

Writing process research 2011
Key-stroke logging and eye tracking

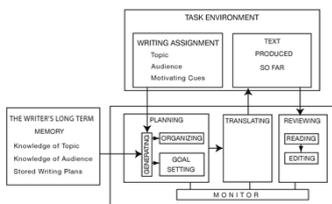
Theoretical framework

David Galbraith (d.galbraith@staffs.ac.uk)
Centre for Educational Psychology Research,
Staffordshire University

Outline of talk

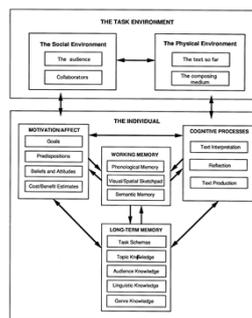
1. Classical models of writing
 - Hayes & Flower (1980); Bereiter & Scardamalia (1987); Hayes (1996); Kellogg (1992); van den Bergh et al. (2010)
2. Hayes' model of text production
 - Chenoweth & Hayes (2001, 2003); Hayes (2009)
3. Dual process model
 - Galbraith (2009)
4. Some key-stroke logging data
 - Baaijen, Galbraith & de Glopper (2010)

Hayes and Flower (1980)



1. Thinking aloud protocols
2. Identification of basic processes
3. Configurations of the monitor
4. Expertise

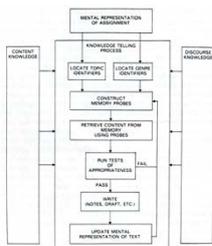
Hayes (1996)



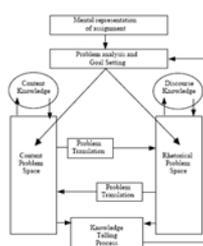
1. Refinement of basic processes
2. Incorporation of working memory (cf. Kellogg)
3. Process combinations emerging from WM availability & task schemas

Bereiter and Scardamalia (1987)

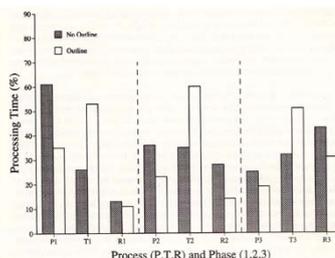
The knowledge-telling model



The knowledge-transforming model



Kellogg (1988)



Planning declines across phases
Revision increases across phases

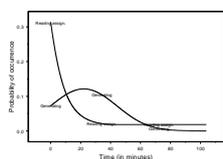
Outlining reduces planning, and increases translating, during phase 1 and 2

Effects on key-stroke data / eye-tracking?
Reduced pause time?
Longer bursts?
Increased reading time in later phases?

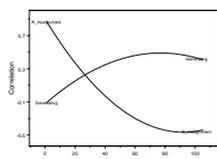
FIGURE 6.2. Processing time in a letter-writing experiment for planning (P), translating (T), and reviewing (R) as a function of prewriting strategy. (From Kellogg, 1988. Copyright © 1988 by the American Psychological Association. Reprinted by permission.)

Van den Bergh et al (2010)

Probability of occurrence of 2 processes



Relationship with quality at different points during writing



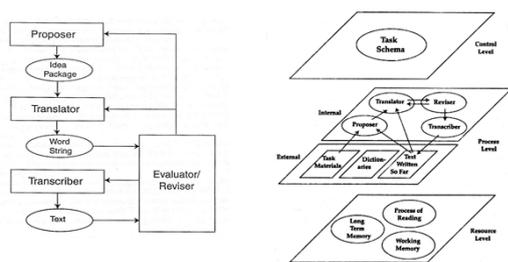
Writing as problem solving

(Hayes, 1996; Bereiter and Scardamalia, 1987)

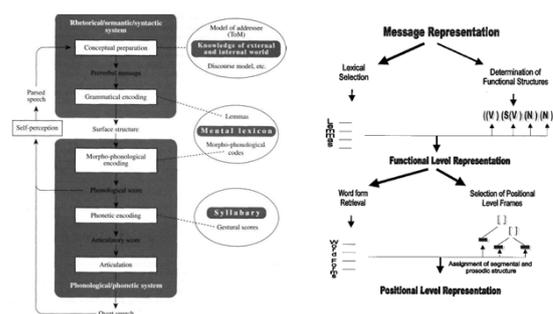
- The thinking behind the text
 - Retrieval of content from long-term memory
 - Manipulation in working memory
- Knowledge telling v knowledge transforming
 - Adapting to external rhetorical constraints
 - Managing cognitive load (Kellogg, 1994)
- Problem solving all the way down?
 - Text production as local planning (Flower & Hayes, 1984)
 - Passive output process

Text production

Chenoweth and Hayes (2001, 2003)



Models of spoken language production (Levelt, 1989, 1999) (Vigliocco & Hartsuiker, 2002)



Empirical observations

- Text produced in sentence parts
 - Production bursts (P-bursts) and revision bursts
- Factors affecting burst size
 - Linguistic experience
 - Verbal working memory capacity
 - Grammatical structure
- Re-reading of text produced so far

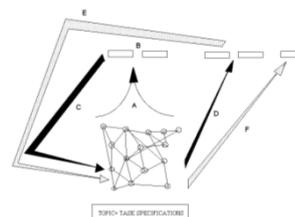
Open questions

- Effects of conceptualisation?
 - cf. Knowledge-telling v knowledge-transforming
- Relation between processes?
 - Chenoweth and Hayes claim no overlap between processes
 - Alamargot et al. 2007 provide evidence of higher level processing during handwritten transcription
- Mismatch between translation and transcription bursts (Baaijen et al., in preparation)
 - Chenoweth and Hayes claim translation process is prime source of bursts

Dual process model (Galbraith, 2009)

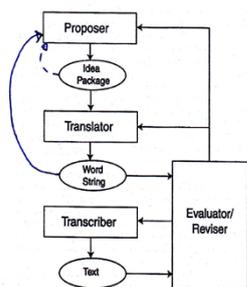
- Knowledge-retrieval process
 - Retrieval of ideas from explicit memory store (hippocampus)
 - Manipulation of ideas in working memory to create rhetorically appropriate global model
 - Dependent on spatial component of working memory
 - Leads to creation of single knowledge object in episodic memory (but not understanding)
- Knowledge-constituting process
 - Synthesis of ideas within semantic memory (neo-cortex)
 - Dispositionally guided text production
 - Sequential process, not dependent on spatial component of working memory
 - Leads to formulation of ideas corresponding to writer's implicit understanding of the topic

Knowledge-constituting process



- Writer's disposition = fixed connections between features in a high dimensional semantic space (internal constraints)
- Ideas created by constraint satisfaction within network (content synthesis)
- Successive utterances produced by inhibitory feedback from output to disposition (self-movement of thought)

Relation to Chenoweth and Hayes model



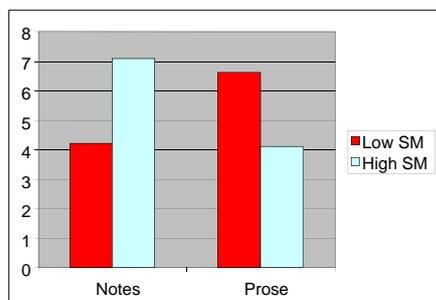
1. Synthesis rather than retrieval of content
2. Indirect relationship between reviser and proposer
3. Direct feedback from output of translator to proposer
4. Rhetorically planned v. dispositionally guided text production as source of discovery

Self-monitoring

(Snyder, 1987; Gangestad & Snyder, 2000)

- High self-monitors
 - are "particularly sensitive to the expression and self-presentation of relevant others in social situations and use these cues as guidelines for monitoring (that is regulating and controlling) their own verbal and non-verbal self-presentation".
 - Assume that they are more likely to direct their writing towards rhetorical goals (external constraints).
- Low self-monitors'
 - "expressive behaviour is controlled from within by their affective states (they express it as they feel it) rather than moulded and tailored to fit the situation".
 - They are more likely to express their ideas directly as they unfold (internal constraints).

New ideas as a function of self-monitoring and mode of writing
Galbraith (1992, 1996)



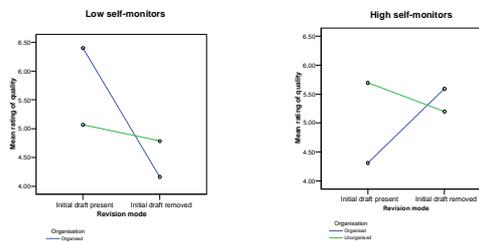
Recent studies on the two component processes

- Knowledge transforming during outlining
(Galbraith, Hallam, Olive & Le Bigot, 2009)
 - Development of ideas during outlining depends on rhetorical goals and spatial component of WM
 - Text quality related to the extent to which existing ideas are reorganised into rhetorically appropriate global structure
 - Impact on text production processes?
- Knowledge-constituting during text production
(Galbraith, Torrance & Hallam, 2006)
 - Low self-monitors (dispositionally guided) synthetically planned rough drafts lead to development of new ideas that are coherently related to initial content
 - High self-monitors' outline planned texts lead to generation of new content but this disrupts conceptual coherence
 - Process differences?

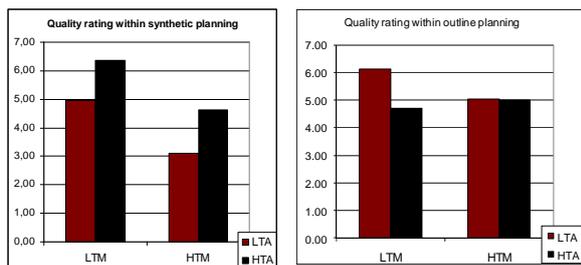
Relationship between the 2 processes

- Both processes required for effective writing
- Fundamental conflict because processes are optimised under opposing conditions
- Low and high self-monitors prioritise different components
 - Low SM prioritise knowledge-constituting and use bottom-up strategy
 - High SM prioritise knowledge-transforming and use top-down strategy

Effects of different drafting strategies on text quality (Galbraith, Torrance & Hallam, in prep.)



Individual differences in effects of outlining: Writing beliefs (Baaijen & Galbraith, 2010)



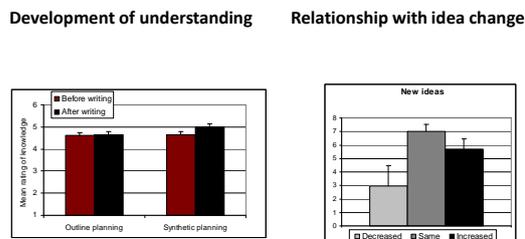
Baaijen, Galbraith & de Gloppe(2010)

- 84 university students writing article for university newspaper about dependence on computers and internet.
 - Low and high self-monitors
 - Outline planned v synthetically planned (5 minutes; single draft)
 - Measures:
 - Ratings of knowledge before and after writing
 - Changes in ideas produced before and after writing
 - Process measures derived from key-stroke logs

Predictions

- Problem solving models
 - High self-monitors should modify text more during production and hence develop understanding more
 - Agnostic about effect of planning
 - Amount of idea change should be related to development of understanding
- Dual process model
 - Low self-monitors' synthetically planned text production should involve more modification of text and hence greater development of understanding
 - Development of understanding should be associated with type of process rather than amount of idea change

Development of understanding and idea change



Considerations when analysing key-stroke logs

- 1. Taking drafting context into account
 - Raw process data codes on basis of key-stroke
 - Linear continuation v events
 - As data preparation step
 - As measure in itself
- 2. Types of bursts
 - Hayes – production bursts and revision bursts
 - Baaijen – more refined sub-categories particularly of revision bursts
- 3. Translation v transcription
 - Less direct relation between pauses and text production?
 - 2 seconds to segment text into units

The two systems involved in the dual process model

Features of system	Knowledge-retrieval system	Knowledge-constituting system
Form of representation	Explicit representation of knowledge in separate fixed units	Implicit representation of knowledge in connections between units
Generation of content	Retrieval from memory	Synthesis
Organization of content	Associative spread of activation within long-term memory or goal-directed manipulation of content in working memory	Feedback from content in working memory to writer's disposition

Drafting strategies

- Outline v rough draft (Kellogg, 1988)
 - No benefit of rough drafting
- Galbraith & Torrance (2004) claim that rough draft strategy should be
 - Unorganised initial draft
 - Identification of ideas in initial text
 - Rewriting

Galbraith, Torrance & Hallam (in prep)

- Low and high self-monitors writing 2 drafts
- Initial draft
 - Unorganised v. organised
 - Notes v. prose
- Reading and identifying ideas
- Final draft
 - Initial draft retained v. removed