Role of attention in experts' working memory functions - with consecutive interpreters as example

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1. Expertise – what is it?
   - definition of expert
   - deliberate practise
   - attention and expertise

2. Interpreting – what is it?
   - simultaneous and consecutive interpreting – differences

3. Master thesis & scientific article: Experiments
   - Word span measures – concrete and abstract
   - Attention and foreign language expertise
   - Prose recall – concrete and abstract

4. Conclusions - questions
Levels of expertise
Chi, 2003, 22

- Novice – noviisi
- Initiater – aloittelija (passed initiation rituals)
- Apprentice – oppipoika
- Journeyman – ammattilainen, asiantuntija
- Expert – ekspertti, huippu-, eliitti-
- Master – mestari, opettaja

Who is an expert?

Ericsson ja Smith, 1991:

- expert performance – consistently superior performance on a specified set of representative tasks for a domain

- intensive dedication in one domain of expertise at least for 10 yrs
Expertise – not innate

Ericsson K.A. et al., 1993:
- IQ does not correlate with exceptional skills:
  - correlation visible only in beginning of career:
    - after 5 yrs no differences
- Talent = practising from very early age
  - Schlaug et al., 1995: absolute pitch:
    - achieved at approx. 6 years by listening and practising
- learned skill – not innate - deliberate practise

Deliberate practise

- intensive practise
  - approx. 4 hrs/day,
  - 3-5 days/week
- motivation to practise and get better
- goal
- feedback

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Deliberate practise

Experience **alone not enough**

- reorganization of knowledge
  - faster accuracy
  - learning from mistakes
  - new alternative methods
- deliberate training (coaching)
  - instructions help the weakest most
  - high tolerance for errors, mistakes, even misfortune
  - overcoming plateaus
    - unlearning may be needed
    - conscious effort to avoid automatisation (new goals)

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Expertise

- **Expert only in one’s own domain**, no transfer:
  - WM, Chase & Simon (1973), chess: experts recall relevant positions, not random positions
  - BUT: Gobet et al. 2001, meta-analysis: experts better even in memorizing random positions but not statistically significant
- **Basic functions automatisized**
- Selective access to knowledge
- Metakognitive skills (self-reflection)
- Understanding and integrating information from different sources:
  - context, perception, experience etc.
Expertise

➤ Perception
  • larger units
  • profound knowledge
  • organisation of patterns, models with automatisation

➤ Analysis of current situation & anticipation of future
  • qualitative (not quantitative) problem solving
  • even tiny cues enough for solution
  • fast feedback – fast development

➤ Interruptions - no influence (Oulasvirta, 2006)

➤ Even physiological adaptation (finger lengths of musicians, athletics etc.)

Expertise and attention

➤ Little research available

➤ Direction of attention differs in experts:
  • Ericsson & Charness, 1994:
    • medical students recall details, experts global relevant information
  • Ericsson & Harris, 1990 (chess):
    • experts direct attention to board center
    • novices to board borders after 50 hrs practice
Attention and memory

Conway et al., 2005:
- **short-term memory** - maintenance
  - phonological coding – surface information
  - simple STM tasks: digit span, word span
- **working memory** – attention control
  - maintenance of stimuli & goals
  - protection from distraction, interference
  - complex WM tasks: reading span, listening span, operation span, etc.

Unsworth & Engle, 2007:
- High and low WM-spans differ in:
  1. Ability to maintain information in primary memory (WM)
  2. Ability to search information in secondary memory (LTM)
    - select relevant information
    - inhibit distractions

Cowan, 2001
**Interpreting: classified by time delay**

### Simultaneous interpreting (SI)
- Translating and speaking while listening to source language text
  - delay 3-5 s or 3-4 words
- usu. by means of technical equipment:
  - sound isolated booths
  - incoming voice through headphones
  - outgoing voice through a microphone
  - unhindered view of speaker and audience
- working in pairs: 20 min each
- translation into mother tongue (L1)
- several languages at once (one booth per language)

### Consecutive interpreting
- in two phases:
  - listening and note-taking
  - speaking
- a few sentences at a time
  - = 1-3 min
- BUT: expert interpreters – 5-10 min, up to ½ h
Interpreting: where?

**Simultaneous interp.**
- conferences
- congresses
- symposiums
- big scale meetings
- UN – six official languag.
- EU – 23 languages
- relaying
- bi-active: into L2
- remote interpreting

**Consecutive interp.**
- courts
- negotiations, meetings
- community interp.
  - in Finland mostly refugees
- conferences
  - usually 1-2 languages
- no techn. equipment needed
- BUT time consuming:
  +2/3 of the speaker's time

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Interpreting: how is it possible?

- excellent knowledge in both languages:
  - automatisized search for equivalent words and phrases
- excellent general knowledge in:
  - politics, culture, sciences etc. of the countries where the languages are spoken
- thorough preparation beforehand:
  - background knowledge of subject in question
  - terminology and new words and their equivalents in both languages
Interpreting: how is it possible?

Simultaneous:
- attention divided betw. listening AND:
  - reformulation
  - speaking
  - error monitoring
  - eventual error corrections
  - monitoring overall message
- anticipation
  - conference = supertext

Consecutive:
- analysis of sentence meaning (message)
- compressing
  - chunking
- efficient reformulation
- anticipation:
  - structure in general
  - phrases, speech patterns
  - ends of sentences

Interpreting: possible problems

Simultaneous:
- fast speakers
- no materials beforehand
- no written material at all
- speaker reading written text - NO speaking freely
- extreme time pressure

Consecutive:
- partly same problems
  BUT:
  - possibility to ask questions, clarifications, draw pictures, sketches
- less time pressure
- mostly conversational style, no reading written texts
Attention and memory of consecutive interpreters

Experiments, reported in:
1. Hiltunen, 2008: Pro gradu, Helsinki University, Cognitive science
2. Scientific article: coming 2009

Subjects:
- consecutive interpreters (12-15)
  - age in average 47.5 yrs; experience 16.8 yrs
- foreign language teachers (12-15)
  - age in average 45.3 yrs; experience 16.2 yrs

Stimuli:
- Finnish concrete and abstract words (frequency controlled)
- Finnish concrete and abstract prose
Attention and memory of consecutive interpreters

Hypotheses in pro gradu:
- Consecutive interpreters are experts with
  - short-term memory functions no different from those of foreign language teachers
  - exceptional working memory functions differing from other foreign language experts
- Attention explains a great deal of interpreters’ exceptional WM functions
  - ability to maintain information in WM
    - to direct attention to relevant material
    - to inhibit any distractions

Experiments 1 & 2: Inhibition

1. Simple short-term memory span (no inhibition needed)
   - free recall: 10 words (always at beginning of session)

2. Complex working memory span:
   - 2x3 words, 2x4 words, … 2x10 words (=104 w)
   - free recall after each block, spoken
   - inhibition needed in order to prevent proactive interference (PI)
### Experiment 3: Prose recall

3. Prose recall, 2 prose texts:
- **Concrete text**: short story by Sinikka Nopola
  - 186 words, presented in 10 sequences
- **Abstract text**: short research article by Raimo Raitasalo in Kelan sanomat (website)
  - 197 words presented in 11 sequences
- Word-based judgements of concreteness (scale: 0 – abstract; 10 – concrete):
  - Concrete text: 6.39 (2.23)
  - Abstract text: 4.28 (1.65) (difference: $p < .001$)

- No note-taking
- Free recall, spoken
- Exp. 2 and 3 counterbalanced between subjects

### Results: Pro gradu

Concrete stimuli
Results: Simple STM span

- **Exp. 1** Simple span (no inhibition, 10 concrete words):
  - Interpreters: 5.92 (1.19)
  - Teachers: 6.13 (0.92)

- **Exp. 2** Strict memory span (best correctly recalled word block, number of words):
  - Interpreters: 5.50 (0.91)
  - Teachers: 5.37 (0.52)

- **Hypothesis correct**: No differences in simple short-term memory functions between consecutive interpreters and foreign language teachers

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Results: Complex working memory span

- **Complex total span** (sum of all correctly recalled words)
  - Interpreters: 79.77 (SD 7.60)
  - Teachers: 80.40 (SD 5.87)

- **Hypotheses incorrect**: No differences between subject groups
Significance of inhibition (Attention): 10 word blocks (in A1 vs. B2 ja B3)

Inhibition is significant
- especially B3 vs. A1 (p<.05)
- **BUT:**
  - for BOTH groups

AND: Inhibition is significant only with concrete stimuli:
- stimuli & inhibition interaction, p<.05
Results: article in 2009:

Word span tests, concrete and abstract

Simple short-term memory span with concrete and abstract words

NO concreteness effect:
- Both interpreters and teachers recalled concrete and abstract words equally well

<table>
<thead>
<tr>
<th></th>
<th>Strict span (n = 12 interpreters, 13 teachers)</th>
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<tbody>
<tr>
<td>Strict concr</td>
<td>5.44</td>
</tr>
<tr>
<td>Strict abstr</td>
<td>5.33</td>
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</tbody>
</table>

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Complex working memory span with concrete and abstract words:

**NO concreteness effect:**
- Interpreters and teachers recalled concrete and abstract words equally well.

**Complex working memory span with concrete and abstract words:**

Total recall of 104 words ($n = 12$ interpreters, 13 teachers)

![Bar chart](chart.png)

Concreteness effect

- **Bourassa & Besner, 1994:**
  - *no influence of imageability with abstract material*
- **Walker & Hulme, 1999:** **concreteness effect** in serial recall:
  - with spoken and read stimuli
  - with backward recall
Conclusions & questions

- No concreteness effect possible explanations:
  1. Word spans not effective enough to measure difference??
  - Ericsson & Charness, 1994: recognition of the domain's most representative tasks and repeating these tasks in a laboratory context
  2. Both consecutive interpreters and teachers are experts in foreign languages??

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Conclusions & questions

3. De Beni & Moè, 2003: use of imagery with aural presentation & use of rehearsal with written presentation ➔ better recall
4. Teachers reported using more different strategies with concrete stimuli than interpreters; as to abstract stimuli not known – so far
5. Other explanations??

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Conclusions & questions

Attention and expertise in foreign languages

1. Attention (inhibition) does play a role
   - BUT how?
   - why only with concrete stimuli??

2. Attention, abstractness, strategies and foreign language expertise seem to be intertwined
   - HOW?
   - and HOW to measure it?

Results: article in 2009:

Prose recall, concrete and abstract
Idea unit

Mills et al., 1993, 289:

- sentence or part of a sentence
  - that expresses a complete idea
    - contains an actual or implied verb
    - and is usually a phrase-size unit
- practically in Finnish: clause (lause) or shortened clause (lauseenvastike)

Prose recall with concrete and abstract texts

- Abstract text was recalled better than concrete text
  - p < .001
- Interpreters recalled BOTH texts better than teachers
  - p < .001

Prose recall
Probability of recall by groups
1 = concrete, 2 = abstract
(Y - standard deviation)
Prose recall: sequence length in concrete and abstract texts

- Abstract long sequences (with 22 to 25 words) were recalled better than concrete long sequences
  - $p < .001$

- Interpreters recalled both texts and all sequences better than teachers

- Abstract long sequences best
  - group & text interaction: $p < .005$
Prose recall, abstract: Mistakes

- Interpreters made fewer mistakes in:
  - understanding time descriptions
  - understanding causal relationships
- Only the best interpreter(s) recalled all details in:
  - important lists of definitions
  - the longest sequence of 25 words

Conclusions & questions

Prose recall: interpreters ARE BETTER than foreign language teachers
- as expected
- especially in recall of abstract texts
- But WHAT explains this?
- Vincent & Wang, 1998: constraint attunement hypothesis (CAH)
  - Weber & Brewer, 2003: experts attuned to domain relevant structure
  - But what is domain relevant for interpreters?
Conclusions & questions

- **What is the difference between abstract and concrete texts??**
  - Marschack et al., 1991:
    - causality and temporal sequences in prose recall
    - could explain the difference between the two texts
    - BUT does not explain, why interpreters were better than teachers

Litterature