Fragments: the implications for teachers, learners and media users/researchers of personal construal and fragmentary recollection of aural and visual messages

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Abstract. A theory is advanced which proposes that when experience is recalled, it is recalled in fragments. The fragments are then woven together to make a story about the experience, which is what is often called construal, or making sense. There are manifold implications of the theory: in the design of instruction which explicitly employs the theory in the ways in which students are invited to work on materials in different media; for assessment which explicitly calls upon fragment processing skills; for research into the effective use of educational media.

Introduction

> If you get at the difference and distinguishing characteristic of each thing, then, as many persons affirm, you will secure its explanation; but while you lay hold only of the common and not the characteristic quality, your explanation will relate to all things to which this common quality belongs.
>
> Thaetetus of Plato (translated by Jowett, 1871)

The overall aim of this paper is to contribute to the development of a research programme which will in turn assist people to select and exploit media for educational purposes and to design instructions which make use of the particular characteristics of different media and the way in which people make sense of them. The term *media* is taken to include print, lectures, tutorials, audio/video cassettes/tapes/broadcasts/discs, audiovision and film.

The specific aim of this paper is to increase awareness of the importance of learners' fragmentary apprehension, idiosyncratic construal and fragmentary recollection of aural and visual messages. I do this by introducing the idea of a *fragment*. A fragment can be thought of as an atomic component of the experience of studying from any medium or media mix. The idea arises quite naturally out of interrogating our experience of learning in particular, and life in general. Simple as it is, it leads to a number of observations about the conduct of classes with students of all ages, and about the use of visual, aural and written media. Analysis of details and types of fragments, and how they are worked on by students, suggests directions for research into the selection of media, and their effective use.

A first approach to fragments

The television, film and advertising industries are generally more successful than the education industry in getting and maintaining people's attention, assisting people to internalise the gist of a communication, and ensuring the long-term retention of elements of the original communication. They are more successful partly because they are better-funded, partly because they make more considered choices between media, and mainly because they are more aware of how to manipulate attention (e.g. by using presentational conventions and special effects). This is not an argument for turning all education into *Sesame Street*. However, educators could follow the lead of commercial practice and take more account of the structure of different media. In particular, both by using the notion of a fragment and in other ways we need to understand the relationship between:

– what our students already know (e.g. Reigeluth, 1983)

– our students' familiarity with filmic presentational conventions (e.g. Bates and Gallagher, 1977; Salomon, 1979)

– the efforts made by producers to determine the construals made by learners, such as through juxtapositions of contrasting images or through orienting activities (e.g. Hannafin and Curtis, 1986)

– students' study methods, attitudes and expectations (e.g. Kember and Harper, 1987)

– the nature of students' actual construals of messages (e.g. Beaty, 1987; Donald, 1987; Duffy and Waller 1985; Edwards and Mercer 1987)

– what enhances the medium- to long-term memorability of construals (Fishbein and Gutwein, 1981; Landauer, 1988).

It is widely recognised that even those learners who are paying full attention, rarely perceive or recall more than a fraction of the events in the classroom. In addition, their individual construal of those events is determined by their background and expectations. Similar comments apply to viewing television and films. In the latter case, those partial recollections are often episodic. What is not often realised is the role of the film/television editor in determining what is remembered and what is not. While working on this exposition, I came across an interview given by James Stewart, in which he gave a vivid account of this:

> "... in the editing of a film the editor can, by changing the sequence of shots, amplify your acting performance in a way you have nothing to do with. I call them little pieces of time: they are moments created by you, but more often they are created by the cutter... I remember a fellow once came up to me, and said, 'I've seen a lot of your pictures, and they're all fine, but the one I like best is when you're in this room...' ...it turns out he doesn't know the name of the

picture or who else was in it, or what it was about – 'you're in this room and you're about to leave, and this guy lets you have it, he really tells you off. And then you turn around, and the look you give him! You really told that guy off with just one look.' Now that wasn't telling me very much, but the minute he said it I knew exactly which picture he meant, and that is what I mean by little pieces of time. This turn-around scene was done by the director, by the cutter."

(The Guardian, page 12, December 3, 1983)

Stewart's "little pieces of time" are what I mean by fragments. In discussing this idea with colleagues, I find it useful to invoke their experience by asking them to spend a few seconds or so recalling as many as possible of the main incidents of the previous day. When I try the exercise myself, I usually find that I have an immediate overall flavour of the day dominated by some specific events, and that with some effort I can focus on particular details and fill in gaps. Some days seem to flood back in a rich and vivid tapestry. When I quickly get a sense of (some would say an image of) one or more events of the day which come immediately to mind, I am then aware that I could fill in details in between, by mentally reliving the incident and "seeing" what came next. Even so, I cannot relive the whole day in real time – all I can recall are fragments of the whole. Sometimes I find I have to begin at the beginning of the day and work at trying to re-enter the events in sequence. Usually, I then find various incidents slowly coming back to me. I can pause on any one of them and develop it, recalling what happened before and after, and filling in details of the context, of my thoughts and feelings, and so on. The important thing is that what is available are fragments of the day, some of which can be pieced together to give a more or less coherent impression of the day as a whole.

For example, a colleague, when asked to recall the previous day, reported a vivid recall of picking her daughter up from a party. At first this seemed to be a complete recall of a large segment of time, but on further interrogation it turned out that the vividness referred to standing in the kitchen talking to the mother. Details of the kitchen window, the light, and the people were prominent. In being asked to speak about her recall, this image had been generalised into a description of the purpose of the event, of which standing in the kitchen was a particular, detailed incident. Thus, once the generalised memory of the kitchen is triggered, it can be developed into a recall of the conversation and the difficulty in persuading her daughter it was time to leave, etc.

Educational examples

Supported by Stewart's remarks quoted earlier, and by numerous informal enquiries, I claim that if the same exercise is tried with a T.V. programme, film, radio programme or text, the result will be the same. There will be some more-or-less

readily recallable fragments, which can be pieced together to give an impression of the whole. You might like to pause and test this claim on something like a T.V. or radio programme, or a book or lecture that you have recently encountered. My suspicion is that you found something similar: that some fragments come to mind, not necessarily in their original order, and that you can distinguish between generalised large scale events, and detailed incidents which you could describe reasonably precisely. I wish to focus attention on the detailed incidents or fragments, and to seek a crisp and workable definition. For the moment they seem highly personal and idiosyncratic, but as we begin to examine their nature and what we do with them, they will take on more objectivity and substance. I have deliberately begun with an intrinsic "sense" of fragment, relating it as directly as possible to experience. An extrinsic definition will emerge shortly.

The exercise of trying to recall a TV programme or film is no mere game. My colleagues and I (ME234, 1989) in the Centre for Maths Education have developed it into a powerful and effective way of working on video-tapes of classrooms as well as on posters, computer animations (Mason, 1985) and text-books.

Fragment features

Bearing in mind that I am interested in media such as video, audiotape and text, which can be reviewed in order to check details, I want to begin to move away from the notion of fragment as an aspect of memory, that is as what is recalled, towards the notion of fragment as an objective part of the medium which is recalled. There are two main features of fragments which serve to to discriminate them from other aspects of our experience:

– A fragment is a recallable incident which spans a single block of time

– The content of a fragment can be agreed upon by two observers of the event.

By saying "recallable" rather than "recalled" I indicate that I wish to think of the video or whatever as consisting of fragments. My task then is to define such fragments, and this is the role of the two features. A single block of time means that the entire incident is recalled all at once. It does not consist of two or more incidents with some sort of hiatus in between. Potential agreement between two observers means that the fragment concerns specific external incidents rather than personal constructions and generalizations of experience. Such constructions are important – indeed they are the crux of the matter – but their importance arises from what we do with fragments, and will be developed shortly.

Both qualities of fragments are critical, for they serve to limit the extent of what I encompass by the term. It is essential that a fragment be known by what people experience, and not by some interpretation or generalization of their experience. By demanding a single block of time I avoid the temptation to link separate

incidents by means of an abstract description. By demanding negotiable agreement between observers, a fragment is forced to remain close to experience, and not drift away into abstractions. Thus "picking up my daughter" does not describe a fragment – it names an event. The fragment is the actual imagery/aurality (inner pictures, words, etc) which triggered the abstract naming "picking up my daughter".

It is well known in legal and psychological circles that "facts" are remarkably relative when recounted by witnesses. The reason is that we immediately interpret what we see and hear, presumably in an attempt to make sense of it. The interpretation involves stressing some sensations, ignoring others, and filling in with our own fabricated ones, all a product of what we call a frame of mind. Hudson (1968) shows how frames of mind can be delicately probed by a variety of questions and activities, and a 1988 example is given by the two different interpretations given by the husband and wife in Gibraltar who watched the same shooting take place through the same window, but saw quite different events – surrender and shock. The idea of a "frame of mind" is an old one, but it has been exploited to provide a structural metaphor for computer programmes trying to mimic human behaviour. In the hands of Minsky (1980), frames of mind become a powerful way of implementing behaviour on a machine. I shall not need the technical details of what Minsky calls a frame, but the same approach underlies my own thinking, so I shall indicate very briefly some of the salient features.

We all have standard, culturally-determined responses to a wide variety of stimuli, from traffic lights to raised eyebrows. At any given moment we are in a particular frame of mind which can be thought of as a propensity to act in a certain way. For example, when we enter a restaurant, we immediately drop into a set of expectations and ways of acting that are particular to us in restaurants. In order to be activated, a frame needs certain data, but in line with our habitual behaviour patterns, there are a number of default values for the data which are assumed to be valid unless supplied by the given situation. For example, if a waiter-like figure comes towards us bearing a large piece of paper or card, we immediately expect it to be a menu.

We all have default values and even over-riding values for the various parameters of common situations, allowing us to fill in missing values, and to over-ride others with our own preferences! For example, it would take most people some time to realise that a "proffered menu" was not actually a menu, so strong are the default parameters in some situations.

Once activated, a frame-of-mind with sufficient data values activates another frame-of-mind, in the sense that associations are triggered and details of recalled incidents appear in consciousness. The result of a sequence of frames being activated *is* what we experience as interpretation and abstract naming of the incident. When an interpreted recall is reported, general descriptions like "picking up my

daughter..." tend to be used rather than the precise recounting of actually being present in the event: "I can see the kitchen window, and ...". Being precise is an important part of the application of fragments to instruction.

Fragments cannot be approached or accessed through generality – they are concerned with the detail. Although we cannot even speak about "kitchen window" without having interpreted what we see *as* a kitchen window, it is usually possible to distinguish between such local construing of details and the global construing of incidents which links them together into a coherent whole. The value of trying to isolate fragments is that the global construing is seen as work done *on* fragments to link them together, whereas the local construing is what produces a fragment. The next section develops the idea of local and global fragment construal.

Let me recap the meaning of fragment developed so far. A *fragment* is a temporally continuous recallable incident whose content can be negotiated and agreed. It is generally of short duration because it must be recallable (without effort to expand details) and since its content can be agreed, it must be detailed enough not to require extensive interpretation.

Fragments stand at the boundary between what can be objectively agreed, and what is subjectively construed. Construal involves interpretation and even transformation, to the extent that the original incident is no longer recognizable. (This frequently happens when people compare political interpretations of events!)

Although I began with a subjective definition of a fragment in terms of the viewer, the two qualities extracted suggest that it might be possible to reach an external or objective definition. To be of specific use with particular media, the qualities will have to be interpreted in medium-specific detail, invoking and drawing attention to the symbolic and technical structure of the particular medium. Before developing such a definition and its particularities in different media, some remarks are in order concerning what we do with the fragments we perceive.

Fragment construal

As soon as one or two fragments are recalled, it is difficult not to start interpreting them. There are two actions which take place:
 – We try to account for the individual fragment in its own terms
 – We try to account for collections of fragments.

These two actions might sensibly be referred to as local and global construing though inevitably one will blur into the other. The basis for making a distinction is that locally, we try to relate the incident to our own past experience, and we do this by constructing some "story" about the incident which gives it meaning. The "story" need not be verbal, indeed it will involve a combination of imagery and sounds, a general sense of pattern, and both emotional and physical reactions. By contrast global construing attempts to connect fragments together. This may

require adjustments, even wholesale alterations to how individual fragments are construed, but global construing is concerned with weaving individual fragments into a coherent story. My image for this is something like Figure 1.

Of course part of the meaning which we construct for an individual fragment consists of its role in the global story, and so I do not wish to suggest that local construing precedes or is entirely separate from global construing. On the other hand I am convinced from talking to students that there is a preponderance of local and an absence of global construing. Many teachers report that students seem to isolate topics in separate components instead of connecting them together. For example, fractions and decimals are often perceived and treated by students as distinct entities, entirely unconnected with each other, or with whole numbers. Students have local stories but no connections. It is not enough for teachers to "tell them" the connections, because connections are something individuals must make for themselves, even after having been told several times. In common parlance, "the penny must drop". What seems to be missing from students' experience and from teachers guidance is global construing.

Let me take a hypothetical example. One recallable "incident" from a film might be that the protagonist travels from Europe to India and back. Everyone can agree that it happens. On further enquiry, it turns out that "Europe" is in fact London and Amsterdam, and "India" is a scene with Indian farmers encountering a wayward cow on some country lane. How could two or more viewers agree that London and Amsterdam are correct? There may be some street scenes, or what purport to be street scenes, with double-decker buses and windmills, but unless there is some specific and definitive indication, we cannot speak of these as fragments, but rather as construals. The sensitive film-director or novelist needs only to offer a vignette – a fragment – and knows that viewers will construe the rest.
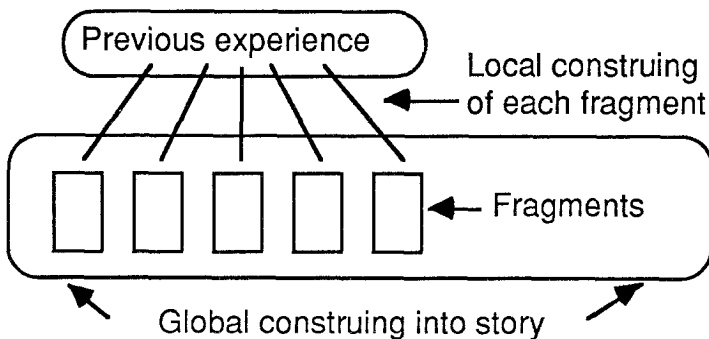

Figure 1. Local and global construing

What *can* be agreed is that there are is a scene showing something that looks like a London double-decker bus, and that there is a scene showing what looks like a canal in Amsterdam, and that the people in the lane with the cow look like Indians. These are the fragments, the specific incidents for which everyone can agree that they give the same names to the images that they saw. The naming and generalising of these fragments is part of local construing.

It is worth noting that film viewers actually see only gradations of coloured light on a screen, generated by light passing through celluloid, so in order to talk about fragments it is necessary to interpret what has been seen, to construe locally. The fragments are the incidents or "bits" on which common agreement can be reached ("looked like a cow", "looked like a double-decker", ...).

The "novel" from which the "film" was derived would similarly have recognizable fragments. Readers would be able to point to specific words and sentences, but these would be chosen because they had evoked mental images which in retrospect are much like the mental images available after seeing the film. There is likely to be less agreement about details, however, because we each bring our own default parameters to images evoked by words, while it is harder to impose your own parameters on images recalled from visual stimuli.

Construing of fragments has to do with generalizing, with using frames and default values to fill out what is seen in order to construe meaning. There is a lesson here for talking about fragments in a specific programme or text, and hence for research into these matters. A fragment is what is recalled about an incident. Generalisation is part of construal. Generalisation and interpretation must be kept at bay when agreeing on fragments. They cannot be banished entirely because of the "celluloid argument", but they must be kept local. They are relevant only when moving from fragment perception to fragment construal.

The distinction between local and global construing is best summed up by the difference between "working through" and "working on". Students tend to work through their assigned tasks, in the sense that having listened to or watched some exposition, they work through exercises or assessment questions, responding to the questions piecemeal. By contrast, they could try to tell themselves or someone else how what they saw fits together. They could work on the relationships with other ideas and examples, reconstructing the exposition in their own terms and integrating it into their experience. In fact this is usually what the exercises are supposed to achieve, but with one eye firmly on mastering examples so as to score good grades, students are actually led away from useful and significant learning. Rarely are they encouraged or assisted to sit back and work on the material as a whole, trying to verbalize their probably fuzzy notions of what the topic is about.

For example, applied to reading a text, local construing means working through the text, trying to make sense of it as you go. Some bits stick, others slip into

recesses of memory and are not easily recalled. Global construing means sitting back and reflecting on how the ideas fit together. It is not actually the ideas that fit together but the fragments which represent or constitute our sense of meaning of the ideas. Thus global construing has to do with linking fragments together. Recalling an idea is actually experienced as entering the appropriate frame (in the sense of Minsky), which contains links to a variety of fragments whose weaving together resulted in the idea becoming meaningful. Many students fail to carry out this level of construing. They "work through" material, but they do not "work on" material. Frye (1981) refers to "centrifugal reading" and "centripetal reading" of a text to describe something very similar to what I mean by local and global. Centrifugal reading pays attention to formal meanings and logic, whereas centripetal reading produces a gestalt synthesis.

Ausubel's notion of an advance organizer (1960) is an attempt to delineate and signpost fragments, to make them more memorable, more recallable and hence to foster global construing. By themselves, signposts can be of some assistance, but their biggest contribution is in assisting the recall of fragments during global construal. Signposts are someone else's fragment delineation, so to be of any use to the viewer they must stand out clearly from the other fragments, and be readily construed both locally and globally. Otherwise, they simply contribute to the fragments which need to be construed.

There are some close relationships with Pask's description of wholist and serialist styles of learning (Pask, 1972), which I will take up in the next section.

Local/global and wholist/serialist

Care is needed *not* to fall into the tempting trap of identifying serialism with local construing and wholism with global construing. What distinguishes a wholist from a serialist approach is not whether global or local construing takes place, but the sort of fragments that are easily recalled and how they are globally construed.

Local construing for a wholist means working through a sequence of levels of increasing detail, from the top down as it were. To be at all effective, material structured with a wholist in mind must still provide images and detail which will resonate with experience and so make sense. These images constitute the wholist's perceived fragments. Local construing for a serialist means working step by step through the details. Each fragment is encountered separately, with the hope that later it will all fall into place – what I am calling global construing.

Global construing for a wholist means piecing fragments together, starting with rough images which give an overall flavour and which serve as place holders. From them detail can be developed when required by filling out the images and linking them to more detailed fragments. When such working through amounts to reconstructing a detailed image for oneself, fragment transformation

occurs, and significant learning has taken place, because the details can easily be reconstructed from the image when required. The wholist approach is to account for the impressionistic fuzzy fragments first, and then to approach detail. Global construing for a serialist means accounting for the fragments associated with details, one by one, accumulating them and drawing them into some coherent story.

Different people will recall different incidents in any programme or text, depending on what connected with their experience – what they were able to construe locally at the time. The definition of a fragment involves "recallable", implying that they are not just what one person recalls, but what someone might recall. On the face of it this might lead to everything or anything being a fragment, but my conjecture is that fragments can be discerned without recourse to "subjects" and experiments, that they can be objectively delineated.

Objective fragments

Could any incident/episode/fragment be recallable? Is there any objective quality to distinguish a fragment without asking people what they can recall?

One quality of a subjective fragment is that it be a temporally continuous incident. That means not just for the viewer (which I use as a generic term for the person being subjected to the medium), but also in the programme. Thus cuts from one context to another cannot be recalled as one self-contained incident, and so constitute an evident boundary for a fragment. In texts, students often find paragraph changes have the same effect. There seems to be little or no connection from one to the other, and a good rule of thumb would be that a change of paragraph is intended as a change of fragment. Changes of imagery and mood are also boundaries of fragments. Thus a richly metaphoric sentence might comprise several fragments, and in poetry almost every word is likely to constitute a fragment.

Fragments are not discrete. They may overlap considerably, in the same way that my knowledge of a large city is in the form of patches (corresponding to the fragments). I am perfectly confident inside each patch, and I have some sense of how the patches fit together, but not at sufficient level of detail to constitute one whole patch. I occasionally find myself surprised because while in one patch I suddenly recognize that I have moved into another. Each patch, like each fragment, seems to have a flavour of its own.

Returning for a moment to the hypothetical film with the protagonist in Europe and India, the actual fragments are the vignettes: the double-decker in the "London" street, the "Amsterdam" canal, the "Indian" country lane, which evoke in viewers the corresponding labels. It may easily be the case that such vignettes are faked in any case, and it is this ability to give people a strong impression of

reality that gives visual media their power. So too the sensitive novelist can with a few well chosen words offer a fragment, knowing that readers will fill in the rest. Directors, novelists and poets (among many others) have, I suggest, at least an intuitive if not an articulate sense of fragments.

To recognize fragments objectively, that is, other than by asking people what they can remember, there are two aspects which are of importance – boundaries and content. By boundaries I mean aspects of the event which involve a change of context, forcing a change of fragment by definition. By content I mean specific features of the content of the programme which are whole in and of themselves. For example, movement of an object across the screen, or a passage describing a person or scene.

It is my conjecture that by viewing a T.V. programme or film, it should be relatively straight forward to agree on the principal fragments. Generally it is the boundaries which will stand out, as changes in mood, context or direction. Further indicators will be developed in a later section.

Before pursuing the main theme, it may be useful to stand back for a moment and look at the educational ethos which is suggested and supported by the observations made so far.

Ethos

The notion of fragments in an educational context only makes sense if the general ethos is student-centred, in which each student is perceived as an active participant in the action which we variously describe as learning and as teaching. Students who are attending to some material are by definition active, because they are trying to make sense of what they encounter.

The idea of a fragment seems to me to follow naturally from observing my own experience in lectures, and with texts, T.V., radio and audio cassettes. Starting from the position of a student being able to recall bits and pieces, those bits and pieces must have made some sense, and so I am led to the fundamental perspective of the student as meaning maker. (See also Bruner, 1986; von Glasersfeld, 1984.) There are some major implications for the teacher which accompany this perspective.

Commonly, media such as broadcast T.V. and radio, video and audio cassettes, and texts and lectures are viewed as channels of communication, evoking a rich metaphor in which bundles of information or knowledge are conveyed along the channel from sender to receiver, like barges on a canal carrying lumps of coal. The current "information-technology" buzz word compounds this image, and impels us to see information/knowledge as a package conveyed from teacher to student. Despite the absurdity of such a concrete image, the metaphor pervades the way we talk about teaching.

When teachers and producers talk about teaching and learning, one usually hears comments such as: "What are you trying to tell the student?"; "They didn't get it"; and "What is the main message of the programme?"

Lakoff and Johnson (1980) have drawn attention to the prevalence of metaphor in everyday speech, and in particular they have recorded a large number of statements which all invoke a metaphor of teaching as the conveying of some "thing" to the students, which in extreme cases amounts to pouring knowledge into the student, and the tabula rasa image. Even if we don't really see teaching this way, our language guides our thinking, and leads us to unintended conclusions. It is not easy to avoid talking as if teachers "give" things to students, or as if producers put "messages" in their programmes like messages in bottles thrown in the sea. One way to weaken the grip of the channel image on our thinking is to focus on the sense of media as mediation, of reconciling or bringing together.

I suggest that a number of problems arise in media research because the producer/academic is seen as the source, as the conveyor of knowledge and information, while the student as active agent is ignored. For example, in order to decide if there have been any cognitive "learning outcomes", one usually tests to see if the students can answer questions which the programme has answered either explicitly or implicitly (according to the producer's view). For affective learning outcomes, one looks for expressions of attitude which correspond to what the producer had in mind. Since the probes all contain strong indications of what the researcher is looking for, subjects can be expected to respond accordingly. If students are seen as constantly and actively trying to construe meaning in events, researcher probes must themselves be construed by students in the context of the experiment, thus reshaping and reforming their impression of what the programme was about.

One of the principal values of rejecting a channel image in favour of a mediational image is that we no longer see the producer/academic as attempting to convey their message, but rather as trying to provide the student with some sort of entry to, or foothold on some ideas or relationships. Instead of the academic knowing, and passing on that knowledge, we are encouraged by "mediation" to see the producer/academic as agent for bringing students and content into contact, and learning something themselves in the process.

The image of a student gaining entry or foothold is important because it runs counter to the passive-receptor (receptacle) image of students that is prevalent, in favour of the student as necessarily active and exploring. The trouble with the standard active/passive dichotomy is that it all too often becomes identified with physical passivity and activity. A student is not considered active unless observably doing something physical. In fact students are active much of the time, frequently without any particular outward sign, for they are busy trying to make sense of what they are seeing, hearing and imagining. Even the simplest of

teacher instructions to a class, or researcher's probing of subjects is liable to be construed in several ways depending on the students' orientation, perspective, and desire to please.

By way of summary, let me pause for a moment and try to draw together several aspects of the ethos that accompanies fragments. I see the student as active agent, trying to make sense of experiences. I see the producer/academic as having already woven together some reasonably articulate and coherent story about what is going on or about how to approach some topic area. I see the outcome of the producer/academic's activity as a component of the students' experience which has to be worked on, in the sense of construing meaning, developing a reasonably coherent (though possibly still pre-articulate) story about it, and in the process linking it into past experience and past stories. There may be varying degrees of correspondence between the producer/academic's version and the student's, and there may be varying degrees of construing, from rote memory to total reconstruction.

Seeing the student as active agent in learning is becoming relatively widespread at present, stemming from Piaget's genetic epistemology, Kelly's constructivism, and Dewey's pragmatism, but the roots go back much further through the teaching styles of religious mystics in a wide variety of cultures. Plato even claims in the Thaetetus that Socrates saw himself not as a teacher but as a midwife for ideas, in other words, as mediator and facilitator.

The teacher/producer has a major task in selecting what to present to students, and in what way. By being aware that students will not simply receive it, but rather will be touched by bits and pieces, and will be able to recall some bits and reconstruct others, teacher/producers can be more effective in selecting material. Their aim is to present something significant for the student to work on. Notice that I say work *on* and not work *through*. The working through will come as well of course, but the important thing is the working on. In particular, the material can be prepared so as to focus students' attention on the need to reconstruct the content for themselves from the fragments they can recall. Where they find gaps or difficulties, they can ask detailed and pertinent questions – something that happens all too rarely at present. Looking for entry points or footholds for students brings about quite a different approach to the planning of teaching materials. It also suggests how one should go about assessing the qualities of teaching materials, whether in the form of texts, lectures, television or any other medium.

Assessment

I have used "assessment" for the title of this section because it comes closest to capturing two apparently different activities – teaching, and media research. The teacher is concerned in the end to make some sort of judgement on the student's

activities. The researcher wants to be able to make comparisons in the use of media. In both cases therefore some assessment has to be made of the students and particularly of the "learning outcomes". This is an extremely tricky area, especially in the context of the student as active construer, because it is not easy to see how to get at what the student has been doing. Fragments do, however, offer some assistance.

It is important to distinguish, as far as is possible, between two levels. The upper or outer level concerns the skills required in order to construe fragments globally, to work on material that has been encountered in some way. The lower or inner level is the particular material to be worked on. In earlier sections I claimed that global construing is but weakly carried out if at all by many students, to the extent that it seems reasonable to devote time to working on "how to work on". It is actually rare to find teachers or producers devoting time to this – either students are expected to be skilled already, or else to pick it up by osmosis. In regard to media such as broadcast radio and television, audio and video cassettes, and micro-computers, (not to say computer-controlled video discs etc.), assumptions that students know how to process what they see and hear are tenuous in the extreme. For example, in several studies at the Open University, Bates and Gallagher (1977) found that in general about one-third of the adult students did not know what to do with documentary-style programmes intended as case studies. Another third claimed to know what to do, but couldn't see how to go about it, and the remaining third claimed to know and claimed to do it as well.

Most examinations assess students' ability to recall fragments which they should have encountered at some point. There is a premium on time, so instant recall rather than reconstruction is essential. Occasionally students are called upon to link fragments together (for example, in the traditional compare and contrast type questions), but even here it is expected that there has been specific preparation in similar types of questions beforehand. In other words it is possible for students to avoid global construing and still to receive good grades. Most educational testing is also of the fragment recall variety. Rarely does a question evoke or depend upon students having made sense of the event being researched.

Table 1 lists some of the skills that one might look for in the use of a particular medium. Some of them are of educational importance in the sense that they are what teachers would like students to be able to do, while others are concerned specifically with the medium. These latter are the ones that will inform us about the selection of appropriate media. All of them are relative to a particular situation – they are not skills which can be learned once and employed automatically ever after, but rather skills which pertain to particular content in a particular course. Only with considerable experience (what we call "the professional') could these skills be referred to without a specific context. I have used the word programme throughout because I have electronic media in mind, but the skills are equally applicable to reading texts and to attending classes.

Table 1. Fragment processing skills

Skill level	Example
1.	Able to recall a significant number of fragments.
2.	Able to reconstruct intermediate details between the recalled fragments.
3.	Able to account for specific fragments in relation to previous experience.
4.	Able to account reasonably coherently for groups of fragments.
5a.	Given a concept or a relationship between concepts, able to specify one or more fragments in the programme which is a specific instance.
5b.	Given a concept or a relationship between concepts, able to specify one or more examples from outside the programme which is a specific instance.
6a.	Given one or more fragments from a programme, able to state concepts or relationships which the fragments illustrate.
6b.	Given one or more fragments from outside a programme, able to state concepts or relationships which the fragments illustrate.

There is no doubt that students find even level 1 difficult, presumably because they are rarely called upon to try it, despite the essential part it plays in learning. An added factor is that they do not have the professional's frameworks which produce selective (and sometimes blinkered) attention to discipline-pertinent fragments. Simply recalling fragments is a skill which can be trained. Educating attention by the frameworks of a discipline is what education is supposed to be doing, at least in part. The fact that students do not have all these skills highly developed, suggests that it is essential for some time to be devoted to developing them, and this has implications for the design of materials and the conduct of classes, which I will go into shortly. Only when there is some certainty that students are able to engage in both local and global construing does it make sense to look at what students are doing with the fragments, the extent to which they are construing the sort of story that the teacher has in mind (particularly in the cases of the sciences), or the sort of story which conforms to criteria for coherence and support (particularly in arts and social sciences).

I see those fragment processing skills, given in Table 1 in a context-free form, as forming the core of a series of questions, some content free, enabling the students to show what fragments they recall and what processing they have done, and some content-specific to see if recall of specific fragments can be triggered. (See Mason, 1987 for specific application to mathematics assessment.) Examiners can use such questions to assess the students, and researchers can use them to assess the event! The more experience students have of such questions, the more skilful they will become in answering them, so that the skills themselves will be developed – a true Heisenbergian state in which the fact of the researchers' "experiment" alters the state of the system. Research in this area is not a matter simply of what people actually do, but much more importantly, what they can do. The value of the media in assisting learning must take into account the processes by which students work on those media.

One conclusion that I come to on the basis of these considerations is that it makes sense to structure classes, texts and programmes so that students are given assistance in coping with the fragments. For example, it means being explicit about when a fragment is showing a specific instance of a general idea which is important in the topic. Many teachers and academics reject this approach because it seems to be doing the work for the student, or it is talking down, or it intrudes on the message. In fact, it is an important if not major part of a student's induction into the rituals of a discipline to find out what sorts of questions the discipline asks, how it goes about answering them, and how it moves between and develops generality and particularity. I suspect that it is precisely here that the technological media can be of most assistance, and that fragments provide a helpful way of looking at what the media offer students.

Once students have had some explicit assistance with ways of working on fragments and have gained confidence, it then makes sense to invoke an idea of Salomon (1979) concerning uncertainty: students can be stimulated to greater effort by subtle choice and editing of fragments, maintaining throughout a moderate level of uncertainty in the viewer and thereby activating more strongly the construal functionings (I am reminded of Antonioni films). I do maintain, however, that most students need explicit guidance and success before being able to make much of such challenging programmes.

I shall argue in the next section that where a medium stresses particularities, special devices are needed to refer to the generality. I happen to favour explicitness, but subtle methods are fine as long as students end up being able to relate specific fragments to general ideas appropriately.

Fragments in specific media

Salomon (1979) has used the term "symbol systems" to refer to the qualities of specific media, and these will play an important role as we learn how to delineate fragments in each medium. The zoom of a camera, the paragraphs and chapters in a book, the linking of tape aural instructions and visual frames, the conventional notation on diagrams, charts and maps are all examples of symbol systems. Static-media have ways to indicate motion, and motion-media have ways of keeping attention on static images. For example, cartoons (in print) have numerous conventions to convey movement, force and power, including arrows and surrogate arrows such as lines and shading. The examples so far have been technical symbol systems, in the sense that they are artefacts of the technical features of various media. Salomon also draws attention to more subtle forms of symbol systems, such as the use of animation to portray a dynamic to what might otherwise seem static. Good examples of this are mathematical notions such as functions and transformations which are dynamic by nature, but static in print and in their extrinsic definition. By the use of carefully chosen animation, a sense of movement can be communicated to viewers in a manner not possible in print.

Table 2. Examples of symbol systems

Category	Example
All	– Signposting indicating what is coming or has happened (elemental global construing cue, done for viewer not by viewer).
Film/T.V./Video	– Zoom in (concentration) – Zoom out (reflection, whole view) – Fade, screen wipe (change of mood, context,) – Split screen (simultaneity) – Cut away (attention holding) – Cut away to new scene (change of attention) – Animation (dynamic imaging) – Location (seeing and hearing something of faraway or inaccessible places/events)
T.V./Video	– Colour Separation Overlay (fantasy, ability to conceive of/enter impossible situations)
Videotape	– Fade to black, to field of question marks etc. (indication of time to pause, stop the tape and reflect, globally construe, reconstruct etc.) – Short segments, ability to stop/replay
Audio/audiotape	– Musical insert (reflection, relaxation), location/background sound (invites imagining the context), explicit imagery
Audiovision	– Change of visual frame (movement of attention)
Text	– Change of subject (change of mental identification) – Change of pace – long complex sentences/short simple sentences, alternating short and long, quoted speech, displayed figures/formulae – Change of chapter (breathing space, opportunity for reflection etc., change of mood etc.) – Metaphor/imagery
Tutorial	– Body postures – Emotions displayed by tutor, felt by student – Change of speaker – Change of topic – Change of pace – Change of attention focus – tutor, board, students, particular student

The technical symbol systems seem to me to correspond generally (but not always) to ways in which the media define boundaries of fragments. The more subtle symbol systems correspond generally to how content is depicted, as for example with animation, and the labelling conventions of different media. The examples of symbol systems in Table 2 are intended merely as a first stab at recording the features of various media which serve to delineate fragments. It must be emphasised that these are preliminary, and need to be refined on the basis of experience and research. Note that a medium like *video-tape* is listed by itself for features peculiar to it, but is included under *video* for features in common with broadcast T.V. etc.

Salomon goes much further than simply drawing attention to characteristic features or "symbol systems" present in media. He argues that the different systems draw upon or evoke different mental processing, or what I call construal functionings (see Davis and Mason, 1983, for elaboration). In Table 2 there are brackets which indicate for some of the technical symbol systems the corresponding or metaphoric mental activity. Salomon attributes differences in knowledge acquisition from different media to differences in the mental processing skills evoked. Furthermore, he suggests that exposure to specific symbol systems (for example a zoom in) can "supplant" the corresponding mental functioning (concentrating on detail). Work with fragments suggests that such "supplantation" or awakening of an inherent mental functioning is likely to be stimulated most strongly (or even only?) when the functioning in question is used as part of global construing.

A more plausible version of supplantation concerns the impact of visual images. One of the most powerful mental functionings we possess is the ability to form and recall mental images or "senses of" scenes and even of abstract ideas. In Salomon's "supplantation" terms, the visual media can provide students with mental images that they might not have been able to construct for themselves – such as seeing an operation or delicate scientific experiment, or some complex geometrical relationship depicted on a screen. There is a good deal of room for caution however, because of the well known phenomenon of seeing the "film of the book". It is usually very difficult to throw away the images of the film and return to the more delicate, less detailed, but in many ways richer personal images which arise while reading. I say richer because very often there is much more than visual imagery involved. There is likely to be a complex association of emotions, physical tenseness and other less easily articulated awarenesses that go together to form the web of personal meaning. One aim of a teacher, perhaps even the main aim, is to help students to construct such intricate and ethereal webs for themselves, and to test, repair and modify them where necessary. That is what fragments, and fragment construal, brings to the foreground.

It has often been pointed out that a visual medium has a very difficult time draining Lake Superior, filling it with whipped cream and placing a large cherry on top. There is something remarkably particular about visual images conveyed (here the metaphor seems appropriate) by visual means. The essence of construing lies in the linking of the particular to the general. If it is the case that showing models and pictures tends to particularize, and so leads students away from the generality, then special effort is needed to reinforce generalizing. (See Mason, 1983 for more details.) This is turn suggests care in the construction of fragments, and in the sorts of questions used to get students recalling the fragments and globally construing them. It also suggests that despite the penetrating work of Lakoff and Johnson on the prevalence of metaphor in everyday speech, little attention is given in academic disciplines to training students to notice, examine and contruct

metaphors. In fact, images and metaphors permeate academia. They may be the one major tool for understanding, or claiming to understand anything! The extent to which different media and their symbol systems can and do support metaphoric thought may have a lot to do with what role they can most usefully play in an educational context.

The essence of fragments is that they are recallable, and so it is important to consider what features of a medium are involved in making an incident recallable. This is primarily the role of local construing, so that what makes an incident recallable has a lot to do with being able to make sense of it in terms of prior experience. A significant part of it must also have to do with personal predelictions. Some people seem to be more visually or more aurally centered than others, though it seems that these strengths are to some considerable extent trainable. Furthermore, we all have to learn to process new media in order to pick up the conventions – and it is not just a matter of being told the conventions, but of absorbing them as part of your construal-functionings. For example, the first showing of a "moving picture" had people rushing for the exits when a train was shown coming towards them; children eventually learn that T.V. sets do not in fact contain little people running around behind the screen; we all have to learn to interpret photographs; children often expect to be able to turn over a picture and see the back of the objects pictured. It follows that in defining fragments it is important not to be guided by a sophisticated professional perspective on the content and the conventions which overlooks the genuine fragments of the viewer.

Fragments in the classroom

Awareness of fragments and the role that they play in our making sense of the world would have direct influence in the classroom. Such a teacher would generate quiet moments and invite students to reflect on salient moments so far. There would be pauses during exposition to permit students to construe what had been said, and to try saying it to a neighbour. There would be explicit demonstrations of how to work on material. Students would frequently be invited to "say what they see", and to record what they say in note, diagram, pictorial and symbolic form. Students would be called upon to account for "surprises" and for relationships between apparently disparate ideas.

Such activity is predicated on the assumption that education is meant to do more than furnish dinner-party conversation for the future, in which participants merely report what they recall from newspapers, magazines and novels. Superficial recounting is only surface level processing of fragments. Global construing is what counts, where each individual is called upon to fashion a reasonably coherent account of "all and everything", of which the "fragments" are but fragments.

There is a good example of the use of fragments (albeit without explicit recognition of this) in the technique known at Stanford as TeleVisual Instruction (T.V.I.). Briefly what happens is that a lecture is taped (two cameras – one on the lecturer and one on a pad of paper). The lecturer occasionally asks a question, and may or may not engage the live students in a discussion. The tape is then shown to another (off-campus) group of students who watch it in the company of a tutor, chosen because of interest in refreshing the material, not because of expertise. The tape is stopped at least every few minutes, either when a student asks for it, or when the tutor or the lecturer on the tape asks a question. The students then discuss what they have seen. It is claimed that students learn the material well and happily, more so even than the live students!

In fragment terms, the students are frequently being challenged to reflect on what they have seen, to reconstruct it, and if need be to go back and re-view a segment in order to reach agreement. It has been suggested that T.V.I. shows that educational television can do well with simple recorded lectures, without the need for complex apparatus, large studios, and expensive technicians. What this view misses is that the power of global construing of fragments is what makes T.V.I. work, and that this power is not usually applied to more sophisticated programmes. Imagine what might happen if students were not submitted to an hour's lecture, but rather to a few minutes' exposure to carefully chosen animations, models, split screen television, etc. In other words, what if the symbol systems of video-tape were exploited by means of the fragment processing perspective, to present students with the pertinent challenges of the subject matter? We might actually find something happening!

Another example, too little known given its importance, can be found in the animated geometry films of Nicolet, expanded and made in colour by C. Gattegno (1970). These films last for at most 5 minutes. One particularly effective way of working with them is to see them once, and then to reconstruct them, fragment by fragment, through discussion. What usually comes out is that different people describe what they saw in different ways, and these different ways, once negotiated, form a rich multiple perspective, essential to appreciating the geometry. (For descriptions of this way of working, see Beeney et al., 1982; Shuller, 1983; Love, 1988.)

Directions for research

The first task is to develop questioning styles which help people distinguish between fragments and general impressions. This involves training in speaking directly from mental images and sounds, rather than from abstractions and generalizations. There is sufficient experience to suggest that this is only a matter of training (see Bandler and Grinder, 1979, for just one of many sources of confirmation).

The second task is to verify the objectivity of fragments. I see this as a developmental process, building on Salomon's idea of symbol-systems. I conjecture that the notion of a fragment would assist directors, authors etc to communicate with each other and in particular with media researchers. Thus, a director, asked to outline the fragments of a television programme, would find attention being drawn to a finer level of detail than is normally considered during programme design discussions. Comparison could be made with the fragments as predicted by a researcher, and the fragments as elicited from viewers. This would help all three groups – designers, researchers and students – to learn to distinguish the media-specific qualities of fragments, and an offshoot would be a greater awareness on the part of all three groups of the potential of the medium.

A third task is to use the fragment processing skills as the basis for training students in global construing, while at the same time learning which media-specific qualities assist and detract from students' sense-making. Great care is needed not to fall into the trap of analysing what uninitiated students can do and not do. It is important to remain in touch with the development of the processing skills, and in particular, to observe how the media can support, even supplant discipline-specific versions of the skills.

The fragment-perspective also raises a number of questions which lead me to make conjectures – I shall offer one as an example.

Why do we weave fragments together so intricately?

Educational television programmes and documentaries which last for between 30 and 90 minutes put a tremendous strain on our capacity to construct meaning. Trying to recall fragments of such programmes is usually extremely difficult, simply because so much happens. Add to this the intricacy of most educational programmes, in which general principles are exemplified, compared, contrasted and interrelated. It is a wonder that viewers make anything of them at all. In fact, the particular fragments that are recalled are ones which are immediately locally construed, in other words, which resonate with some other experience and seem to make sense. The most frequent comment made by Open University students about programmes is that they never seem to deal with the difficult bits of the course. I take this to mean that the parts that made sense to students made sense because they could relate them to things they already grasped. My conjecture is that once you start thinking in fragment terms, you move away from trying to make complex matters clear by intricate piecing together of exposition, and towards seeking simple fragments which students can recall and work on, which invoke questioning and relating to other fragments because of surprises or unexpectednesses. Students are much more likely to be willing and able to make sense of a simple event which challenges their understanding than of a complex event which is only vaguely recallable.

Simplicity of programmes, and frequent pauses for reflection and construal, lead directly from broadcast to cassette (and videodisc) because they can be stopped and replayed at will. Simply transferring programmes to tape does not make best use of the fragments however, for the simplicity message remains. Once you abandon the perspective of a programme as a source and see it as a mediator, or more imaginatively, once you abandon the idea of a programme as food, and see it as a bone to be chewed, the sort of opportunities you want to offer students will change. Educational programmes such as MI10 (Roseveare, 1987) have begun to exploit the short-scene structure of soap operas, to good effect, in that the brief segments are more easily reconstructible from the recalled fragments than is a longer exposition. The essence of the matter is remembering that it is the student who must do the real work, not the producer. If we are dedicated to using media in maximally efficient ways, we may find ourselves abandoning the education-as-entertainment perspective, so popular with documentary lovers, but of so little use to students studying a course. A move to simplicity, and to fostering work on fragments instead of exposure to fragments seems to me to have obvious implications for, and direct bearing on the use of interactive computer graphics and computer-controlled videodiscs. In both cases the fragmentary aspect of what is depicted is clear. What is not so clear is how to control the impulse to keep students hooked on the medium, pressing buttons and watching things happen. The combination of animated graphics and some form of control are addictive (viz. space invaders) but as many people have observed, the addiction makes it harder to turn the machine off and work on what has happened, to pause and make a specific conjecture about what will happen next before it happens (Mason, 1985). The making and testing of conjectures is intimately bound up with the linking together of the particular and the general, which in turn is the essence of the fragment processing skills. Processing what is experienced is the heart of learning, not simply the experiencing!

Postscript

If fragments do form a useful way of thinking about learning from media, it ought to be possible now at the end of my exposition, to reflect back on the salient fragments, and to try to reconstruct a story which links them all together. Gaps, inconsistencies and doubts may then highlight weaknesses in my exposition, or in your recall. If a global reconstruction is possible, it might also be possible to specialise mentally to a specific teaching-learning situation of interest and to see what the fragment perspective contributes.

Acknowledgements

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