Cognitive Aptitudes for Implicit and Explicit Learning

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Overview

- Conceptualizing language aptitude: Past and Present
- Applying aptitude to explain variation in:
  - Ultimate attainment (i.e., ceiling)
  - Outcomes under different instructional interventions (i.e., rate)
- Future research and applications
Factors in L2 Learning

How do individuals differ in learning languages?

- **Affective** (e.g., motivation, personality)
- **Experiential** (e.g., language experience)
- **Biological** (e.g., age)
- **Cognitive** (e.g., language aptitude)
Language Aptitude

- “Special talent” for language; “language flair”; “knack” for languages
- No unitary construct of aptitude: Not one indivisible ‘thing’ but many ‘things’ (componential)
- We should speak of cognitive aptitudeS for language learning: Cognitive and perceptual abilities that predispose individuals to learn well or rapidly
Language Aptitude in the Past

- J. B. Carroll as the dominating figure (50’s and 60’s)
- Carroll’s assumptions about aptitude:
  - Componential
  - Independent of intelligence
    - True for some aptitudes (Woltz, 1990, 1999)
    - Not true for other aptitudes
      - Intelligence ↔ Working Memory (Engle et al., 1999; Kyllonen, 1996; Kyllonen & Christal, 1990)
      - Intelligence ↔ LLAMA tests B, E, F (Granena, 2012)
  - Innate and stable
    - Some aptitudes are trainable (Jaeggi et al., 2010, 2011) or impacted by experience (Papagno & Vallar, 1995; Grigorenko et al., 2000)
Carroll’s model and the MLAT (Carroll & Sapon, 1959)

- **Phonetic Coding:** Ability to form associations between sounds-symbols = **Auditory ability**
- **Rote Learning:** Conscious storage of information in LTM by repetition = **Memory ability**
- **Grammatical Sensitivity:** Ability to recognize grammatical functions
- **Inductive Learning:** Ability to infer (notice and identify) patterns or rules = **Language analytic ability** (Skehan, 1989)
Limitations

• Weighted in favor of explicit cognitive processes
  ▪ Conscious reflection on language forms, time to think and analyze, and memorize
    ▪ Designed to predict rate under intensive conditions (audiolingualism)

• Advances in understanding how languages are learned and in teaching methodology (Long & Doughty, 2009)
  ▪ Study of language as object vs. experiential approaches

• Advances in the understanding of human memory systems (e.g., Baddeley & Hitch’s WM model in 1974)
Limitations

• New aptitude constructs
  ▪ Implicit learning and memory processes as abilities
    (Woltz, 2003) (e.g., primability, SRT anticipations)
    ▪ Learning “in the absence of
      1) conscious intention to learn
      2) conscious awareness of the fact that we are learning
      3) conscious attribution of any noticed change to the effects of
         learning” (Jiménez, 2002: 62)
  ▪ Meaningful individual differences do exist (Kaufman et
     al., 2010; Reber & Allen, 2000) vs. Reber (1989)
  ▪ Carroll and Maxwell’s (1979) “budding but fitful and hesitant
     courtship between psychometrics and experimental cognitive
     psychology” (p. 604)
Updating Aptitude

• Doughty et al.’s (2010) Hi-LAB (High Level Language Aptitude Battery)
  ▪ Active Memory and Processing (WM, STM, Task Switching, Processing Speed)
  ▪ Foreign Sounds (Learning/Distinguishing foreign sounds)
  ▪ Implicit Learning (Priming, SRT Anticipations)
  ▪ Explicit Learning (Explicit Induction, Rote Memory)
Updating Aptitude

• Granena (2012; 2013a)
  - Explicit Language Aptitude: Relevant for explicit language learning and processing (intentionally) through reasoning and deliberate hypothesis testing
    - LLAMA B, E and F in the LLAMA aptitude test
    - GAMA (intelligence)
  - Implicit Language Aptitude: Relevant to acquire patterns in input without awareness of the rules (implicit induction)
    - LLAMA D
    - Probabilistic Serial Reaction Time Task

- Include study time (offline measures)
- Involve working out relations (problem-solving)
- Allow strategy use
- No study phase
- Involve online processing
- Minimal demands on executive functions
Sample Items

- GAMA (explicit aptitude): Matching, Analogies, Sequences, Construction
Sample Items

- Probabilistic SRT Task (implicit aptitude)
What can Cognitive Aptitudes Explain?

- **Learning success**
  - Speed of language acquisition *(rate)*
  - Variation in ultimate attainment *(ceiling)*

- **The nature of the learning process**
  - In different learner populations (e.g., child vs. adult learners; DeKeyser, 2000)
  - Under different instructed conditions (e.g., Feedback types, task conditions, types of instruction): **ATI research** (Erlam, 2005; Sheen, 2007)
    - **Example:** Language analytical ability will play a role in a teaching method that makes learners figure out rules by themselves
Some Research Findings

Cognitive aptitudes and ultimate attainment in informal contexts

Explicit Aptitudes
Granena (2012)

Implicit Aptitudes
Granena (2012)

Cognitive aptitudes and rate in formal contexts

Explicit Aptitudes
Yilmaz & Granena (submitted)

Implicit Aptitudes
?
Aptitude and Ultimate Attainment

  - Aptitude measures were weighted heavily in favor of explicit cognitive processes (i.e., language analysis)
  - L2 attainment measures allowed time to reflect on language correctness (untimed GJT)

Some positive association between the two sets of scores is to be expected because they are tapping into the same metalinguistic abilities (Long 2007:73)

Evidence from aptitude and L2 measures that are less similar would be more robust!!
Granena (2012)

- Chinese L1-Spanish L2 learners in a naturalistic learning context (long-term residents in Spain)
  - 50 child L2 learners (AOs 3-6)
  - 50 adult L2 learners (AOs > 16)
  - 20 NS controls

- Explicit language aptitude (LLAMA B, E, F, and intelligence) and implicit language aptitude (LLAMA D and SRT task)

- Agreement structures and non-agreement structures

- L2 measures requiring more or less automatic use of language knowledge
Granena (2012)

- Results for both early and late learners, not NSs

+ controlled

- Metalinguistic Knowledge Test
- Untimed GJTs
- Explicit Language Aptitude

+ automatic

- Timed GJTs
- Word Monitoring Task
- Implicit Language Aptitude (agreement structures)
Summary

Differences in cognitive aptitudes explain variation in ultimate attainment in both early and late learners.

However, the effects of aptitude differ depending on:

1) Type of L2 measure

- **Explicit aptitude**: L2 measures that focus on language correctness + controlled use of knowledge (also in Granena, 2013b)

- **Implicit aptitude**: Meaning-based measures + automatic use of knowledge

2) Target structure (salient vs. non-salient)

No relationship in NSs (typically at ceiling or highly homogenous)
Aptitude and L2 instruction

- Differences in cognitive aptitudes may moderate the effectiveness of different types of instruction

- ATI research
  - Types
    - A. Intentionally matching learners to treatment condition (aptitude is measured prior to the experiment)
      1. Collect aptitude data on participants
      2. Identify aptitude subgroups (e.g., analytic vs. memory)
      3. Randomly assign from each subgroup into treatment groups
      4. Assess effectiveness of treatments
    - B. Including aptitude as a moderator variable (aptitude is measured at the time of the experiment) (e.g., Erlam, 2005; Sheen, 2007)
Pretest/Posttest/Delayed Posttest design (N = 80)

Explicit language aptitude (LLAMA subtests B/E/F)

Different feedback groups that were comparable in aptitude:

1) Explicit Feedback (n = 16): Direct correction
2) Implicit Feedback (n = 16): Recasts
3) Mixed Feedback (n = 16): Explicit feedback in first two obligatory contexts and implicit feedback in the rest
4) Reduced Explicit Feedback (n = 16): Explicit feedback in first two obligatory contexts
5) No Feedback (n = 16)

Oral production as outcome measure

Use of the indefinite article by Turkish EFL learners
Results

In terms of the effectiveness of feedback...

- In the immediate posttest
  - All the feedback groups > No Feedback group
  - Explicit and Mixed > Implicit and Reduced Explicit
  - Explicit = Mixed
  - Implicit = Reduced Explicit

- In the delayed posttest (2 months)
  - All the feedback groups > No Feedback group
  - No differences among feedback groups
Results

In terms of the effects of explicit language aptitude...

- The impact of aptitude on learning outcomes depended on feedback group (significant interaction)
- Aptitude explained 43% of the variance in immediate posttest scores in the Explicit Feedback group \((r = .66*)\) (and between 0% and 8% in the other groups)
- No significant relationship between aptitude and delayed posttest scores
Conclusions

- Certain types of instruction do match L2 learners’ cognitive abilities better
- Explicit feedback seems to require a mental process that is facilitated/hampered by the value of aptitude for explicit learning
- It may have put pressure on the learners to focus attention on language structure, search for rules and formulate/test hypotheses
Pedagogical implications

Vatz, Tare, Jackson, & Doughty (To appear)

- An instructional treatment may level the playing field and yield superior results regardless of aptitude

- Aptitude may play a role within a treatment, but this treatment may be still as good, or better, than other options, even for the lower-aptitude learners

- Two treatments may be equally effective but aptitude plays a role only in one of them

  - Favor the type of instruction that produces similar outcomes without benefitting subgroups (unless students can be matched to instruction)

Explicit Feedback = Mixed Feedback

[+ aptitude] [- aptitude]
What are **aptitude profiles**?

- IDs are not simply continuous but “learner types” (patterns of aptitude) can be identified (Skehan, 1986; 1989; 1991; Pimsleur et al., 1966)
  - Analytically vs. memory-oriented learners (Skehan, 1986)
- Aptitude components are relatively independent
- We can apply this idea to explicit and implicit aptitude, since they are not correlated (Granena, 2012):
  - **High** Explicit, **Low** Implicit
  - **Low** Explicit, **High** Implicit
  - **High** Explicit, **High** Implicit
Further Research: Aptitude Profiles

- **Research design: A proposal** *(Yilmaz & Granena, In preparation)*
  - **ILA** (Implicit Language Aptitude)
  - **ELA** (Explicit Language Aptitude)

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Other Research Ideas?

- Other instructional interventions (triangulation)
  - Methods of instruction – e.g., rule explanation vs. input flood
  - Task design features – e.g., high vs. low cognitive demands of tasks
- The role of aptitude in NSs (children and adults)
- Aptitudes × target structures
- Online learning and technology to investigate aptitude profiles
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THANK YOU!!

QUESTIONS, COMMENTS, SUGGESTIONS?
Bibliography

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