Computer Support for the Rhythms of Writing

Mike Sharples

School of Cognitive and Computing Sciences
University of Sussex
Falmer
Brighton BN1 9QH
UK
Email: mike@uk.ac.sussex.cogs

Abstract

Writing is a rhythmic activity. The nature and frequency of the rhythms depend on, among other factors, the disposition of the writer, the type of text, the external representations, and the writer's tools. The computer encourages new rhythms of writing. The easy ability to make low-level revisions with a word processor may lead a writer to oscillate rapidly between composing and revising, and the facilities offered by modern writing packages may entice the writer to switch between composition and displacement activities such as word counting or spell checking. The combined effect is to set up complex cycles of engagement and reflection which may disrupt the flow of composition. The article describes the Writer's Assistant, a writing environment designed to study computer support for writing processes, and it concludes by proposing more focused investigation of the rhythms of writing.

Keywords: writing, computers, composing, cognition, dynamics, rhythms

Writing and Computers

The picture of writing that has emerged from research over the past fifteen years (Collins & Gentner, 1980; Daiute, 1981; Gregg & Steinberg, 1980; Hayes et al., 1987) is of a complex and demanding activity. Writing involves more than just presenting words neatly on a page, and much of a writer's time may be spent in gathering ideas, forming intentions, collecting resources, and producing plans. The studies have found that writing, in general, is not a simple linear progression through planning, drafting and revising, but rather the emerging text provides the writer with a continual source of new ideas, leading to revisions of plan and redrafting.

Recent accounts of writing have moved beyond an examination of mental processes to consider the writer as a member of a community of practice, holding attitudes and approaches to writing derived from a long apprenticeship, and in constant interaction with other writers, who give a context for the task and who may provide direction, support and criticism. These studies have included investigations of authors' approaches to writing (Hartley and Branthwaite, 1989), the use of external representations (plans, notes, drafts and annotations) to structure the

task and share understanding (Neuwirth and Kaufer, 1989), the characteristics of different writing tools and media (Eklundh, 1992) and the social and organizational context in which writing occurs (Flower, 1989; Ede and Lunsford, 1990).

Our own investigations have concentrated on the way that writers use external representations as an external memory, as an intermediate notation between thought and text, and as a means of specifying constraint and structure for the written text (Sharples & Pemberton, 1992). We have also carried out extended studies of collaborative writing to identify the issues (such as the partitioning and coordination of tasks), that are central to the design of software for co-authoring (Plowman, Goodlet & Sharples, 1993; Sharples et al., 1993).

The main implication of these studies for software design is that existing word processors offer only limited support to writers. There is a need for a writing environment which assists an entire episode of writing, from capturing ideas to delivering a finished document, and which allows writers working alone or in groups to set down and share their ideas, plans and intentions. We are developing the Writer's Assistant as a tool to investigate the processes of writing, and as a prototype writing environment. It combines an ideas organiser, a structure editor and a text editor, and it is designed to support a variety of writing strategies, derived from an explicit model of transitions between external representations (Sharples & Pemberton, 1990). Other articles have discussed the development of the Writer's Assistant (Sharples, Goodlet and Pemberton, 1992) and the algorithm it uses for transforming between a network of idea notes and a linear draft (Sharples, Clutterbuck and Goodlet, in press). This article concentrates on the dynamics of writing. It discusses writing as a rhythmic activity, the factors that influence these rhythms, how the Writer's Assistant supports regular movement between exploring ideas and composing text, and the implications for the design of computer tools to support the writing process. The article is based on published studies of the dynamics of writing, and on writers' self-reports of the writing process, and it concludes with some suggestions for further, more focused, studies of the rhythms of writing.

The Dynamics of Writing

There have been a number of investigations into the dynamics of writing, looking at the interaction between planning, creating ideas and producing and revising language (Hayes & Flower, 1980), at events in the writing process such as pauses (Matsuhashi, 1981) and at writers' descriptions of their composing processes (Bridwell-Bowles, Johnson, & Brehe, 1987). Although these studies indicate that writing, planning and rewriting are intermixed, they have made only passing reference to writing as a rhythmic activity.

Writing and Thinking

There appear to be two differing accounts of the interaction between thinking and text production. Flower and Hayes suggest that they take place concurrently:

> The writer must exercise a number of skills, and meet a number of demands — more or less all at once. As a dynamic process, writing is the act of dealing with an excessive number of simultaneous demands or constraints. Viewed in this way, a writer in the act is a thinker on a full-time cognitive overload. (Flower & Hayes, 1980, p. 33)

By contrast, Smith describes writing and thinking as separate, but interleaved, activities:

> The actual flow of words at the moment of writing is something over which the writer has little control, beyond turning the faucet off … There can be contemplation before the event of writing and contemplation afterwards. But the actual words that manifest themselves to express whatever thought lies behind them are neither premeditated nor predictable. (Smith, 1982, p. 104)

The apparent contradiction comes from different interpretations of the word 'thinking'. We think w*ith* the writing when we are performing it, but we cannot think *about* the writing (or

about anything else) until we pause. Writing differs from most other activities in demanding complete attention. We can walk or drive a car while simultaneously reflecting or talking. Some creative activities such as painting may become completely engrossing, but a painter can also continue to make brush strokes while holding a conversation or thinking about what to do next. That is not possible with writing.

A simple experiment will confirm this. Try to write an easy piece of prose (such as an account of "what I did since I woke up this morning") and at the same time recite the nine times table, out loud or silently. You will find yourself alternating between writing and reciting; it is not possible to do both at once. Nor is it possible simultaneously to write and to think about the structure of the text. The only conscious action that a writer can perform while producing text (apart from speaking the text out loud) is to stop. It follows, therefore, that a writer in the act has two options: to be carried along by the flow of words, perhaps in some unplanned direction, or to alternate between thinking and writing. Most writers are unable to sustain the strain of prolonged creative text production (although, as we shall see later, a few prolific writers can do so), and so, in the words of Frank Smith, when we write we "weave in and out of consciousness".

The Cycle of Engagement and Reflection

Writing consists of a regular movement between engagement and reflection. An engaged writer is devoting full attention to the task of creating text (whether it be notes or fully fleshed-out prose). Reflection consists of 'sitting back' and reviewing all or part of the written material, forming and transforming ideas, and planning what new material to create and how to organise it (see Figure 1). It is usually engagement in the production of text which is described as being creative, "It is the act of writing that produces discoveries" (Mandel, 1978), but Boden has argued that creativity arises also from the reflective exploration and transformation of 'conceptual spaces' (Boden, 1990). The suggestion in this article is that it is the rhythmic cycle of engagement and reflection which pushes composition forward, with engagement providing new material for consideration, and reflection offering a re-interpretation of the material, and new plans to be enacted.

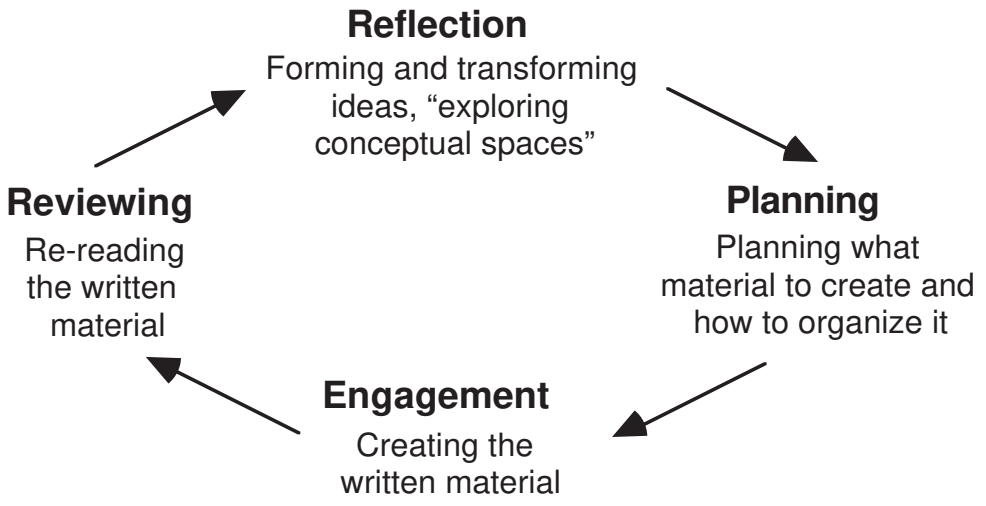

Figure 1. The Cycle of Engagement and Reflection

Writers set up distinctive rhythms of engagement and reflection. The period of these rhythms may be short, as when a writer looks back over each sentence as it is written, or long, when a writer re-reads an entire piece of writing and plans a major revision. Normally, there will be some mixture of these, and the nature and frequency of the rhythms depend on, among other factors, the disposition of the writer, the type of text, the representations used in writing, and the writer's tools.

The Writer's Disposition

A number of researchers (Bridwell-Bowles, et al., 1987; Chandler, 1992) have described two types of writer, the Planner and the Discoverer. Planners tend to use writing as a means of recording or communicating ideas which they have already formed, while Discoverers use the act of writing as a way of finding out what they want to say. Galbraith (1992) uses a similar dichotomy in characterising academic theories of writing. The 'classical' position suggests that a writer understands and develops the topic by carrying out mental problem analysis to produce ideas which are then expressed as text. The 'romantic' position holds that only through the act of writing can a writer understand herself and her topic. By engaging directly and immediately with the text, without pre-planning, a writer allows ideas to flow past the barriers of rational thought. Once the ideas are set down in physical form, they can later be reworked and polished.

Chandler (1992) suggests that Planners and Discoverers are extremes and that individual writers lie somewhere between the poles, but he does not indicate how writers can merge the two approaches. Perhaps they only partially engage with the text while writing, or are able to organise their ideas at the same time as putting them down on paper. But as we have seen, writing is not like that. The act of writing demands full attention. It is not possible to 'have your mind somewhere else', while performing the activity, nor simultaneously to write and reflect. What situates a writer between the two poles of Discoverer or Planner is whether the writer is oriented towards reflecting on, or engaging with the text.

Writers with a Planner orientation are driven by reflection — for these people, writing flows from understanding. They spend a large proportion of their time on exploring ideas and on generating plans and constraints to guide their composing. When they write, it is in an attempt to carry out a pre-prepared plan. Their rhythm is, typically, one of rapid alternation between writing and reflecting, making minor changes and adjustments to keep plan and text in harmony. Conversely, those with a Discoverer orientation are driven by engagement with the text — for them, understanding arises from writing. They may prefer to begin a writing task by scribbling out a draft which reveals their thoughts to them, and they then "seem loath to leave their texts alone" (Chandler, 1992, p. 70) which may involve them in re-reading to gain ideas which are then incorporated into the text. Their rhythm is typically one of longer periods of engagement, followed by re-reading and extensive revision.

At the polar extremes are the pathological dispositions of writers who are caught in prolonged engagement or reflection; their rhythm has come to a halt. At one pole are writers whose full attention is focused on the act of writing for long periods of time, leaving no opportunity for monitoring or critical appraisal. The quotation below is from the author Thomas Wolfe:

> I wrote too much again. I not only wrote what was essential, but time and time again my enthusiasm for a good scene, one of those enchanting vistas which can open up so magically to a man in the full flow of creation, would overpower me, and I would write thousands of words on a scene which contributed nothing of vital importance to a book whose greatest need already was ruthless condensation. (Ghiselin, 1954)

At the other pole are the overly-reflective writers who cannot turn on the flow of words. Trying to think too hard about the plans and detail of a text can result either in a complete breakdown of activity, or to interminable tinkering with ideas and text:

> Dorothy Parker reported that it often took her 6 months to write a story: "I think it out and then write it sentence by sentence — no first draft. I can't write five words but I change seven." (Bridwell-Bowles, et al., 1987, p. 83–84)

The Text Type

For most writers, a Planning or a Discovery approach to writing is not a fixed psychological trait. In general, writers are adaptable and they can alter their approach to fit the writing task. Scholarly articles encourage rapid cycles of engagement and reflection. They are generally constrained by the need to construct a balanced argument and to fit the text into a conventional form, such as a research report.

Narrative fiction writing normally encourages longer periods of engagement, because the writer needs to retell an event or to create a scene and allow imagined characters to act it out. For this, it is important that the imagined world is kept intact and in progress. A break for reflection may destroy the mental play.

The Type of Representation

Putting ideas down onto paper is not a matter of 'emptying the mind' but of actively reconstructing it:

> Putting things into words … is indeed making conscious what has hitherto not been fully so. (Storr, 1972)

External markings (such as sketches, notes, topic lists, outlines, argument structures, topic maps, and the draft text itself) are both representations of mental content and things in themselves, new stimuli dissociated from the moment of their production and available for reinterpretation. The form and structure of the different types of representation encourage distinctive rhythms as they are created and revisited.

The paragraph supports a rhythm of writing that matches cognitive load and text presentation. It is long enough to hold a topic or argument, but short enough for it to represent a 'chunk' of ideas. The writer can easily stop and scan back over a paragraph, and read it as a self-contained unit. Both Bridwell-Bowles (1987) and Matsuhashi (1981) found that the writers they studied paused regularly at paragraph breaks.

More recently, 'structured outlines' have been developed to provide an overview of the document structure and a reminder of the writer's structural plan. They encourage longer, infrequent pauses while the writer assesses how the writing fits a general structure.

Notes Networks (Sharples, Goodlet, & Pemberton, 1992; Trigg & Suchman, 1989) and Mind Maps (Buzan, 1989) are intended as 'intermediate representations' allowing a writer to visualise associations between mental concepts, before committing them to text. They allow a writer to build up a 'map' of the topics to be included in a text and to show in an easy visual form the relationships between ideas and topics. They offer distinctive, new ways of working. A writer can engage with and explore ideas as external objects, without the need to express them as written text. They also provide a visual reminder of the ideas and intentions to be referred to while writing. Instead of taking a complete mental break from writing, to assess whether the prose fits the intentions, a writer can glance at an 'external memory' to recall an idea or can add a new note to the network to record an idea that has arisen during writing. Notes Networks and other intermediate representations (such as argument trees) lead to new rhythms as the writer moves between text and diagram:

> We noted in his [an academic writer] sessions that he often alternated between diagramming or treeing his ideas on paper and writing. (Bridwell-Bowles, et al., 1987, p. 88)

The Writer's Tools

Perhaps the most important external influences on the rhythms of writing are the writer's tools. Typewriters and dictating machines are 'single mode' tools, machines whose sole purpose is to transcribe or record language. They allow words to flow as freely as possible and are suited to writing which is rapid and conversational. They differ in that a dictating machine gives no overview of the text, it can be replayed but not perceived as a whole. Typewritten text shows its structure and allows large chunks to be reviewed at a glance:

> When typing, you're more conscious of the appearance of your writing. You view it stretched out before you, detached from you. (McLuhan, 1969 cited in Chandler, 1992, p. 70)

The pen is the most intimate writing tool. The writer carves out each word on the page and the style of the handwriting indicates the speed and care of the writer. The hand moves steadily onwards, offering a more continuous engagement than the staccato rhythm of the typewriter. A pen and paper are also the most adaptable of media: margin notes, annotations, lists, diagrams, deletions and revisions can all appear together on the page as a permanent reminder of the writer's activity. It is not surprising that the pen can accommodate many styles and rhythms of writing, from the hurried scribble to the carefully crafted manuscript.

What neither the typewriter nor the pen provide is the means for the text to be easily moulded and re-represented. A writer with a pen is fixed to one representation of the written product (usually linear text). Creating text out of an outline or notes network, or vice versa, requires the writer to make an effort to abstract and re-represent the material. Thus, the rhythm of writing with pen and paper is either a rapid movement between engagement and mental reflection (limited by short term memory to chunks of a paragraph or less), or much longer cycles of writing, review, abstraction, and re-writing.

The computer brings two new rhythms of writing. The first is a consequence of the easy ability to make low-level revisions, such as substituting a word or revising a spelling. This can lead to what has been termed 'downsliding' (Collins & Gentner, 1980), the compulsion to tinker with recently written text. (In some writing classrooms, students are taught to overcome downsliding by turning down the brightness of their computer displays, so that they can write without visual distraction). The second is due to the computer providing many different modes and activities. The typical word processor now provides a wealth of displacement activities, such as spell checking, grammar checking, word counting, and formatting, to distract the writer from the business of creating words. As a consequence of computer use, the rhythms of writing are becoming ever more complex and syncopated. Whereas previously writers might pause to reflect and revise, now they can also stop to check a spelling, find a synonym, or change the page layout.

New computer tools will offer yet more movements away from the text, towards alternative views or representations of the material. One which is already widely available is the dynamic outliner in Microsoft Word. It compresses a document into an outline, by automatically extracting the pattern of headings and sub-headings. A writer can begin either by planning an outline, or by writing a draft, and the outliner supports a new rhythm of engaged writing punctuated by sessions of overviewing and restructuring the document.

It is not clear whether these new tools will be a boon or a hindrance to writers, or more specifically, what kinds of writing they will enhance and what kinds they will confound. They offer new facilities for gaining overviews of a document under construction. They provide bridges between the associational nature of ideas and the linear stream of written text. And they help a writer to fit the text to conventions of style and structure. But they may also distance a writer from the text, by providing easy ways to view it as an object. They may disrupt familiar rhythms of writing by encouraging the writer to move away from engagement with the text itself to performing generalised operations on its style or structure. Heidegger described the typewriter as snatching the script away from the essential realm of the hand (cited

in Chandler, 1992, p. 69). The computer may further tear apart the intimate relationship of thought and word.

The Writer's Assistant

The effects of new technology on the writing process cannot be discussed in the abstract; there are far too many confounding factors and differences of writing practice. What is needed is a sound understanding of the mental and physical activities of writing, as performed in differing contexts and with differing tools. This article has focused on an aspect of writing that has gained little attention, the rhythmic movement between engagement and thinking. It suggests that these rhythms should be studied by teachers of writing and designers of new tools for writers. In particular, we should consider how to encourage new potentially productive cycles of engagement and reflection, how to support continued rhythmic writing and how to dampen distracting rhythms.

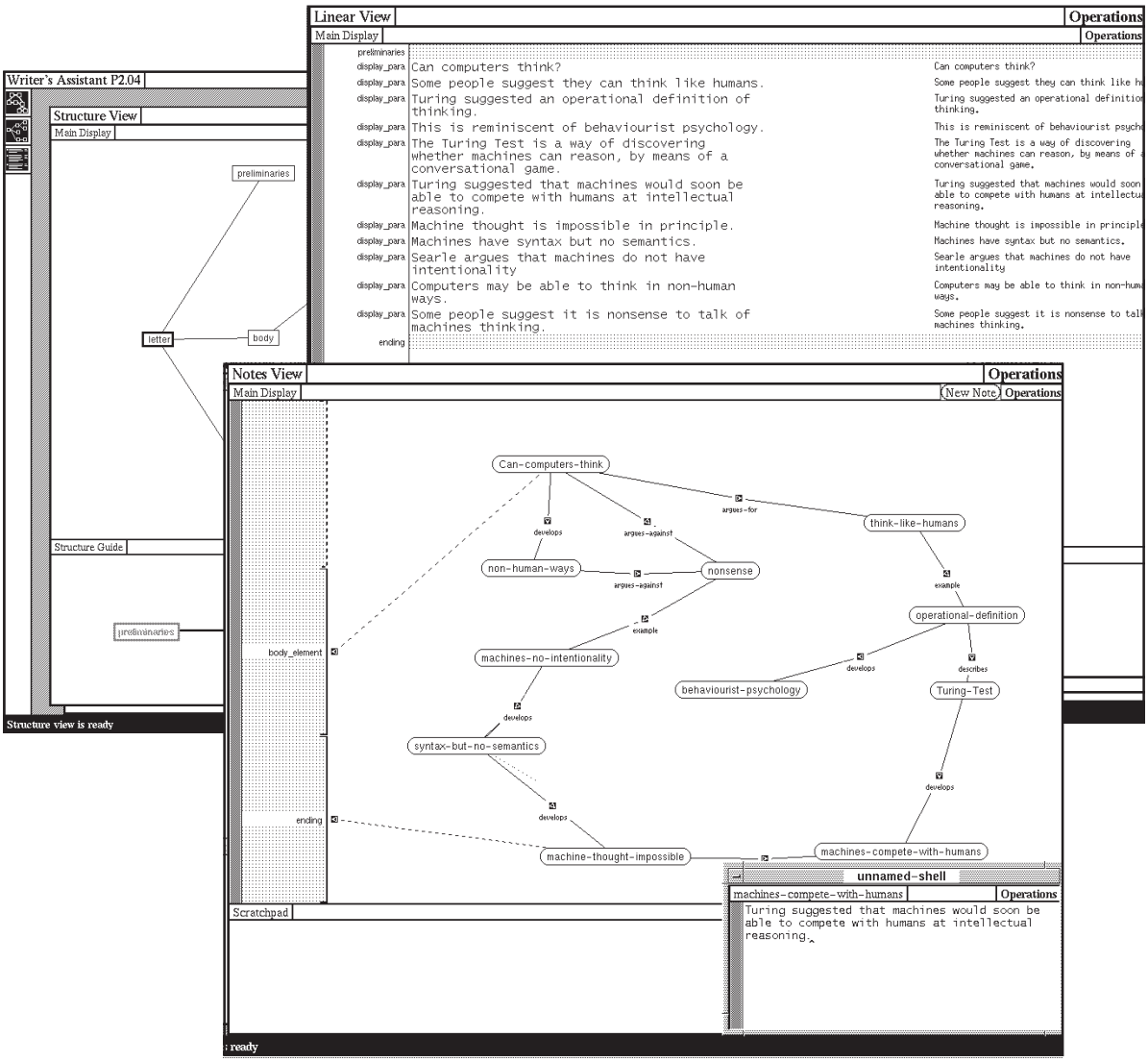

Figure 2. The three views of the Writer's Assistant

We are developing the Writer's Assistant as a test environment for studying the processes of writing. The Writer's Assistant offers three 'views' of the emerging document (see Figure 2):

a Notes Network view which allows the writer to set down ideas as notes and to link them together into a network of association, a Structure View which lets the writer create and manipulate a structural outline of the text, and a Linear View which enables the writer to type in text with the minimum of interference. A writer can move rapidly between the views by, for example, creating a rough outline, filling in some text, dumping ideas as notes, linking these notes into a network, forming the network into a string of text, and merging it with the outline. The program is designed to assist with moving between the views by, for example, automatically traversing the Notes Network to form a linear text, and finding an appropriate place in the outline structure to place the text elements (Sharples, Clutterbuck and Goodlet, in press).

One aim of the Writer's Assistant is to develop an integrated writing environment for people who create complex documents as part of their professional lives, but it can also be used to investigate the effect of new tools and representations on the writing process. Studies of writers using this and similar tools, such as the Writing Environment (Lansman, Smith & Weber, 1993) and SEPIA (Haake and Wilson, 1992) could help to answer questions such as: Is it important for a writer to maintain a regular rhythm of engagement and reflection? Does the provision of multiple views disrupt a writer's rhythm, or does it facilitate writing by offering new ways of reflecting on the structure and ideas behind a text? What is the relationship between a writer's disposition and the new computer tools?

The Writer's Assistant is only a first step towards more general support for writing, merging pen and paper with computer. The DigitalDesk, being developed by Xerox EuroPARC (Newman & Wellner, 1992) is aimed at providing seamless movement between paper and screen. For the prototype, a video camera and a projector are suspended above an ordinary desk, so that electronic documents can be projected onto the desk, and paper ones can automatically be digitised into computer text. Software connected to the camera will be able to recognise hand gestures, so that a person working at the desk can move the projected documents around just as they would push sheets of paper. A writer will be able to combine the informality of written sketches and notes with the regularity of computer-based outlines, plans and documents. Whether such systems will liberate the writer to discover new patterns of working, or whether they will just cause the writing process to become confused and disharmonious, will depend on how well they are able to support and augment the familiar rhythms of writing.

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