

COGNITIVE PROCESSES OF CHUNKING FOR LEARNING AND TEACHING STRATEGIES

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INTRODUCTION

WHAT CHUNKING CAN DO FOR US

Arguments:

1. Chunking is a key psychological concept in learning processes because it is
 - Observed across domains and it
 - bridges between input perception and processing and storing of the information. It is also
 - Related to the verbal short-term memory, which is a key to language learning.
2. Chunking is a highly useful tool in the classroom and beyond (i.e., autonomous learning)

WHAT IS CHUNKING?

HISTORY OF OBSERVED CHUNKING

- Effects of item grouping were observed as early as Adams (1915)
- Only a little after the famous studies of nonword learning by Ebbinghaus (1850-1909)
- What are these effects of item grouping?

GROUPING EFFECTS (IMPROVED RECALL RATES)

- Recall rates are improved when items are grouped
- It happens in temporal, rhythmical, or spatial grouping and also when
- Imposed either externally or internally (by the subject themselves)

(Ryan, 1969)

THE ROLE OF CHUNKING

THE ROLE OF CHUNKING IN INFORMATION PROCESSING

- Physical constraints in information processing
- +
- Short-term memory constraints (see later slides)
- =
- 'Chunks link the external environment and internal cognitive processes' (Gobet 2001)
- But what about hierarchical processing of knowledge (generative grammar)?

THE ROLE OF CHUNKING IN LANGUAGE PROCESSING

- Domain generality of chunking
- +
- Observations of human learning of natural languages (sounds first, meanings later, etc.)
- =
- Gives observation-based concept of chunking stronger explanatory power than theory-based generative grammar (or grammar in general)

DOMAIN GENERALITY

CHUNKING ACROSS DOMAINS (DOMAIN GENERALITY)

These domains (and probably more) have been investigated

1. Motor, sensorimotor
2. Visual
3. Auditory

We will briefly look at each of these with examples of chunking.

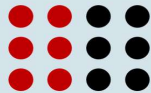
MOTOR, SENSORIMOTOR CHUNKING

- Imagine you are dialling a new number on the phone.
0753534082 > 075 353 4082
- Typing
- Playing a musical instrument

VISUAL CHUNKING

- Colours and shapes
- (Paine, 2022)

The image below demonstrates one of the principles of visual grouping – similarity of color. It is one of several principles designers wield to help users make sense of visual scenes. In using these principles, the designer is essentially telling users how to determine “what goes with what” in the image. The processes by which we determine which elements are part of the same “thing” are so fundamental that we’re hardly aware of them; and yet, they are powerful forces that structure everything we experience. To convince yourself of this, try to see the image below as three rows instead of two (or four) columns. It isn’t easy.



AUDITORY CHUNKING

- Listening to music rhythms, melodies...
- Listening to language

CONCLUSION

- '(C)hunking underlies many aspects of human learning' (Gobet, et al. 2001)

RECAP

SO FAR I HAVE ARGUED

- Chunking is grouping of information.
- Domain generality of chunking indicates it is a fundamental cognitive process and is a key to learning
- Chunking may explain language processing better than generative grammar

CHUNKING AND SHORT-TERM MEMORY

SHORT-TERM MEMORY CAPACITIES

Let us measure our STM capacities. Don't worry I want be asking you to share them. I'll read out a string of numbers, but DO NOT write it down until I say so. Try to memorise it as well as you can.

1. First in Japanese:
 2. Next in English:
 3. Finally in English and in chunks
- We'll check the answers in the next slide

OUR SHORT-TERM MEMORY CONSTRAINTS

Check your answers now.

1. 日本語 0426765186
(Tokyo University of Pharmacy and Life Sciences 5111)
 1. In English 0753539271 (Kyoto Campus Plaza 9111)
 2. In chunks in English 075 753 7531 (Kyoto U)
- Anyone with the perfect scores? Don't worry if you didn't. The short-term memory, almost by definition, has tiny capacity limits.

OUR SHORT-TERM MEMORY CONSTRAINTS

- Miller's Magical Number Seven \pm 2 (1956) reported our STM capacities are about 7 - crucially, chunks = items (however big each chunk is, 7 items will be retained)
- Later, Cowan proposed four
- In Listening Span tests (Daneman & Carpenter, form of WM tests) four quite large

*However, STM and WM are not exactly the same concept.

WORKING MEMORY CAPACITIES IN SLA

- Why was it more difficult in your second language?
- Gathercole and colleagues reported the WM capacities are smaller in L2
- Language learners (students in our class) have a huge disadvantage!

THE ROLE OF CHUNKING IN LEARNING

THE ROLE OF CHUNKING IN LEARNING

(T)here are reciprocal interactions between long-term sequence representations and short-term storage whereby long-term sequences information allows the chunking of working memory contents that accord with these consolidated patterns, thus extending the span of short-term storage for chunkable materials. The more the long-term storage of frequent language sequences, the more easily they can serve as labels for meaning reference. The more automatic their access, the more fluent is the resultant language use, concomitantly freeing attentional resources for analysis of the meaning of the message, either for comprehension or for production planning (N. Ellis, 1996).

MILLER'S CHUNKING

- Strategy to enhance memory by grouping items in terms of varying semantic attributes

↓
 IBMFBICIAIRS (12 random letters = 12 items)
 through (long-term) learning
 IBM FBI CIA IRS (4 chunks = 4 items)

↓
 LTM reciprocally augmenting STM capacities
 IBM FBI CIA IRS + BBC.NHK...

CHUNKING: TWO WAYS

- Conscious and effortful (Miller; Ellis)
- Automatic and without awareness (Gobet & colleagues, Terrace)
 - Typical in perceptual process

Next we'll look at natural language learning

SOUND TO MEANING

- It takes about 2 years for human infants to learn to segment words at a level similar to that of native adult listeners (=the foundations for language understanding) (Jusczyk, 1999)

HUMANS SPEAK IN CHUNKS NOT SYNTAX

People don't actually say 'Furious green ideas'

'(C)onversational speech is broken into fluent units of complete grammatical clauses of 4-10 words, uttered at or faster than normal rates of articulation' (N.Ellis, 1996)

CONCLUSIONS

We first learn how to chunk sounds in order to learn to speak.

We speak in chunks rather than generate endless possibilities of word combinations.

Similarly, learning sound sequences comes before rule discovery.

Taken together, I propose a paradigm shift from algorithm-based to skill-based learning (almost like procedural memory) is a path worth exploring

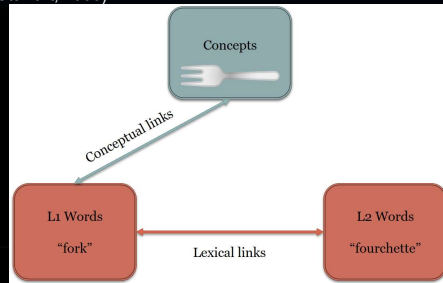
SOUND TO MEANING

Significantly,

- short-term memory is all about verbal sounds;
- long-term memory about meaning

SOUND TO MEANING

- Beginning learners naturally focus on sounds; advanced learners on meaning (Word association model by Kroll & Stewart, 1999)



THE SUMMARY

I HAVE ARGUED

- Chunking is grouping of information.
- Domain generality of chunking indicates it is a fundamental cognitive process and is a key to learning
- Chunking augments short-term memory
- Evidence indicates we tend to speak in chunks rather than generate endless possibilities of sentences based on rules
- It is worth exploring the paradigm shift from algorithm-based learning to skill-based learning, focusing on vocabulary and fluency instead of grammar

USING CHUNKING TO STRATEGIZE LEARNING AND TEACHING

TWO APPROACHES

1. Apply chunking processes to learning
2. Encourage skill-based learning

1. APPLY CHUNKING PROCESSES TO LEARNING

- 1) Note-taking in chunks
- 2) Useful teaching techniques
- 3) Awareness raising through mini-lessons

1). NOTE-TAKING IN CHUNKS

- Powerful daily practice in class
- Ss: take notes in meaningful segments divided by themselves
- T: assist by pausing for note-taking at intervals, observing Ss carefully and offering to do so (Ss will not speak up to ask for pauses)

2). TEACHING TECHNIQUES

- Finger drills
- Backward drills
- British Council/Teaching English from:
- <https://www.teachingenglish.org.uk/article/drilling-2>

3). MINI-LESSONS ON COGNITIVE PROCESSES

- For teaching (this talk and further reading)
- For learning (to develop autonomous learners)

2. ENCOURAGE SKILL-BASED LEARNING

- 1) Provide opportunities for students to use language for its authentic purposes
 - Talk about weekend activities in pairs (the past tense) or daily routines (present tense)
 - Essay writing; story writing
 - Extensive reading
- 2) Provide models with plenty of 'useful phrases' (Remember mirror neurons!)

THANKS FOR LISTENING!
YOUR FEEDBACK IS APPRECIATED.

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Hope to see you again in Kyoto!