LANGUAGE APTITUDE in Second Language Acquisition
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The notion of language aptitude (LA) has considerably developed from the creation, by Carroll and Sapon in 1959, of the MLAT (Modern Language Aptitude Test), a static measurement test of learners’ linguistic ability used to predict academic outcomes.

Conceptually, LA has increased in extension and complexity with its integration with language specific processes by P. Skehan (1998) and with its inclusion into an interactionist developmental approach to Second Language Acquisition by P. Robinson (2001), resulting in a multicomponential dynamic notion of language aptitude that can be used for diagnostic and instructional adaptation to the individual learner.

As a result of this redefinition, the complex of LA has recently regained a central position in psycholinguistic research preoccupied with the re-conceptualisation of general and linguistic processes of language acquisition and their development during the learning of the first, second and more languages.
Questions

- What is language aptitude?
- What are the major developments in its theoretical conceptualisation since the 1950s?
- How does LA relate to language specific and general cognitive processes and mechanisms at stake in the acquisition of a second language?
- What types of interactions have been established between LA and differences in instructional treatments (implicit/ explicit conditions for types of instruction or feedback, metalinguistic knowledge)?
- What are the recent developments in terms of measurement tests of Language Aptitude?
- To what extent does Language Aptitude also have an impact on L1 and child L2 acquisition?
- How can the concept of Language Aptitude be integrated into a dynamic bi- and multilingualism framework?
- To what degree are Language Aptitude and general cognitive abilities correlated?
- What are the resulting pedagogical implications for L2 learners with various degrees of Language Aptitude?
Definition of Language Aptitude

- Carroll (1981):
  “The individual’s initial state of readiness and capacity for learning a foreign language, and probable facility in doing so”

  “cognitive and perceptual abilities that predispose individuals to learn [a second language] well or rapidly”
Language Aptitude in SLA
vs in Educational Psychology

- Language aptitude in SLA does not comprehend all the learner’s characteristics that come into play for reaching a specific learning goal, such as:
  - Affective
  - Conative (motivation)
  - Other cognitive variables

- Contrastingly, in SLA, it is considered from a cognitive perspective as a language specific L2 learning ability involving special learning processes and mechanisms.
Language Aptitude = an Individual Difference

- LA = one of the most important Individual Differences (IDs) in SLA (Cochran et al., 2010; Li 2015).
- Distinct from other individual factors, such as:
  - general intelligence (though correlated with it; Linck et al. 2013) and academic ability.
  - affective factors: personality, attitudes towards the language, motivation (Dörnyei & Skehan, 2003).
  - musical aptitude

- However, LA interacts with other individual (motivation) and environmental (parental background, literacy) factors for the achievement of the highest possible level in language proficiency for each individual learner (Gardner 1985; Skehan, 1986).
Language Aptitude = a predictive factor

- A largely innate, relatively fixed talent for learning languages (Abrahamsson & Hyltenstam, 2009; Carroll, 1990; 1993)
- LA correlates positively with L2 learning rate and ultimate attainment.
- It is “predictive of how well, relative to other individuals, an individual can learn a language in a given amount of time and under given conditions”.
Language Aptitude = a complex construct

- A composite of several, relatively independent cognitive abilities (Carroll, 1990; Robinson, 2005)
- The learners’ reliance on some abilities has lead to the identification of 2 L2 learner orientations (Skehan, 1989):
  - The analysis-oriented learner relies more on the analysable quality of language.
  - The expression-oriented learner depends more on chunks of language and efficient memory.
Overview of research on LA

• 1950s – 1990s: Focus on the predictive power of LA
• 1990s – 2005: Redefinition of the LA construct
• 2005 – to date: Revitalisation of LA research
Overview of research on LA 1950s-1990s

- Originally, research on LA was a relatively independent field that concentrated on:
  - the **prognostic and diagnostic** values of language aptitude scores, independently from the instructional context.
  - Distinguishing the **componential abilities** that would have the best predictive value of language academic success.
  - **Instructed settings** (not naturalistic) following Krashen’s (1981) distinction between:
    - L2 acquisition (relying on unconscious processes in naturalistic contexts, on the model of L1 acquisition)
    - vs L2 learning (based on conscious processes, in classroom contexts)
    - LA was hypothesised to affect language learning only, not acquisition.
Since the 1990s, research on language aptitude has been integrated into SLA research.

Reconceptualisation of the concept of LA

And its links with cognitive processes involved in language learning (explicit vs implicit processes, noticing) (Schmidt, 1994; Skehan, 1998).

Traditionally, researchers argued that language aptitude only plays a role in explicit processes and adult L2 acquisition (FDH, Bley-Vroman, 1991; Paradis, 1994; DeKeyser, 2000).

However, recent empirical studies have revealed that LA may also affect implicit processes and child L2 acquisition.

Conclusion: Language Aptitude may influence all types of learning for all ages of learners, whether before and after the limit of a critical period (Skehan, 2014).
Overview of research on LA 2005-to date

- Robinson (2005) reopened the debate on the relationships between language aptitude and:
  - various settings/ different types of instructional treatments/ feedback methods/ learning tasks
  - Age of acquisition
- He formulated a process-oriented, dynamic, theory of the language aptitude construct by linking it to Cronbach and Snow’s (1977) interactional approach.
- His reflexion aimed at catering for IDs (including LA) in the L2 classroom and matching types of instruction with groups of L2 learners for better efficacy.
- As a result, Language Aptitude has become a revitalised area of SLA research:
  - Increasing number of studies since 2007,
  - Influenced by the advances in cognitive and educational psychology,
  - New developments in the conceptualisation of LA,
  - New measurement methods of LA.
Conclusion: 2 main strands of research on LA

- Today, 2 main strands of SLA research on LA:
  - The predictive approach:
    - Investigates the correlation of L2 learners aptitude with grades or proficiency tests. LA has been consistently found to be the best predictor of linguistic performance (Cochran et al., 2010).
    - Focuses on testing the Fundamental Difference Hypothesis between child vs adult L2 acquisition (FDH; Bley-Vroman, 1990) by challenging the hypothesis that LA only plays a role for late L2 learners.
  - The interactional approach:
    - Mostly experimental studies (laboratory research, via individual or computer-delivered instruction), though sometimes tested in classroom settings.
    - Aiming at exploring the effects of LA or specific(sets of) LA components in relation to:
      - different instructional treatments (implicit/ explicit, inductive/ deductive)
      - particular linguistic features (ex. a particular grammatical structure).
Theory of Language Aptitude

• Modern Language Aptitude Test (Carroll & Sapon, 1959)
• Model of Process-Sensitive Aptitude (Skehan, 1998)
• Interactionist approach to Language Aptitude (Robinson, 2001)
“usually considered the best verbal aptitude test in terms of its predictive value for L2 learning. Some of the minor technical problems discovered over the years do not affect the “Words in Sentence” part (Carroll, 1990), which is specifically aimed at measuring grammatical sensitivity and therefore should be the best predictor of grammar learning.” (DeKeyser, 2000, p. 509).

Problems:
- Outdated types of instruction and tasks (focus on form, audiolingual method)
- Lack of theoretical conceptualisation (ex. Problemqtic notion of memory restrictded to rote learning ability)
- Not testing more implicit processes of SLA.
Modern Language Aptitude Test
MLAT (Carroll & Sapon, 1959)

- The test consists in 4 subtests that have been proven to highly correlate with success in second language acquisition:
  - **Phonetic/phonemic coding ability:** the ability to identify speech sounds and form sound-symbol mappings (linked to aptitude for pronunciation)
  - **Grammatical sensitivity:** the ability to identify the functions of constituents in a sentence (aptitude for grammatical learning)
  - **Inductive learning ability:** the ability to infer the rules of a set of previously unknown language materials (also grammatical learning)
  - **Rote learning ability:** the ability to learn associations between lexical forms and meanings rapidly and efficiently (aptitude for vocabulary acquisition)
Skehan related 3 of the MLAT aptitude subcomponents with cognitive processes and stages of second language acquisition:

<table>
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<tr>
<th>SLA stage</th>
<th>Corresponding aptitude constructs</th>
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| Input processing strategies, such as segmentation  | **Attentional control**  
**Working memory**  
**Phonemic coding ability**  
**Working memory**  
**Grammatical sensitivity**  
**Inductive language learning ability**  
**Grammatical sensitivity**  
**Inductive language learning ability**  
**Automatization**  
**Integrative memory**  
**Chunking**  
**Retrieval memory** |
| Noticing                                           |                                                                        |
| Pattern identification                             |                                                                        |
| Pattern restructuring and manipulation             |                                                                        |
| Pattern control                                    |                                                                        |
| Pattern integration                                |                                                                        |

- **Auditory ability (phonemic coding ability)** – for Input processing: this ability enables learners to process input more readily by providing processable comprehensible input for the next stage of processing. Most important element at early stages of SLA (/ later stages).

- **Memory ability (rote learning ability)** – for Output processing: memory dealing with the acquisition of new information, their storage and retrieval, especially the component of memory that ensures the efficient retrieval of information during demanding online (real-time) conversation. Memory gains more prominence as the level of proficiency increases for the purpose of having native-like selection and fluency, thus enriching exemplar-based (/ rule-based) system and idiomatic language.

- **Language analytic ability** (2 subcomponents: Inductive language learning ability + Grammatical sensitivity) – for Central processing: the capacity to infer rules and make generalisations. The analytic ability is equally important at all stages of SLA, has a linear relationship with proficiency level and participates to the development of the rule-based system.

- LA and **Noticing**: a learner’s level of ability in noticing relevant qualities in the input (due to better working memory or being field independent)
- LA and **Pattern identification**: a learner’s ability in pattern extraction capacities and generalisation
- LA and **Pattern restructuring and manipulation** (anti-fossilisation stage of development): a learner’s different ability in changing the established rules of his interlanguage
- LA and **Pattern control** or error avoidance: a different ability in having control over an emerging interlanguage (focus on accuracy and automatisation in production)
- LA and **Pattern integration**, lexicalisation (production): different ability in producing a pattern (lexicalised chunks) that can be accessed as a whole (focus on routinisation).
LA and Working Memory

- In the last 30 years, SLA research has focused on the role of memory.
- Recent work in cognitive psychology has challenged the static concept of short-term memory (STM; passive storage of information, Carroll, 1962) and concentrated on the notion of working memory (WM; the process and mechanism involved in manipulating and temporarily storing information, Baddeley, 1999).

- 3 subcomponents of WM (Baddeley, 1999):
  1. **The central executive**: responsible for the simultaneous manipulation and storage of new information, characterised by its limited capacity. LA: a higher WM capacity has been linked to better L2 reading skills (Harrington & Sawyer, 1992) and more benefit from interactional feedback (Mackey et al. 2002).
  2. **The phonological store**: holds phonological information and is subject to decay.
  3. **The subvocal articulatory rehearsal**: recodes non-auditory material (ex: when reading) into a form suitable for the phonological store and, through rehearsal, prevents decay of information held in the phonological store.
Interactionist approach to LA
Robinson (2001)

- Redefined the concept of LA as a complex dynamic construct.
- Included LA in a SLA developmental theory (N. Ellis, 1998)
- Robinson specified the relationships between:
  - acquisition processes and mechanisms used by a learner to respond to
  - the demands of learning contexts on them
- LA, cognitive processes and learning context interact together to enhance/ inhibit L2 development from one stage of interlanguage to the next.
Aptitude Complex/ Ability Differentiation Framework Robinson (2005)

- Research framework for empirical studies exploring LA in relation to 4 theoretical hypotheses:
  - The Aptitude Complex Hypothesis
  - The Ability Differentiation Hypothesis
  - The Fundamental Difference Hypothesis
  - The Fundamental Similarity Hypothesis

- LA integrated with:
  - interactionist theory, emphasising the role of acquisition context and conditions (Snow, 1994)
  - Sternberg’s (2002) triarchic theory of intelligence
Aptitude Complex Hypothesis and LA

- The Aptitude Complex Hypothesis (ACH) (Interactionist theory, Snow, 1994):
- structured a hierarchy of language aptitude abilities
- linked to different input processing mechanisms
- Facilitating/ inhibiting performance under various types of instructional treatment (implicit/ explicit) and contexts (instructed/ naturalistic)
Aptitude Complex Hypothesis and LA

Hierarchy of LA ability components:

- **At task level, 1st order cognitive abilities**: the completion of a language task requires the activation of a set of relevant primary cognitive processes (ex. Attention, Working Memory - WM, Short Term Memory - STM, Long Term Memory - LTM, Basic Processing Speed - BPS).

- **At cognitive process level, 2nd order abilities**: the 1st order cognitive abilities combine into 2nd order sets of abilities that each support a particular process of L2 learning (such as Noticing the Gap / Memory for Contingent Speech – MCS / Deep Semantic Processing – DSP / Metalinguistic Rule Rehearsal – MRR).

- **At instructional treatment level, aptitude complexes**: The 2nd order abilities can be grouped into aptitude complexes that enhance/ inhibit language learning under specific instructional conditions. Each aptitude complex can be evaluated in terms of the combination of the high or low level of each of its constituent abilities (High High - HH, High Low - HL, Low High – LH or Low Low – LL).
Aptitude Complex Hypothesis and LA

1. Aptitude complexes, e.g.
   - HL: HL
   - HH: HH
   - LL: LL
   - LH: LH
   - MCS
   - NTG

2. Aptitude for focus on form (via recasts)
   - Memory for contingent speech
   - Phonological WM capacity
   - Speed of PWM Analogies
   - Perception speed
   - Pattern recognition
   - Inspection time (Anderson, 1992) (Sasaki, 1996)
   - Sound symbol
   - Listening-span test (Mackey et al., to appear)
   - Ability tests, e.g.

3. Aptitude for incidental learning (via oral content)
   - Deep semantic processing
   - Infering word meaning
   - WM for text
   - Words in context (de Graaff, 1997)
   - Text memory (Harley & Hart, 1997)

4. Aptitude for incidental learning (via written content)
   - Memory for contingent text
   - Speed of WMT
   - Grammatical sensitivity
   - Words in sentences/ Paired associates (Carroll & Sapon, 1959)
   - Metalinguistic rule rehearsal
   - Rote memory

5. Aptitude for explicit rule learning
   - MCT
   - MRR
Aptitude Complex Hypothesis and LA
Aptitude Complex Hypothesis and LA

 Abilities (inner circle, initial input-based learning):
  > Processing Speed (PS); Pattern recognition (PR); Phonological Working Memory Capacity (PWMC); Phonological Working Memory Speed (PWMS); Semantic Priming (SP); Lexical Inferencing (IN); Text Working Memory Capacity (TWMC); Text Working Memory Speed (TWMS); Grammatical Sensitivity (GS); Rote Memory (RM)

Aptitude Complexes (2nd circle, input-based learning):
  > Noticing the Gap (NTG); Memory for Contingent Speech (MCS); Deep Semantic Processing (DSP); Memory for Contingent Text (MCT); Metalinguistic Rule Rehearsal (MRR)
Aptitude Complex Hypothesis and LA (Ctd)

- Task Aptitudes (3rd circle, output practice and complex task performance):
  - Single Task (+/- ST); Planning Time (+/- PT); Background Knowledge (+/- BK); Here-and-Now (+/- H&N); Few Elements (+/- FE); Reasoning (+/- R); Open Task (+/- O); 1-Way Task (+/- 1way); Convergent Task (+/- CON); Same Gender Participants (+/- SG); Same Proficiency Participants (+/- SP); Familiar Participants (+/- FAM)

- Pragmatic/Interactional Abilities/Traits (4th circle, transfer of task performance to real-world interactive settings):
  - Interactional Intelligence (II); Self Presentation/Impression Management (SP/IM); Mind Reading (MR); Pragmatic Ability (PA); Social Insight (SI); Emotional Intelligence (EI); Self-Efficacy (SE); Openness to Experience (OTE); Gesture Reading (GR); Nonverbal Sensitivity (NVS)
Ability Differentiation Hypothesis and LA

ADH (Deary et al., 1996):
- In adults and high-IQ groups: abilities are more differentiated (higher effect of certain abilities / lower effect of general intelligence).
- In children and low-IQ groups: abilities are less differentiated (higher effect of general intelligence / lower effect of specific abilities).

The ADH predicts that adults and high-IQ groups should present a number of HH, HL, LH and LL patterns in their tested aptitude complexes / children and low-IQ groups should show more HL and LH patterns.
Fundamental Difference Hypothesis and LA

- FDH (Bley-Vroman, 1990):
- Post-critical period adults, because of cognitive maturational constraints, do not any longer have access to (implicit) language specific innate learning mechanisms characteristic of child L1 acquisition.
- Instead, they rely on their L1 knowledge + (explicit) general cognitive abilities.
- The reliance on general problem-solving abilities that differ among individuals explains the variations in terms of adult ultimate level of L2 attainment (in contrast to limited variation in adult L1 proficiency level).
Fundamental Similarity Hypothesis and LA

- FDH => FSH (Robinson, 1996):
  - In contrast to child FLA, differences among adults’ levels of attainment can be explained
    - Not by the distinctions between implicit/explicit processes or acquisition/learning
    - But by the interaction of the general cognitive processes with the properties of the task/classroom learning conditions/naturalistic exposure
  - These properties predispose (or not) the input to make different demands on cognitive processes (ex. focal attention, noticing, rehearsal in memory) and their relevant limited resources.
Empirical Evidence

• Meta-analytic review (Li, 2015)

• Studies testing theory (FDH) on LA, Age and Ultimate Attainment

• Studies on Aptitude Treatment Interaction (ATI)
Meta-analytic Review (Li, 2015) on 33 studies on language aptitude and L2 grammar acquisition:

- Medium effect size effect of LA in both predictive and interactional studies. Importance of LA has been overestimated until now, but it is predictive of initial L2 grammar learning and less so of ultimate level of grammatical acquisition.
- Language aptitude and analytical ability are more predictive of grammar learning than rote memory or phonetic coding ability.
- High school students are more likely to draw on their language aptitude than university students (rate of learning vs ultimate attainment).
- The effectiveness of explicit instruction was more related to aptitude than implicit instruction. This finding supports Dornyei and Skehan’s (2003) claim that aptitude presupposes instruction with focus on form. The correlation of aptitude with grammatical learning under implicit conditions was only significant in laboratory studies, not in classroom studies. This result might be explained by the fact that laboratory conditions offer a lesser degree of implicitness.
- While younger learners were more reliant on aptitude in predictive studies, the opposite was true in interactional studies. In interactional studies, it is possible that motivation was a more influential predictive factor than aptitude.
Empirical studies on LA, Age and Ultimate Attainment

Harley & Hart (1997):

- compared acquisition of French by English L1 children in two different language learning contexts (immersive education/ 3-month bilingual home stay).
- Results: LA, as measured by Memory for Text, predicted successful learning for pre-critical period immersion students (age: 12 years)/ post-critical period immersion students related positively to LA as language analytic ability (age: 16 years).
- Age and aptitude interact and affect language performance, with pre-critical period learning relating to a different set of abilities than post-critical period learning.
- In the case of older students, the learning context (instructed immersion vs home-stay exposure) influenced aptitude-outcomes relationships: naturalistic incidental exposure levelled out aptitude differences compared to instructed classroom learning (with analytic orientation).
DeKeyser (2000):
- Replication of Johnson and Newport study. Among 57 Hungarian L1 adults immigrants in the USA, very few adults scored in the range of child arrivals on a Grammatical Judgment Test (GJT).
- For all adults, strong correlations between performance on the GJT and grammatical sensitivity (measured with WS subtest of MLAT).
- No such correlations in the cases of child immigrants.
- DeKeyser proposed that aptitude can mitigate the effects of a sensitive period, by reflecting a greater capacity for explicit learning and domain general abilities.
- Confirms FDH, and the predominance of general problem-solving capacities, especially metalinguistic ability, in adult SLA.
Abrahamsson & Hyltenstam (2009):

- A replication of DeKeyser’s (2000) study comparing the L2 proficiency and language aptitude of 42 carefully selected near-native L2 speakers of Swedish.
- Confirmed that language aptitude was required for adults (Age of Acquisition – AoA > 12) to reach a very high level of proficiency (as measured with a finer-grained battery of tests).
- Language aptitude was tested using a version of the Swansea LAT (Meara et al. 2003; based on MLAT) that includes 5 subcomponents: Phonetic memory, Lexical-morphological analytical skills, Grammatical inferencing skills, Aural memory for unfamiliar sound sequences and Sound-Symbol associations.
- All the L2 learners’ Ultimate Attainment (UA) was near-native, but none of them reached nativelikeness.
- Interestingly, for the first time, the researchers found small, but significant effects of aptitude for L2 learners who had started L2 acquisition before the age of 12 years.
DeKeyser et al. (2010):

- a replication of DeKeyser’s (2000) study
- using an L1-based aptitude test comparable to SAT (verbal Scholastic Aptitude Test)
- did not find any significant aptitude effects for young L2 learners in two parallel cross-linguistic studies of early Russian learners of L2 English and learners of Hebrew in the USA.
- The only correlation between aptitude and proficiency concerned the group with age of acquisition between 18 and 40.
Studies testing theory (FDH) on LA, Age and Ultimate Attainment

- Bylund et al. (2012): like Hyltenstam & Abrahamsson (2009), the researchers found aptitude effects on pre-pubescent L2 learners’ (Age of Acquisition <12) Ultimate Attainment.
- Used a Grammatical Judgment Test and a non L1-based aptitude test (Swansea Language Aptitude Tests; Meara et al. 2003)
- Aptitude was reported as the only significant predictor for nativelike performance in both L1 and L2.
- Bylund et al. (2010, p. 443) suggest that “language aptitude has a compensatory function in [first] language attrition, helping the attriter to retain a high level of L1 proficiency despite reduced L1 contact”.
- Abrahamsson (2013) also found significant effects of aptitude for his control Native Speaker (NS) group.

- This suggests that L2 aptitude may be linked to (implicit) L1 development, thus confirming Skehan’s (1986) finding that speed of first language development at ages 2-3 years correlates with measured foreign language aptitude 10-12 years later.
Studies testing theory (FDH) on LA, Age and Ultimate Attainment

Granena & Long (2013):
- Used the Llama aptitude test (Meara, 2005)
- Found conflicting evidence against recent research findings on the role of aptitude in early L2 acquisition.
- Demonstrated an effect of language aptitude only for the Chinese immigrants that had arrived in Spain after the age of 15, but not for the 2 other groups of learners (ages: 3-6 and 7-15).
- Granena & Long (2013) explain this conflicting result with the divergent format of their Grammaticality Judgment Test: introducing pressured time for the completion of the test might have induced participants to use implicit processes.
- Former studies that have elicited an effect of aptitude on younger learners’ performance might be due to the untimed task condition that allowed them to use explicit processes.

Spada et al. (2014):
- Explored the relationship between timed/ untimed and written/ auditory GJT formats.
- Showed that both implicit and explicit knowledge are drawn from whatever the test format.
Studies on Aptitude Treatment Interaction

Experimental = laboratory studies on adults

Robinson (1996):
- Adult Japanese learners of L2 English received English instruction under different conditions: explicit (with rules instruction) / implicit (instructed only to memorise) / incidental (focus on meaning only) / search for rules.
- The explicit condition group showed less variance in their performance.
- Aptitude measured by Words in Sentence (grammatical sensitivity) and Paired Associates (L1 and L2 pairs, rote memory ability) positively correlated with learning under all conditions, except the incidental learning.
- Conclusion: learners in the incidental condition were not able to draw on aptitude to compensate for focus on meaning in order to notice formal structures and acquire them.

Robinson (1997): LA and incidental learning condition
- Addressed the issue of the Aptitude Complex(es) needed for incidental learning.
- Operationalised aptitude as a measure of Working Memory capacity, a short form of the Wechsler Adult Intelligence Scale.
- Participants learning Samoan under incidental conditions were tested with a Grammatical Judgment Test.
- The GJT showed positive correlations with aptitude and Working Memory scores, although not with general intelligence. The strongest predictor of grammatical learning under incidental conditions was Working Memory.
- Supports the Fundamental Similarity Hypothesis in that adult differences in acquisition can be linked, not to individual divergences in acquisition processes (implicit/ explicit), but to learning conditions and their demands on those processes, similar for all adult learners.
- Adult incidental learning is sensitive to aptitude that is operationalised as Working Memory.
Studies on Aptitude Treatment Interaction

DeGraaff (1997):
- Tested the acquisition of both an artificial and a natural grammar in implicit (exposure without rule explanation) and explicit (with rule explanation) conditions.
- 2 measures of language aptitude (Words in Sentence and Words in Context) were significantly correlated with learning under both implicit and explicit conditions. When collapsing the results of abilities into one aptitude score, DeGraaff found that aptitude related to 3 of the 4 conditions (2 types of grammar x 2 conditions).
- Showed an increase of the effect of aptitude over time of learning for both learned languages. Predominantly, the more time for instruction in the implicit condition, the greater the impact of aptitude, and the effect of aptitude shows differential evolutions over time under explicit versus implicit conditions.
- Limitation: implicit instruction in laboratory conditions may have permitted explicit processing. More research needs to control the consequences of the aptitude factor over longer time of instruction.
- Conclusion: DeGraaff did not confirm P. Robinson’s hypothesis of different aptitude complexes for implicit vs explicit learning. No significantly divergent effect was found between Verbal analytical ability under the explicit condition (grammatical sensitivity as measured with Words in Sentence-test) vs under implicit condition (the ability to infer word meaning as measured with Words in Context-test).
Studies on Aptitude Treatment Interaction

- Interventionist studies = in natural classroom environment
- Ranta (2002) tested the role of language aptitude in the communicative classroom environment with focus on meaning (not on form).
- Her results show that the measurement of language analytical ability through a L1 Grammatical Judgment Test is associated with above average performance on the L2 measure.
- This suggests that aptitude operationalised as analytical ability can predict learners’ outcomes in implicit/naturalistic learning environments (not only in experimental studies).
Studies on Aptitude Treatment Interaction

Erlam (2005):
- Explored the relationship between 3 instructional methods and learner aptitude in a New Zealand school.
- Tested the acquisition of direct object pronoun.
- Found that, between the 3 groups of participants (n= 60), assigned to the 3 different instructional methods (deductive instruction group/ inductive instruction group/ structured input instruction group), deductive instruction that gives opportunities to produce language output may neutralise individual differences in language aptitude.
- However, other differences in individual gains did not correlate significantly with differences in aptitude.
- Conclusions: the structured input condition could level out individual differences in aptitude (perhaps due to more salient grammatical structures that can be noticed by low aptitude learners).
- Students with greater language analytical ability benefitted more from structured input instruction in terms of being able to produce the target structure in written form.
- Learners with greater working memory capacity also benefited more from structured input instruction and were more successful at maintaining long-term representations of the target language forms, maybe by processing input more deeply.
- Complements Skehan’s model (1998): the role of working memory seems to be crucial in the processing of both language input - and output.
Studies on Aptitude Treatment Interaction

Skehan (2014) in his review of 7 ATI studies concludes that:

- Higher aptitude is associated with a greater capacity to benefit from instruction, whether it is explicit or implicit, even on short periods.
- At a micro-level, the only linguistic features showing a positive relationship with aptitude were salience and redundancy. Aptitude seems to work with instruction when the language point is salient, with aptitude facilitating input processing, or redundant, in which case aptitude enables the learners to focus their attention on the grammatical point, rather than the utterance meaning. If the language point is not communicatively prominent, the higher level of language aptitude may not come into play for noticing grammatical structures.
- Aptitude might be more related to early processes of language acquisition such as noticing and early pattern identification.

Problems:
- Problem of comparability of the studies.
- By their experimental nature and short duration, they presuppose that aptitude can show effects on language learning in a brief period of time.
- Disparate and imprecise level of the learners.
- Focus on only 1 to 4 language structures.
Studies on Aptitude Treatment Interaction

Research into aptitude and types of feedback:

- Skehan (2014) in his review of 4 studies on feedback concluded that:
  - Participants with high aptitude benefited more from explicit feedback and less from implicit feedback.
  - The quality of the focal structure (saliency, redundancy) also made a difference: in both implicit and explicit feedback conditions, aptitude played a role in learning a grammar point when it was not necessary for communicating meaning on behalf of its redundancy, or compensated for its lack of salience in the input.
  - In addition, in the implicit condition, the more distance between L1 and L2, the greater the role of aptitude for benefiting from corrective feedback.
  - Explicit corrective feedback and higher degree of aptitude seem to be associated with greater effectiveness in learning non-prominent features in the L2 input, and seem to make it more likely for the learner to notice the grammatical structure in question. Lower aptitude students might not notice the grammatical feature, and this even though it benefits from explicit feedback.
  - High levels of aptitude might not be enough to compensate for the lack of prominence in implicit feedback.
Studies on Aptitude Treatment Interaction

Aptitude and metalinguistic knowledge:

- demonstrated moderate to moderate-to-strong relationships between aptitude (as measured by a grammatical sensitivity test), metalinguistic knowledge and language performance.
- Skehan (2014) points at two difficulties:
  - Participants are all third-level students.
  - Need for longitudinal studies to differentiate between aptitude and rate of acquisition.
Recent Language Aptitude Tests

• Focusing on domain-specific language learning abilities (Llama)
• Focusing on general language learning abilities (CANAL-FT, HiLab)
Llama (2005)

Llama Language Aptitude Tests (Meara, 2005a; 2005b):
- based on the MLAT
- partially validated by Granena (2013)
- measures more implicit learning aptitude than the MLAT.

- The Llama test battery is composed of 4 subtests:
  - paired associates learning
  - sound-symbol association
  - inductive language learning ability (no grammatical sensitivity component in contrast with MLAT)
  - Identification of previously heard sound sequences in new sound sequences.
CANAL-FT (Grigorenko, Sternberg & Ehrman, 2000):

- Theory-driven language aptitude test based on Sternberg’s (1985; 2002) triadic theory of the Successful Human Intelligence (composed of analytical/ practical/ creative intelligence). It mainly focuses on how people cope with the Cognitive Ability for Novelty (and ambiguity) in Acquisition of Language.

- Ecologically valid as it tests language acquisition (of an artificial language) in process.

- Dynamic as it involves the capacity to learn over time of testing (knowledge tested at 2 times, for immediate and delayed recall).

- Multifunctional: it assesses students’ level of ability, strengths and weaknesses and individual profiles (ex: preference for oral/ visual modes of acquisition, for implicit/ explicit learning). The results can be used for developing learners’ learning strategies, adapted teaching methods and placement in L2 programs.

- Suitable for high IQ learners, as it has been showed to differentiate between highly educated learners.
CANAL-FT

- CANAL-FT tests 5 acquisition processes:
  - selective encoding: the process used to distinguish in the input more or less relevant information for one’s purpose
  - accidental encoding: the encoding of background information outside of the scope of the learner’s attention
  - selective comparison: the ability to compare new information with old information, and the possibility to hold ambiguous, contradictory or incomplete information in working memory without rejecting it.
  - selective transfer: the ability to apply inferred rules to new contexts and tasks in L2 production
  - selective combination: the ability to synthesise old and new elements of information and integrate them in an updated unit of knowledge.
The construct of aptitude is operationalised for 4 language levels of processing: phonological/lexical/morphological/syntactic) and 2 modes of input (visual and oral).

2 times of testing: immediate recall (testing working memory ability) and delayed recall (for a measurement of long-term memory ability).

The subcomponents of the CANAL-FT measure the various aspects of the theory in integrated format to simulate real Foreign Language learning:

- Learning meanings of neologisms from context
- Understanding the meaning of passages
- Continuous paired-associate learning
- Sentential inference
- Learning language rules
HiLab

- High-Level Language Aptitude Battery - HiLab (J. A. Linck et al., 2013):
  - discriminates (and predicts) foreign language learners who attain a near-native level of L2 proficiency (Ultimate Attainment).
  - captures learning processes required for language acquisition in informal settings (/ instructed settings)
  - not based on a construct of aptitude implying a theory of a language specific module (UG or other)
  - But on more general cognitive processes (such as logical reasoning, inductive reasoning, associative memory)
  - “it is primarily cognitive and perceptual abilities that constrain a learner’s highest attainable proficiency level”.
  - Validated correlation of aptitude tested with HiLab with higher level of proficiency, listening and reading.
HiLab

Test subcomponents:

- Working Memory (including phonological Short term memory and Task set switching)
- Associative memory (Paired associates)
- Implicit learning (Serial reaction time)
- Executive functions
Static/ Dynamic components of LA

• Developmental account of LA
• LA and Multilingualism
• LA and general intelligence
Developmental account of LA

- Stability of LA: Politzer & Weiss (1969): training adults on the cognitive tasks included in an aptitude test did not lead to improvement in language aptitude scores nor L2 proficiency.
- Stability ≠ innateness.
- However, LA has been shown to influence children’s rate of L1 acquisition from preschool (Wells, 1985) and children’s ability for classroom learning (Humes-Bartlo, 1989). Researchers studying adults with a nativelike level of Ultimate Attainment explain this phenomena with a genetically determined disposition for learning languages (Ioup et al., 1994).
- Recently developed LA tests could show the developmental nature of LA, as, with age, a child grows to rely more and more on implicit and explicit cognitive processes, instead of implicit processes predominantly in first and simultaneous second language acquisition.
- Other researchers conclude to a variable component of LA, that may be “crucially dependent on past learning experiences” (Carroll; 1981; Skehan, 1989). McLaughlin (1990): prior learning of a second language can augment language aptitude; aptitude has a teachable component (i.e. learning strategies; see Nayak et al., 1990). Experience in childhood, before the age of 10, has been shown to be associated with enhanced language aptitude in adulthood (Eisenstein, 1980).
LA and Multilingualism

- Grigorenko et al. (2000) found that the more languages a person could speak, write or read, the higher the performance on the CANAL-FT test battery. Positive influence of language learning experience on language aptitude.
- Nonetheless, an alternative explanation for these results could be that a higher level of LA is conducive to increased motivation and ease for learning multiple foreign languages.

Thompson (2013): used the CANAL-FT to test a new theoretical conceptualisation merging the aptitude and multilingualism constructs. Measuring the LA of 79 Brazilian language learners, he found that:

- multilingual learners had a significantly higher level of aptitude than their monolingual and bilingual peers.
- a significant effect of multilingualism was found even among those participants who had a very low level of previous experience in the 3rd (or more) language (supporting De Angelis, 2007).
- A positive correlation between the number of learnt languages and the level of language aptitude.
- Correlation between LA and the Perceived Positive Language Interaction (PPLI: the concept from research into multilingualism according to which multilingual participants who are aware of the positive interactions between the languages they are learning and their aptitude to acquire foreign languages).

The results support the constructs of:

- **The Dynamic Bilingualism** (Garcia, 2009; bilingualism is a dynamic cycle in which the linguistic system is constantly changing in a nonlinear way)
- **The Dynamic Model of Multilingualism** (DMM; Herdina & Jessner, 2002; multilingual language learning is continuously in flux, with the learner’s languages constantly interacting with each other in an overall multicompontential psycholinguistic system).
LA and Dynamic Multilingualism

- Bilingualism affects how subsequent languages are learnt (Sanz, 2000):

- **Increased metalinguistic awareness**: Metalinguistic knowledge (explicit knowledge of language information and organisation of language systems) acts as an advanced organiser by speeding up the language learning process (Ellis, 1994). Bilinguals have a better understanding of metalanguage, which speeds up the learning of subsequent languages and helps to analyse language into a structured system (Thomas, 1992).

- **Improved ability to notice structural patterns** (Bialystok, 2006), restructure their mental representations of the rules governing linguistic input (Nayak et al., 1990; Klein, 1995) and synthesise additional linguistic systems.

- **Better at processing language learning** (McLaughlin & Nayak, 1989; Nayal et al. 1990): Developing metalinguistic awareness frees up resources to devote to the form of the new language. Automatic processes represent a lesser cognitive load than controlled processes (VanPatten, 1996), and controlled processes become automatic more quickly for subsequent languages.

- **More efficient learning strategies** (Nayak et al., 1990: increased ability to search for underlying rules, better use of mnemonic devices, adaptive use of strategies).

- **Positive effects on L3 learning in immersive contexts** (Cenoz & Valencia, 1994; Sanz, 2000; 2008).

- **Transferability of linguistic knowledge between the learner’s languages is affected by Perceived Language Distance** (the distance a leaner perceives between his languages, Kellerman, 1987).
Dynamic Multilingualism and General Intelligence

- Bilingualism has been shown to have a positive effect on general intelligence (Peal & Lambert, 1962), and particularly on mental flexibility and a more diversified set of mental abilities.
- Other intellectual capacities increase with the number of learned languages:
  - seeing the world through a different perspective (Malakoff & Hakuta, 1991)
  - problem-solving (Byalistok & Majumder, 1998)
  - creative thinking (Ricciardelli, 1992)
  - less anxiety (Dewaele, 2002; Dewaele et al. 2008)
  - higher tolerance to ambiguity (Dewaele & Li Wei, 2013).
Based on Sternberg’s (1998) triarchic theory of intelligence, Grigorenko et al. (2000) verified that “language aptitude is based, in part, on expertise in certain kinds of information processing that, like any other kinds of expertise, can be developed”.

Dynamic nature of LA, parallel to the dynamicity of other intelligence components: aptitude fluctuates with the language learning experiences (esp. types of instruction) of the individual learner.

Sternberg emphasizes that additional aspects of LA should be assessed:

- Its creative component: dealing with novelty and ambiguity in diverse situations, including language learning situations)
- Its practical component: dealing with everyday problems. Ex. selecting an environment for language learning/ learning tacit knowledge from the environment, intuitively read and interact successfully with others = social intelligence)
- Not only the analytical component: analysing, judging, comparing, contrasting, solving familiar problems by using abstract judgments.
LA and General Intelligence

- Evidence of a significant correlation between language aptitude scores and intelligence tests used together as predictors of successful L2 acquisition (Grigorenko et al., 2000).
- Correlations found in empirical studies vary from low/moderate (Gardner & Lambert, 1972; Skehan, 1989) to moderate/strong (Sasaki, 1996; Wesche, Edwards & Wells, 1982).

- The CANAL-FT showed correlations both with the MLAT (confirming its validity as a language aptitude test) and with two measures of general cognitive abilities:
  - The Test of g: Culture Fair (CFT; Catell, 1940; Cattell & Cattell, 1973): a test of fluid intelligence designed to reduce the influence of verbal comprehension, culture and educational level.
  - The Concept Mastery Test (CMT; Terman, 1970): a test of crystallised intelligence or acquired knowledge base (culture-relative) measuring the richness of concepts and ideas of people with high intelligence with two subtests of Synonyms and Antonyms, and Analogies.
Conclusion

- Language aptitude = an improved ability for L2 learners to notice structural patterns, restructure their mental representations of the rules governing linguistic input and synthesise additional linguistic systems.

- Medium effect size effect of LA in both predictive and interactional studies.

- More research is needed to disentangle how aptitude correlates with Age and knowledge acquisition processes, such as implicit and explicit learning.

- Need for further research in Aptitude Treatment Interaction and development of appropriate tests specifically designed to measure the relationships between different types of treatments and language aptitude.

- The correlations observed between aptitude and younger children, though controversial, suggest a continuity between early and late second language learning ability. The link between language aptitude and L1 resistance to attrition and L1 level of proficiency corroborate this hypothesis. Exploring how aptitude correlates with second language acquisition at different ages may reveal how the language learning ability develops over time.
Conclusion

Meisel’s (2011) 3-tier theoretical proposition concerning the cognitive processes involved in language acquisition, ie.:

- a core of UG abilities sensitive to age effects
- a language acquisition device (LAD) containing more than UG (with domain specific discovery and processing mechanisms)
- a language making capacity subsuming the previous abilities and including domain general operations

would lead research to reconsider aptitude not as a predictive set of tests used for determining future level of achievement, but as a complex of abilities susceptible of opening the way for a more profound understanding of what a language making capacity really is and how its components change over time.

The research debate on domain-general (as explored by HiLab aptitude test) versus domain-specific abilities (measured with MLAT-based procedures) might be illuminated by research on language aptitude that compares the effectiveness of different tests. LA = a central focus of SLA research to advance both theoretical and practical knowledge.
Pedagogical implications

- Recent research shows controversial effects of degree of language aptitude not only on adults, but also on children’s L2 learning rate and level of ultimate attainment, before and after the end of the critical period.

- High school students, having lower levels of proficiency, are more likely to draw on aptitude resources than university students that have reached a stage of near ultimate attainment.

- Age: younger L2 learners (12 years) draw more on aptitude operationalised as memory ability whereas older learners are more able to exploit their grammatical analytic ability for language acquisition. Pedagogically, this means that teaching might focus on younger children memorising chunks of language that they will analyse and use productively later. With age and developing proficiency, tasks should make increasing demands on learners’ analytical skills and creative output production.

- Correlation between LA scores and measures of general intelligence => children with high level of general intelligence may also have a higher level of language aptitude. However, language aptitude test results are better predictors of their attainment in linguistic proficiency than general cognitive abilities tests.

- Children with high IQ might have more differentiated sets of language abilities (working memory, analytical ability, etc.), with some aptitude complexes reaching a high level and others being more limited.

- Individual differences in language aptitude and motivation might compensate for each other => encourage motivation by promoting the use of a range of strategies to increase self-efficacy and compensate for lower degrees of aptitude in various abilities (memory/analytic/auditory).
Pedagogical implications

LA affects L2 learning differently under various types of contexts/tasks/feedback/input conditions.

- **Instructional context:** instructed learning with analytic orientation draws more on language aptitude compared to naturalistic learning that levels out differences in LA.

- **Implicit/explicit learning condition:** higher aptitude is associated with a greater capacity to benefit from instruction, whether it is explicit or implicit, even on short periods.

- **Incidental learning condition:** not sufficient for learners to draw on aptitude to compensate for a focus on meaning. L2 learners that benefit more from this learning condition mainly draw on Working Memory resources.

- **Structured input:**
  - Structured input presenting salient grammatical structures might level out differences in LA. Children with a high level of aptitude benefit from structured input and are consequently more able to use the learned grammatical features in written productions. Children with higher ability in Working Memory also benefit from structured input and maintain long-term representations of these features.
  - Aptitude seems to work with instruction when the language point is salient, with aptitude facilitating input processing, or redundant, in which case aptitude enables the learners to focus their attention on the grammatical point, rather than the utterance meaning.

- **Type of feedback:** Learners with high aptitude benefit more from explicit than implicit feedback. In both implicit and explicit feedback conditions, aptitude favoursises grammar learning when the structure is redundant, or compensates for its lack of salience in the input.
Pedagogical Implications

LA is composed of a stable component and a dynamic (teachable) component, which can be developed through:

- L2 learning experience before the age of 10
- bi- and multilingualism, even at a very low level of experience in the L3, L4 +.
- the learning of numerous languages should be encouraged as the number of learnt languages plays a role in developing language aptitude.
- Perceived Positive Language Interaction between the learnt languages should be promoted.
- Encourage the development of language aptitude by emphasizing typological proximity of the learners’ languages, thus increasing their ability to transfer linguistic knowledge (Perceived Language Distance; Kellerman, 1987).
- the learning of language acquisition strategies, at which high aptitude learners are more efficient: searching for underlying rules, mnemonic devices, adaptive orchestration of strategies
- raising metalinguistic awareness, as learners with high aptitude might be more efficient at processing language learning. Automatic processes represent a lesser cognitive load than controlled ones and free up cognitive resources. With metalinguistic awareness, controlled processes become automatic more quickly when learning additional languages.