

How Young Pupils' Memories Work

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'What happened at school today?'
'Nothing.'

WITH SMALL CHILDREN, this lack of response is not perversity but represents a real difficulty the child has. It usually turns out, if you ask more carefully, that something did happen, that your five- or six-year-old hasn't forgotten, has the language to tell you, but finds it difficult to get it out. Parents don't demand instant recall and fluency. Teachers, finding some children can manage to talk about what happened, may decide those children are 'brighter', have better memories, remember things more easily, than others. Investigation suggests that we must not be hasty in such judgements and that the way we design class work for children should recognise how memory is developing.

A clue about memory development, and particularly memory about events, comes from *infantile amnesia*. Past the age of ten years, or thereabouts, most of us find it impossible to recall anything that happened before we turned four or five. Freud noticed this and put it down, as one would expect of him, to guilt induced by infantile sexuality. This implies that children's minds work the same way as adults. I, and recent researchers, find a better explanation in what we have discovered about the way our minds develop.

Kathleen Nelson discovered, for example that three-year-olds can answer general questions about events (What happens when you have dinner?) with general answers (we wash our hands then sit at the table) much better than specific questions (What happened at breakfast this morning?) which are usually answered with silence. She and her colleagues suggested that small children have no memory of individual episodes only for events which are repeated – if events repeat then a fusion of experience takes place and specific memories are no longer available.

My investigations, with Julie Wilkinson, show that this picture of how children remember is not complete. In particular it does not deal with things children remember but *cannot* put into words.

What happened in the Park?

Julie Wilkinson took pairs of four-year-olds for a walk in the park. They played games on the way there and when they got there. On the way back they called in at a shop and bought something to drink. Nothing unusual was happening. The children knew Julie and they often went for walks in the park.

The next day at school the children were asked 'What happened yesterday?' When they had all had a go at answering that, half the children were asked some more probing questions, but the other half started off back to the park and were asked, as they walked along, about yesterday's trip. When Julie and the child passed a place where something had happened the child would often spontaneously, unprompted, tell what had happened there. If that didn't happen Julie would cue them by asking 'What happened here?' If there was still no recall she asked a more direct question, 'Did we find something here?' The classroom questions also gave successively greater clues. In all cases Julie provided the correct answer if the child did not. The results were quite outstanding.

Table 1

Park Study – effects of context on verbal and non-verbal recall

	Out of context	In context
Free recall		
verbal/11	1.0	3.3
nonverbal/10	0.4	3.0
Total recall		
verbal/11	6.0	8.9
nonverbal/10	3.5	7.0

The probe questions produced an enormous amount of extra material and the effect of context was massive. This means we must never assume (as the legal system does) that if it cannot be spoken it is not remembered. It is just harder to get out, that way.

The sorting out in Table 1 also gives us another teaching aid – if there is a chance for context or acting-out to help recall, then purely verbal knowledge (for example, the name of a song) is also more easily brought to mind. There is a lot of purely verbal knowledge required in school, from colour names to arithmetical tables to the dates of peace treaties. Context and non-verbal answers will help show what has been learnt but is difficult to express.

The search for a theory

From the Park Study we clearly need a theory of memory that will have these characteristics:

1. it allows the nature of the questions to affect recall;
2. it allows situational context to affect recall;
3. it allows non-verbal recall.

The need for these three characteristics is also seen in these three cases –

1. What was her name?

We all have the experience of being aware of everything we know about someone, other than their name. We know where she works, where she lives, her husband's first name, the last time we met, the colour of her eyes; we even feel certain we will instantly recognise her name if someone else produces it and, if we had started with her name, all the rest would still come to mind.

2. Don't you remember?

We all have gaps in our memories and are, at times, unable to recall events, despite detailed clues being supplied. An example in our research was a man who could not recall an evening when he nearly had a stand up fight with a waiter about a table reservation until his wife reminded him that the restaurant had a long driveway with orange trees. The content of the episode itself did not serve as a cue – something else did.

3. What made me think of that?

We all have the experience of memories being triggered by something that was just part of the background of an event. Scents, or pieces of music are often the trigger. The smell of sulphurous coal takes one person back to his days in a single-men's camp on a construction site. 'They're playing our tune' is another example. Or this experience:

A couple of years ago I changed my perfume. The perfume I wore before that I had worn during a very unhappy time in my life. A few months ago, I found this large bottle of perfume and thought, 'I can't let this go to waste,' and sprayed some on. Almost immediately I was back in hospital coming around after having my stomach pumped.

Note that the smell was not the smell of the hospital.

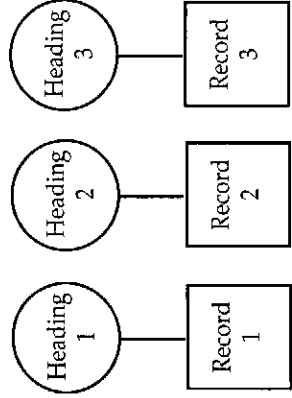
What we learn from these three kinds of event is that we need a model which readily allows the following three properties:

1. not all knowledge is retrievable;
2. the central parts of an episode do not necessarily cue recall of that episode;
3. peripheral cues, which may be non-essential parts of the context, can serve to cue recall and may be the only effective cue.

The Headed Records (HR) model was designed to do this.

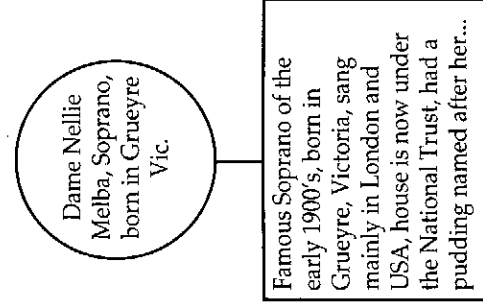
The HR model is that our memory is in separate, distinct Records. Either you remember all of the Record or none of it. They are not connected directly to each other. Each Record has a Heading; when we try to remember something it is the Headings we search, and if our brain finds a Heading with the right cue, then the Record is revealed to us - it 'pops into our head'. BUT, what is in the Headings is never revealed to us - we never 'see' what is in the Headings.

Here is how the model works for our three common problems of memory.



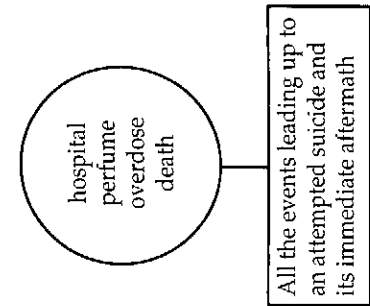
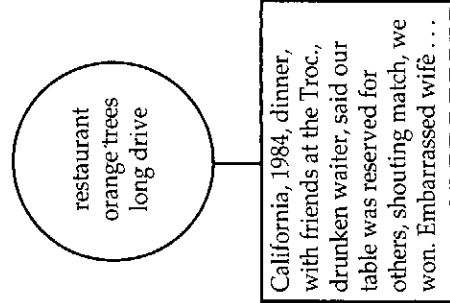
1. What was her name?

This is the case of the person's name being in the Heading but not the Record. 'Soprano' in the Heading opened up the Record to us, but the name is in the inaccessible Heading.



2. Don't you remember?

This happens when you try to use part of the Record as a Heading. This incident has been stored by the memory under a heading that doesn't mention the (embarrassing) fight. You can't get to the Record without the correct heading.



3. What made me think of that?

The Heading (which we can't look at) contains items we might not expect a Heading to have, in this case perfume worn at the time.

What is Memory For?

I believe that our memory system is designed to help us interpret the world and guide our actions on the basis of experience. It is not designed, as a computer is, to instantly find, translate into English words and regurgitate, facts. A system of Records with Headings works well for interpreting and guiding, but no extra efficiency would derive from being able to examine Headings.

We are constantly receiving new experiences and making new Records with new Headings. This happens at two levels: one concrete, one abstract.

1. Concrete.

We receive, hear, see, taste, smell, feel; we have emotions and ideas; we decide what to do. These give us our primary Records, some items of which make up the Headings.

2. Abstract.

We recall Records of what happened, how we felt, what we did, and can use these to muse, to cogitate, or even to re-tell. The result of this recall, this thinking, these reminiscences, gives us a secondary Record and its Headings. If we were narrating the story, telling someone or writing it down, the memories will have to be changed from the brain's 'code' into a verbal code. This is an extra step.

This sounds very complex, and it is. In adults it is by no means instantaneous - think of all the 'ers' and 'ums' we use when having to explain something. In children it may be an impossible skill.

Searching, Way Back

How do we set about searching? Suppose you are asked 'Could you tell me the address of your best friend, please?' You will have to search for a name under the Heading <best friend>. Maybe you haven't got such a Heading, so some thinking about <friends> and <best> will be necessary. When a Record has popped into your mind you will then have to check that it has an address in it. If not, perhaps something else in the Record will be a Heading for another Record... and so on. Bits of this are at a conscious level, bits are not.

Let us think briefly about the way such a system might develop. As we get more experience we are going to use different things as cues. In particular, when we develop language we will get a whole new set of language-based elements for the Headings. Consider, then, what would be happening to you as a three-year-old. Your conceptual system is just beginning to set up useful cognitive categories, and your language system is still rudimentary. You have found a way of setting up Headings that seems to work. You create new Headed Records of your current experience. Then, suppose that right now, as an adult, you try to access one of the Records you laid down as a three-year-old. You form a Heading but it is a Heading based on your current way of conceptualising the world. This will fail if you are trying to search for something set up using the organising system you used at the age of three.

This failure of retrieval is very severe. Possibly the only categories that have survived over the years are our basic emotions. Only under very special circumstances will we be able to retrieve the original Records. The exceptions will include episodes that we have repeated to ourselves over the years or heard other people repeating at a time when our Heading system was close enough to the adult form to be compatible. These would be secondary records. Apart from these episodes we will, to all intents and purposes, be amnesic for our infant and early childhood experiences. We do not need repression as an explanatory concept for infantile amnesia.

Searching, Not Far Back

We seldom have the simple task of remembering one incident or fact - something stored neatly in one Record. For most recall we go through a *Retrieval Cycle*.

One can readily see the operation of this cycle. Ask someone a simple question like 'What did you do yesterday afternoon?' Our experiments showed that it was rarely that someone could answer a question like that directly. Here is an example:

A: What happened yesterday afternoon?

B: [... 5 secs ...] What happened yesterday afternoon?, er, what happened yesterday afternoon? Right, er, thinking about what was yesterday. Oh my God, what's today? Wednesday today so it must have been Tuesday. What's so special about Tuesdays? Tuesdays are general seminar day, made the tea, er, ... (meta comments) ... What did I do after lunch? Ah, I've got it. I didn't come in yesterday morning, so I came in for lunch, yes I came in for a late lunch and then I was running around. Did I run any subjects yesterday afternoon? ...Er, Good God, I can't remember. I can't think what I did between coming back from lunch and four o'clock. OK, yes, right, after lunch, yes, it relates to tea time. I went to Safeways and got the biscuits, than I came back, and then, I think, I sat here, actually, and worked out... no, yes, I did a bit of work, it's all coming back now! And then Tim asked me to do his experiment so I did Tim's experiment and by that time it was teatime.

Simple questions are not easy to answer even by an adult who succeeds only by going round the retrieval cycle a number of times, evaluating the information he had, and formulating a new description (for a new Heading) every time. Think of the problem a child is having, not only operating the cycle, but managing the 'code' change into language as well.

The Witch Study

The basic thesis of this article has been stated already: children are not only registering what they see, hear, touch, taste and smell, what they feel, and what they do, BUT they are also creating a system of Headings for retrieving what they have experienced. Their 'trial' Headings are not the same as ours so it is not surprising if what triggers a memory in us doesn't trigger it in them. Couple that to learning new skills of 're-coding' memories into language, and running an efficient retrieval cycle, and it is surprising we are able to communicate with young children at all.

As an example of problems and development of memory of events here is a short description of an experiment Julie Wilkinson carried out in 1988 with a group of children between 3½ and 5 years old.

Normally at (English) tea time, mid afternoon, the children at this Day Nursery sit at the table, each with their own place-mat identified by a picture - a ball, or train, etc. After something to eat and drink they get down, go to the bathroom, go to the toilet and wash their hands and face. Then they sit on other chairs or the floor and read till the tables are cleared and toys put out.

On the day in question the children discovered that onto their place-mats a picture of a black cat had been stuck. Before they could start their tea there was an interruption - a 'witch' in black

cape and pointed hat came in and told the children she had lost her black cats. This caused great excitement. They were found on the place-mats. The children were told to give the place-mats to the witch when they went to the bathroom, after tea, to say a magic word, and the cats would tell the witch if the child had been good.

After all that was over, the children went to the staffroom where Julie had a stuffed owl, said to be the witch's, and the children were encouraged to stroke it and talk to it. The whole event took about 20 minutes, and was super-imposed on normal routines.

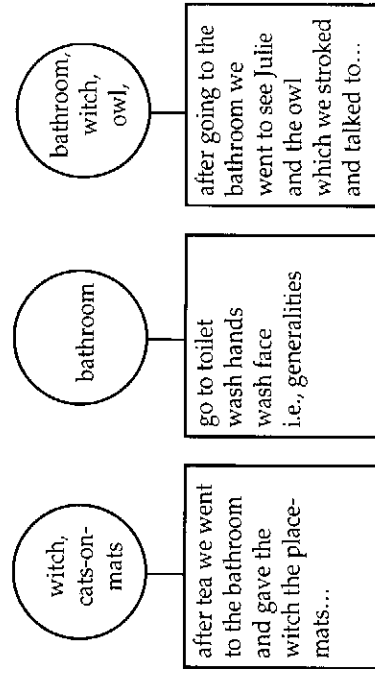
Next day the children were first asked, 'What happened yesterday at tea time?' Then, 'Something special happened at tea time, what was it?' Then, 'Tell me about the witch coming at tea time.' This gave a chance for free recall. Then there were directive questions, 'What was the witch looking for?' 'What did you have to do at the bathroom?' and so on.

There were 11 children. Only 4 could answer the first question, mentioning 2 events each. Two remembered some of the incidents after question two. Talk about the witch got at least one of the incidents recalled by the other five children. Helped by the directive questions an overall average of 7.8 items were talked about.

Analysis of the questions answered and the children's ages shows even between 3½ and 5 the ability to access memories and elaborate them increases quickly.

Asking how the children organised their replies was most revealing. To, 'What happened at the bathroom?' one child said nothing and four gave generalisations such as, 'wash our face and go toilet.' Three made a general statement plus information from the next episode, 'wash ourselves and then we had to come in here to see the owl.' Three just mentioned the owl. No child mentioned giving the witch the place-mats, the cats, the magic word nor the have-you-been-good? talk.

Of course the numbers are breathtakingly small, but sensible patterns seem to be emerging. They suggest that, using our Headed Records model most children had organised their memories something like this.



If we look at the actual conversations in which we 'dragged' the story out of the children we can see a little further into the way they have organised their memories. Here is a fairly typical conversation.

J. Can you tell me what happened at tea time yesterday?

H. (aged 4y.1m.) Yes.

J. Can you tell me all about it?

H. A witch came.

J. Anything else? What else happened?

H. We had cats on our mats.

J. Anything else? What else happened?

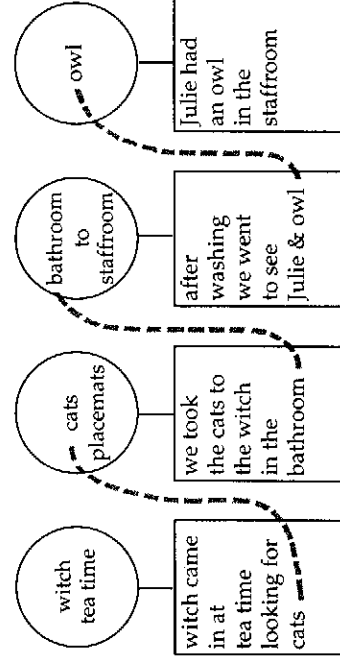
H. We saw the owl.

J. What else?

- H. And you was hold the owl.
 J. Yes I was. Anything else you remember? ... What else?
 H. The witch said give me our cats back when you go to the bathroom.
 J. Anything else?
 H. (shakes head)

The main thing to notice is that the experimenter kept on encouraging the child by asking 'anything else?' or something like that. The child responded to this but never more than two points at a time. They did not require clues to continue; just encouragement.

This, and other more complex evidence suggests that the basic organisation is that the Records are small, each containing part of the story in approximate chronological order, and one item in each Record is part of the Heading of the next Record.



In none of the Headings is <yesterday> one of the items.

One can note in passing that the reason for so little coming out each time is surely partly the child's difficulty in turning memories into language. Also the children do not seem to turn the telling into another Record with a new Heading - making secondary Records is not well developed. Thus the reason for the child recalling the memory at all may be to 'Please Julie' and the system tries to get away with as little as possible! Day-dreaming, for its own sake, is not yet one of their pastimes, nor the enjoyment we get from remembering the good-old-days.

Notes

Professor John Morton is Director of the British Medical Research Council's Cognitive Development Unit, 17 Gordon St, London WC1H 0AH. This paper is adapted from his Presidents' Award Lecture to the British Psychological Society, 1989 Annual Conference, St. Andrews. Professor Morton says

My debt to Julie Wilkinson in this paper should be apparent. She designed and carried out the experiments reported herein and has discussed at great length the issues raised. I have added some statistical and theoretical analyses of my own.

Julie Wilkinson's work can be found more fully in

Wilkinson, J. (1988a) Context effects in Children's memory. In M.M. Gruneberg, P.E. Morris and R.N. Sykes (Eds.) *Practical Aspects of Memory: Current research and issues*. Volume 1. Chichester: John Wiley and Sons.

and

Wilkinson, J. (1988b) Preschoolers' event memory: methods for facilitating recall. London: University College, PhD Thesis.

Freud's description and analysis of infantile amnesia is in

Freud, S. (1973) Introductory Lectures on Psychoanalysis, Chapter 13, *The Pelican Freud Library*, Harmondsworth: Penguin, Vol. 2.

The work of Katherine Nelson on children's inability to give more than generalised replies can be found in

Does teaching help memory?

The narratives the children told lacked structure. In an attempt to increase the structure we tried telling the children our version of what happened, but casting it as a story, with the child's name inserted. The children were captivated by this play. 'Once upon a time there was a little girl named Sally who went to Day Nursery. On Tuesday, just when Sally and the others were having tea...' The children were asked questions, just the same as for the actual event, the next day.

If you count just the events they managed to recall then the results are hardly different from those before. But if you look at the quality there is an impressive improvement. This is the child whose episodic conversation was given earlier.

Helen was reading a hungry snake book and someone knocked on the door and then she said, 'Hello children' and she said, 'I am Wanda the witch' and she said, 'Go office when you've washed your hands and see the owl'... and the witch said bathroom higgledy piggledy and Wanda the witch took the cats off the mats and then we had a little run, play, run out the garden.

What has happened? Using our Headed Record model to describe the changes we can say that at first the children formed ordinary separate Records of the separate episodes, seeing the witch, handing over the cats, petting the owl, etc. (The difficulty the children had in recall was in chaining the episodes together.) The story-telling, however, would form a new single Record allowing the child to produce a single coherent utterance with narrative structure. There is evidence also that, in their retelling of the story, the children drew on items tucked away in their earlier Records but previously not verbalised, for example the 'run out the garden.'

Conclusion

We can see that the problem the young child has to face when trying to satisfy the questioning adult is quite acute. The child is placed in the position of trying to produce narrative speech from a Record which was set up for a totally different purpose. Primary Records are for USING: they get used for interpreting the world and guiding action and have a construction which is appropriate for these uses. If you try to use them for narrative it will not be efficient. There are many ways of failing to get a four-year-old to recall.

Nelson, K. and Gruendel, J. (1981) General event representations: basic building blocks of cognitive development, *Advances in Developmental Psychology*, New York: Academic Press, Vol. 1.

and

Nelson, K. and Gruendel, J. (1986) Children's scripts. In K. Nelson (Ed.) *Event Knowledge: Structure and function in development*. Hillsdale, N.J.: L.E.A.

The theory of Headed Records was first put forward in

Morton, J., Hammersley, R.H. and Bekerian, D.A. (1985) Headed records: a model for memory and its failures, *Cognition*, Vol. 20, pp. 1-23.

From the section called **Searching, Way Back** on, a whole theoretical step has been omitted. It is called *Description* (following Norman and Bobrow) and helps to explain how the mind knows which Heading to search for, retrieval depending on getting a match between the Description and the Heading. For an account of how it fits in see the original John Morton paper

Morton, John (1990) The Development of Event Memory, *The Psychologist: Bulletin of the British Psychological Society*, Vol. 1, pp. 3-10.

and

Norman, D.A. and Bobrow, D.C. (1979) Descriptions: an intermediate stage in memory retrieval, *Cognitive Psychology*, Vol. II, pp. 107-123.

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