Language Aptitude in L2 Learning: A Synthetic Review

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What Is Language Aptitude?

- Cognitive abilities predictive of learning rate and ultimate attainment in a second language
- Components of traditional aptitude
  - Phonetic coding
  - Language analytic ability
  - Rote memory
- Recent development/cutting edge: implicit aptitude

Characteristics of Traditional Aptitude (Li, 2015, 2016)

- Not easily changeable but may be subject to experience
- Increases with age
- Uncorrelated with motivation
- Negatively correlated with anxiety
- Distinct from working memory
- Overlaps with but is dissociable from intelligence

Measures of Language Aptitude

- The Modern Language Aptitude Test (MLAT) (Carroll & Sapon, 1959)
  - Number Learning: learn numbers in a new language
  - Phonetic Script: learn sound-symbol associations
  - Spelling Clues: answer questions about English vocabulary
  - Words in Sentences: identify functions of sentence elements
  - Paired Associates: memorize word-meaning associations
- Validated with 5,000 foreign language learners
- Initial motive: to select elite learners

Other Aptitude Tests

- LLAMA (Meara, 2005)
  - Most popular in current research
  - Free
  - Modelled on the MLAT
  - Language neutral
  - Low internal reliability except for LLAMA_B (Bokander & Bylund, 2019)

- Hi-LAB (Linck et al., 2013)
  - Abilities for high proficiency
  - Significant predictors: rote memory, phonological short-term memory, and serial reaction time
  - Outcome measures: reading and listening

Perceptions of Aptitude and Actual Aptitude

- Li (2020)

	Actual Aptitude (Scores on Aptitude Test)			
Self-Assessed Aptitude	Overall Aptitude	Phonetic Coding	Analytic Ability	Memory
Overall Aptitude	.25*	.22	.14	.14
Phonetic Coding	.12	.04	-.05	.06
Analytic Ability	.32*	.20	.20	.18
Memory	.32	.12	-.06	.30*

Theories of Traditional Language Aptitude

- **The Carrollian Approach:** a Behavioristic approach to language learning; represented by the MLAT (Carroll & Sapon, 1959)

- **Aptitude-Treatment Interaction (ATI):** different learning conditions draw on different clusters of cognitive abilities (Robinson, 2011)

- **Fundamental Difference Hypothesis:** children depend on UG and adults on domain-general analytic ability (Bley-Vroman, 1990)

- **The Staged Model:** noticing, patterning, controlling, and lexicalizing (Skehan, 2012)

Research

- <u>Aptitude and instructed learning (regardless of context)</u>: How does aptitude relate to learning outcomes?

- <u>Aptitude and instruction type</u>: How does aptitude relate to the effects of different instructional treatments?

- <u>Aptitude and age</u>: Do child and adult language learning correlate with aptitude differently?

Aptitude and Instructed Learning

- A strong predictor of L2 proficiency: r = .50 (Li, 2015, 2016). Compare:

  - Working memory: r = .25 (Linck et al., 2013)
  - Motivation: r = .37 (Masgoret & Gardner, 2003)
  - Anxiety: r = -.36 (Teimouri et al., 2019)
  - Intelligence: r = .50 (Neisser et al., 1996)

# Aptitude and Instructed Learning

- Stronger correlations for high school learners than university learners (Li, 2015)
  - Aptitude is likely more important for initial learning
  - Similar to the findings for working memory (Cheung, 1996; Serafini & Sanz, 2016)

Aptitude and Age

- Core statement: adults draw on aptitude while children don't

- Hypothesis 1: Aptitude is correlated with adult SLA but not child SLA

  - Yes: DeKeyser (2000); Granena & Long (2012)
  - No: Abrahamsson & Hyltenstam (2008)

- Hypothesis 2: To achieve high proficiency, early starters don't have to rely on aptitude, but late starters do

  - Yes. Abrahamsson & Hyltenstam (2008); DeKeyser (2000)
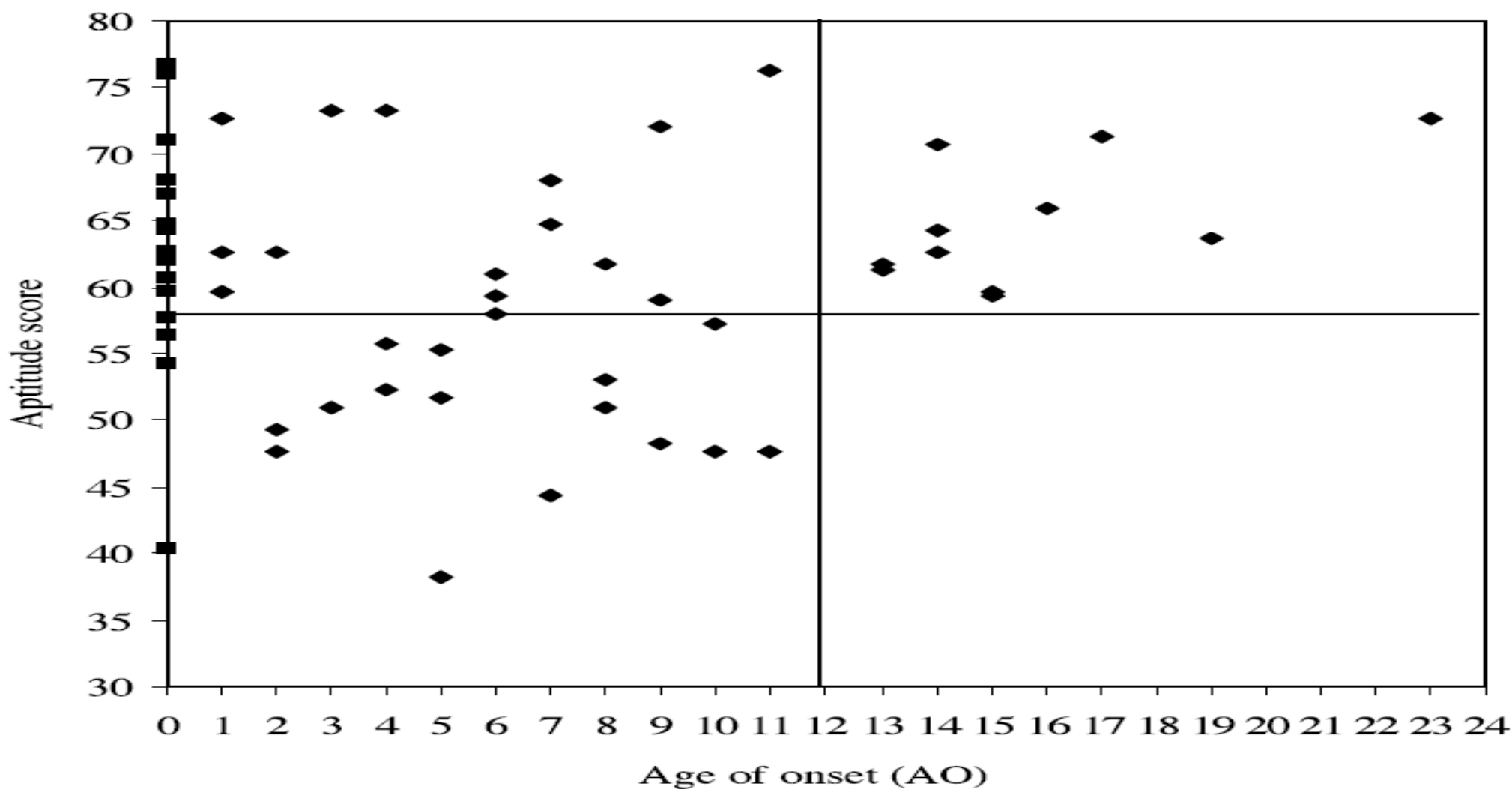
Aptitude –Treatment Interaction

- Deductive vs inductive instruction
  - Deductive: rule followed by practice; inductive: rule extrapolated from input material
  - High-aptitude learners benefited more from inductive instruction; low-aptitude learners achieved more through deductive instruction (Erlam, 2005; Hwu et al., 2012)
- Explicit vs. implicit instruction
  - Aptitude is more strongly correlated with the effects of explicit instruction than implicit instruction (Li, 2015), hence the need for implicit aptitude

Implicit Aptitude: Cutting-Edge

- Implicit aptitude: cognitive abilities for unconscious computation of distributional and transitional probabilities
- Implicit learning
  - As a process or learning outcome—primary focus of research
  - As a cognitive ability—new
- Recent initiatives on implicit aptitude in SLA
  - 2021 special issue of *Studies in Second Language Acquisition*
  - 2021 AAAL colloquium

Distinguishing Explicit and Implicit learning

- Dual-process theories of learning (Evans & Frankish, 2009)
  - Explicit learning: evolutionarily more recent, rule-based, analytic, fast, flexible, short-lived
  - Implicit learning: more primitive, data-driven, intuitive, slow, inflexible, sustainable
- Evidence for the separation
  - Explicit learning abilities are uncorrelated or negatively with implicit learning (Gebauer & Mackintosh, 2007; Reber et al, 1991; Robinson, 2005)
  - Patients with cognitive deficits in explicit learning have intact implicit learning abilities (Arciuli, 2017) and vice versa (Jiménez-Fernández et al., 2011)

Implicit Aptitude in SLA Theories

- **Usage-based SLA** (Han, 2020)
  - "The bulk of language acquisition is implicit learning from usage" (Ellis, 2005, p. 306)
  - Language learning is a matter of sequence learning
  - Explicit learning prepares the fodder for implicit learning

- **Interaction Hypothesis:** learning is optimal when input is detected initially and processed implicitly thereafter (Long, 2015)

- **Skill Acquisition Theory:** explicit aptitude facilitates initial learning and implicit aptitude is important in advanced learning (DeKeyser, 2020)

Summary of Theoretical Claims

- Implicit aptitude makes an independent contribution to SLA
- Implicit aptitude important for complex structures; explicit aptitude for simple structures
- Implicit aptitude important for advanced L2 learning; explicit aptitude for initial learning
- Implicit aptitude is facilitative of both adjacent and non-adjacent structures

Summary of Theoretical Claims

- Double dissociation: Implicit and explicit aptitude versus implicit and explicit instruction

- Implicit aptitude for grammar; explicit aptitude for vocabulary

- Implicit and explicit aptitude may interfere with each other

- Implicit aptitude may contribute directly to implicit knowledge; explicit aptitude may contribute to implicit knowledge indirectly by providing materials for implicit learning

Characteristics of Implicit Aptitude

- Componential: not a unitary construct

- Domain general and domain specific

- Developmental: increases with age (Hodel et al., 2014; Saffran, 2001) and does not decline significantly (Ward et al., 2013).

- Subject to experience (Granena, 2013; Potter et al., 2016)

Components of Implicit Aptitude

- Sensitivity to
  - distributional statistics: frequency
  - transitional probability: co-occurrence
- Selective attention
  - Ability to select relevant input
  - Once selected, input is processed implicitly
  - Involves low levels of awareness
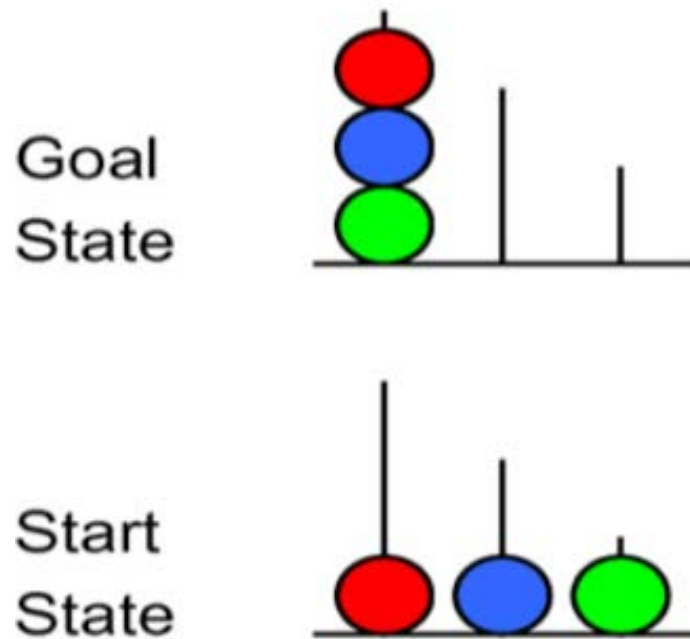
Measures of Implicit Aptitude

- Sequence learning
  - Serial reaction time: popular and most reliable predictor of learning
  - LLAMA_D: inconsistent measure of implicit aptitude
  - Artificial grammar (Li, in preparation)
- Syntactic priming (Li, in press)
- Process control (procedural memory)
  - Tower of London
  - Sugar production
  - Weather prediction

Serial Reaction Time
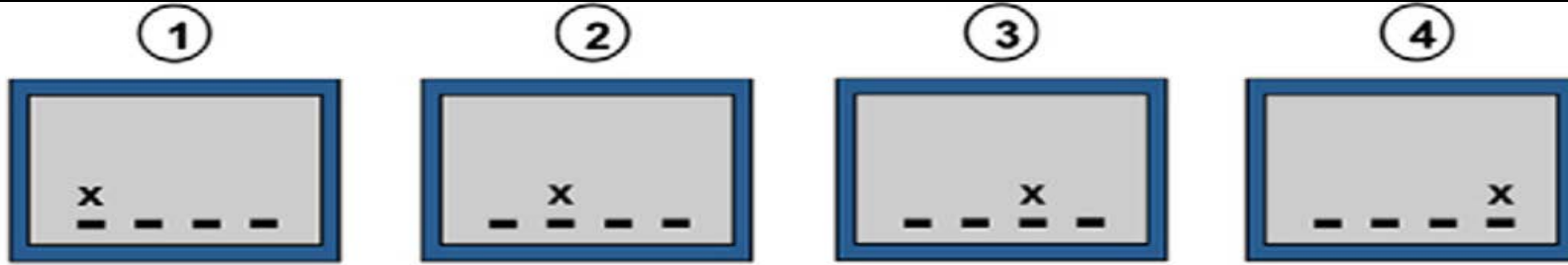
- Learners respond to a symbol appearing at different locations
- The locations are based on two sequences

    A: 1–2–1–4–3–2–4–1–3–4–2–3– (target, more frequent)

    B: 1–2–4–3–1–4–2–1-3–2–3–4– (control, less frequent)

- Learners respond faster to the target sequence

Tower of London (Kaller et al., 2011)

Goal State

Start State

Rules

- Can only move one ball
- Can't be moved if another ball on top
- 3 balls can be on 1st peg, 2 on the 2nd peg and one on the 3rd peg
- ☐ A test of procedural memory

Validation of the Construct of Implicit Aptitude

- **Divergent validity:** whether implicit aptitude is uncorrelated with explicit aptitude
  - Yes: implicit aptitude is uncorrelated or negatively correlated with explicit aptitude (Hamrick, 2015; Li, in press; Linck et al., 2013; Suzuki & DeKeyser, 2017; Yi, 2018)
- **Convergent validity:** whether measures of implicit aptitude are correlated
- **Predictive validity:** whether implicit aptitude is predictive of L2 attainment
  - Naturalistic settings: learners are exposed to the L2 in daily life
  - Instructed settings: classroom
    - Correlational
    - Experimental

Poor Convergent Validity of Implicit Aptitude

- Measures of implicit aptitude are uncorrelated or negatively correlated
  - Li (in press): serial reaction time negatively correlated with syntactic priming
  - Godfroid & Kim (in press): serial reaction time, statistical learning, and Tower of London were uncorrelated
  - Buffington et al. (in press): weather prediction, Tower of London, and serial reaction time were uncorrelated; weather prediction loaded with declarative memory (explicit aptitude)
- Implicit aptitude is multi-dimensional
  - Unlike explicit aptitude or intelligence (e.g., Flaim & Blaisdell, 2020)

A Modular View of Implicit Aptitude

- Formulate a mapping sentence to clarify the construct
  - "Implicit aptitude is the ability to learn the distributional/transitional relationships between adjacent/non-adjacent structures in verbal/nonverbal stimuli in the visual/auditory modality." (Li, in press; adapted from Siegelman et al., 2017)
- Also specify the predicted domain of L2 knowledge and the L2 skill

Predictive Validity

- ## Naturalistic learning
  - Important for learners with longer residence (Grenana, 2013; Suzuki & DeKeyser, 2015, 2017; Yi, 2018) or homogeneous backgrounds (Godfroid & Kim, in press); only correlated with agreement structures (Granena, 2013)
- ## Instructed learning
  - Correlational research: correlated with high proficiency (listening and reading) (Linck et al., 2013) and implicit or procedural knowledge (e.g. oral production) (Granena, 2019; Saito, 2019; Suzuki, in press)
  - Experimental research
    - Natural language: implicated under implicit conditions in highly controlled experimental studies (Yilmaz & Granena, 2019)
    - Artificial language: associated with later stages of learning under incidental conditions (Hamrick, 2015; Morgan-Short et al., 2014)

Relation to Fundamental Difference Hypothesis

- Fundamental Difference Hypothesis: children draw on implicit aptitude while adults rely on explicit aptitude
- Research: counter evidence for the Fundamental Difference Hypothesis
  - Implicit aptitude is predictive of both child and adult learning (Yilmaz and Granena, 2019; Morgan-Short et al., 2014)
  - Explicit aptitude is predictive of both child and adult learning (Abrahamsson & Hyltenstam, 2008; Kiss & Nikolov, 2005; Roehr-Brackin & Tellier, 2019)
  - Adults have stronger implicit and explicit aptitude than children (Hodel et al., 2014; Thomas et al., 2004)
- Possible explanations (Li & DeKeyser, in press)
  - Adults may have lost some aspects of implicit aptitude
  - Implicit aptitude measured through psychometric tasks is domain general

Pedagogical Implications

- Uses of aptitude scores
  - Select learners
  - Diagnose learning disabilities
  - Placement
  - Advise students
- Utility of implicit aptitude
  - Aptitude tests must include implicit aptitude
  - Learners with weak explicit aptitude may have strong implicit aptitude
- Accommodating learners with different aptitude profiles
  - Mix explicit and implicit instruction
  - Mix inductive and deductive instruction