanced general learning ability) likely made most of the extensive input.

Furthermore, focusing on the effectiveness of *computer-based phonetic training*, Kissling (2014) conducted a study of American learners of Spanish to explore the impact of age, attitude (i.e., learners' desire to acquire a native-like accent and their beliefs about their ability to change their accent), memory (i.e., phonological short-term memory), aptitude (i.e., phonemic coding), L2 learning experience (number of Spanish courses taken in high school, number of Spanish courses they have taken in the college, experience using Spanish outside the classrooms, and their study-abroad experience in Spanish-speaking countries) and sound discrimination ability on the acquisition of Spanish consonants. Whereas the improvements made in the control group (who participated in a computer-delivered pronunciation learning course with no explicit phoneticinstruction) were not associated with any of the learners' internal factors, the improvements made in the experiment group (who participated in the same computer-delivered pronunciation learning course as the control group but with explicit instruction of phonetics) were linked to the participants' age and a greater sound discrimination ability, suggesting that the learners with greater sound discrimination ability may particularly benefit from explicit phonetic training.

These studies have overall demonstrated that greater cognitive abilities (e.g., advanced general learning ability, sound discrimination ability) may play an important role in regulating the development of L2 pronunciation knowledge especially when learners engage in explicit phonetic instruction.

2.3.5 Summary of the Section and Focus of the Present Thesis III

To summarise, in the context of L2 pronunciation teaching, there has been a consensus on the importance of intelligibility as a learning goal for adult L2 learners (Derwing & Munro, 2015; Levis, 2005). So far, a number of studies have explored intelligibility-oriented pronunciation pedagogy (e.g., Couper, 2011; Derwing et al.,1998; Derwing et al., 2014; Kennedy & Trofimovich, 2010), and they have pointed towards explicit phonetic instruction (i.e., perceptual and production practice) having a positive impact on L2 learners' pronunciation development. As proposed in Robinson's (2005, 2007, 2012) Aptitude Complexes Hypothesis, learners' different types of aptitude would have differential roles in facilitating different types of instruction. For instance, Yalçin and Spada (2016) found that the participants with greater explicit learning aptitude (grammar inference, phonemic coding) benefited more from explicit grammar instruction. Despite such scholarly interest in the influence of learners' IDs on the learning gains from different instruction types used to teach L2 grammar, research on L2 *pronunciation* teaching has not fully explored the impact the learner IDs except for a handful of studies (Kissling, 2014; Trofimovich et al., 2013).

The main focus of the present study is to test the hypotheses of DST concerning the variability in L2 pronunciation learning. While the previous research on L2 pronunciation pedagogy suggests that pronunciation instruction can be considered as a factor that is likely to contribute to changes in L2 learners' language systems, only a handful studies examined how the instruction can interact with learners' IDs. Therefore, in addition to the two aims of

the thesis (the first one being to reveal the components in L2 learners' systems, the second being to investigate how the systems are related to their language systems), the present thesis investigates whether if the L2 pronunciation instruction interact with the self-regulatory loop of L2 learner systems.

Furthermore, revealing the relative impact of different types of learners' IDs on L2 pronunciation learning under an instructed condition can inform teachers to plan effective classroom instruction depending on the IDs profiles of their students (Ellis & Shintani, 2013).

2.4 Rationales of the Current Thesis

The overall goal of the current thesis is to empirically investigate the recent conceptualisation of IDs as a dynamic system. Since the DST's fundamental focus concerns illustrating and tracking the patterns emerge in the systems, the current thesis set to identify (a) the relationship among the components in the learner systems, (b) the initial conditions of the relationship between L2 learner systems and their language systems, (c) the most prominent components that involved in the system changes, and (d) the relationship between the components in the learner systems and the external environment (i.e., the L2 instruction in classroom contexts).To this end, four issues have been addressed in this chapter. First, the traditional concept of IDs in SLA research considered learner ID as discrete and stable components that predict successful mastery of an L2 (e.g., Horwitz, 2000). Such concept of ID as mutually isolated variables had led to the problematic view that different types of ID (e.g., cognitive or motivation) influence L2 learning independently from one another. Accordingly, empirical research that draw on this traditional concept of ID also showed strong tendency to investigate single aspect of ID (e.g., aptitude) and its influence on L2 learning process (e.g., Segalowitz & Trofimovich, 2012). However, recent ID researchers considered that (a) learners' IDs do not exist as independent and stable components, but they continuously interact with each other, and (b) nature of IDs are facilitated and constrained by

the factors specific to certain context (e.g., Dewaele, 2009). Dynamic interactions between learner ID and learning behaviour have long researched by cognitive psychologist especially in terms of human intellectual functioning that consists of cognitive, motivational, and emotional domains (e.g., Matthews & Zeidner, 2004).

Since individual's language use and language acquisition are, like other aspects of human functioning, shaped through the learners' unique experience in the social environment (Zuengler & Miller, 2006), Dörnyei (2009, 2010a) and his colleagues (Dörnyei & Ryan, 2015) have stressed the necessity of investigating learner ID through the application of DST and human intellectual functioning (i.e., the trilogy of cognitive, motivational, and emotional domains) in the field of SLA. However, despite such conceptual advancement in ID research, existing ID research that draws on the principle of DST is extremely limited (e.g., Serafini, 2017). Therefore, focusing on Japanese learners of English, the first goal of the thesis is to explore dynamic interrelationship among cognitive (i.e., foreign language leaning aptitude), motivational (i.e., L2 pronunciation specific motivation), and emotion (i.e., L2 pronunciation specific anxiety).

Secondly, a crucial hypothesis of DST in terms of the relationship between IDs and learners' language that the different IDs can affect L2 learning in multiple ways with the influence of external environment (e.g., Dörnyei, 2010a). In other words, which learner ID factors are most relevant for developing particular aspects of L2 features may differ depending on the time, the progress of learners' L2 and context where the learning is taken place (Ellis & Larsen–Freeman, 2006). Thus, it is crucial to examine the relationship between ID factors and the rate and outcome of L2 learning from a holistic view. From this point of view, ID research that has only examined the influence of single aspect of ID on L2 acquisition appear to present an oversimplified and picture of the interactions between learners and the learning environment (e.g., focusing on aptitude and experience, or focusing

on motivation and emotion) (Dörnyei, 2009a, 2010a; Dörnyei & Ryan, 2015; Larsen–Freeman, 2001, 2015; Serafini, 2017). In the context of L2 pronunciation research, although a growing number of studies have been examining the relationship between L2 learning experience (e.g., amount and quality of exposure to L2 and use of L2) and foreign language aptitude (e.g., Baker Smemoe & Haslam, 2013; Saito & Hanzawa, 2016), and L2 experience, emotion (enjoyment, anxiety) and L2 learning motivation (e.g., Saito et al., 2018), the available evidence is insufficient to conclude the relationship between the components of ID (cognitive, motivational, and emotional factors) and L2 pronunciation learning. Thus, by adopting dynamic system perspective, the current thesis examines which ID profiles and L2 learning experience are relatively crucial in developing L2 comprehensibility and accentedness in an EFL context.

Thirdly, although extensive research has been conducted to explore the effectiveness of pronunciation instruction on intelligible L2 pronunciation acquisition (e.g., Bradlow et al., 1999; Couper, 2011; Derwing et al., 1997, 1998; Dlaska & Krekeler, 2013; MacDonald et al., 1994; Saito & Lyster, 2012; Thomson & Derwing, 2015), the influence of learner IDs has rarely considered in research of L2 pronunciation instruction (e.g., Kissling, 2014). Therefore, with the longitudinal dataset, the present thesis explores the dynamic and complex contribution of IDs to the development of comprehensibility and accentedness in relation to the impact of pronunciation instruction.

Fourthly, drawing on Robinson's (2005, 2007, 2012) Aptitude Complexes Hypothesis, researchers of L2 pedagogy have started to explore what learner ID are relatively crucial in benefitting more from the instruction when learning different L2 grammatical features (e.g., Yalçin & Spada, 2016). In terms of the research of L2 pronunciation instruction, however, only a handful of studies examined which learner IDs increase the learning gain from the instruction (e.g., Kissling, 2014 for computer-based consonant

learning in an EFL setting, Trofimovich et al., 2013 for the effectiveness of traditional vs. independent reading and listening activity for accuracy and comprehensibility in an ESL setting). These two studies have indicated that L2 learners' greater cognitive ability (sound discrimination skill in Kissling, 2014; L1 literacy skills, and the general academic ability for Trofimovich et al, 2013) and the amount of L2 contact in a naturalistic setting (Trofimovich et al., 2013) benefit more from the instruction. Such findings should be extended to understand the relationship among IDs and L2 pronunciation instruction in an EFL classroom. Therefore, the current thesis also investigates the interaction between IDs and the effect of instruction on the improvement in L2 comprehensibility and accentedness.

Focusing on Japanese learners of English in Japan, the following research questions are set:

Research Question 1: What is the strength and direction of the relationship between cognitive, motivational and emotional IDs of Japanese learners of English?

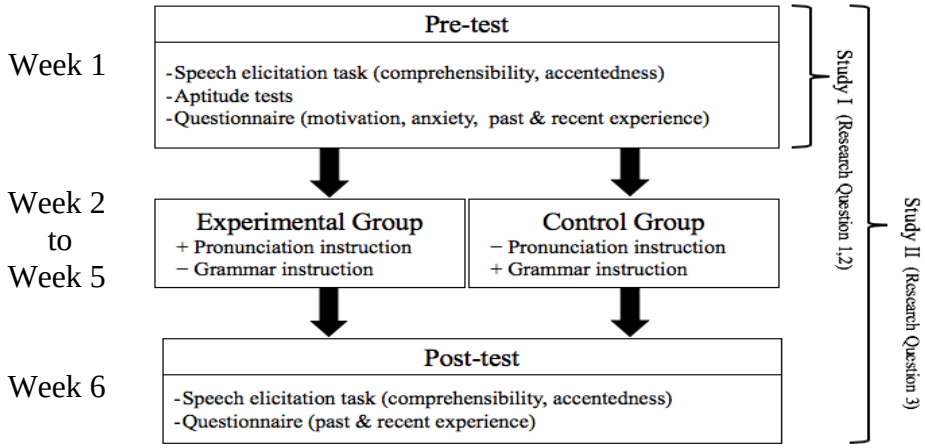
Research Question 2: To what extent do learners' L2 learning experience, cognitive, motivational, and emotional factors determine their L2 pronunciation measured via comprehensibility and accentedness?

Research Question 3: To what extent do L2 learning experience, cognitive, motivational, and emotional factors influence the development of L2 comprehensibility and accentedness when pronunciation instruction is provided?

To address these research questions, two studies (Study I for Research Question 1 and 2, Study II for Research Question 3) are conducted. Study I is a *cross-sectional* study that explored the interrelationships among aptitude, motivation and anxiety profiles of Japanese learners of English (N =51), and how these IDs and L2 learning experience differentially influenced the development of L2 comprehensibility and accentedness during their approximately six years of English learning in an EFL setting. Study II is a *longitudinal* study

that examined the relative contribution of IDs in relation to the effectiveness of the explicit phonetic instruction. To this end, an experimental group (N =51) and a control group (N = 12) were prepared and both groups received instructions (pronunciation focused instruction for the experimental group, grammar instruction for the control group) for 50 minutes per week for four consecutive weeks (see Figure 2.2).

Figure 2.2 *Summary of the Research Time Frame*



2.4.1 Predictions

2.4.1.1 Research Question 1: Relationships between Cognition, Motivation, & Emotion.

While there are no previous studies that examined the interrelationship between foreign language learning aptitude, L2 learning motivation, and L2 learning anxiety at the same time, several studies provide valuable evidence to make predictions (e.g., Meleshko & Alden, 1993; Sarason et al., 1995; Sparks & Ganschow, 2007). In terms of the relationship between motivation and anxiety, it appears that there are two possible relationships (e.g., Clément et al., 1994; Dörnyei & Ushioda, 2009; MacIntyre & Gregersen, 2012; Kitano, 2001; Tóth, 2007). One possibility is a *negative* relationship between the two: the L2 learners with higher level of anxiety of learning an L2 tend to have lower motivation towards learning an L2 (e.g., Clément et al., 1994; Gardner et al., 1997). In particular, those learners with higher Ought-to L2 self (a prevention-oriented motivation derived from learners' perceived

obligation and parental expectations) likely to have higher degree of L2 learning anxiety due to the presence of the pressure and worry of the possible negative outcome (e.g., Papi & Teimouri, 2014; Teimouri, 2016). By contrast, L2 learners whose Ideal L2 self (i.e., promotion-oriented internalised motivation towards learning an L2) tend not to feel much anxiety towards L2 learning. Another possible relationship is a *positive* relationship between the two: the L2 learners with higher level of anxiety of learning an L2 tend to have higher motivation towards learning an L2. As Gardner and McIntyre (1993) posited that L2 learners with higher anxiety may inclined to have frustrating and worrying experience in using and learning L2, such negative experience could decrease their motivation. In addition, Horwitz (1996) also discussed that L2 learners who are highly motivated to master an L2 may put too much pressure on themselves to meet their own expectation, resulting in a high level of anxiety towards the quality of their L2 performance (e.g., Horwitz, 1996; Jackson, 2002; Kitano, 2001).

In terms of the cognitive domain, the factor analytic studies (Sparks et al., 2011) and correlation analyses (Gardner et al., 1997; Li, 2016) have suggested that foreign language learning aptitude measures may be independent of motivational and emotional domains. However, while foreign language learning aptitude may not be influenced by motivation and emotion, it may affect these two domains. Sparks and colleague (Ganschow & Sparks, 1996; Sparks & Ganschow; 1995; Sparks & Patton, 2013; Sparks et al., 2000, 2009, 2011) provided evidence that lower foreign language aptitude may decrease motivation and increase anxiety because the L2 learners with lower foreign language aptitude may experience poorer L2 performance.

2.4.1.2 Research Question 2: Relationship between L2 Learners' Self-regulatory ID Systems and Their L2 Language Systems. As the L2 experience studies indicated that learners' L2 pronunciation accuracy would develop according to the amount of recent and

meaning-oriented interactions (Saito & Hanzawa, 2016), the participants who *recently* participated in extensive extracurricular L2 learning experiences (e.g., informal interactions with native and fluent non-native speakers in the target language) and engaged in the L2 speaking activities in language lessons at the university may exhibit better comprehensibility and accentedness. Such quality of L2 performance can be achieved by means of exposure to the rich linguistic resources (e.g., Derwing & Munro, 2013 for the evidence within naturalistic settings; Muñoz, 2014 for classroom settings).

As for the link between aptitude and L2 pronunciation, the participants who have greater phonemic coding ability and sound sequence recognition may demonstrate better accentedness scores in particular, because these types of aptitude could help the learners attend to detailed segmental and prosodic features in the input they receive (Saito et al., 2019). By contrast, since the components contributing to higher comprehensibility are not limited to the accuracy of phonological features, greater phonemic coding ability would not be necessarily associated with better comprehensibility. Since greater associative memory (the learners' greater capability of retaining information) has been found to contribute to the effective speech delivery (Saito et al., 2019), the participants who have stronger associative memory may produce the utterances smoothly and with less pauses. Since the temporal qualities of the L2 speech have been found to be largely associated with comprehensibility (e.g., Trofimovich & Isaacs, 2012), higher associative memory it may be associated with better comprehensibility than accentedness.

With respect to the link between L2 learning motivation and L2 pronunciation, the previous studies have found that certain types of motivation may help the learners notice the detailed features of input in a implicit condition (e.g., Takahashi, 2005 for pragmalinguistic factors; Ushioda, 2016). In fact, learners with strongly internalised motivation towards learning L2 pronunciation (i.e., Ideal L2 self) may likely to be able to benefit more from

available input and see improvements in comprehensibility when seeking more opportunities to use and be exposed to the target language, resulting in improving comprehensibility (e.g., Saito et al., 2017; Saito et al., 2018). However, since the longitudinal studies of the learners in the naturalistic contexts revealed that reduction of the foreign accentedness requires years of experience using the target language (e.g., Munro & Derwing, 2008), so a strong sense of Ideal L2 self may not be directly linked to better accentedness. Instead, it may rely on the quality and quantity of L2 learning experience or special cognitive skills such as foreign language aptitude. Concerning Ought-to L2 self, it may not be a predictor of L2 pronunciation acquisition. As previous studies have indicated (Saito et al., 2018), this could be because it does not reflect internalised motivation, but it represents the intensity of the obligation one feels. Learning the target language because of a feeling of expectation may not necessarily lead to increased L2 use and L2 exposure.

Furthermore, those who report a high degree of pronunciation learning anxiety may not successfully refine their perception of segmental and prosodic features of the target languages because anxiety hinders their attention control (Eysenck, 1979; Piechurska-Kuciel, 2008) and it can act as a barrier to gaining opportunities to receive L2 input and impeding speech production (e.g., MacIntyre & Gardner, 1994; Tobias, 1986; Vasa & Pine, 2004). Hence, the learners with higher degrees of anxiety may show higher accentedness and lower comprehensibility scores. Table 2.1 shows the summary of the predictions.

Table 2.1

List of Predicted Factors of L2 Comprehensibility and Accentedness (Research Question 2)

Comprehensibility	Accentedness
• Recent extracurricular learning	• Recent extracurricular learning
• Recent curricular learning	• Recent curricular learning
• Associative memory	• Phonemic coding
• Ideal L2 self	• Sound sequence recognition
• Anxiety	• Anxiety

2.4.1.3 Predictions for Research Question 3: Relationship between L2 Learners' Self-regulatory IDs Systems, L2 instruction, and the changes in the learners' L2 Language Systems.

For the research question 3, previous longitudinal studies of aptitude (Saito et al., 2019) and motivation (Saito et al., 2017) and anxiety (Saito et al., 2018) suggested that those IDs can robustly predict the L2 pronunciation development over one academic semester. Therefore, it can be hypothesised that the same IDs variables that are found to determine the L2 pronunciation at the onset of the study (Study I) may also affect the learners' L2 pronunciation development during the four weeks of intervention. In addition, based on the positive impact of the pronunciation instruction (explicit phonetic instruction, focused on form, fluency enhancement) on the improvement of both individual and global aspects of L2 pronunciation (Derwing & Munro, 2015), the four weeks of pronunciation instruction would likely reinforce the development of accentedness and comprehensibility.

In addition, existing studies have pointed out that the better auditory processing skill may make the most of the pronunciation focused instructions and make the improvements more than those who have relatively lower perception skill (e.g., Kissling, 2014). Furthermore, a number of studies on the aptitude treatment interactions (ATI) have suggested that explicit learning aptitude that concerns with analysing of the inputs (e.g. phonemic coding) may be called upon when receiving the explicit instruction and corrective feedback on the acquisitionally-difficult structures (e.g., Li, 2015; Yalçin & Spada, 2016 for L2 morphological learning). Therefore, learners with greater phonemic coding may benefit from the explicit phonetic instructions and corrective feedback.

Chapter 3 Cross-Sectional Investigation of Second Language Pronunciation Learning as the Dynamic Systems (Study I)

Focusing on three components of learner ID (aptitude, motivation and anxiety), Study I was sought to investigate (a) the relationship among the components in the learner systems, and (b) the relationship between L2 learner systems and their language systems. Therefore, the following research questions were formulated:

Research Question 1: What is the strength and direction of the relationship between cognitive, motivational and emotional IDs of Japanese learners of English?

Research Question 2: To what extent do learners' L2 learning experience, cognitive, motivational, and emotional factors determine their L2 pronunciation measured via comprehensibility and accentedness?

3.1 Methodology

3.1.1 Participants

A total of 51 Japanese learners of English with varied learning experiences and backgrounds were recruited in Japan. During the project, they were all first-year undergraduate students from various majors (e.g., engineering, medicine, sociology, education, literature, and cultural studies). All of the participants had received L2 instruction in formal EFL classrooms for six years, and had no prior experience living or studying in English-speaking countries. The average age was 19.41 years at the time of the project (*Range* = 18–20).

3.1.2 Procedure

After obtaining the necessary permissions from the universities in Japan, participants were recruited via posters and mailing lists. Interested students contacted one of the researchers, at which point the researcher scheduled individual appointments with each of the possible participants to determine candidacy. Upon completing a set of consent forms, the participants performed a spontaneous speech task, and took a LLAMA aptitude test on a laptop (approximately 30 minutes). Finally, they filled out a questionnaire sheet containing a set of questions about their language-learning background, L2 language learning and contact, L2 pronunciation specific motivation, and L2 pronunciation specific anxiety. The entire session lasted approximately 60 minutes.

3.1.3 Measures of Individual Differences

3.1.3.1 Aptitude Test. In order to measure the participants' foreign language learning aptitude, the LLAMA test was used (Meara, 2005). The test was not only chosen for its

popularity in SLA research (e.g., Bylund et al., 2010; Forsberg & Sandgren, 2013; Granena & Long, 2013; Serrano et al., 2012; Smeds, 2012; Yalçin, 2012), but most importantly due to its first-language independent nature (in comparison to other available tests that are mainly for English native speakers). The sub-tests chosen for the current study included sound sequence recognition (LLAMA D) – for incidental learning aptitude (Granena, 2013), associative memory (LLAMA B), and phonemic coding ability (LLAMA E) – for explicit learning aptitude. Except for LLAMA D whose maximum score is 75 %, maximum scores of LLAMA B and E are 100 %. The entire test session for measuring the aptitude took approximately 30 minutes. Descriptive statistics of 51 participants' aptitude scores are illustrated in Table 3.1.

3.1.3.2 Questionnaire Instruments. After taking the aptitude test, the participants were asked to fill out a set of Likert-scale questionnaires that was designed to capture their L2 experience, L2 pronunciation-specific anxiety, and L2 pronunciation-specific motivation, respectively. According to the existing L2 pronunciation research, quality and quantity of L2 experience (i.e., how much L2 learners received quality of input and used a target language in the interactions) significantly contribute to the improvement in their L2 pronunciation (e.g., Derwing & Munro, 2013 for naturalistic setting; Muñoz, 2014; Saito & Hanzawa, 2016 for EFL setting). Hence, in order to control for such learner-external influence on the learner language systems and illustrate to what degree their language systems can interact with an external factor, a decision was made to take into account of the participants' L2 experience as the predictors of the analyses. To elicit the participants' experience profile, the current study adopted the EFL Experience Questionnaire used in Saito & Hanzawa (2016). The items were devised based on Language Contact Profile (Freed et al., 2004), and tailored to tap into various types of L2 learning experience *specific to* foreign language classroom contexts. In particular, the questionnaire was designed to capture (a) the participants' *past* L2 learning

experience before the university (i.e., at elementary, junior high, and high schools), and (b) the participants' *current* L2 learning experience at the university. In addition, the two types of L2 learning experience were further divided into either experience inside the classroom or outside the classroom (i.e., cram schools, and informal conversation with native, and proficient non-native speakers). Based on the participants' answers, their total hours of L2 experience were calculated to create four types of experiential variables– past curricular English learning, past extracurricular English learning, recent curricular English learning, recent extracurricular English learning (see Table 3.1 for descriptive statistics).

In terms of anxiety, the current study did not employ the oft-used Foreign Language Classroom Anxiety scale by Horwitz due to our emphasis on a skill-specific investigation – L2 pronunciation. Instead, the questionnaire developed by Baran-Łucarz (2016) – Measure of Pronunciation Anxiety in the FL Classroom (MPA-FLC)– was adopted in order to measure the participants' L2 pronunciation specific anxiety. The following four constructs from MPA-FLC were used directly: Fear of negative evaluation related to pronunciation (7 items), pronunciation self-efficacy and self-assessment (6 items), pronunciation self-image (6 items), and beliefs related to the anxiety of pronunciation of English (4 items). Since some statements were phrased positively, they were reversed coded. The higher the score, the higher the level of anxiety a student was considered to be experiencing during their L2 pronunciation learning.

Finally, to measure the participants' pronunciation-specific motivation, the current study used the pronunciation motivation questionnaire items of learners' Ideal L2 self and Ought-to L2 self from the Baran-Łucarz's (2017) study (which was originally validated by Taguchi et al., 2009). In order to elicit their motivation that is associated with pronunciation learning, the statements highlight learning of pronunciation instead of general English skills (e.g., "I imagine myself as someone who is able to speak English *with accented but*

comprehensible pronunciation."). Four categories of the questionnaire were prepared: Ideal L2 self of comprehensible pronunciation (4 items), Ideal L2 self of native-like pronunciation (4 items), ought-to L2 self of comprehensible pronunciation (4 items), and ought-to L2 self of native-like pronunciation (4 items). The details of L2 pronunciation-specific anxiety and L2 pronunciation-specific motivation are summarised in Table 3.2. In order to help the participants to understand the questionnaire items, all the questions were translated into Japanese by the researcher and double checked by two translators. To assess whether each item accurately measures three constructs (Ideal L2 self, Ought-to L2 self, anxiety), reliability indices of items were calculated by Cronbach's alpha (Larson–Hall, 2016). Since the values indicated that the constructs demonstrated a relatively high level of internal consistency (α = .92 for Ideal L2 self, α = .91 for Ought-to L2 self, and α = .81 for anxiety), averaged scores for each construct was computed. Descriptive statistics of 51 participants' averaged responses to pronunciation learning motivation an anxiety questionnaire is illustrated in Table 3.2.

Table 3.1

Descriptive Statistics of Individual Differences among 51 Japanese Students

	M	*SD*	*Range* *Min–Max*
Foreign Language Learning Aptitude			
Sound sequence recognition (0-75 %)	25.9	14.3	0–55
Associative memory (0-100 %)	58.9	19.4	20–95
Phonemic coding ability (0-100 %)	72.3	23.4	20–100
L2 pronunciation learning motivation and anxiety			
Ideal L2 self	3.85	.94	1.63–6
Ought to L2 self	2.63	1.14	1–5.25
Pronunciation Anxiety	3.62	.58	2.29–4.96
Past L2 experience[a]			
Past curricular English learning	1509.49	404.22	834.2–2502.7
Past extracurricular English learning outside the classroom	479.62	529.5	0–2763.42

Recent L2 experience[b]			
Recent curricular English learning	154.93	177.44	0–855
Recent extracurricular English learning	12.7	20.85	0–95

Note. a. Total length of past English learning was calculated based on the total weeks they engaged in learning English during elementary, junior high, and high school. Curricular English learning indicates that all the English lessons they received *inside the regular schools*, while extracurricular English learning refers to any English learning activities (e.g., cram schools for exam preparation) taken place outside the lessons provided in elementary, junior high, and high schools.

b. Total length of recent English learning was calculated based on the total weeks they engaged in learning English since they entered the university. Curricular English learning refers to their participation in the English classes (reading, writing, listening, speaking classes) offered at the university, while extracurricular English learning refers to any activities they engaged in outside university classes (e.g., online platforms for English learning, mobile phone applications, informal conversations with natives or fluent non-native speakers).

Table 3.2

Items used in Motivation and Anxiety Questionnaire and Its Descriptive Statistics

	M	SD	Range Min–Max
1. Questionnaire items of pronunciation specific anxiety			
Fear of negative evaluation related to pronunciation			
I (would) feel uneasy pronouncing English sounds and/or words with a Japanese accent.	4.05	1.43	1–6
I would rather others do not hear me making pronunciation mistakes.	3.62	1.5	1–6
I fear others might find my pronunciation of English strange or funny.	3.5	1.36	1–6
I am worried what others might think of me when they hear my English pronunciation.	3.67	1.44	1–6
I get nervous and feel shy when making a pronunciation mistake.	3.47	1.32	1–6
I feel stressed knowing that others are listening to me.	2.86	1.33	1–6
I feel more embarrassed making a pronunciation mistake that any other type of mistake when I speak in English.	2.65	1.28	1–6

Pronunciation self-efficacy and self-assessment			
I find it more difficult to improve pronunciation than grammar or vocabulary.	3.45	1.46	1–6
I remember the pronunciation of new words easily.	3.75	1.21	2–6
My pronunciation is at a lower level than that of people around me.	3.82	1.35	1–6
I am satisfied with my present level of English pronunciation.	5.08	1.	3–6
I have a talent to pick up the pronunciation of English.	4.31	1.03	2–6
My pronunciation of English is far from acceptable.	3.49	1.17	1–6
Pronunciation self-image			
I look funny pronunciation ‘th’ sound.	2.7	1.3	1–6
I like singing and/or speaking to myself in English.	2.97	1.53	1–6
Sometimes I like to imitate English actors/singers.	3.57	1.45	1–6
I do not like listening to myself reading English aloud.	3.17	1.3	1–6
I think I sound unnatural speaking English.	3.8	1.13	1–6
I look natural speaking English.	4.2	1.27	1–6
Belief related to the anxiety of pronunciation of English			
The comprehensibility of a speaker depends on his/her level of proficiency.	4.39	1.04	1–6
Some words in English sound funny and /or awkward.	4.53	1.08	1–5
The pronunciation of English is difficult for Japanese.	4.53	1.08	1–6
The level of pronunciation affects the ability to understand spoken language	4.29	1.27	1–6
2. Questionnaire items of pronunciation specific motivation			
***Ideal L2-self* related to pronunciation**			
I can imagine myself living abroad and having a discussion in English with accented but comprehensible pronunciation.	3.89	1.33	1–6
I can imagine a situation where I am speaking with foreigners in English with accented but comprehensible pronunciation.	4.07	1.23	1–6
I imagine myself as someone who is able to speak English with accented but comprehensible pronunciation.	4.08	1.26	1–6
Whenever I think of my future career, I imagine myself using English with accented but comprehensible pronunciation.	4.	1.15	2–6
I can imagine myself living abroad and having a discussion in English with nativelike pronunciation.	3.8	1.27	1–6
I can imagine a situation where I am speaking with foreigners in English with nativelike pronunciation.	3.82	1.26	1–6
I imagine myself as someone who is able to speak English with nativelike pronunciation.	3.86	1.27	1–6
Whenever I think of my future career, I imagine myself using English with nativelike pronunciation.	3.78	1.36	1–6
***Ought-to L2 self* related to pronunciation**			
I study English pronunciation to speak English with accented but comprehensible pronunciation because close friends of mine think it is important.	3.47	1.46	1–6
I have to study English pronunciation to speak English with accented but comprehensible pronunciation, because if I do not study it, I think my parents will be disappointed in me.	2.14	1.28	1–5
Speaking English with accented but comprehensible pronunciation is necessary because people surrounding me expect me to do so.	2.67	1.46	1–6
My parents believe that I must be able to speak English with accented but comprehensible pronunciation to be an educated person.	2.33	1.37	1–5
I study English pronunciation to speak English with near native-like pronunciation because close friends of mine think it is important to speak English with near native-like pronunciation.	2.94	1.64	1–6
I have to study English pronunciation to speak English with near native-like pronunciation, because if I do not study it, I think my parents will be disappointed in me.	2.23	1.47	1–6

Speaking English with near native-like pronunciation is necessary because people surrounding me expect me to do so.	2.78	1.59	1–6
My parents believe that I must be able to speak English with near native-like pronunciation to be an educated person.	2.33	1.52	1–6

3.1.4 Pronunciation Measures

3.1.4.1 Speaking Task. There is ample evidence that adult L2 learners can carefully monitor their correct pronunciation forms, when their speech is elicited via relatively controlled and decontextualized tasks (e.g., word and sentence reading). In such contexts, L2 learners can fully allocate their cognitive resources to phonological accuracy, which may not index how they actually use a target language in real-life settings (Piske et al., 2001). In the current study, I adopted a picture description task in order to elicit participants' L2 spontaneous pronunciation knowledge, defined as learners' automatized ability to deliver speech with a primary focus on conveying intended message under some form of time pressure (Saito & Plonsky, 2019). Importantly, spontaneous speech elicited from the picture description task is different from *extemporaneous* speech elicited from an open-ended interview and interaction task, where there is no structure, planning time nor formal procedure (ibid.).

The picture description task was adapted from a semi-structured spontaneous speech task from EIKEN English Test for the Pre-Grade 1 Level of the (EIKEN, 2016). The participants first had one minute of planning time before being given two minutes to describe a story. Following the testing procedure established by EIKEN, the task sheet included four sequential pictures with several linguistic aids and a sentence to start their description are provided (Lambert et al., 2017). Moreover, to minimize possible topic effect on the participants' oral performance (Kazemi & Zarei, 2015), two different stories (Story A and Story B) were prepared and randomly assigned to the participants (see Appendix A). All of the speech samples were recorded via a voice recorder and stored digitally in the researcher's laptop. In keeping with the standards of L2 speech research (e.g., Derwing & Munro, 1997),

and to minimize rater fatigue, the first 30 seconds of the approximately 2-minute speeches were taken from each of the 51 speech samples and saved as WAV files for the speech rating.

3.1.4.2 L2 Pronunciation Rating. Whereas some studies have examined L2 pronunciation proficiency via trained raters' assessments in accordance with detailed descriptors (e.g., Isaacs et al., 2015), much research attention has been given to untrained raters' *intuitive* judgements of L2 pronunciation (Kang, 2010; Kang et al., 2010; Munro & Derwing, 2001; Trofimovich & Isaacs, 2012). As seen in a range of existing studies (e.g., Derwing & Munro, 1997), I operationalized such intuitive judgements through scaler judgements of overall comprehensibility (ease of understanding) and accentedness (phonological nativelikeness).

3.1.4.3 Raters. Four raters (2 females, 2 males) with ample linguistic and pedagogical backgrounds were recruited in London for a rating session of speech samples involve in Study I and Study II. According to the research on listener factors, listeners' judgments are likely to be affected by factors such as their familiarity with the accent (e.g., Winke et al., 2013) and their language teaching experience (e.g., Kennedy & Trofimovich, 2008). Following the previous studies that employed subjective speech rating (e.g., Nagle, 2018a; Saito et al., 2018; Suzuki & Kormos, 2019), we carefully control the familiarity with Japanese-accented English using a 6 point-scale (1 = *not at all*, 6 = *very much*). According to the result of the familiarity rating, all four raters reported a high-level of familiarity with Japanese-accented English (M = 5.5; *Range* = 5–6). Thus, it was assumed that the leniency to the speech samples were relatively similar among the four raters and they are sufficiently sensitive to the speakers' use of Japanese sound system in the speech samples owing to their high familiarity to Japanese-accented English. All of them held master's degrees in applied linguistics and reported extensive experience in teaching English (M = 7.8 years) and participation in speech analyses of this kind. None of them reported any hearing problems.

3.1.4.4 Procedure of the Pronunciation Rating. The rating session was conducted via individual meetings with the author in a quiet room at a university in London, UK. The author helped the raters familiarize themselves with the rating procedure as well as the evaluation criteria. With a printed booklet (see Appendix B), the raters were asked to listen to speech samples through headphones connected to a laptop computer, and subsequently evaluate the samples by circling a number on a 9-point scale for accentedness (*1 = heavily accented, 9 = not accented at all*) and comprehensibility (*1 = difficult to understand, 9 = easy to understand*). To ensure accurate and smooth rating, the author first provided a short training session to each of the raters prior to the main session. The training session included a brief explanation of the definitions of comprehensibility and accentedness, and a practice rating with three speech samples that were not included in the main dataset. In order to ensure that the raters sufficiently understood the two constructs, the researcher asked the raters to explain their reasoning. Based on the explanations given, the researcher provided them with feedback. Subsequently, the raters proceeded to the main session. The speech samples were presented in a randomised order. In order to avoid raters' fatigue, they took 15 minutes breaks after one third, and two thirds of the speech samples were evaluated.

3.1.4.5 Inter-Rater Reliability. After all of the rating sessions were completed, the inter-rater reliability for the comprehensibility and accentedness results were calculated. The Cronbach alpha analyses demonstrate acceptable agreements based on Larson-Hall's (2010) benchmark ($\alpha > .70$): The Cronbach alpha of the four raters' judgments of comprehensibility was $\alpha = .82$ and accentedness was $\alpha = .80$. Thus, the results of the four raters' judgments were averaged to represent each speaker's comprehensibility and accentedness scores.

3.1.4.6 Characteristics of Comprehensibility and Accentedness. The results indicated that the participants' scores were varied widely in both accentedness ($M = 5.04$; *Range* = 2.00–8.25) and comprehensibility ($M = 5.35$; *Range* = 2.25–8.75) (see Table 3.3 for

descriptive statistics of the rating results). To further examine the relationship between constructs of accentedness and comprehensibility, a set of correlation analyses was computed. Two global constructs – accentedness and comprehensibility – showed a strong and positive correlation ($r = .65$, $p < .001$).

Table 3.3

Descriptive Statistics of Global Pronunciation Measures

Pronunciation measures	*M*	*SD*	Range		95% CI	
			Minimum	*Maximum*	*Lower*	*Upper*
Accentedness (1-9)	5.04	1.04	2.00	8.25	4.75	5.33
Comprehensibility (1-9)	5.35	1.11	2.25	8.75	5.04	5.67

3.1.5 Data Analysis

The goal of the current study was to address (a) the strength and direction of the relationship between aptitude, L2 pronunciation-specific motivation, and L2 pronunciation-specific anxiety (i.e., Research Question 1), and (b) how learners' L2 learning experience, aptitude, L2 pronunciation-specific motivation, and L2 pronunciation-specific anxiety predict L2 comprehensibility and accentedness of 51 Japanese learners of English (i.e., Research Question 2). To this end, the current study conducted a set correlation analyses for Research Question 1, and mixed-effect modelling analyses for Research Question 2. In order to build models that predicts the learners' comprehensibility and accentedness scores, *Imer* function of *Ime4* package was used in R (R Core Team, 2016). The fixed effects in the modelling included sound sequence recognition, phonemic coding, associative memory, Ideal L2 self, Ought-to L2 self, anxiety, and various L2 experience factors (past curricular English learning, past extracurricular English learning, recent curricular English learning, and recent extracurricular English learning). The model was fit with random effect of task type due to the variations in the speech elicitation task (i.e., Story A, Story B). In order to ensure the

comparability of the effects of the cognitive, sociopsychological, and experiential predictors that were measured through the different scaling systems, those ten variables were converted to z-scores prior to the analyses. For the evaluation of the models, we employed the pairwise Likelihood Ration Test (Baayen, 2008) to see whether the compared model decreases the Akaike's Information Criterion (AIC) with forward selection method. The variables that did not improved the model fit via model comparisons were discarded. The details of R syntax for the mixed-effect modelling analyses are described in Appendix C.

3.2 Results

3.2.1 The Strength and Direction of ID Interactions

First research question was to explore the intensity and directions of L2 learners' aptitude, L2 pronunciation-specific motivation and L2 pronunciation-specific anxiety in an EFL context, and how these IDs predict the amount of experience using L2. To this end, a set of correlation analyses were performed within each types of variables (aptitude, motivation, and anxiety variables) and across the types of variables (see Table 3.4).

Overall, the results showed that there was no statistically significant correlation. However, while most of the correlation values were close to zero (e.g., r = .045 for Ideal L2 self and sound sequence recognition) and considered as weak effect size (Larsen-Hall, 2010), some values suggested several features of the relationship among aptitude, motivation, and anxiety variables. First, the direction of the correlation anxiety and two motivation measures were found to be different. Anxiety was negatively correlated with Ideal L2 self (r =-.288, p = .04). Secondly, sound sequence recognition showed some degree of negative correlations with Ought-to L2 self (r = -.295, p = .036) and anxiety (r = -.251, p = .076), while associative memory was associated with anxiety (r = .211, p = .138).

Table 3.4

The Results of Correlation Analyses between ID Variables

	2		3		4		5		6	
	r	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*
1. Sound sequence recognition	.184	.197	.126	.376	.045	.752	-.295	.036	-.251	.076
2. Rote and associative memory			.170	.233	-.068	.636	.113	.431	.211	.138
3. Phonemic coding					-.187	.188	.010	.945	.035	.808
4. Ideal L2 self							.192	.177	-.288	.040
5. Ought to L2 self									.123	.389
6. Anxiety										

Note. Statistical significance at $p < .008$ (Bonferroni corrected)

3.2.2 Predictors of L2 Pronunciation

3.2.2.1 Accentedness, Experience and IDs Factors. First, in order to avoid multicollinearity in the model selection, the variance inflation factors (VIFs) of all the predictors were computed by using *car* package in R. The results showed that all the predictors were below 2.0, indicating that the multicollinearity was not detected (for details of VIFs, see Table 3.5). In the default model, potential variability in the participants' performance in two types of task (represented by *Task* in the model) was included as a random effect with no fixed effect. Then, the default model was compared to the models with fixed effects (e.g., *Task* vs. *Task + Sound sequence recognition*) (see Table 3.6). According to the comparisons, phonemic coding ability (AIC = 150.53, p =.02), anxiety (AIC = 147.66, p = .003), recent curricular English learning (AIC = 148.8, p = .007), and recent extracurricular English learning (AIC = 133.06, p <.001) showed better model fit than the default model.

Since recent extracurricular English learning decreased the AIC most, next comparisons were made with a model that included this variable. Adding phonemic coding ability (AIC = 131.09, p = .046) and anxiety (AIC = 130.53, p =.033) improved the model fit, whereas recent curricular English learning (AIC = 131.64, p =.064) did not. Finally, a model

with recent English learning outside the classroom and phonemic coding was compared to a model that also included anxiety (AIC = 125.98, p = .01). Since the final comparison revealed that inclusion of three fixed effects was found to decrease AIC the most (AIC = 125.98), this model was considered to be the final model for the analysis. According to the estimated regression coefficients and its confidence intervals at 95% level in the final model, phonemic coding ability (β = .29), anxiety (β = -.31), and recent extracurricular English learning (β = .49) showed a significant contribution to determining accentedness score (Table 3.7). The predictive powers of these variables were further confirmed by the inspection of their confidence intervals at 95% level: All the values of the estimated regression coefficients were positive. The fixed effects in the final model explain a significant amount of variance in the accentedness score (marginal R^2 = .49). All of the R syntax used for the analyses are described in Appendix C.

3.2.2.2 Comprehensibility, Experience and IDs Factors. Similar to the analysis for the accentedness model, model comparisons based on AIC were conducted for identifying a model that optimally predicts the learners' comprehensibility scores. First of all, since the multicollinearity issue was not detected via inspection of VIF values (see Table 3.5), we proceeded to compare the models with a default model (i.e., a random effect of *Task* with no fixed effect). Through the series of model comparisons with forward elimination approach (see Table 3.8), it has been revealed that none of the variables improved model fit but three variables – Anxiety (AIC = 154.74, p = .006), Recent curricular English learning (AIC = 156.78, p =.017) and Recent extracurricular English learning (AIC =153.75, p = .003). Since Recent extracurricular English learning decreased the AIC most, next comparisons were made with a model that included this variable. While adding Anxiety to the model improved the model fit (AIC = 150.94, p =.028), adding Recent curricular English learning to the model to the model did not (AIC = 152.69, p = .08) (Table 3.8). Therefore, anxiety and recent

English learning outside the classroom were retained as the fixed effects in the final model (AIC = 150.94, see Table 3.9**).** Furthermore, the inspections of the confidence intervals at 95% level confirmed the positive contributions of these variables to comprehensibility. Therefore, among ten variables, Recent extracurricular English learning (β = .33) and Anxiety (β = -.32) were justified as the predictors of higher comprehensibility. The fixed effects in the final model accounted for 24 % of the total variance (marginal R^2 = .24). All of the R syntax used for the analyses are available in Appendix C.

Table 3.5

Summary of VIFs

IDs factors	VIF	
	Accentedness	Comprehensibility
Aptitudes		
Sound sequence recognition	1.119	1.138
Associative memory	1.070	1.071
Phonemic coding	1.263	1.247
Pronunciation specific Motivation and Anxiety		
Ideal L2 self	1.443	1.424
Ought-to L2 self	1.136	1.140
Anxiety	1.140	1.423
L2 experience		

Past curricular English learning	1.230	1.117
Past extracurricular English learning	1.134	1.136
Recent curricular English learning	1.177	1.164
Recent extracurricular English learning	1.312	1.317

Table 3.6

Summary of Model Comparisons for Accentedness

Variable	AIC	χ^2	*p*
Task (intercept)	154.03	n.a.	n.a.
In comparison to a model with Intercept + no Fixed Effect			
Sound sequence recognition	155.87	.159	.690
Associative memory	156.01	.023	.880
Phonemic coding ability	150.53	5.50	.019*
Ideal L2 self	154.16	1.87	.172
Ought-to L2 self	155.41	.617	.432
Anxiety	147.66	8.37	.004
Past curricular English learning	155.87	.157	.692
Past extracurricular English learning	155.79	.238	.626
Recent curricular English learning	148.80	7.23	.007*
Recent extracurricular English learning	133.06	23.0	<.001*
In comparison to a model with Intercept + Recent extracurricular English learning			
Recent extracurricular English learning + Phonemic coding	131.09	3.979	.046*
Recent extracurricular English learning + Anxiety	130.53	4.535	.033*

Recent extracurricular English learning + Recent English learning inside the classroom	131.64	3.422	.064
In comparison to a model with Intercept + Recent extracurricular English learning + Phonemic coding			
Recent extracurricular English learning + Phonemic coding + Anxiety	125.98	7.110	.008*

Note. * $p < .05$

Table 3.7

Summary of the Final Model for Reduced Accentedness

Predictors	Estimate	*SE*	*t*-value	*p*	95% *CI*	
					Lower	Upper
(Intercept)	4.98	.10	48.04	<.001*	4.70	5.23
Phonemic coding	.290	.11	2.65	.010*	.070	.500
Anxiety	-.310	.11	-2.76	.008*	-.520	-.080
Recent extracurricular English learning	.490	.11	4.44	<.001*	.270	.720
Random effect (intercepts)	Variance	*SD*				
Task	<.001	<.001				
Information criterion	Estimate					
LogLikelihood	-56.99					
DIC	114.0					
AIC	126.0					
BIC	137.6					
R^2	Estimate					
Marginal	.49					
Conditional	.49					

Note. DIC = Deviance Information Criterion; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion

Table 3.8

Summary of Model Comparisons for Comprehensibility

Variable	AIC	χ^2	*p*
Task (intercept)	160.4	n.a.	n.a.
In comparison to a model with Intercept + no Fixed Effect			
Sound sequence recognition	162.40	.002	.959
Associative memory	161.60	.802	.370
Phonemic coding	160.60	1.80	.180
Ideal L2 self	161.39	1.01	.315
Ought to L2 self	162.36	.043	.836
Anxiety	154.74	7.66	.006
Past curricular English learning	161.21	1.19	.275
Past extracurricular English learning	162.40	.001	.980
Recent curricular English learning	156.78	5.63	.017*
Recent extracurricular English learning	153.75	8.65	.003*
In comparison to a model with Intercept + Recent extracurricular English learning			
Recent extracurricular English learning+ Recent English learning inside the classroom	152.69	3.06	.080
Recent extracurricular English learning+ Anxiety	150.94	4.81	.028*

Note. * $p < .05$

Table 3.9

Summary of the Final Model for Comprehensibility

Predictors	Estimate	*SE*	*t*-value	*p*	95% *CI*	
					Lower	Upper
(Intercept)	5.35	.13	39.677	<.001*	5.04	5.66
Anxiety	-.320	.14	-2.246	.030*	-.600	-.050
Recent extracurricular English learning	.330	.14	2.481	.017*	.072	.631
Random effect (intercepts)	Variance	*SD*				
Task	<.001	<.001				
Information criterion	Estimate					
LogLikelihood	-70.47					
DIC	140.9					
AIC	150.9					
BIC	160.6					
R^2	Estimate					
Marginal	.24					
Conditional	.24					

Note. DIC = Deviance Information Criterion; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion

3. 3 Discussion

The main focus of the present study is to analyse the source of the variability in L2 pronunciation learning through the lens of Dynamic Systems Theory (DST). In this cross-sectional study, I attempted to reveal the inter-relationship among the three domains of learner IDs that are thought to consist of the self-regulatory loop of L2 learners' system, and how the L2 learners' systems are related to their language systems. For these purposes, focusing on $N = 51$ Japanese learners of English in EFL context, the current study examined (a) the strength and direction of the relationship between aptitude, L2 pronunciation-specific motivation, and L2 pronunciation-specific anxiety (i.e., Research Question 1), and (b) the differential contribution of experiential, cognitive, motivational, and emotional factors of ID

to L2 pronunciation measured via two constructs (comprehensibility and accentedness) (i.e., Research Question 2).

According to the L2 speech studies, accentedness is mainly affected by segmental and prosodic errors, whereas comprehensibility is hampered by a wider range of features including lexicogrammatical, temporal and phonological errors (e.g., Trofimovich & Isaacs, 2012). Since correlation analysis between comprehensibility and accentedness ratings were strong, the results reflect the findings of existing L2 speech literature that the two global constructs are interrelated but differentially influenced by the participants' pronunciation errors. In terms of IDs measures, while considering past and recent L2 learning experience (inside the classroom vs. outside the classroom) as experiential variables, explicit and implicit foreign language learning aptitudes were used to determine the participants' various types of aptitude, and pronunciation-specific learning motivation and anxiety were employed as measures of motivational and emotional IDs. Descriptive statistics revealed a varying degree of aptitude, motivation and anxiety scores, as well as different types of and amount of L2 learning experience among the participants.

3.3.1 Interrelationships between Aptitude, Motivation, and Anxiety

Research Question 1 was set to explore the interrelationships among the three domains of learner IDs (i.e., foreign language learning aptitude, and anxiety and motivation) that consist of the self-regulatory loop of L2 learners' system. According to the results of the correlation analyses, two characteristics were observed in the current dataset. First, two motivation measures were differentially associated with anxiety: Ideal L2 self was negatively correlated with anxiety, Ought-to L2 self was positively correlated with anxiety. Secondly, different aptitude measures showed different relationship with motivation and anxiety: sound sequence recognition showed negative correlations with Ought-to L2 self and anxiety, and associative memory was positively associated with anxiety.

With respect to the first findings, such results partially corroborate the studies that reported the relationship between anxiety and L2 motivational self such as Teimouri (2016) and Saito et al. (2018). Teimouri's (2016) study explored the relationship between emotions (anxiety, shame, joy) and L2 self-system (also Papi & Teimouri, 2014). According to Teimouri (2016), Ought-to L2 self (especially feeling of obligation from others) represents most extrinsic types of learning motivation. It is a reflection of L2 learners' perceived degree of obligation (parental pressures or course requirements) that are tied to their social and educational contexts that temporarily require them to learn their L2. Accordingly, their motivational drive is essentially related to the avoidance of negative outcomes and concerns related to meeting requirements such as their parents' expectations. Thus, those learners with higher Ought-to L2 are likely to feel anxious due to the constant worry about a potential negative outcome. By contrast, Ideal L2 self predominantly has a promotional focus and L2 learners are inclined to pay attention to the progress they make (Teimouri, 2016). Therefore, L2 learners with higher degree of Ideal L2 self are less likely to be anxious about meeting social and educational requirements or worry about evolutions from others.

According to psychology research (e.g., Eysenck & Calvo, 1992; Leitenberg, 1990; Meleshko & Alden, 1993), anxiety may facilitate cognitive function because anxious people may make compensatory efforts to avoid threats (e.g., Eysenck & Calvo, 1992). Therefore, the participants who reported higher pronunciation learning anxiety may have tended to put more cognitive efforts into learning their L2. Such a compensatory effort could have contributed to the development of stronger associative memory. Furthermore, the results suggested that the participants with a higher degree of Ought-to L2 self and anxiety tended to have worse sound sequence recognition ability. According to Sparks and his colleagues (Ganschow & Sparks, 1996; Sparks & Ganschow; 1995; Sparks et al., 2000, 2009, 2011) and the appraisal theory (Boekaerts, 1993; Scherer, 1999; Smith & Lazarus, 1990), L2 learners'

motivation is malleable to their self-evaluation of their performance in a given task. In the case of SLA, Sparks et al. (2000, 2009) argued that L2 learners who have poor L1 ability tend not to perform well, and such lack of L1 and L2 ability may induce lower motivation towards learning their L2. Building on this account of the relationship between cognition and motivation, the participants who had greater sound sequence recognition ability may have generally had a smooth experience learning their L2, resulting in lower anxiety towards L2 pronunciation learning and a lack of a feeling of obligation to master L2 pronunciation.

Overall, the correlation values of the ID measures are not significant enough to verify the interrelationships between the three domains of the learner IDs. Yet, the results provide supportive evidence that L2 pronunciation-specific motivation (especially Ideal L2 self) and anxiety may influence each other, and Ought-to L2 self and anxiety may be affected by foreign language learning aptitude. Therefore, the findings here at least support the claim of the DST that learner IDs are not completely independent of each other, but are interlocking with each other (i.e., Dörnyei, 2010a).

3.3.2 The Roles of IDs in L2 Comprehensibility and Accentedness

Research Question 2 was set to explore how L2 learners' systems are related to their language systems. Since the components of L2 learner system (i.e., L2 learners' IDs) can change depending on the environment and time, the DST assumes that the different components of L2 learner system can become relevant to their language system. Due to this principle, it is crucial to examine the relationship between learner IDs and their language holistically. To this end, the variables of foreign language aptitude, L2 pronunciation learning motivation and anxiety were linked to the two dimensions of participants' pronunciation performance. According to the results of the mixed-effects modelling, the predictors that were found to significantly impact on accentedness score were phonemic coding (β= .29), anxiety (β=- .31), and recent English learning outside the classroom (β= .49). In terms of

comprehensibility score, anxiety (β= -.32) and recent English learning outside the classroom (β= .33) were the predictors that robustly predicted the score. Overall, the study confirmed that experiential, cognitive, motivation, and emotional factors play a crucial and different role in determining how and to what degree learners can develop L2 oral ability.

The results demonstrated that different IDs contribute to different dimensions of L2 pronunciation: extensive practice and use of a target language outside the regular classrooms and having lower anxiety towards L2 pronunciation learning robustly interact with the development of accentedness and comprehensibility by facilitating learners' processing of the linguistic and phonological aspects of L2, while further reduction of accentedness may only occur to the certain individuals who have greater phonemic coding ability. Therefore, the cross-sectional study here confirmed a hypothesis of the DST that L2 learners are equipped with different components in their systems, and different components influence their L2 learning at varied times and in various environments (cf. Larsen-Freeman, 1997, 2014; Mercer, 2013).

Approximately 49 % (for accentedness) and 24 % (for comprehensibility) of the participants' scores gained through the speech rating by four native speakers were explained by those IDs in the current data set. Based on Plonsky and Ghanbar's (2018) field-specific benchmark, the variability explained by the models could be considered as mid-to-large for accentedness, and small-to-mid for comprehensibility. A comparison of the modelling results between accentedness and comprehensibility provides two findings. First, both accentedness and comprehensibility had been influenced by the amount of extracurricular L2 learning and degree of anxiety. Secondly, accentedness was uniquely associated with phonemic coding. According to these findings, the details are discussed below.

The current study found that recent L2 experience *beyond* regular English classes at the university was strongly associated with both comprehensibility and accentedness.

Echoing the findings from the previous studies (e.g., Baker Smemoe & Haslam, 2013; Hummel, 2009; Mora & Valls-Ferrer, 2012; Muñoz, 2014; Saito & Hanzawa, 2016; Sparks et al., 2009), the current study confirmed the importance of *extensive* use/input of target language (e.g., Flege, 2016). Since the variable was associated with both accentedness and comprehensibility, the result here suggests that frequent input and output on top of the regular L2 experience they had at the university may have served as a booster that helped them further strengthen and refine pronunciation *and* lexicogrammatical knowledge they have accumulated.

Positive links between extracurricular English learning and two dimensions of L2 pronunciation found in the current study can offer additional evidence to the experience-driven account of successful L2 speech learning (e.g., Flege, 2009; Muñoz, 2014): In EFL classroom settings, the learners who make extra effort to increase the amount of L2 use/exposure even outside the classrooms (e.g., conversation schools, preparation for proficiency exams, communications with international friends) may be able to reduce the degree of L1 transfer in phonological aspects of pronunciation, resulting in the reduction of their accentedness.

With respect to the impact of pronunciation specific anxiety, the current study revealed the relationship between lower anxiety and better comprehensibility and reduced accentedness. Such result concurs with the findings of the previous studies that reported the direct link between anxiety and L2 pronunciation acquisition (e.g., Baran-Łucarz, 2011; Saito et al., 2018; Szyszka, 2011). Since one of the crucial influences of anxiety is its interference of L2 learners' cognitive function (Baran-Łucarz, 2013), the participants who had higher anxiety may have suffered from the disruption in L2 processing. Since the participants' learning both comprehensibility and accentedness were suffered from the degree of anxiety, anxiety may have hampered not only capturing and storing of L2 sound information (e.g.

segmental, syllable) but also L2 lexicogrammatical information when they received the input. Furthermore, since anxiety is also believed to hinder the receiving of the input (MacIntyre & Gardner, 1989, 1994), the participants with strong anxiety may have particularly struggled to make most of the available input from their curricular and extracurricular L2 learning.

Turning the focus onto the effects of cognitive factors, asymmetric patterns were found: phonemic coding were associated with L2 accentedness, while none of the cognitive factors were related to L2 comprehensibility. Such differences in the influence of IDs may have reflected the differences in the constructs of accentedness and comprehensibility: L2 pronunciation studies have revealed that accentedness is mainly linked to segmental and suprasegmental accuracy (i.e., phonological accuracy) whereas comprehensibility is associated with wider range of linguistic features such as temporal, lexical, grammatical, and phonological accuracy (e.g., Trofimovich & Isaacs, 2012). Based on such differences in linguistics correlates of the two dimensions of L2 pronunciation proficiency, L2 learners who have higher phonemic coding ability may have been able to successfully reduce the use of their L1 sound system (i.e., Japanese) by improving the segmental and suprasegmental accuracies. Importantly, phonemic coding is believed to be involved in learners' information processing (e.g., Skehan, 2016). Therefore, the participants who had higher phonemic coding ability may have efficiently processed available L2 input by noticing the differences between L2 and L1, and retaining and integrating the analysed auditory information in their L2 systems.

In line with the past research on the relationship between explicit aptitude and L2 proficiency (e.g., Baker Smemoe & Haslam, 2013 for longitudinal evidence; Saito, et al., 2019 for a cross-sectional evidence), the current study supported the idea that phonemic coding ability can greatly help L2 learners improve segmental and suprasegmental aspects of L2 pronunciation by identifying its positive contribution to accentedness. However, unlike

other cross-sectional studies in the FL classroom where they have found that associative memory was related to superior grammatical complexity and speed fluency in the L2 speech (e.g., Saito, 2017), higher associative memory was not found to be a predictor of comprehensibility or accentedness in the current study (also Saito et al., 2019). These results may have been observed simply because the improvement in grammar use and temporal features may not be fully reflected on the listeners' perceived comprehensibility or accentedness.

However, another account can be provided here. According to the aptitude studies, associative memory has been found to help learners retain vast amount of lexical knowledge, relating new information to the existing knowledge, and control the delivery of such knowledge efficiently, so it mainly involves in the *later stage* of L2 acquisition - proceduralization and automatization of the acquired knowledge (e.g., Linck et al., 2013; Skehan, 2016). Following this line of the aptitude theory, therefore, the participants with higher associative memory in the current study may have not had sufficient declarative knowledge to benefit from the function greater associative memory is to offer.

In addition, such account (i.e., differences in the participants' acquisitional stages from the previous studies) may also be applicable to the insignificant relationship between sound sequence recognition and L2 proficiency in the current study. Sound sequence recognition is believed to enable L2 learners to attend to L2 phonological and word sequences in the incidental and implicit fashion, and considered to be essential to the final stage of L2 acquisition for further refining of their L2 sound processing ability and attaining highly nativelike L2 pronunciation (e.g., Granena, 2013 for naturalistic setting; Saito et al., 2019 for FL setting). Thus, the participants with higher sound sequence recognition may have been still in their earlier stage of L2 pronunciation acquisition where explicit processing and analysing of L2 sounds is more instrumental.

With respect to L2 pronunciation learning motivation, two self-guides were not linked to either comprehensibility or accentedness. While such result support the findings demonstrate in the previous study (Nagle, 2018a), it provided a piece of counter evidence to the past studies that found the strong association of ideal L2 self with comprehensibility (e.g., Saito et al., 2018). However, based on the correlation results between motivation and L2 experience variable, a positive association between higher ideal L2 self and L2 learning outside of the university classrooms has been implied (r = .238, p = .093). Although I have to make it clear that the correlation value did not reach the statistical significance, such trend may indicate that the participants who had strong internalized motivation towards learning English pronunciation may have actively sought opportunities of practicing English *outside* the university classes and may be consistent with the link between motivation and L2 experience (e.g., Saito et al., 2018; Ushioda, 2016). Unlike the past studies that used the original questionnaire focusing on English learning in general, the current study tailored the statement to elicit *pronunciation specific* motivation from the participants. Therefore, in order to confirm the relationship between *pronunciation specific* motivation and L2 pronunciation acquisition, further investigation needs to be conducted.

3.4 Summary of the Chapter

Focusing on N = 51 Japanese learners of English in an EFL context, the main focus of the present thesis is to examine the principles of DST by exploring how various L2 learners' IDs interact with each other, and how those IDs differentially contribute to their L2 pronunciation learning. In this cross-sectional study, two research questions were set: (a) the strength and direction of the relationships between aptitude, L2 pronunciation-specific motivation, and L2 pronunciation-specific anxiety (i.e., Research Question 1), and (b) the differential contribution of experiential factors, and cognitive, motivational, and emotional

IDs of L2 pronunciation measured via comprehensibility and accentedness – two dimensions that consists of multifaceted nature of L2 pronunciation (i.e., Research Question 2).

Research Question 1 focused on the principle that assumes that L2 learners themselves are regarded as self-regulatory systems which consist of multiple interacting components (i.e., a triad of cognitive, motivational and emotional IDs). To examine this principle, the study investigated the strength and direction of the relationship between cognitive, motivational and emotional domains of the participants' intellectual functioning (e.g., Buck, 2005; Dörnyei, 2010a): foreign language learning aptitude for cognitive, L2 pronunciation-specific motivation for motivational, and L2 pronunciation-specific anxiety for emotional domains of IDs. According to the correlation analyses, while the strength of the correlation values was not statistically significant, two characteristics of the interrelationship between cognitive, motivational and emotional IDs were observed. First, the participants' degrees of pronunciation-specific anxiety were differentially correlated with two types of pronunciation-specific motivation. In fact, the participants' Ideal L2 self was negatively correlated with anxiety, while their Ought-to L2 self was positively correlated with anxiety. Secondly, the participants' aptitude profiles demonstrated a complex relationship between motivation and anxiety. While their associative memory showed a positive correlation with their degree of anxiety, the scores of sound sequence recognition were negatively correlated with their Ought-to L2 self and anxiety. Hence, the findings here could be considered as evidence to support the principle of DST that learner IDs are interacting components (rather than the components that exist in isolation).

Research Question 2 was designed to investigate the principle that states that L2 learners' systems interact with their language systems in a complex manner. To scrutinise the complex relationship between the participants' systems and their language systems, the ID variables of foreign language learning aptitude, L2 pronunciation-specific motivation and

anxiety were linked to two dimensions of participants' pronunciation performance – comprehensibility and accentedness while controlling for the effect of L2 learning experience factors. The results showed that L2 pronunciation-specific anxiety contributed to the development of comprehensibility and accentedness, while greater phonemic coding was only associated with the development of accentedness. The results, in turn, confirm that different domains of IDs contribute to different dimensions of L2 pronunciation. Therefore, the cross-sectional study here supports the principle of DST that the different components of learner systems influence their L2 learning at varied times and in various environments (cf. Larsen-Freeman, 1997; 2014; Mercer, 2013).

Importantly, DST considers any changes that occur in the language systems as sensitive to *the initial state* of the systems (i.e., the systems' state prior to the change) (Larsen-Freeman, 2014). Therefore, the findings of the Study I play a crucial role in illustrating the initial condition of the participants' language system (i.e., comprehensibility and accentedness), and contribute to the interpretation of the results obtained in Study II (i.e., an investigation of the changes in the participants' language systems).

Chapter 4 Study II: A Longitudinal investigation of Individual Differences in Predicting L2 Pronunciation Development through the Pronunciation Instruction

While Study I was designed to investigate (a) the relationship among the components in the learner systems, and (b) the relationship between the L2 learner systems and their language systems, the goal of Study II is to explore the most prominent IDs components that involved in the changes of the language system when the pronunciation instruction is provided.

To examine changes in participants' L2 systems, Study II *longitudinally* explored the L2 pronunciation development by focusing on 51 Japanese EFL learners who participated in Study I. The current study examined the relative contributions of explicit pronunciation instruction and learners' experience, aptitude, motivation and anxiety to the improvement of L2 pronunciation. As I introduced earlier (see *2.4 Rationales of the Current Thesis* in Chapter 2), Study II is designed to respond to Research Question 3.

Research Question 3: To what extent do L2 learning experience, cognitive, motivational, and emotional factors influence the development of L2 comprehensibility and accentedness when pronunciation instruction is provided?

4. 1 Methodology

4.1.1 Participants

51 Japanese learners of English who participated in Study I also participated in the study as an experimental group. Furthermore, 12 Japanese learners of English additionally participated in the study as a control group. Therefore, a total of 63 participants took part in the study. At the time of the study, they were all first-year undergraduate students from various majors (e.g., engineering, medicine, sociology, education, literature, and cultural studies), and had begun learning English in formal EFL classrooms approximately at the age of eleven. They reported that they had never taken any intensive pronunciation-focused courses or received pronunciation instruction. All of them had no prior experience living or studying in English-speaking countries and no hearing problems at the time of the study. The average age was $M_{\text{years}} = 19.1$ (*Range* = 18–20).

4.1.2 Procedure

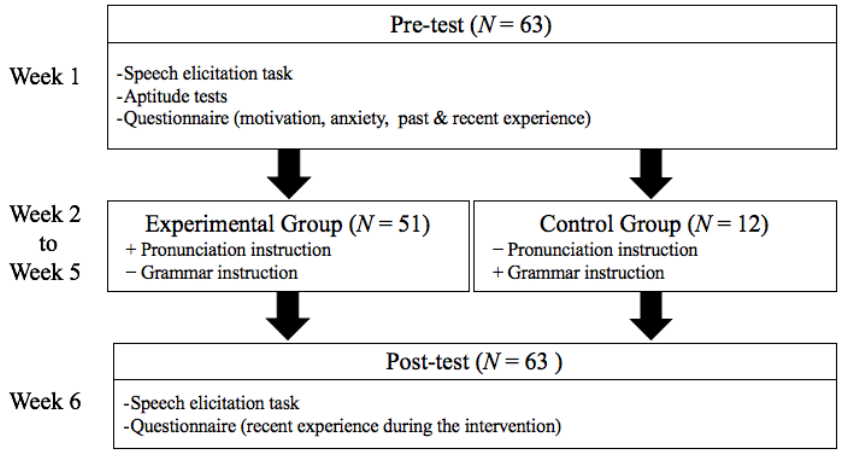
The experimental group that comprised of 51 learners from Study I received four weekly pronunciation instruction for 50 minutes. Another group was a control group that consisted of ten learners. They also received four weekly lessons, but the focus of the lessons was on English grammar exercise.

Prior to the intervention, the participants of both groups performed the speech production task (Time 1), aptitude test, and a questionnaire for measuring motivation, anxiety, and L2 experience. After the intervention, the participants took the speech production test (Time 2) and reported the any changes in L2 experience during the intervention. Following the procedures established by past L2 speech research (e.g., Derwing

& Munro, 1997), the participants' speech samples at pre- and post-test were subsequently rated for comprehensibility and nativelikeness on a 9-point scale by the native listeners. The overall data collection process is described in Figure 4.1 below.

Figure 4.1

Data Collection Process



4.1.3 Individual Differences Measures

4.1.3.1 Foreign Language Learning Aptitude. The instrument and the procedure are the same as Study I. Therefore, please see *3.1.3.1 Aptitude Test.* For the detailed description.

4.1.3.2 Motivation, Anxiety, and Experience Questionnaire. The instrument and the procedure are the same as Study I. Therefore, please see *3.1.3.2 Questionnaire Instruments* for the detailed description. The descriptive statistics of the participants' responses to the motivation and anxiety questionnaire can be found in Table 4.1. Following the methodological decisions of previous studies on sociopsychological IDs (e.g., Baran-Łucarz, 2014; Nagle, 2018a), the internal consistency of each construct was examined via Cronbach's alpha (α = .92 for Ideal L2 self, α = .91 for Ought-to L2 self, and α = .82 for anxiety). Since the alpha values were above the threshold (α >.8; see Larson-Hall, 2010), the average scores were calculated to represent three constructs. For the details of IDs and experience profiles (aptitude, motivation, anxiety, and L2 experience scores), a descriptive statistic is provided in Table 4.2.

4.1.3.3 Language Background Questionnaire. The instrument and the procedure are the same as Study I. Therefore, please see *3.1.3.2 Questionnaire Instruments* for the detailed description.

Table 4.1

Descriptive Statistics of Items used in Motivation and Anxiety Questionnaire and Descriptive Statictics

	M	SD	Range Min–Max
1. Questionnaire items of pronunciation specific anxiety			
Fear of negative evaluation related to pronunciation			
I (would) feel uneasy pronouncing English sounds and/or words with a Japanese accent.	4.1	1.42	1–6
I would rather others do not hear me making pronunciation mistakes.	3.63	1.5	1–6
I fear others might find my pronunciation of English strange or funny.	3.4	1.41	1–6
I am worried what others might think of me when they hear my English pronunciation.	3.59	1.48	1–6
I get nervous and feel shy when making a pronunciation mistake.	3.51	1.36	1–6
I feel stressed knowing that others are listening to me.	2.81	1.42	1–6
I feel more embarrassed making a pronunciation mistake that any other type of mistake when I speak in English.	2.6	1.29	1–6
Pronunciation self-efficacy and self-assessment			
I find it more difficult to improve pronunciation than grammar or vocabulary.	3.24	1.48	1–6
I remember the pronunciation of new words easily.	3.7	1.21	2–6
My pronunciation is at a lower level than that of people around me.	3.78	1.34	1–6
I am satisfied with my present level of English pronunciation.	4.48	1.56	1–6
I have a talent to pick up the pronunciation of English.	3.97	1.29	1–6
My pronunciation of English is far from acceptable.	3.35	1.18	1–6
Pronunciation self-image			
I look funny pronunciation ‘th’ sound.	2.57	1.29	1–6
I like singing and/or speaking to myself in English.	3.23	1.62	1–6
Sometimes I like to imitate English actors/singers.	3.67	1.48	1–6
I do not like listening to myself reading English aloud.	3.03	1.31	1–6
I think I sound unnatural speaking English.	3.75	1.09	1–6
I look natural speaking English.	3.89	1.4	1–6
Belief related to the anxiety of pronunciation of English			
The comprehensibility of a speaker depends on his/her level of proficiency.	4.49	1.08	1–6

Some words in English sound funny and /or awkward.	3.29	1.24	1–5
The pronunciation of English is difficult for Japanese.	4.46	1.12	1–6
The level of pronunciation affects the ability to understand spoken language	4.24	1.32	1–6
2. Questionnaire items of pronunciation-specific motivation			
***Ideal L2-self* for pronunciation learning**			
I can imagine myself living abroad and having a discussion in English with accented but comprehensible pronunciation.	3.9	1.27	1–6
I can imagine a situation where I am speaking with foreigners in English with accented but comprehensible pronunciation.	4.11	1.18	1–6
I imagine myself as someone who is able to speak English with accented but comprehensible pronunciation.	4.08	1.21	1–6
Whenever I think of my future career, I imagine myself using English with accented but comprehensible pronunciation.	3.99	1.13	2–6
I can imagine myself living abroad and having a discussion in English with nativelike pronunciation.	3.83	1.2	1–6
I can imagine a situation where I am speaking with foreigners in English with nativelike pronunciation.	3.81	1.2	1–6
I imagine myself as someone who is able to speak English with nativelike pronunciation.	3.86	1.2	1–6
Whenever I think of my future career, I imagine myself using English with nativelike pronunciation.	3.81	1.28	1–6
***Ought-to L2 self* for pronunciation learning**			
I study English pronunciation to speak English with accented but comprehensible pronunciation because close friends of mine think it is important.	3.51	1.45	1–6
I have to study English pronunciation to speak English with accented but comprehensible pronunciation, because if I do not study it, I think my parents will be disappointed in me.	2.19	1.29	1–5
Speaking English with accented but comprehensible pronunciation is necessary because people surrounding me expect me to do so.	2.75	1.52	1–6
My parents believe that I must be able to speak English with accented but comprehensible pronunciation to be an educated person.	2.41	1.4	1–5
I study English pronunciation to speak English with near native-like pronunciation because close friends of mine think it is important to speak English with near native-like pronunciation.	2.94	1.56	1–6
I have to study English pronunciation to speak English with near native-like pronunciation, because if I do not study it, I think my parents will be disappointed in me.	2.21	1.45	1–6
Speaking English with near native-like pronunciation is necessary because people surrounding me expect me to do so.	2.84	1.62	1–6
My parents believe that I must be able to speak English with near native-like pronunciation to be an educated person.	2.41	1.49	1–6

Table 4.2

Descriptive Statistics of Individual Differences and L2 Learning Experience Profiles of 63 Japanese EFL Learners

		M	*SD*	*Range* *Min–Max*
Foreign Language Learning Aptitude				
Sound sequence recognition (0-75 %)	Experimental	24.7	14.99	0–55
	Control	27.91	14.91	0–60
Associative memory (0-100 %)	Experimental	57.75	19	20–95
	Control	64.17	21.3	30-95
Phonemic coding ability (0-100 %)	Experimental	69.8	24.65	20–100
	Control	75.8	20.21	30-100
L2 pronunciation learning motivation and anxiety				
Ideal L2 self	Experimental	3.92	1.01	1.63–6
	Control	3.96	.75	2.88-5.38
Ought-to L2 self	Experimental	1.16	.162	1-5.25
	Control	1.29	.373	1.13-4.88
Pronunciation Anxiety	Experimental	3.67	.562	2.29-4.96
	Control	3.31	.522	2.48-4.08
Past L2 experience[a]				
Past curricular English learning	Experimental	1567.57	426.5	834.24–2502.72
	Control	1329.57	341.9	834.24-1772.76
Past extracurricular English learning	Experimental	459.55	570.93	0–2763.42
	Control	601.78	538.59	0-1564.2
Recent L2 experience[b] (T1)				
Recent curricular English learning	Experimental	128.68	167.1	0-855
	Control	160	110.1	60–405
Recent extracurricular English learning	Experimental	14.53	22.5	0–95
	Control	7.12	14.68	0-38
Recent L2 experience (T2)				
Recent curricular English learning	Experimental	15.49	10.24	0-40
	Control	18.83	5.43	12-28
Recent extracurricular English learning	Experimental	3.37	4.24	0-16
	Control	1.83	3.12	0-8

Note. a. Total length of past English learning was calculated based on the total weeks they engaged in learning English during elementary, junior high, and high school. Curricular English learning indicates that all the English lessons they received *inside the regular schools*, while extracurricular English learning refers to any

English learning activities (e.g., cram schools for exam preparation) taken place outside the lessons provided in elementary, junior high, and high schools.

b. Total length of recent English learning was calculated based on the total weeks they engaged in learning English since they entered the university. Curricular English learning refers to their participation in the English classes (reading, writing, listening, speaking classes) offered at the university, while extracurricular English learning refers to any activities they engaged in outside university classes (e.g., online platforms for English learning, mobile phone applications, informal conversations with natives or fluent non-native speakers).

4.1.4 Measuring of Pronunciation Development

4.1.4.1 Speaking Task. The current study used the same tasks as Study I used. Therefore, please see for the detailed description of the task.

4.1.4.2 Raters. Since the rating sessions for Study I and Study II were carried out at the same time, the raters participated in the current study were the same listeners described in Study I.

4.1.4.3 Speech Ratings. A blind paired-comparison task (e.g., Bradlow et al., 1999; MacDonald et al., 1994) was used to make a within-subject comparison (pre-test vs. post-test speeches). The task was used to ensure the four raters' accurate assessments of the progress/deterioration of the post-test speech samples. The rating session was conducted via individual meetings with one of the researchers in a quiet room at a university in London, UK. The researcher helped the raters familiarize themselves with the rating procedure as well as the evaluation criteria. With a printed booklet (see Appendix B), the raters were asked to listen to speech samples through headphones connected to a laptop computer, and subsequently, evaluate the samples by circling a number on a 9-point scale for comprehensibility (*1 = difficult to understand, 9 = easy to understand*), and then accentedness (*1 = heavily accented, 9 = not accented at all*). To ensure accurate and smooth rating, the author first provided a short training session to each of the raters prior to the main session. The training session included a brief explanation of the definitions of

comprehensibility and accentedness, and a practice rating with three speech samples that were not included in the main dataset. Then the author asked the raters to explain their reasoning to confirm their sufficient understanding of the two constructs. Based on the explanations given, the author provided them with feedback. Subsequently, the raters proceeded to the main session. To avoid the inaccurate evaluation caused by fatigue, the raters took 15 minutes breaks after one-third, and two-thirds of the speech samples were evaluated. The entire session lasted approximately eighty minutes per rater. The Cronbach's alpha of the four raters' judgments of comprehensibility was $\alpha = .82$ and accentedness was $\alpha = .80$. Since the alpha values demonstrated acceptable agreements based on Larson-Hall's (2010) benchmark ($\alpha > .70$), the rating results from the four raters were averaged to make up each speaker's comprehensibility and accentedness scores (see Table 4.3).

4.1.5 Instruction

The explicit instructions used by past research can be broadly categorized into articulatory-based and auditory-based instructions with former highlighting L2 learners' understanding of manner and place of articulation of sounds in contrast to their L1, and the latter emphasizing L2 learners' perceptual development of sounds by introducing similarities and dissimilarities of L2 and their L1 counterparts (Saito & Plonsky, 2019). Since production and perception are assumed to complement each other to facilitate L2 speech learning (Nagle, 2018b), the current study incorporated the training of both dimensions in the syllabus. The participants received four weekly pronunciation instruction and each session lasted approximately sixty minutes (for detailed description of intervention, see Supporting Information B). The sessions were led by the author who is a native speaker of Japanese with a master's degree in TESOL and highly proficient in English. The study used an non-native teacher whose L1 is Japanese not only because non-native teachers are capable of providing effective pronunciation instruction (Levis et al., 2016), but also because teachers/listeners of

the same L1 are better equipped at noticing pronunciation errors that are derived from the L1 phonological system (e.g., Riney et al., 2000). Following the procedure of phonetic instruction used by Couper (2003), the instruction involved a range of perception and production practice in the following manner:

- First, the target items were introduced, and how to produce a particular feature was explicitly explained. Segmental that were covered in the intervention were /b/, /v/, /z/, /ð/, /θ/, /r/, /l/, /s/, and /ʃ/ because they have been regarded as problematic for comprehensibility among Japanese learners of English (Saito, 2011). In the case of the phonemes, graphical representations and explanations of the place and manner of articulation were also given (i.e., articulatory-based instruction).

- In the next stage, using multiple sound examples, they were asked to discriminate the target item (e.g., /r/ vs. /l/) with peers several times. Then, in order to compare their pronunciation with the model, they recorded themselves with their mobile phone (i.e., auditory-based instruction).

- The second part of the instruction involved meaning-oriented communication activities. Each session offered a simple topic (e.g., "what is the last movie you watched?") to engage in a conversation activity, and an argumentative topic to help the participants engage in a meaning-oriented communication (instead of a mundane drill or a simple greeting). Prior to the activity, the author reminded the participants the certain features they should attend to

when listening to peers and producing speech by themselves. If necessary, recasts were used as a form of corrective feedback.

In order to determine the overall effectiveness of the pronunciation instruction, twelve participants also participated in the study as a control group. The instruction given to the control group was designed to improve the participants' grammatical knowledge, and the materials used for the instruction were the grammar exercise (e.g., filling the blanks, passage comprehension, error recognition) chosen from the textbook for The Test of English for International Communication (TOEIC) (Trew, 2007). The length and frequency of the instruction were the same as they were for the experimental group: they engaged in 50 minutes of weekly grammar exercise for four weeks (i.e., 4 weekly session × 50 mins; Figure 4.1).

In order to make sure that the groups did not differ in terms of their ID profiles, L2 experience and L2 pronunciation, a series of statistical analyses were conducted. First, prior to the t-tests, Levene's test was conducted to test the hypothesis of equal population variances (Table 4.4). Since all the variables did not show any statistical significance, the null hypothesis of equal population variances was not rejected. Therefore, a series of t-tests were conducted to examine the possible differences between the two groups. Due to the uneven number of participants in each group (51 vs. 12), Welch's t-test was used (Table 4.4). According to the results, the experimental and control groups were not statistically different concerning the Time 1 (pre-test) scores of comprehensibility and accentedness as well as the ID and experiential profiles. After the intervention, the Time 2 (post-test) scores of the two groups were compared by using the paired-samples t-test (Table 4.5). The results indicated that only experimental group showed statistically significant improvements in

comprehensibility and accentedness. Therefore, the effectiveness of the pronunciation instruction was verified.

Table 4.3

Descriptive Statistics of Comprehensibility and Accentedness Rating

		M	*SD*	*Range*
				Min–Max
Comprehensibility (Time 1)	Experimental	5.35	1.11	2.25–8.75
	Control	5.50	.95	4.00–7.00
Comprehensibility (Time 2)	Experimental	6.17	1.02	4.00–8.50
	Control	5.54	.87	4.25-6.75
Accentedness (Time 1)	Experimental	4.97	1.04	2.00–8.25
	Control	4.96	1.00	3.75–6.75
Accentedness (Time 2)	Experimental	5.65	1.01	3.25–8.25
	Control	4.89	.92	3.75–6.25

Table 4.4

Results of Levene's Homogeneity Test and Welch's T-Test

	Levene's Test		*Welch's T-Test*	
	F	*p*	*F*	*p*
Comprehensibility (Time 1)	.273	.603	.179	.674
Accentedness (Time 1)	.362	.550	.013	.908
Sound sequence recognition	.436	.512	.449	.505
Phonemic coding	1.04	.312	.617	.435
Associative memory	.694	.408	1.06	.307
Ideal L2 self	.896	.355	.020	.887
Ought to L2 self	.610	.438	.609	.438
Anxiety	.002	.963	3.95	.051
Past curricular learning	.561	.457	3.23	.077
Past extracurricular learning	.548	.462	.615	.436
Recent curricular learning	.021	.884	.380	540
Recent extracurricular learning	3.32	.073	1.17	.283

Table 4.5

Results of Paired Samples T-test

	t	*df*	*p*
Experimental group			
Comprehensibility (Time 1, Time 2)	6.468	50	<.001*
Accentedness (Time 1, Time 2)	8.436	50	<.001*
Control group			
Comprehensibility (Time 1, Time 2)	.364	12	.723
Accentedness (Time 1, Time 2)	.788	12	.447

4.1.6 Data Analysis

To illustrate the influence of the IDs on the effectiveness of pronunciation instruction on L2 pronunciation learning, the current study aims to inspect the interaction effect of pronunciation instruction and IDs variables by using mixed effects modelling in R (R Core Team, 2016). To this end, *Imer* function in *Ime4* package was used. The fixed effects in the modelling included three types of aptitude (indicated as *Sound sequence recognition*, *Phonemic coding*, *Associative memory* in R code), three factor scores of motivation and anxiety (indicated as *Ideal L2 self, Ought-to L2 self, Anxiety* in R code), four experience measures (indicated as *Past curricular and extracurricular English learning, Recent curricular and extracurricular English learning* in R code) and the instruction (indicated as *Time* in R code). For ensuring the comparability of the aptitude, motivation, anxiety and L2 experience variables that were measured through the different scaling systems, those variables were converted to z-scores prior to the analysis. Although the models were fitted with a random effect of subjects (*Subject* in R code) and the task (Story A, Story B; *Task* in R code) for considering the variations in the intercept among the participants, a random effect of *Task* caused the model convergence issues for both comprehensibility and accentedness, it was removed from the analysis. Furthermore, in order to avoid the multicollinearity issue among the independent variables, the Variance Inflation Factors (VIFs) were examined prior to the model construction (see Table 4.6).

To investigate the potential moderating effect of learner IDs and experiential variables on the effectiveness of pronunciation instruction, the interactions between instruction (i.e., *Time*), and learner IDs including aptitude (i.e., *Sound sequence recognition*, *Phonemic coding*, *Associative memory*), motivation (i.e., *Ideal L2 self*, *Ought-to L2 self*) and *Anxiety*, and their experiential factors (i.e., *Past curricular learning*, *Past extracurricular learning*, *Recent curricular learning*, and *Recent extracurricular learning*) were examined by following procedure. First, interaction terms were prepared by combining instruction (*Time*) and one fixed effect. (e.g., *Sound sequence recognition*). For instance, in order to inspect the interaction between *Sound sequence recognition* (a cognitive IDs variable) and the instruction, the following code was prepared: *Time + Sound sequence recognition + Time:Sound sequence recognition*. In the R code of mixed effects analysis, such an interaction term was indicated as *Time* Sound sequence recognition*. After preparing the interaction terms for all the fixed effects, the codes were run individually. For instance, the code of an interaction between Time and Sound sequence recognition for accentedness include the following: *Accentedness Model <- lmer(Accentedness ~ Time*Sound sequence recognition + (1 | Subject), data = Longitudinal_data, REML=F*)(see Table 4.7 and Table 4.8). In addition, in in order to confirm the impact of instruction on the participants' pronunciation, a separate code was run for obtaining the estimated beta value for *Time* (e.g., *Impact of Instruction_Accentedness <- lmer(Accentedness ~ Time + (1 | Subject), data = Longitudinal_data, REML=F*). For the details of the code used in the analysis, please see R syntax in Appendix C.

4.2 Results

4.2.1 The Roles of Aptitude, Motivation and Anxiety in the Effectiveness of Instruction on the Reduction of L2 Accentedness

First, the estimated beta value of pronunciation instruction was examined. The result of mixed effects analysis revealed a significant impact on the participants' accentedness (i.e., β =.69, p <.001). Then the second analysis was concerned with the inspection of the interaction between IDs variables and pronunciation instruction provided to the participants. According to the result of mixed effects modelling, the estimated beta values of the ID variables elicited from the experimental group (who received the pronunciation instruction) did not show statistically significant interaction effect (i.e., p >.137) (see Table 4.7). This was also the case with the control group who received the grammar instruction (i.e., p >.087) (Table 4.7). The estimated beta values, standard errors, t-values of the model that includes the interactions are summarised in Table 4.7 for the experimental group and Table 4.8 for the control group.

4.2.2 The Roles of Aptitude, Motivation and Anxiety in in the Effectiveness of Instruction on the Increase of L2 Comprehensibility

Similar to the results found in the participants' accentedness, while the result of mixed effects analysis revealed a significant impact of pronunciation instruction on the participants' comprehensibility (i.e., β =.83, p <.001), none of the ID factors showed statistically significant interaction effect for both experimental (i.e., p >.137) and control groups (i.e., p >.071). The results are reported in Table 4.8.

Table 4.6

Summary of VIFs

IDs factors	VIF	
	Accentedness	Comprehensibility

Aptitudes		
Sound sequence recognition	1.301	1.138
Associative memory	1175	1.071
Phonemic coding	1.276	1.247
Pronunciation specific Motivation and Anxiety		
Ideal L2 self	1.303	1.424
Ought-to L2 self	1.538	1.14
Anxiety	1.383	1.423
L2 experience		
Past curricular English learning	1.302	1.117
Past extracurricular English learning	1.174	1.136
Recent curricular English learning	1.146	1.164
Recent extracurricular English learning	1.524	1.317

Table 4.7

Inspections of Interactions between Instruction and IDs (Accentedness)

Variable	Estimate	*SE*	t-value	*p*
Experimental group				
Time:Sound sequence recognition	.026	.062	.425	.673
Time:Associative memory	<.001	.066	.003	.998
Time:Phonemic coding	-.021	.059	-.356	.724
Time:Ideal L2 self	.064	.063	1.02	.314
Time:Ought-to L2 self	-.004	.064	-.066	.947
Time:Anxiety	.014	.064	.225	.823
Time:Past curricular English learning	-.057	.060	-.953	.345
Time:Past extracurricular English learning	.063	.059	1.06	.294
Time:Recent curricular English learning	-.098	.065	-1.56	.137
Time:Recent extracurricular English learning	-.075	.059	-1.27	.209
Control group				
Time:Sound sequence recognition	-.230	.122	-1.90	.087
Time:Associative memory	.157	.133	1.19	.263
Time:Phonemic coding	-.089	.139	-.640	.536
Time:Ideal L2 self	-.202	.126	-1.60	.141
Time:Ought-to L2 self	.029	.141	.210	.839
Time:Anxiety	-.151	.133	-1.14	.283
Time:Past curricular English learning	-.022	.141	-.156	.879

Time:Past extracurricular English learning	.135	.135	1.00	.341
Time:Recent curricular English learning	-.172	.131	-1.31	.219
Time:Recent extracurricular English learning	-.022	.141	-.156	.879

Note. * $p < .05$

Table 4.8

Inspections of Interactions between Instruction and IDs (Comprehensibility)

Variable	Estimate	*SE*	t-value	*p*
Experimental group				
Time:Sound sequence recognition	.003	.123	.027	.980
Time:Associative memory	-.117	.129	-.905	.370
Time:Phonemic coding	.040	.116	.342	.734
Time:Ideal L2 self	-.025	.126	-.200	.843
Time:Ought-to L2 self	-.030	.126	-.235	.815
Time:Anxiety	.125	.125	1.00	.322
Time:Past curricular English learning	-.177	.117	-1.51	.137
Time:Past extracurricular English learning	-.043	.117	-.368	.714
Time:Recent curricular English learning	-.113	.134	-.844	.403
Time:Recent extracurricular English learning	-.006	.117	-.050	.960
Control group				
Time:Sound sequence recognition	-.209	.103	-2.02	.071
Time:Associative memory	.179	.109	1.65	.131
Time:Phonemic coding	.064	.121	.531	.607
Time:Ideal L2 self	.013	.123	.105	.918
Time:Ought-to L2 self	-.072	.121	-.594	.566
Time:Anxiety	-.032	.122	-.263	.798
Time:Past curricular English learning	-.034	.122	-.277	.787
Time:Past extracurricular English learning	.101	.118	.853	.414
Time:Recent curricular English learning	-.007	.123	-.058	.955

Time:Recent extracurricular English learning	-.034	.122	-.277	.787

Note. * $p < .05$

4.3 Discussion

To conceptualise learner IDs within the framework of DST, this study aimed to test the dynamic and complex relationship between L2 learners' self-regulatory loop of IDs (i.e., L2 learner system) and two dimensions of L2 pronunciation (i.e., learners' language systems). To this end, I explored the IDs variables that involved in the gain in L2 accentedness and comprehensibility through pronunciation instruction.

4.3.1 Effect of Pronunciation Instruction

According to the results of mixed effects modelling, the impact of instruction was relatively strong and positive for both accentedness and comprehensibility (β = .69 for accentedness, β = .83 for comprehensibility). The result here provides additional evidence that pronunciation instruction (i.e., explicit phonetic instruction + meaning-oriented communication activity) can be effective for developing comprehensibility (e.g., Derwing & Munro, 2015) as well as increasing accuracy in producing L2 sounds. According to Saito and Plonsky (2019), spontaneous speech allows researchers to measure to the extent to which the learners established proceduralization and automatization that are developed from stored declarative knowledge they obtained through the instruction. Therefore, the improvements that were demonstrated in the spontaneous speech task in the current study indicates that the learners could successfully obtain the declarative knowledge of L2 sounds and phonological rules via the instructions, and at least to some extent transformed such knowledge towards the development of spontaneous pronunciation knowledge (i.e., proceduralisation).

4.3.2 The Role of IDs in the Effectiveness of Pronunciation Instruction

The results of the inspection of the interaction between the instruction and the IDs variables revealed that none of the IDs factors influenced the effectiveness of pronunciation

instruction on the participants' L2 pronunciation improvement. This means that having particular IDs profile does not lead to higher gains from L2 pronunciation instruction. According to the Aptitude Complexes Hypothesis (Robinson, 2005, 2007), it is assumed that the learners with larger rote memory capacity would be benefit more from explicit instructions due to the positive influence of rote memory on metalinguistic rule rehearsals. In addition, since phonemic coding is believed to enhance the learners' noticing of the differences between L1 and L2, the learners with greater phonemic coding would benefit more from the explicit corrective feedback (e.g., Yalçin & Spada, 2016 with grammar instruction). Thus, it was hypothesised that the learners with higher associative memory and phonemic coding could improve their L2 pronunciation more than the learners with lower associative memory and phonemic coding. However, the results showed that none of the cognitive IDs or sociopsychological IDs had the moderating effect (Table 4.7 for accentedness, Table 4.8 for comprehensibility). Therefore, the prediction was not supported. Such results are contrary to the research evidence that the aptitude likely to play a moderating role in the effectiveness of L2 grammar instruction (e.g., Ranta, 2002; Yalçin & Spada, 2016) and Robinson's hypothesis. Instead, the results concurred with Erlam's (2005) study that found a neutralising effect of deductive instruction (i.e., explicit explanation of the grammatical rules) on the acquisition of direct object pronouns. The results also support Skehan's (1989) view towards the role of aptitude in L2 learning. According to Skehan (1989), foreign language aptitude would facilitate learners' acquisition of the target features when the features are presented in a relatively unstructured manner, while learning of L2 features under the structured and guided condition may negate any effect of IDs that could cause the variability in the learning outcome. Therefore, the results of the current study may suggest that the auditory-based and articulatory-based instruction can be beneficial for all the language learners regardless of the differences in their cognitive IDs. Moreover, the current

study explored whether sociopsychological IDs (motivation, and anxiety) would show moderating effects or not. However, the results revealed that motivation and anxiety did not affect the effectiveness of the pronunciation instruction, indicating that the participants had made tangible improvement irrespective to the levels and types of motivation and the levels of anxiety. Thus, similar to the case of aptitude, the explicit explanation of L2 pronunciation features (i.e., articulatory-based and auditory-based instruction) may be generally beneficial for advancing L2 learners' pronunciation proficiency, and the amount of learning gain is not subject to the participants' level of anxiety and motivation towards learning L2.

4.4 Summary of the Chapter

In the context of Japanese learners of English in an EFL setting (N = 51), the aim of the current thesis is to adapt the principles of DST in ID research by investigating how various L2 learners' IDs interact with each other, and how those IDs differentially contribute to L2 learning. While Study I examined the interrelationship among the IDs and their impact on the participants' L2 systems (comprehensibility and accentedness), Study II attempted to shed light on the complex relationship between the participants' systems (the self-regulatory loop of IDs), pronunciation instruction, and the *changes* in their language systems. For this purpose, the study focused on the two aspects of L2 global pronunciation proficiency – accentedness and comprehensibility, and examined which and to what extent the participants' IDs increased the gain from L2 pronunciation instruction.

According to the results of interactions, there were no significant interactions between the participants' IDs and the instruction. This was the case in both accentedness and comprehensibility. The results here indicate that the participants' systems may not affect the impact of the external factors on the development of their language systems (i.e., comprehensibility and accentedness).

Chapter 5 General Discussion

Chapter 5 discusses and synthesises the findings from Study I and Study II to explore the overall changes in the relationship between learners' ID factors and their L2 pronunciation. First, prior to the main discussion, the theoretical background and motivation of the thesis are revisited. This is followed by the presentation of the results from Study I (for Research Question 1 and 2) and Study II (for Research Question 3). Subsequently, general discussion for each research question is provided. Lastly, integrating the findings in each study (Study I and II), I discuss the complex interplay of various IDs and experience.

5.1 The Background of the Study

Traditionally, learner IDs have been treated as either background noise in the systematic language development or context-independent and absolute factors that independently influence L2 learning (Dörnyei & Ryan, 2015; Larsen–Freeman, 2001, 2015). In this classical ID paradigm, components of IDs are assumed to have clear boundaries between them, be stable, be independent from each other, and to be separated from learner-external factors such as temporal and environmental variables. In particular, a pervasive assumption that IDs are modular components of learner internal variables in the classic paradigm has led to the existing studies' tendency of focusing on a single ID component in isolation from others (Segalowitz & Trofimovich, 2012; Serafini, 2017). However, the

classical ID paradigm has been challenged by scholars (e.g., Ellis & Larsen-Freeman, 2006; Kinginger, 2008; Pavlenko, 2002; Schumann, 2004). First, individual learner characteristics are not stable and homogenous. They consist of multiple different elements and form complex constellations within learners. These elements constantly interact together and sensitive to the temporal and situational factors (e.g., Kinginger, 2004). Secondly, ID factors do not independently influence language learning. As brain functions in relation to the external stimuli and behaviour are a result of the interaction between human cognition and situational (Funder, 2006), cognitive, motivational and emotional aspects of human mental functioning, they influence language learning as a result of L2 learners' interaction with a particular time or situation (e.g., Dewaele, 2009; Dörnyei, 2009a, 2010a). Since the dynamic view towards learners, language and situation are incorporated into a new ID paradigm, the direction of ID research has been shifted to describe the dynamic interaction between learner variables and situational factors by applying Dynamic Systems Theory (DST) (e.g., Dewaele & Furnham, 1999; Mercer, Ryan, & Williams, 2012; Serafini, 2017) and identifying certain stabilised patterns of the dynamic interactions between learners, their languages and the learning environment (Dörnyei, 2010a).

Concerning existing IDs research in relation to L2 pronunciation acquisition, the studies focused on the contribution of cognitive and sociopsychological IDs on L2 learners' development of pronunciation skills have revealed that different learner characteristics differentially influence the comprehensibility and accentedness of L2 pronunciation (e.g., Pennington & Rogerson-Revell, 2019). Concerning cognitive IDs, the phonemic coding (Baker Smemoe & Haslam, 2013; Granena & Long, 2013; Saito et al, 2019), associative memory (Saito, 2017) and sound sequence recognition (Saito et al., 2019) of foreign language aptitude appear to have a positive influence on L2learners' development of phonology and fluency. In terms of motivational learner IDs, L2 learning motivation

(measured as a part of PLAB) was found to contribute to better fluency and comprehensibility (Baker-Smemoe & Haslam, 2013), aspiration to use English for future career development and achieve comprehensible L2 pronunciation (Saito et al., 2018), and strong Ideal L2 self were associated with comprehensibility. However, Nagle (2018a) did not find a link between L2 motivation (Ideal L2 self, Ought-to L2 self) and L2 pronunciation development. Lastly, with respect to emotional states, while language enjoyment appears to contribute to successful development of comprehensibility (Saito, et al., 2018), anxiety could be detrimental to progress in refining segmental accuracy (Baran-Łucarz, 2011) and comprehensibility (Saito et al., 2018). Although various findings from existing studies offer us insight on the unique roles of IDs, they are not sufficient to determine the complex relationship between learner IDs and the development of different dimensions of L2 pronunciation from the dynamic perspective (cf. Trofimovich & Kennedy, 2014; Trofimovich et al., 2014).

Importantly, learner IDs have been also explored in the area of L2 teaching. The studies of aptitude-treatment-interactions indicated that certain cognitive ID may be advantageous for learning L2 grammatical features through particular types of instruction (e.g., Yalçin & Spada, 2016). However, such a complex relationship between learner ID and the types of instruction has not been sufficiently explored in the area of L2 *pronunciation* pedagogy. In fact, while research on L2 pronunciation pedagogy has extensively investigated the effectiveness of pronunciation instruction for facilitating L2 learners' speech intelligibility, the existing studies have not covered the influence of learner IDs on the effectiveness of pronunciation instruction (Kissling, 2014).

Therefore, in light of the new dynamic conceptualisation of learner IDs (Dörnyei, 2010a, 2009b), two issues can be addressed. First, the existing L2 pronunciation studies played a crucial role in pointing out that cognitive, motivational and emotional aspects of IDs

differentially influence the L2 pronunciation learning process. However, focus of the research is rather sporadic and their conceptualisation of IDs lacks a dynamic and holistic perspective (Serafini, 2017). While in some cases researchers made effort to investigate one or two types of IDs among cognitive, motivational and emotional IDs, such as Baker Smemoe and Haslam (2013) who investigated motivation and aptitude and Saito et al. (2018) who investigated the differential influences of the L2 Motivation Self System and emotion (enjoyment, anxiety), no attempt has been made to explore the three subcomponents in an integrated manner. Therefore, in order to respond to the recent reconceptualisation of IDs and move current understanding of the influence of learner IDs on L2 pronunciation development forward, the current study attempted to conceptualise L2 pronunciation learning and learner IDs as dynamic systems and investigate the relationship between them. Secondly, despite the research evidence that learner IDs affect the rate and outcomes of L2 pronunciation learning (Hansen-Edwards, 2017; Pennington & Rogerson-Revell, 2019), the role of IDs in L2 pronunciation learning through L2 pronunciation instruction has not been fully explored. The research questions set in Chapter 2 are as follows:

Research Question 1: What is the strength and direction of the relationship between cognitive, motivational and emotional IDs of Japanese learners of English?

Research Question 2: To what extent do learners' L2 learning experience, cognitive, motivational, and emotional factors determine their L2 pronunciation measured via comprehensibility and accentedness?

Research Question 3: To what extent do L2 learning experience, cognitive, motivational, and emotional factors influence the development of L2 comprehensibility and accentedness when pronunciation instruction is provided?

Through answering these questions, the overall aim of the current study is to describe how the components of learners' IDs interact each other and dynamically interact with their L2

language systems (especially pronunciation). In order to answer to the research questions above, two studies were conducted (Study I for Research Question 1 and 2, and Study II for Research Question 3), both consisting of 51 Japanese learners of English in Japan (i.e., an EFL context).

5.2 Summary of the Results

5.2.1 Study I: ID Factors that Affect L2 Comprehensibility and Accentedness

In order to answer Research Questions 1 and 2, Study I cross-sectionally explored (a) the interrelationships among IDs, and (b) to what extent the ID variables and L2 experiential variables contributed to the participants' L2 comprehensibility and accentedness. For these purposes, 51 Japanese students' aptitude profiles (phonemic coding, associative memory, sound sequence recognition) were collected through LLAMA tests (Meara, 2005) and their L2 pronunciation specific motivation (Ideal L2 self, Ought-to L2 self, adapted from Baran-Łucarz, 2017) and L2 pronunciation specific anxiety (Baran-Łucarz, 2016) as well as past and recent L2 curricular and extracurricular learning experience (Freed et al., 2004) were collected via the questionnaire. In terms of the L2 pronunciation measures, a picture description task was used to elicit the participants' relatively less controlled, extemporaneous speeches (cf. Saito & Plonsky, 2019). Subsequently, the speech samples were holistically evaluated by native judges in terms of comprehensibility and accentedness (cf. Derwing & Munro, 1995).

The results of Research Question 1 indicated that there were no statically significant correlations between aptitude, motivation and anxiety. In fact, most of the correlation values were close to zero. However, several noteworthy relationships were observed. First, Ideal L2 self and Ought-to L2 self were differentially associated with anxiety. Ought-to L2 self was weakly but positively correlated with anxiety and Ideal L2 self was negatively correlated with anxiety. Secondly, different aptitude variables showed unique relationship with motivation

and anxiety. In fact, sound sequence recognition was negatively correlated with Ought-to L2 self and anxiety, and associative memory was positively correlated with Anxiety.

The results of Research Question 2 illustrated which ID factors were salient in shaping the participants' past L2 pronunciation learning trajectories. According to mixed-effects modelling analyses, the participants' amount of extracurricular L2 learning experience (activities they engaged in outside university classes such as informal conversations with natives or fluent non-native speakers) was the strongest predictor of accentedness (β =.49). The second strongest predictor was the degree of anxiety the participants experienced when learning L2 pronunciation (β = -.31). Lastly, the participants' explicit foreign language learning aptitude –phonemic coding was found to be a predictor of better accentedness scores (β = .29). Regarding comprehensibility, concurring with the case of accentedness, the mixed-effects modelling analyses revealed that the participants' amount of recent extracurricular L2 learning (β = .33) and the degree of anxiety towards L2 pronunciation learning (β = -.32) were predictors of comprehensibility. However, despite identifying phonemic coding as a contributor towards reduced accentedness, it was not a predictor of comprehensibility.

5.2.2 Study II: ID Factors that Affect L2 Pronunciation Learning Gain in Instruction Contexts

Study II aimed to investigate whether certain ID variables and L2 experiential variables would enhance the gain from pronunciation-focused instruction. For this purpose, the same 51 Japanese students from Study I participated in Study II as an experimental group and 12 Japanese students were newly added to serve as a control group. Similar to the research design of Study I, the participants' aptitude profiles (phonemic coding, associative memory, sound sequence recognition), L2 pronunciation specific motivation (Ideal L2 self, Ought-to L2 self), and L2 pronunciation specific anxiety and their past L2 curricular and extracurricular learning experience were collected via the questionnaire prior to the

intervention (Time 1). In addition, to determine the participants' amount of extracurricular and curricular experience during the intervention, an L2 experience questionnaire was conducted at the post-test phase (Time 2). In terms of the L2 pronunciation measures, in order to compare the participants' performance at Time 1, a picture description task was used to elicit the participants' extemporaneous speeches after they received the instruction (i.e., Time 2). To examine the improvements in comprehensibility and accentedness, the same native judges from Study I rated the collected speech samples.

According to a series of t-tests, the groups did not significantly differ in terms of their ID profiles and the amount of past and recent regular L2 learning experience inside and outside the classroom. For the experimental group, 50 minutes of weekly pronunciation instruction was provided for four weeks. Drawing on past pronunciation instruction research which revealed that the combination of articulatory- and auditory-based instruction is likely to be effective (e.g., Couper, 2003; Derwing & Munro, 2015; Saito & Plonsky, 2019), the contents of the instruction were comprised of three parts: (a) articulatory-based instruction: explicit explanation of the articulatory features of consonants (/b/, /v/, /z/, /ð/, /θ/, /r/, /l/, /s/, and /ʃ/) that had been found to impair listeners' comprehensibility in Saito's study (2011) were provided, (b) auditory-based instruction: using minimal pairs of the selected consonants (e.g., /r/ vs. /l/), the participants engaged in a set of phonetic discrimination tasks and recorded their own speech to evaluate their own pronunciation performance, and (c) meaning-oriented production practice. Throughout the meaning-oriented activity, recasts were used as a form of corrective feedback. In terms of the control group, the content of the instruction given to them was designed to focus on improving the participants' grammatical accuracy (e.g., Saito & Akiyama, 2018). The materials were chosen from the textbook for Reading part of TOEIC. The length and frequency of the instruction were the same as they were for the experimental group.

The results of the paired samples t-test indicated that only the experimental group made statistically significant improvements in both accentedness and comprehensibility. After the effectiveness of the pronunciation instruction was confirmed, mixed-effects modelling analyses were conducted to evaluate the extent to which the instruction itself contributed to the improvement in comprehensibility and accentedness. The results suggested that compared to the ID factors and past and recent L2 learning experience factors, the instruction was found to be the strongest predictor in both components of L2 pronunciation (i.e., β = .70 for accentedness, β = .82 for comprehensibility).

In terms of the interaction between the instruction and the IDs in predicting accentedness and comprehensibility development, statistically significant interactions were not observed. The results in Study I and Study II are summarised in Table 5.1.

Table 5.1

Summary of the results in Study I and Study II

Pronunciation dimensions	Prediction at the onset	Results of Study I (Time 1)	Results of Study II (Time 2)
Comprehensibility			
	• Recent extracurricular learning • Recent curricular learning • Associative memory • Ideal L2 self • Anxiety	• Recent extracurricular learning (.33) • Anxiety (-.32)	• No interaction was observed
Accentedness			
	• Recent extracurricular learning • Recent curricular learning • Phonemic coding • Sound sequence recognition • Anxiety	• Recent extracurricular learning (.49) • Anxiety (-.31) • Phonemic coding (.29)	• No interaction was observed

Note. The values in the brackets suggest the estimated beta values of the variables.

5.3 Discussion

This study aimed to test the dynamic relationship between L2 learners' self-regulatory loop of IDs (i.e., L2 learner system) and their language systems. To this end, Study I examined (a) the relationships among the components in the learner systems (Research Question 1), and (b) the relationship between L2 learner systems and their language systems

(Research Question 2). Study II investigated the most prominent components that were involved in the system change. In the following sections, first of all, I discuss how the participants' aptitude, motivation, and anxiety were interrelated with each other. Then, the contributions of these IDs towards the participants' accentedness and comprehensibility before and after the explicit phonetic instruction are discussed. This is followed by the discussion of why the interaction effect was not found between the IDs and the explicit phonetic instruction. Lastly, possible reasons why certain IDs did not either interact with the instruction nor influence the participants' pronunciation (accentedness and comprehensibility) are discussed.

5.3.1 The Complex Relationships between Aptitude, Motivation, and Anxiety

Based on the correlation analyses, the correlations among aptitude, motivation and anxiety were not statically significant. The results here suggest that the three domains of IDs functioned relatively independently from each other. However, two characteristics are found. First, while anxiety was positively associated with Ought-to L2 self, it was negatively correlated with Ideal L2 self. Secondly, Ought-to L2 self and anxiety were negatively correlated with sound sequence recognition and anxiety was positively linked to associative memory.

5.3.1.1 Motivation vs. Anxiety. Concerning the relationship between motivation and anxiety, the results obtained here support the empirical evidence reported in Teimouri's study (2016) of Ought-to L2 self, Ideal L2 self and their relationship with emotional factors. Teimouri (2016) identified that L2 learner's anxiety is positively connected with higher Ought-to L2 self than Ideal L2 self. Learners with higher Ought-to L2 self tend to be extrinsically motivated to learn an L2 so that they can meet temporal requirements such as the ones set by schools or satisfy the expectations of their parents. Therefore, their purpose for learning an L2 is to avoid any negative disciplinary consequences. Accordingly, they are

inclined to anticipate the possible negative outcomes and fear facing situation where they fail to meet the requirements. Such anticipation of learning outcomes and worry are also a source of language learning anxiety (e.g., Horwitz, 2010). In terms of Ideal L2 self, since L2 learners with higher Ideal L2 self have strong personal goals and hope to improve their L2 skills for future use, they are less likely to worry about others' evaluations and anticipate failure. Thus, learners with higher Ideal L2 self are inclined to be less anxious (Papi & Teimouri, 2014; Teimouri, 2016). Based on these accounts, the results found here indicate that the participants who had high Ought-to L2 self of improving their L2 pronunciation to meet the expectation/requirements may have been experiencing anxiety towards L2 pronunciation learning. By contrast, the participants who had high Ideal L2 self may have had a strong desire to improve their L2 for their future goals and may have been less anxious about evaluations from others and making mistakes.

5.3.1.2 Aptitude vs. Motivation and Anxiety. First, although not statistically significant, a relatively strong correlation was found between anxiety and associative memory (r = .211). This result indicated that the participants with higher anxiety had higher associative memory. According to psychologists (e.g., Eysenck & Calvo, 1992; Leitenberg, 1990; Meleshko & Alden, 1993), an anxious person is likely to use varieties of cognitive strategies than less anxious person in order to avoid the threat. Therefore, the participants who are anxious likely to put more cognitive efforts to learn L2 and such effort may have strengthened the function of associative memory.

Secondly, although not statistically significant, Ought to L2 self and anxiety were negatively related to sound sequence recognition (r = -.295, r = -251, respectively), suggesting that the participants who were highly anxious and highly motivated to meet expectation set by schools or their parents tended to have low sound sequence recognition ability. According to the Sparks and his colleagues (Ganschow & Sparks, 1996; Sparks et al.,

2000, 2009, 2011), L2 learners' motivational and emotional states can be affected by their perception of how well they are learning their L2 and their general learning ability. In other words, L2 learners who have strong learning abilities in their L1 are likely to have positive emotion and motivation towards L2 language learning. On the other hand, L2 learners whose academic ability is poor may constantly struggle to learn L2 and their experience of struggle and frustration may lead to the decrease of their motivation towards learning an L2 (e.g., Sparks et al., 2000, 2009). Therefore, the participants who had better sound sequence recognition may have experienced fewer struggles during the learning L2 process and such relatively positive learning experience may have led to positive emotions (less anxiety) and less concern with meeting the expectations of others (lower Ought-to L2 self) regarding L2 learning. However, such interpretations are tentative and further research is required to explore the relationships between aptitude measures, motivation and anxiety.

5.3.2 Complex and Dynamic Nature of L2 Pronunciation Learning

Based on the findings of Research Question 2 (the relationship between L2 learner systems and their language systems), three principles of DST can be attested to. The following overall remarks were formulated:

1. The results of the cross-sectional study (Study I) confirmed that focusing on one single domain of IDs may not be sufficient to capture the complex relationship between learner ID and their L2 performance. Thus, as DST proponents (e.g., Dörnyei, 2009; Larsen-Freeman & Cameron, 2008; Serafini, 2017) have argued, it is crucial to take a *holistic* approach to examine the contribution of IDs to L2 learning. In the case of the present thesis, it demonstrated that both cognitive (phonemic coding) and emotional (anxiety) IDs were associated with L2 pronunciation performance.

2. The DST assumes that learners' language systems are an assembly of interacting elements (e.g., Cooper, 1999). The current thesis found that phonemic coding was only associated with accentedness, yet the level of anxiety affected both accentedness and comprehensibility (in Study I). The differential results obtained through these two constructs support the conceptualisation of L2 learners' language systems using the framework of DST: L2 pronunciation should be conceptualised as a *multidimensional* language system.

3. The DST assumes that certain relationships between systems repeatedly emerges and establish stability. Such a stabilised state is called the attractor state (e.g., Larsen–Freeman, 2012). In the current thesis, anxiety and phonemic coding were found to be significant predictors of the improvements in two dimensions of L2 pronunciation at the initial condition of the systems' states (Study I). Therefore, in terms of L2 pronunciation learning, anxiety and phonemic coding could be the components of the systems' attractor states.

By focusing on the result of Research Question 2, the next section discusses the details of the complex influence of IDs on the development of L2 pronunciation.

5.3.2.1 L2 Accentedness. First of all, the thesis found that the ID variables and experiential factors that influenced the participants' accentedness scores at Time 1 were recent extracurricular learning experience, phonemic coding, and anxiety. Such results may reflect that these factors have played a crucial role in developing L2 phonetic categories and developing L2 knowledge in terms of L2 phonological rules in the participants' long-term memory throughout their approximately six years of English learning in an EFL setting. In

addition, as pointed out above, due to the relatively less controlled structure of the speech elicitation task, the participants' performance is assumed to mirror the extent to which their L2 pronunciation knowledge has been developed (from declarative knowledge to proceduralised or automatised knowledge).

In terms of the amount of extracurricular L2 learning experience, it remained the strongest predictor among the ID and experiential variables. Thus, the positive influence of L2 experience in the current thesis supports the Speech Learning Model, which posits that extensive exposure to accurate and rich exemplars is crucial for learners to perceive new sounds, and analyse and process them to form L2 phonetic categories in their long-term memory (Flege, 2009). The studies of L2 speakers in FL and immersion settings pointed out that the quality of the experience is crucial.

A number of studies have proven that the linguistic richness of the speech that L2 learners are exposed to is more important than the quantity of the speech for pronunciation acquisition (e.g., Derwing & Munro, 2013; Flege & Liu, 2001; Jia & Fuse 2007; Paradis, 2011; Unsworth 2013). Particularly in the context of FL classroom setting, Muñoz (2014) has stated that having interactions with native speakers would be significantly more effective at improving one's oral performance than years of L2 curricular learning (also see Saito & Hanzawa, 2016, 2018). Therefore, the current thesis reflects this as the L2 learning activities the participants engaged in outside the university classes included informal conversations with natives or fluent non-native speakers, deepening their English lexicogrammatical and phonological knowledge via online English learning platforms and mobile phone applications may have served as accurate and rich exemplars to the participants.

In addition, several EFL studies of L2 experience have found that the effect of L2 experience may differ depending on the proficiency level of L2 learners (Muñoz, 2008; Saito et al., 2019). For instance, Saito et al. (2019) examined the L2 pronunciation development of

Japanese learners of English over one academic year. They found that the learners' improvements in comprehensibility and various aspects of L2 pronunciation were owed to L2 experience and explicit aptitude at the end of the first semester. However, all the improvements observed at the end of the second semester were unrelated to L2 experience but an incidental learning aptitude (i.e., sound sequence recognition). The study observed that when the amount of L2 experience increased due to the changes in the learners' learning environment (e.g., the first year of university English class), the learners may have been able to refine certain phonological features required to attain minimally comprehensible English. However, when the learners reached a certain threshold, L2 input and use may have been no longer effective. Considering that the participants in the current thesis continued to benefit from extracurricular L2 experience, it can be inferred that the learners may have not reached to such a minimum level of L2 pronunciation proficiency and still had plenty of room to refine their pronunciation.

Another predictor that was found to influence the participants' accentedness was anxiety. These results suggest that anxiety was persistently affecting the participants' learning of L2 pronunciation. Anxiety is known to be a powerful factor that hinders successful SLA (e.g., Maclntyre & Gardner, 1989). A number of SLA studies that explored the relationship between L2 learners' degree of anxiety and achievement in various dimensions of L2 have reported its negative impact (Teimouri, Goetze, & Plonsky, 2019 for a meta-analysis) and this is not exceptional in terms of L2 pronunciation studies (Baran-Łucarz, 2011; Saito et al., 2018). The current thesis also confirmed such a consistent negative effect of anxiety with the use of *pronunciation specific* anxiety (Baran-Łucarz, 2016). According to studies of the impact of anxiety on human cognition (e.g., Maclntyre & Gardner, 1994), anxiety may (a) persistently impede the reception and processing of input in their mental operation and (b) their attention may not be sufficiently allocated to the output

procedure because some parts of their attention would be preoccupied by concern of negative evaluation from others (Eysenk, 1979). Thus, not only could the quality and amount of input processed be significantly lessened by anxiety but the quality of production could also suffer as a result, resulting in unsuccessful reductions of L1 features in the extemporaneous speech production.

The third variable that was found to affect the participants' accentedness is phonemic coding. According to aptitude theory, phonemic coding (a type of explicit learning aptitude) is assumed to play a crucial role in the input processing stage of the language-learning process: it helps learners to identify unfamiliar sounds and analyse them in detail (Kormos, 2013; Skehan, 2016). Therefore, it is considered to be particularly important in the acquisition of L2 phonological and orthographic systems. Accordingly, the studies of aptitude effect on L2 pronunciation learning have reported that better phonemic coding contributed to the improvement in phonological accuracy (e.g., Baker-Smemoe & Haslam, 2013; Saito, 2017; Saito, et al., 2019). Therefore, the current study added additional evidence that phonemic coding is consistently related to the development of L2 pronunciation accuracy. The participants who had greater phonemic coding in the current thesis may have been able to attend to unfamiliar sounds in the available input (which were not in their existing phonetic representation) and efficiently process these sounds, resulting in the production of less L1-influenced prosodic and segmental features.

Overall, in order for learners of English in an EFL context to successfully reduce their accentedness, they must rely on a special ability to analyse and process the incoming L2 sound (phonemic coding) and/or be extensively exposed to rich exemplars to enhance their perception and practice/expand their motor skills in communication (L2 extracurricular L2 experience; Saito & Hanzawa, 2016), and make an effort to minimise their level of anxiety (Saito et al., 2018).

5.3.2.2 L2 Comprehensibility. Similar to the case of accentedness, extracurricular L2 experience and anxiety were found to influence the participants' comprehensibility. According to the literature on L2 speech constructs, comprehensibility is related to the improvement of grammatical, lexical, temporal as well as phonological accuracy (Trofimovich & Isaacs, 2012). This means that learners must holistically strengthen various communicatively relevant L2 features: they not only have to enrich their L2 mental lexicon to produce accurate segmental and prosodic features, but also select appropriate vocabulary and grammar at the lexicogrammatical encoding stage. Furthermore, as reviewed above, in order to produce speech smoothly (i.e., less breakdown, higher speech rate), speech production processes must be effectively executed overall (Kormos, 2014). In other words, learning of *accurate* linguistic features (e.g., lexicogrammar and phonology) via instruction or input at the initial stage is crucial because they are responsible for the development of declarative knowledge, and a substantial amount of practice is essential to proceduralise and automatise the declarative knowledge (DeKeyser, 2015; Foote & Trofimovich, 2017). In this respect, it is not surprising to find that extracurricular L2 experience (exposure to the L2 through media, practicing of conversation at a language school, and informal conversations with native and non-native speakers) was found to be a strong predictor of comprehensibility scores. Similar to the case of accentedness, therefore, the results here again support the importance of using the target language through contact with users of target language (Muñoz, 2014; Saito & Akiyama, 2018; Saito & Hanzawa, 2016, 2018).

Furthermore, the positive relationship between comprehensibility and the exposure and use of L2 can be accounted for by the interactionist view of SLA (Gass & Mackey, 2015). The centre of this approach is that the language development is triggered by the range of feedback behaviours that interlocutors provide when communication breakdowns occur. When speech is unintelligible or incomprehensible, the interlocutors likely make a conscious

or intuitive effort to compensate for the lack of linguistic information by asking clarification requests, providing feedback or confirmation checks. Proponents of the interactionist approach consider that such negotiation of meaning draws L2 learners' attention to the problematic aspects of their interlanguage and unnoticed linguistic features (e.g., Gass & Mackey, 2015; Long, 1996). Therefore, drawing on the interactionist account, learners who spend more time having conversations frequently with native and non-native speakers may have preferentially developed a range of linguistic features that are relevant to successful communication in their private and academic settings (e.g., L1 influenced yet comprehensible prosodic and segmental production, adequate vocabulary and grammar use, as well as optimal fluency)(cf. Derwing & Munro, 2013 for the case of immersion setting).

With respect to the participants' level of anxiety, it was found to be a predictor of comprehensibility. Along with its negative impact on accentedness, it can be speculated that the participants with a high level of anxiety may have had difficulties in the cognitive processing of input especially in terms of receiving proper input and processing of the input in the memory (Maclntyre & Gardner, 1994). Considering the fact that the participants' level of anxiety affected both accentedness and comprehensibility, it can be interpreted that anxiety may not only disrupt the learning process of phonological features (i.e., creating of L2 phonetic representations, consolidating knowledge related to L2 phonological rules) but also lexicogrammatical features (i.e., expanding L2 lexical knowledge and L2 syntactical rules).

5.3.2.3 Interactions between IDs and Instruction. In order to examine the relationship between accentedness and comprehensibility in the participants' language systems, the interaction between the IDs variables and pronunciation instruction were examined. According to the past studies of aptitude treatment interactions, it has been indicated that explicit learning aptitude (especially related to analytic abilities) facilitates the L2 learning of acquisitionally difficult features when the learners receive form-focused

instruction (e.g., Yalçin & Spada, 2016 for an evidence of morphological acquisition). Therefore, it was predicted that the learners with greater phonemic coding ability would benefit more from the instruction and feedback (cf. Kissling, 2014; see 2.4.1 Predictions). However, the results revealed that there was no interaction between the instruction and phonemic coding ability. Thus, the prediction was rejected.

The reason for the insignificant interaction of phonemic coding could be attributed to the effect of instruction. The results in the Study II concur with what Erlam (2005) reported in her aptitude-treatment-interaction study which used a similar instruction method to that of Study II. In her study, three groups of participants received different types of instruction (deductive instruction, inductive instruction, and structured input) on direct object pronouns in French. The deductive instruction used in the deductive group involved explicit rule explanations and form-focused activities in order for them to apply the rules they learnt from the instruction. Subsequently, corrections were provided to the learners so that they could notice the errors they made and review the rules (see DeKeyser, 1998 for the approach). The learners' writing, reading, listening and speaking performance scores were linked to the aptitude scores (language analytic ability in MLAT, phonemic coding ability, and working memory). Although the overall learning gains the group obtained were greater than the other groups (inductive instruction, and structured input), the learners' aptitude did not account for these differences in gains. Compared to other ATI studies that found the modifying effect of explicit learning aptitude in the instructional gains (e.g., Ranta, 2002), Erlam (2005) observed that the deductive instruction (rule explanation and production practice) provided to the learners may have been beneficial to the learners regardless of the differences in the aptitude. Skehan (1989) also states that presenting linguistic features in a structured manner may level off the impact of varied individual differences among the learners. Therefore, intensive perceptual and production practice and reforming pronunciation knowledge via explicit

instruction may have equalised the differential degree of impact phonemic coding ability would have had on the participants.

5.3.2.4 Non-significant Predictors. Prior to the data collection, predictions were made in terms of the factors that could influence comprehensibility and accentedness. The predictions were made based on existing studies that have explored the impact of different types of L2 learning experience, aptitude, motivation and emotion. Overall, the predictions were partially supported but partially rejected. Therefore, this section focuses on the predictions that were not supported by the current study and discusses possible reasons for such results.

First, it was hypothesised that both recent curricular and extracurricular L2 learning were predictive of comprehensibility and accentedness. However, it turned out that only extracurricular L2 learning was associated with better L2 pronunciation. Since L2 experience studies in immersion settings have found the extensive exposure to the target language and meaning-oriented L2 use are the crucial determinants of comprehensibility and accentedness development (Derwing & Munro, 2013; Saito, 2015), it may be reasonable to consider that exposure to the L2 in largely informal contexts (exposure to English through various platforms, frequent and extensive interaction with native or fluent non-native speakers) may function similarly to L2 experience obtained in immersion setting and helped the participants develop both accurate L2 sound production (accentedness) and functionally effective L2 speech production (comprehensibility). From this point of view, a semester-long recent curricular learning experience (i.e., reading, grammar, writing, listening and activity-based speaking lessons) might not be sufficient to strengthen overall L2 pronunciation ability. Such weak and short-lived effects of general English curricular classes (focus on four skills) on L2 pronunciation have also been reported in previous studies on instructional types (e.g., Saito & Akiyama, 2016; Saito & Hanzawa, 2018). For example, a longitudinal study by Saito &

Hanzawa (2018) found that although form-focused classes that were designed to develop reading, listening, writing and speaking skills were offered at a university and helped learners to improving their word stress and intonation accuracy during the first semester, the effect of form-focused classes ceased during the second semester. Therefore, although the focus on grammar rule learning, comprehension training via listening or reading via speaking may help the learners expand the L2 knowledge to some extent, constant L2 use may be necessary when it comes to continuously improving production skills (Flege, 2009).

With respect to the aptitude factors, while a prediction that concerned a contribution from greater phonemic coding to better accentedness was supported, the link between better associative memory and higher comprehensibility, and the link between better sound sequence recognition and better accentedness were not supported. While such findings would attract various interpretations, one of them may be related to the participants' level of L2 pronunciation proficiency. According to the aptitude literature, associative memory would play a crucial role in making their utterances more fluent (better speech rate) by maintaining a vast amount of declarative knowledge and facilitating its transformation into proceduralised and automatised knowledge (cf. Skehan, 2016). Thus, in order for this ability to be fully taken advantage of by the learners, they must have a sufficient amount of L2 declarative knowledge that can be accessed and developed. Based on such a function of associative memory, its lack of significance in the current thesis could be because the participants had not consolidated a large amount of declarative knowledge of L2 lexical, grammatical and phonological information. In addition, while the longitudinal studies such as Saito et al. (2019) revealed a significant influence of sound sequence recognition on segmental and prosodic accuracies, the present thesis did not find such a relationship. This is in line with previous *cross-sectional* studies (Granena & Long, 2013 for naturalistic setting, Saito, 2017 for FL classroom setting) which did not find any link. As Saito et al. (2019) argue, a cross-

sectional design can only show the outcomes of learners' years of learning experience where multiple factors (including sound sequence recognition) may or may not have contributed to the progress at different time point. Therefore, it can be suspected that due to the cross-sectional nature of the dataset, the present thesis could not detect the influence of this aptitude.

Lastly, although the thesis predicted that Ideal L2 self could be a predictor of comprehensibility due to its facilitative role in learners' noticing of L2 linguistic features and getting more opportunities to use and be exposed to the target language (Saito et al., 2018), the present thesis did not find an influence of Ideal L2 self on comprehensibility. The result here aligns with what Nagle (2018a) found in his study: the study found that neither Ideal L2 self nor Ought-to L2 self were related to comprehensibility and accentedness. He suspected that the connection between motivation and L2 pronunciation acquisition may ascribe to the participants' views or priorities towards pronunciation learning. In his study, he found that except for one, the participants had not considered L2 pronunciation as a priority in L2 learning. Therefore, a direct influence of motivation on L2 acquisition may be realised only when L2 learners demonstrate a degree of interest or priority towards improving L2 pronunciation ability. From the current dataset, it is difficult to identify the participants' priorities or their metacognition towards L2 pronunciation learning. Hence, further investigation of participants' metacognition and phonological awareness may be required. However, judging from the weak positive links between Ideal L2 self and the amount of extracurricular L2 learning experience (r =.226, p =.054 in Study I), the learners who had relatively strong internalised motivation for learning L2 pronunciation tended to invest more time on using and listening to their L2. In this respect, the current study supports the positive link between motivation and the amount of time the learners spend using the target language that has been found in the previous literature (e.g., Boo et al., 2015) Therefore, in the case of

the current study, although greater Ideal L2 self did not directly predict L2 pronunciation acquisition, it indirectly contributed to the acquisition by increasing the amount of L2 experience.

5.4 Summary of the Chapter

The current thesis explored the changes in the learners' L2 comprehensibility and accentedness in relation to the learners' differential experience, foreign language aptitude, motivation, and anxiety profiles. According to the results of Study I, the following observations can be made. First of all, the participants were varied significantly in their degrees of foreign language aptitude (associative memory, phonemic coding, and sound sequence recognition), L2 pronunciation-specific motivation (Ideal L2 self, Ought-to L2 self), L2 pronunciation-specific anxiety, how often and for how long they used and were exposed to English outside the regular university English classes, and the number of regular English classes they enrolled in. The participants' who felt anxious about learning L2 pronunciation may have also felt a relatively strong obligation to develop better L2 pronunciation (i.e., Ought-to L2 self), while the learners who were less anxious about L2 pronunciation learning seemed to be more inclined to have an internalised desire to improve their L2 pronunciation. While the nature of the cognitive aspect of their IDs appears to be relatively independent of that of motivation and anxiety, the learners who felt strong expectations from others and anxiety had lower implicit learning aptitude scores (sound sequence recognition), while they had a positive association with explicit learning aptitude in terms of associative memory. Furthermore, the participants with higher internalised motivation tended to have poor phonemic coding ability.

While the participants had equally received approximately six years of formal English education in elementary, junior high and high school, they had developed their English comprehensibility and accentedness considerably differently owing to the differences in the

amounts of time they had spent using English and receiving input via conversation and media (outside the regular English classes they had at the university). The learners who had frequent opportunities to use and listen to English may have been able to steadily improve the accuracy of some phonological features and expand their lexicogrammatical knowledge. In addition, even with relatively limited amount of L2 use and exposure, the participants who had greater phonemic coding ability may have been more able to efficiently notice and analyse unfamiliar sounds from available linguistic information around them and develop the ability to accurately produce segmental and prosodic aspects of English. However, the participants who had relatively high degrees of anxiety towards refining their English pronunciation could have struggled to improve their pronunciation ability arguably because their constant concern about how good their pronunciation was and/or how their pronunciation is perceived/judged by others might have hampered the attention they could otherwise allocate to accessing their memory to produce utterances or noticing linguistic information.

Chapter 6 Conclusion

In the final chapter, the findings from Study I and Study II are summarised. This is followed by a discussion of the theoretical, methodological and pedagogical implications of the results obtained. Lastly, the chapter discuss the limitations of the study and potential directions for further research.

6.1 General Findings

Since IDs have been traditionally conceptualised as components that are independent from each other and monolithic, different constructs of individual differences have not been examined in an integrated manner (Dörnyei & Ryan, 2015). Departing from such a classic paradigm of individual differences, the present thesis adopted the principles of DST which assumes that different components of learner characteristics interact with each other in a particular learning context and influence the development of L2 in a complex manner. Despite the theoretical development of IDs as dynamic systems, researchers tend to focus on single component of IDs (e.g., either cognitive or motivational ID) and overlook potential influence of other IDs to the focused ID and L2 performance (e.g., Serafini, 2017). To overcome such a methodological limitation and attest the complex and dynamic view of IDs, this thesis attempted to holistically describe the relationship among cognitive, motivational and emotional IDs (i.e., Research Question 1) and examine the complex and dynamic natures of their influence on (a) L2 learners' comprehensibility and accentedness (i.e., Research Question 2), and (b) their learning gains through pronunciation instruction (i.e., Research Question 3).

A cross-sectional study reported in Study I was designed to answer Research Question 1 and 2. Research Question 1 was set to understand the relationship among the Japanese EFL learners' cognitive, motivational and emotional domains of IDs, whereas Research Question

2 was set to examine how those interacting IDs and the quality and quantity of L2 learning experience in an EFL setting influence L2 comprehensibility and accentedness. To this end, the learners' IDs profiles of foreign language learning aptitude (phonemic coding, associative memory, and sound sequence recognition), L2 pronunciation learning motivation and anxiety, and past and recent curricular and extracurricular L2 learning experience were collected. and linked to the degree of L2 comprehensibility and accentedness collected. Concerning Research Question 1, the results showed that there was no statistically significant correlation. However, while most of the correlation values were close to zero, some correlation values (r > 2.) indicated an interaction between motivation and anxiety, aptitude and anxiety, and aptitude and motivation. First, anxiety was negatively correlated with Ideal L2 self (r =-.288, p = .04). Secondly, Ought-to L2 self showed some degree of a negative correlation with sound sequence recognition (r = -.295, p = .036) and anxiety also showed a negative correlation with sound sequence recognition (r = -.251, p = .076). In addition, anxiety was positively correlated with associative memory (r = .211, p = .138).

With respect to Research Question 2, based on the previous L2 pronunciation research that concerned with L2 learners' aptitude, motivation, and anxiety profiles, the prediction was made. According to the results of Study I, the prediction was partially confirmed and partially rejected: comprehensibility was predicted by the amount the learners' recent extracurricular and the level of anxiety towards learning L2 pronunciation, while accentedness was predicted by their recent extracurricular learning, phonemic coding, and the level of anxiety towards learning L2 pronunciation.

Based on the results obtained in the cross-sectional study (Study I), a longitudinal study was conducted as Study II. The focus of Study II was to answer Research Question 3 that explores the complex and dynamic relationship between IDs and the participants' gain in comprehensibility and accentedness through the pronunciation instruction. In other words,

the Study II examined the possibility of the interaction effects between IDs variables and pronunciation instruction and their impacts on accentedness and comprehensibility. After four weeks of L2 pronunciation learning, a significant change in the comprehensibility and accentedness scores were observed among the experimental group while the control group did not make statistically significant improvements. It is important to note that the current thesis used the less-controlled, spontaneous speech task to measure the extent to which the participants could access their explicit pronunciation knowledge in a timely manner while their focus is on producing meaningful utterances (cf. Saito & Plonsky, 2019). Since the participants of the experimental group demonstrated a tangible improvement in both comprehensibility and accentedness, the result confirmed that explicit phonetic instruction that consists of articulatory- and auditory-based instruction would facilitate L2 learners' noticing and analysing of the L2 features and further consolidating their existing declarative knowledge for proceduralisation. Subsequently, the results of mixed effects modelling with Time 1 and Time 2 scores of comprehensibility and accentedness revealed no interactions between the IDs and the instruction, suggesting that none of the IDs and experiential variables helped the participants benefit more from the instruction.

6.2 Pedagogical Implications

According to the results of the two studies, two pedagogical implications can be addressed. First, since the degree of pronunciation learning anxiety has found to negatively influence the participants' development of L2 pronunciation, the content of activities and the types of instruction can be modified to avoid the potentially anxiety-inducing situation or to reduce the level of anxiety which L2 learners have been feeling. In order to alleviate the fear and avoid possible fear-inducing situations, teachers may attempt to focus on fostering learning enjoyment and create an atmosphere in which teachers and peers all have a respectful, understanding and tolerant attitude towards making mistakes. This can be achieved by creating a friendly and pleasant classroom atmosphere in which learners are advised to use the target

language frequently and unrestrained (Dewaele et al., 2018). Anxiety may be also mitigated by providing the learners with a number of communicative activities in the low-risk situations where they complete tasks in pairs rather than in a potentially more anxiety-inducing setting in which their performance is observed by large groups of peers and teachers (e.g., Baran-Lucas, 2014).

Secondly, L2 learners' self-confidence can be compromised under conditions such as when they interpret the experience of communication breakdowns with peers and native speakers as the result of flaws in their use of language, and receiving explicit corrective feedback from the teachers in front of the peers in a classroom may provoke the learner's embarrassment (e.g., Teimouri, 2016). Therefore, teachers may want to consider using different types of feedback (e.g., negative vs. positive feedback) depending on the students' needs and attitudes, when reacting to their pronunciation errors. Furthermore, researchers have also suggested that teachers' support for the learners' effective self-training opportunities could also help improve the learners' self-confidence and reduce the degree of anxiety they feel during the use of target language. This can be done by encouraging them to practice pronunciation by themselves and providing the learners with various pronunciation learning strategies they can use outside the classroom (e.g., Sardegna, 2011).

6.3 Theoretical Implications

The findings reported in the present thesis could offer crucial theoretical implications. As pointed out by Serafini (2017), previous ID research has been often focused on single components of IDs and had not paid attention to other components. Hence, one of the aims of the current thesis was to overcome the conceptual limitation of IDs research by conceptualising IDs through the principles of the Dynamic Systems Theory (Dörnyei, 2009a). The results of the two studies in the present thesis support the complex roles of learner IDs in L2 learning (e.g., Dörnyei, 2010a). The current thesis demonstrated that learner IDs varied greatly between each participant, and that their L2 pronunciation learning was affected by different components of IDs. In particular, the current thesis concurs with the previous ID

research in terms of the positive influence of L2 experience, phonemic coding and the negative influence of learners' anxiety on L2 pronunciation learning (e.g., Saito et al., 2018). However, in terms of the influence of associative memory, sound sequence recognition and motivation variables (Ideal L2 self) on learners' L2 pronunciation, while previous studies did find statistically significant link, the present thesis did not. Such discrepancies between previous studies and the current thesis may be ascribed to the influence of various other learner-internal and external factors involved in the participants' L2 pronunciation learning, suggesting that the influence of IDs is not stable but subject to the context. Such dynamic nature of IDs hinted at in the results of the thesis support the latest conceptualisation of IDs that assumes that the relevancy and impact of certain IDs components on L2 learning differ depending on the stages and context of the L2 learning (e.g., Larsen-Freeman, 2014; Kinginger, 2008). In addition, as researchers of ID have stressed that exclusive focus on a single predictor may cause the findings to be oversimplified and cause researchers to overlook the other crucial variables or underlying relationships among the variables (Ackerman, 2003; Ellis, 2006). Indeed, if the thesis had focused on only one aspect of learner IDs (e.g., aptitude), the relationship between other ID components and L2 pronunciation would not have been able to be identified. In other words, the inclusion of both cognitive (aptitude) and sociopsychological (motivation and anxiety) enabled the thesis to capture the complex contribution of various factors towards L2 pronunciation development. Therefore, the findings of the current thesis demonstrated the importance of taking a holistic approach towards investigating the relationships between learner IDs and various domains of L2 learning.

6.4 Methodological Implications

Aside from the implications for theory, the present study also has some implications for research methodology. First of all, unlike other ID studies that have adopted anxiety

questionnaires that focus on English learning in general, the current thesis used the items from the *pronunciation specific* anxiety questionnaire (Baran-Łucarz, 2016). Such a methodological decision was encouraged by SLA scholars' use of skill-specific scales (Elkhafaifi, 2005 for the Foreign Language Listening Anxiety Scale; Cheng, 2004 for the Second Language Writing Anxiety Scale) and the research evidence that the learners' concern about their pronunciation had been found to predict better L2 pronunciation performance (Flege et al.,1995; Moyer, 1999). Indeed, the importance of capturing the nuanced picture of learners' anxiety was confirmed by the robust and negative influence of pronunciation-specific anxiety on the participants' L2 pronunciation found in the present thesis.

Therefore, despite the popularity of general motivation and anxiety questionnaire, future research may benefit from eliciting the learners' feeling of anxiety that are specific to the skill in question.

6.5 Limitations and Directions for Future Research

To close, I would like to acknowledge a number of limitations in the present thesis, which could also serve to address the potential avenues for the future research. First limitation of the current thesis is concerned with the measurements of experience and ID variables. Concerning L2 experience, the participants' past and recent L2 experience profiles was surveyed through a questionnaire (i.e., Language Contact Profile). Although the use of self-reported data is common in this field (cf. Derwing & Munro, 2013), this means that the participants had to recall the number of classes they took long time ago (e.g., at elementary school or at cram schools). Such self-reported data might not accurately reflect what the participants actually experienced. Hence, the findings related to L2 experience in this study need to be treated as tentative. In order to more accurately measure the quantity and quality of L2 experience, some researchers have used different approach/technique such as asking participants to record every interaction they had through mobile phones (Surtees, 2013) or

tracking participants' interactions via electronic language logs (Ranta & Meckelborg, 2013). Since such technology-based approaches may offer more accurate evaluations of actual language experience, further research with such innovative instruments to measure L2 experience is called for to add further evidence of impact of recent L2 learning experience on L2 speech acquisition.

Concerning the cognitive aspect of IDs, following previous L2 pronunciation studies (e.g., Saito et al., 2019), the current study used the LLAMA test as the instrument to gauge participants' foreign language learning aptitude. However, despite its popularity among SLA studies, several scholars have casted doubt on its reliability (e.g., Bokander & Bylund, 2020; Singleton, 2017), suggesting that the results obtained via the LLAMA test need to be treated cautiously. For this reason, I would like to emphasize that the findings in the current study related to the aptitude variables are tentative and further verification would be required. In addition, as I cited in the review of literature, other aptitude tests such as the CANAL-F test (Grigorenko et al., 2000) and Hi-LAB (Doughty et al., 2010) are available for scrutinizing L2 learners' language learning aptitude. Therefore, to further attest the relationship between L2 pronunciation learning process and foreign language learning aptitude, it is important to replicate the study with the tests which reliabilities are stringently verified.

In relation to the foreign language aptitude, another major shortcoming of this thesis is the exclusion of other key variables of general cognitive control such as phonological short-term memory (MacKay et al., 2001; Robinson, 2005), working memory (e.g., DeKeyser & Koeth, 2011; Kormos, 2013; Wen et al., 2017) and attention control (Schmidt, 2001; Segalowitz & Frenkiel-Fishman, 2005). In terms of L2 pronunciation acquisition, such stronger cognitive control may be particularly important for L2 sound processing (e.g., Darcy et al., 2014) For instance, L2 learners with greater inhibitory control may be better able to hinder the learners' automatic response to L1 and lead to pay attention to L2 sounds (Lev-Ari

& Peperkamp, 2014), while L2 learners with a larger capacity of phonological short-term memory may be able to notice the phonetic differences between L1 and L2 due to its longer storage of sound information (Darcy et al., 2015). Furthermore, studies of working memory have suggested that the contribution of working memory capacity to L2 learning may differ depending on the learners' proficiency level (Hu et al., 2013). Operation of working memory seems to be more crucial for L2 learners in the early stage of acquisition while those who are in the advance stage require other factors such as music aptitude (e.g., Nardo & Reiterer, 2009) or personality (e.g., Dörnyei, 2006). Thus, while the current thesis exclusively focused on foreign language aptitude, including of the variables of cognitive control may advance our understanding of the relationship between foreign language aptitude, cognitive control, and L2 pronunciation learning.

Thirdly, although the purpose of the current study was to capture the complex relationship of different IDs in relation to L2 pronunciation through the DST lends, the thesis only covered a minimum number of key IDs that are uniquely relevant to the context of language classrooms. In order to fully apply the principle of DST and draw a full-fledged picture of the relationship between IDs and L2 pronunciation learning, the future DST studies should include as many factors as possible such as working memory (e.g., Hu et al., 2012), musical aptitude (Gilleece, 2006; Li & DeKeyser, 2017), and personality profiles (e.g., Hu & Reiterer, 2009).

Fourthly, the current study used a speaking task (i.e., picture description task) to evaluate the participants' L2 pronunciation performance. Since speakers' speaking style and type of their knowledge drawn to produce a speech (i.e., controlled vs. spontaneous knowledge) from a task may vary depending on the nature of tasks and condition of its administration (e.g., controlled vs. semi-structured task vs. fully free tasks), it is crucial for L2 speech research to use multiple speech tasks to accurately assess speakers' performance

from various angles (see Saito & Plonsky, 2019 for more discussion of task type in relation to L2 declarative knowledge). Therefore, the combination of the control and spontaneous speech elicitation tasks may enable the future L2 pronunciation instruction studies to tap into the learners' degree of declarative knowledge (from the performance of the former task), and proceduralized or automatised knowledge (from the performance of the latter task) developed from the instruction and L2 learning experience they have during the intervention.

Fifthly, although the results of the correlation analyses hinted that the learners with a higher degree of Ideal L2 self had a tendency to spend more time to practice L2 outside the regular university classroom, the current thesis failed to find the direct link between motivation and L2 acquisition (cf., Saito et al., 2018). Since the current thesis used the questionnaire as the only method to elicit their motivation towards learning L2 pronunciation, the interpretation of the results is limited to the results of the statistical analyses. In fact, using a mixed-method approach, Nagle (2018a) could tap into the participants' metacognition about L2 pronunciation (i.e., it's importance to the participants relative to the other domains of L2) and their aims of L2 pronunciation learning via the interview. Thus, in order to overcome such a limitation, future studies may benefit from the adaptation of mixed-method design.

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Appendices

Appendix A: Speech Tasks

Story A

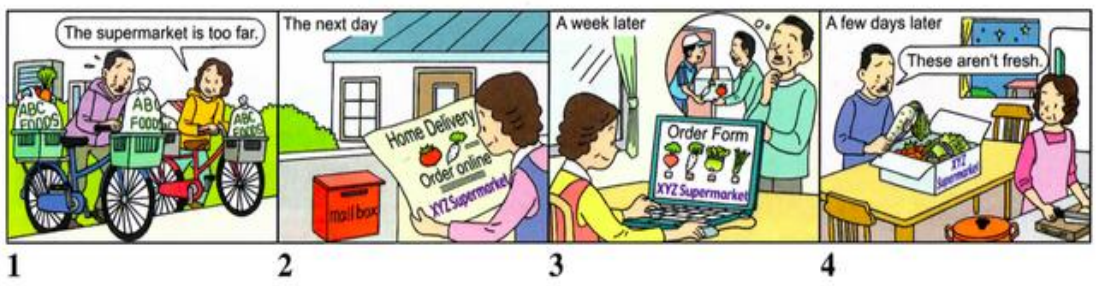
You have **one minute** to prepare.
This is a story about a girl who wanted a smartphone.
You have **two minutes** to narrate the story.

Your story should begin with the following sentence:
One day, a girl was at home with her parents.

Story B

You have **one minute** to prepare.
This is a story about an elderly couple who lived far away from the nearest supermarket.
You have **two minutes** to narrate the story.

Your story should begin with the following sentence:
One day, an elderly couple was coming home from the supermarket.



Appendix B: Training Scripts and a Sample of Rating Screen

A. Training scripts (adopted from Trofimovich & Isaacs, 2012)

- Comprehensibility: The term comprehensibility refers to how difficult it is to understand what the speaker is saying. If you can understand what the speaker is describing (a story) easily regardless of his or her accent, the speech is regarded highly comprehensible. However, if you need effort to understand the speech or barely catch what is being said, then his or her speech has low comprehensibility.

- Accentedness: The term refers to how heavily a speaker's speech is affected by his/her native language. If you hear any features that are not in the native variety, then the speech has high accentedness.

B. A Sample from the rating booklet

- Comprehensibility

Difficult to understand	1	2	3	4	5	6	7	8	9	Easy to understand

- Accentedness

Heavily accented	1	2	3	4	5	6	7	8	9	Not accented at all

Appendix C: The Details of R syntax Used for the Analyses Conducted in Study I and Study II

1. A Crosssectional Investigation of Second Language Pronunciation Learning as the Dynamic System (Study I)

Name of the dataset: Crosssectional_51

Number of participants: 51

Names of depending variables: Accentedness, Comprehensibility

Names of fixed effects: Soundsequencerecognition, Associativememory, Phonemiccoding, IdealL2self, OughttoL2self, Anxiety, Pastcurricular, Pastextracurricular, Recentcurricular, Recentextracurricular (the scores are standardised)

Names of Random effects: TaskStoryAstoryB

Package used: Ime4

Table 1

R Syntax of the Mixed Effect-modelling Analysis for Accentedness (Study I)

List of models and model comparisons		Code
Model No.	Variable included in the model	
Accent_0	Task (intercept)	Accent_0 <- lmer(Accentedness ~ (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
1	Sound sequence recognition	Accent_1<- lmer(Accentedness ~ Soundsequencerecognition + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
2	Associative memory	Accent_2<- lmer(Accentedness ~ Associativememory + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
3	Phonemic coding	Accent_3<- lmer(Accentedness ~ Phonemiccoding + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
4	Ideal L2 self	Accent_4<- lmer(Accentedness ~ IdealL2self + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
5	Ought to L2 self	Accent_5<- lmer(Accentedness ~ OughttoL2self + (1 | TaskStoryA1storyB), data = Crosssectional_51, REML=F)
6	Anxiety	Accent_6<- lmer(Accentedness ~ Anxiety + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
7	Past curricular English learning	Accent_7<- lmer(Accentedness ~ Pastcurricular + (1 | TaskStoryA1storyB), data = Crosssectional_51, REML=F)
8	Past extracurricular English learning	Accent_8<- lmer(Accentedness ~ Pastextracurricular + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
9	Recent curricular English learning	Accent_9<- lmer(Accentedness ~ Recentcurricular + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)

10	Recent extracurricular English learning	Accent_10<- lmer(Accentedness ~ Recentextracurricular + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
10.1	Recent extracurricular English learning+ Recent English learning inside the classroom	Accent_10.1<- lmer(Accentedness ~ Recentextracurricular + Phonemiccoding + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
10.2	Recent extracurricular English learning+ Anxiety	Accent_10.2<- lmer(Accentedness ~ Recentextracurricular + Anxiety + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
10.3	Recent extracurricular English learning + Recent English learning inside the classroom	Accent_10.3<- lmer(Accentedness ~ Recentextracurricular + Recentcurricular + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
10.2.1	Recent extracurricular English learning + Phonemic coding + Anxiety	Accent_10.2.1<- lmer(Accentedness ~ Recentextracurricular + Phonemiccoding + Anxiety + (1 | TaskStoryAstoryB), data = Crosssectional_51_,REML=F)
Model comparisons		
Model 0 vs. Model 1		anova(Accent_0,Accent_1)
Model 0 vs. Model 2		anova(Accent_0,Accent_2)
Model 0 vs. Model 3		anova(Accent_0,Accent_3)
Model 0 vs. Model 4		anova(Accent_0,Accent_4)
Model 0 vs. Model 5		anova(Accent_0,Accent_5)
Model 0 vs. Model 6		anova(Accent_0,Accent_6)
Model 0 vs. Model 7		anova(Accent_0,Accent_7)
Model 0 vs. Model 8		anova(Accent_0,Accent_8)
Model 0 vs. Model 9		anova(Accent_0,Accent_9)
Model 0 vs. Model 10		anova(Accent_0,Accent_10)
Model 10 vs. Model 10.1		anova(Accent_10,Accent_10.1)
Model 10 vs. Model 10.2		anova(Accent_10,Accent_10.2)
Model 10 vs. Model 10.3		anova(Accent_10,Accent_10.3)
Model 10.1 vs. Model 10.1.2		anova(Accent_10.1, Accent_10.1.2)
Output of the final model		Summary (Accent_10.1.2)
R^2 value of the final model		r.squaredGLMM(Accent_10.1.2)

Confidence Intervals of the beta values in the final model	confint(Accent_10.1.2, level = 0.95)

Table 2

R Syntax of the Mixed Effect-modelling Analysis for Comprehensibility (Study I)

List of models and model comparisons		Code
Model No.	Variable included in the model	
0	Task (intercept)	Comp_0 <- lmer(Comprehensibility ~ (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
1	Sound sequence recognition	Comp_1<- lmer(Comprehensibility ~ Soundsequencerecognition + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
2	Associative memory	Comp_2<- lmer(Comprehensibility ~ Associativememory + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
3	Phonemic coding	Comp_3<- lmer(Comprehensibility ~ Phonemiccoding + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
4	Ideal L2 self	Comp_4<- lmer(Comprehensibility ~ IdealL2self + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
5	Ought to L2 self	Comp_5<- lmer(Comprehensibility ~ OughttoL2self + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
6	Anxiety	Comp_6<- lmer(Comprehensibility ~ Anxiety + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
7	Past curricular English learning	Comp_7<- lmer(Comprehensibility ~ Pastcurricular + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
8	Past extracurricular English learning	Comp_8<- lmer(Comprehensibility ~ Pastextracurricular + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
9	Recent curricular English learning	Comp_9<- lmer(Comprehensibility ~ Recentcurricular + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
10	Recent extracurricular English learning	Comp_10<- lmer(Comprehensibility ~ Recentextracurricular + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)

10.1	Recent extracurricular English learning+ Recent English learning inside the classroom	Comp_10.1<- lmer(Comprehensibility ~ Recentextracurricular + Recentcurricular + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
10.2	Recent extracurricular English learning+ Anxiety	Comp_10.2<- lmer(Comprehensibility ~ Recentextracurricular + Anxiety + (1 | TaskStoryAstoryB), data = Crosssectional_51, REML=F)
Model comparisons		
Model 0 vs. Model 1		anova(Comp_0,Comp_1)
Model 0 vs. Model 2		anova(Comp_0,Comp_2)
Model 0 vs. Model 3		anova(Comp_0,Comp_3)
Model 0 vs. Model 4		anova(Comp_0,Comp_4)
Model 0 vs. Model 5		anova(Comp_0,Comp_5)
Model 0 vs. Model 6		anova(Comp_0,Comp_6)
Model 0 vs. Model 7		anova(Comp_0,Comp_7)
Model 0 vs. Model 8		anova(Comp_0,Comp_8)
Model 0 vs. Model 9		anova(Comp_0,Comp_9)
Model 0 vs. Model 10		anova(Comp_0,Comp_10)
Model 10 vs. Model 10.1		anova(Comp_10,Comp_10.1)
Model 10 vs. Model 10.2		anova(Comp_10,Comp_10.2)
Output of the final model		Summary (Comp_10.2)
R^2 value of the final model		r.squaredGLMM(Comp_10.2)
Confidence Intervals of the beta values in the final model		confint(Comp_10.2, level = 0.95)

2. A Longitudinal investigation of Individual Differences in Predicting L2 Pronunciation Development through the Pronunciation Instruction (Study II)

- **Name of the dataset**: Longitudinal_51 for the experimental group, Longitudinal_12 for the control group
- **Number of participants**: 51 for the experimental group, 12 for the control group
- **Names of depending variables**: Accentedness (both Time 1 score and Time 2 score), Comprehensibility (both Time 1 score, Time 2 score)
- **Names of fixed effects**: Soundsequencerecognition, Associativememory, Phonemiccoding, IdealL2self, OughttoL2self, Anxiety, Pastcurricular, Pastextracurricular, Recentcurricular, Recentextracurricular (the scores are standardised)
- **Names of Random effects**: Subject
- **Package used**: lme4

Table 3

Inspection of the Effect of Instruction on L2 pronunciation

L2 Pronunciation	Code
Accentedness	Instruction_Accentedness <- lmer(Accentedness ~ Time + (1 | Subject), data = Longitudinal_51, REML=F)
Comprehensibility	Instruction_Comprehensibility <- lmer(Comprehensibility~ Time + (1 | Subject), data = Longitudinal_51, REML=F)

Table 4

The Interactions between the Instruction and IDs for Accentedness

Experimental Group

Model No.	Variable included in the model	Code
1	Sound sequence recognition	Accent_Interaction_1<- lmer(Accentedness ~ Time*Soundsequencerecognition + (1 | Subject), data = Longitudinal_51, REML=F)
2	Associative memory	Accent_ Interaction_2<- lmer(Accentedness ~ Time*Associativememory + (1 | Subject), data = Longitudinal_51, REML=F)
3	Phonemic coding	Accent_ Interaction_3<- lmer(Accentedness ~ Time*Phonemiccoding + (1 | Subject), data = Longitudinal_51, REML=F)
4	Ideal L2 self	Accent_ Interaction_4<- lmer(Accentedness ~ Time*IdealL2self + (1 | Subject), data = Longitudinal_51, REML=F)
5	Ought to L2 self	Accent_ Interaction_5<- lmer(Accentedness ~ Time*OughttoL2self + (1 | Subject), data = Longitudinal_51, REML=F)
6	Anxiety	Accent_ Interaction_6<- lmer(Accentedness ~ Time*Anxiety + (1 | Subject), data = Longitudinal_51, REML=F)

7	Past curricular English learning	Accent_ Interaction_7<- lmer(Accentedness ~ Time*Pastcurricular + (1 | Subject), data = Longitudinal_51, REML=F)
8	Past extracurricular English learning	Accent_ Interaction_8<- lmer(Accentedness ~ Time*Pastextracurricular + (1 | Subject), data = Longitudinal_51, REML=F)
9	Recent curricular English learning	Accent_ Interaction_9<- lmer(Accentedness ~ Time*Recentcurricular + (1 | Subject), data = Longitudinal_51, REML=F)
10	Recent extracurricular English learning	Accent_ Interaction_10<- lmer(Accentedness ~ Time*Recentextracurricular + (1 | Subject), data = Longitudinal_51, REML=F)

Control Group

Model No.	Variable included in the model	Code
1	Sound sequence recognition	Accent_Interaction_Control_1<- lmer(Accentedness ~ Time*Soundsequencerecognition + (1 | Subject), data = Longitudinal_12, REML=F)
2	Associative memory	Accent_Interaction_Control_2<- lmer(Accentedness ~ Time*Associativememory + (1 | Subject), data = Longitudinal_12, REML=F)
3	Phonemic coding	Accent_Interaction_Control_3<- lmer(Accentedness ~ Time*Phonemiccoding + (1 | Subject), data = Longitudinal_12, REML=F)
4	Ideal L2 self	Accent_Interaction_Control_4<- lmer(Accentedness ~ Time*IdealL2self + (1 | Subject), data = Longitudinal_12, REML=F)
5	Ought to L2 self	Accent_Interaction_Control_5<- lmer(Accentedness ~ Time*OughttoL2self + (1 | Subject), data = Longitudinal_12, REML=F)
6	Anxiety	Accent_Interaction_Control_6<- lmer(Accentedness ~ Time*Anxiety + (1 | Subject), data = Longitudinal_12, REML=F)
7	Past curricular English learning	Accent_Interaction_Control_7<- lmer(Accentedness ~ Time*Pastcurricular + (1 | Subject), data = Longitudinal_12, REML=F)
8	Past extracurricular English learning	Accent_Interaction_Control_8<- lmer(Accentedness ~ Time*Pastextracurricular + (1 | Subject), data = Longitudinal_12, REML=F)
9	Recent curricular English learning	Accent_Interaction_Control_9<- lmer(Accentedness ~ Time*Recentcurricular + (1 | Subject), data = Longitudinal_12, REML=F)

10	Recent extracurricular English learning	Accent_Interaction_Control_10<- lmer(Accentedness ~ Time*Recentextracurricular + (1 | Subject), data = Longitudinal_12, REML=F)

Table 5

The Interactions between the Instruction and IDs for Comprehensibility

Experimental Group		
Model No.	Variable included in the model	Code
1	Sound sequence recognition	Comp_Interaction_1<- lmer(Comprehensibility ~ Time*Soundsequencerecognition + (1 | Subject), data = Longitudinal_51, REML=F)
2	Associative memory	Comp _ Interaction_2<- lmer(Comprehensibility ~ Time*Associativememory + (1 | Subject), data = Longitudinal_51, REML=F)
3	Phonemic coding	Comp _ Interaction_3<- lmer(Comprehensibility ~ Time*Phonemiccoding + (1 | Subject), data = Longitudinal_51, REML=F)
4	Ideal L2 self	Comp _ Interaction_4<- lmer(Comprehensibility ~ Time*IdealL2self + (1 | Subject), data = Longitudinal_51, REML=F)
5	Ought to L2 self	Comp _ Interaction_5<- lmer(Comprehensibility ~ Time*OughttoL2self + (1 | Subject), data = Longitudinal_51, REML=F)
6	Anxiety	Comp _ Interaction_6<- lmer(Comprehensibility ~ Time*Anxiety + (1 | Subject), data = Longitudinal_51, REML=F)
7	Past curricular English learning	Comp_Interaction_7<- lmer(Comprehensibility ~ Time*Pastcurricular + (1 | Subject), data = Longitudinal_51, REML=F)
8	Past extracurricular English learning	Comp _ Interaction_8<- lmer(Comprehensibility ~ Time*Pastextracurricular + (1 | Subject), data = Longitudinal_51, REML=F)
9	Recent curricular English learning	Comp _ Interaction_9<- lmer(Comprehensibility ~ Time*Recentcurricular + (1 | Subject), data = Longitudinal_51, REML=F)
10	Recent extracurricular English learning	Comp _ Interaction_10<- lmer(Comprehensibility ~ Time*Recentextracurricular + (1 | Subject), data = Longitudinal_51, REML=F)
Control Group		

Model No.	Variable included in the model	Code
1	Sound sequence recognition	Comp_Interaction_Control_1<- lmer(Comprehensibility ~ Time*Soundsequencerecognition + (1 | Subject), data = Longitudinal_12, REML=F)
2	Associative memory	Comp_Interaction_Control_2<- lmer(Comprehensibility ~ Time*Associativememory + (1 | Subject), data = Longitudinal_12, REML=F)
3	Phonemic coding	Comp_Interaction_Control_3<- lmer(Comprehensibility ~ Time*Phonemiccoding + (1 | Subject), data = Longitudinal_12, REML=F)
4	Ideal L2 self	Comp_Interaction_Control_4<- lmer(Comprehensibility ~ Time*IdealL2self + (1 | Subject), data = Longitudinal_12, REML=F)
5	Ought to L2 self	Comp_Interaction_Control_5<- lmer(Comprehensibility ~ Time*OughttoL2self + (1 | Subject), data = Longitudinal_12, REML=F)
6	Anxiety	Comp_Interaction_Control_6<- lmer(Comprehensibility ~ Time*Anxiety + (1 | Subject), data = Longitudinal_12, REML=F)
7	Past curricular English learning	Comp_Interaction_Control_7<- lmer(Comprehensibility ~ Time*Pastcurricular + (1 | Subject), data = Longitudinal_12, REML=F)
8	Past extracurricular English learning	Comp_Interaction_Control_8<- lmer(Comprehensibility ~ Time*Pastextracurricular + (1 | Subject), data = Longitudinal_12, REML=F)
9	Recent curricular English learning	Comp_Interaction_Control_9<- lmer(Comprehensibility ~ Time*Recentcurricular + (1 | Subject), data = Longitudinal_12, REML=F)
10	Recent extracurricular English learning	Comp_Interaction_Control_10<- lmer(Comprehensibility ~ Time*Recentextracurricular + (1 | Subject), data = Longitudinal_12, REML=F)