COMPREHENDING AND RECALLING STORIES

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I am going to talk about some of our research on how people understand and remember stories. You may well ask: Why should we study story understanding and recall? There's at least a couple of good reasons.

First, investigation of story understanding promises to increase our knowledge of cognitive processes. To paraphrase Sigmund Freud, I think it's the royal road to the study of the mind. It appears that the procedures people use to understand and recall stories are very general; the procedures are much like those they use to understand the various events around them. And psychologists should be concerned with how people understand and build models of their world so as to guide their actions and decisions. Thus, stories may provide a microcosm or experimental test-tube in which we can study general aspects of human understanding.

Second, story recall is interesting in its own right—it is an activity we perform often in life with notable failings. Because the research refers to common experiences, I find that students are often interested in learning about it.

A number of scientists are presently working on text understanding. I owe particular intellectual debts to Dave Rumelhart, Roger Schank and Bob Abelson, whose ideas have stimulated my research group at Stanford.
I'll be reporting two sets of experiments from my lab. The first set, done by Perry Thorndyke, a former Ph.D. student, developed what may be called the "story grammar" approach. The second set of experiments, done with two current students, Justine Owens and John Black, develop a complementary approach which says we understand episodes in stories according to how they relate to the motives and goals of the characters involved.

With these preliminaries aside, I'll get started now. My first point is that simple stories have a definite constituent structure; that is, they have a constant set of abstract constituents such as a setting, characters, a theme, a plot, episodes, a resolution, and so on, all of which are put together in a principled way so as to make a coherent whole. Indeed, for simple "problem-solving" folktales, there may even be a grammar describing the structure of well-formed stories. Literary analysts have believed that a common structure or set of rules underlies thousands of folktales, myths, and fables found throughout the world. Recently, David Rumelhart conjectured a simple story grammar, and this has been used in research and modified by several other psychologists, including Perry Thorndyke, Jean Mandler, and Nancy Stein.

An example of a story grammar which generated a number of research questions for us is in Table 1, showing Thorndyke's story grammar. This is a context-free grammar of simple rewrite rules. The first rule just defines a story to consist of a setting, a theme, a plot, and a resolution, with the elements usually occurring in that order in the story. Rule two says that the setting consists of the characters and perhaps the location
Table 1

GRAMMAR RULES FOR SIMPLE STORIES

Rules Number

(1) \[ \text{STORY} \rightarrow \text{SETTING} + \text{THEME} + \text{PLOT} + \text{RESOLUTION} \]

(2) \[ \text{SETTING} \rightarrow \text{CHARACTERS} + \text{LOCATION} + \text{TIME} \]

(3) \[ \text{THEME} \rightarrow \text{(EVENT)}^* + \text{GOAL} \]

(4) \[ \text{PLOT} \rightarrow \text{EPISODE}^* \]

(5) \[ \text{EPISODE} \rightarrow \text{SUBGOAL} + \text{ATTEMPT}^* + \text{OUTCOME} \]

(6) \[ \text{ATTEMPT} \rightarrow \begin{cases} \text{EVENT}^* \\ \text{EPISODE} \end{cases} \]

(7) \[ \text{OUTCOME} \rightarrow \begin{cases} \text{EVENT}^* \\ \text{STATE} \end{cases} \]

(8) \[ \text{RESOLUTION} \rightarrow \begin{cases} \text{EVENT} \\ \text{STATE} \end{cases} \]

(9) \[ \begin{aligned} \text{SUBGOAL} & \rightarrow \text{GOAL} \\ \text{GOAL} & \rightarrow \text{DESIRED STATE} \end{aligned} \]

(10) \[ \begin{aligned} \text{CHARACTERS} & \rightarrow \text{LOCATION} \\ \text{LOCATION} & \rightarrow \text{TIME} \\ \text{TIME} & \rightarrow \text{STATE} \end{aligned} \]
and time of the story. Rule three says that the theme of the story is typically just a goal of the main character. For example, the goal may be to rescue the beautiful damsel from the dreadful dragon.

The plot in Rule four is the action-line itself, a series of episodes. Rule five says that each episode has a subgoal, one or more attempts, and an outcome. The subgoal is something that is instrumental to achieving the main goal—for example, our hero wants to get a horse to ride to the dragon's cave. The attempt itself is the action or event—the hero asks the king for a horse. The outcome in Rule seven is often the achievement of some new state—for example, the hero comes in possession of a horse. After several episodes, an outcome occurs which matches the goal of the main character, ending the plot and ushering in the final resolution. The resolution in Rule eight may either be an event or an evaluation or "moral" to the fable.

This framework allows for embedding subgoals within goals using Rules 5 and 6. This produces a hierarchy of sub-goals. Thus the hero may want to do some action, but he can't do that until he has set up certain conditions by doing other things—the hero can't slay the dragon until he transports himself to the care, so he sets up a sub-goal to get there, which sets up the subgoal of finding a horse, and so on.

A story with such embedded subgoals is the "Old Farmer and his Stubborn Animals," which we have borrowed from Rumelhart for our research.
Old Farmer Normal Story

(1) There was once an old farmer (2) who owned a very stubborn donkey, (3) One evening the farmer was trying to put his donkey into its shed. (4) First, the farmer pulled the donkey, (5) but the donkey wouldn't move. (6) Then the farmer pushed the donkey, (7) but still the donkey wouldn't move. (8) Finally, the farmer asked his dog (9) to bark loudly at the donkey (10) and thereby frighten him into the shed. (11) But the dog refused. (12) So then, the farmer asked his cat (13) to scratch the dog (14) so the dog would bark loudly (15) and thereby frighten the donkey into the shed. (16) But the cat replied, "I would gladly scratch the dog (17) if only you would get me some milk." (18) So the farmer went to his cow (19) and asked for some milk (20) to give to the cat. (21) But the cow replied, (22) "I would gladly give you some milk (23) if only you would give me some hay." (24) Thus, the farmer went to the haystack (25) and got some hay. (26) As soon as he gave the hay to the cow, (27) the cow gave the farmer some milk. (28) Then the farmer went to the cat (29) and gave the milk to the cat. (30) As soon as the cat got the milk, (31), it began to scratch the dog. (32) As soon as the cat scratched the dog, (33) the dog began to bark loudly. (34) The barking so frightened the donkey (35) that it jumped immediately into its shed.
Reading this, you notice how a series of subgoals are being recursively generated and stacked up on one another, to a level about four deep; and then the main character just knocks them over like dominoes in order to achieve his final goal. The Farmer story has what we call a very tightly-knit goal structure.

You've now seen an example of a story grammar and heard a story whose goal structure is nicely laid out by the grammar. What claims are made for such a grammar? What can we do with it? First, it is claimed that this grammar generates the possible allowable structures for simple stories; and conversely, that every simple story fits this grammar. I frankly doubt if that's true but that would simply show that the grammar is incomplete and may need another few rules, so that's not serious. Second, a claim of psychological interest is that texts which violate one or more of these rules will be incoherent as stories. One of the first experiments that we planned and Thorndyke ran was to see the effect of deleting the theme or over-riding goal in the Farmer story. We removed the Farmer's main goal and reordered the events so that the subject couldn't detect the implicit goal hierarchy of the original story. However, pretty much the same propositions were involved in the Themeless text as in the original. The results for this are shown in Table 2. Subjects who read this Themeless narrative rated it as less comprehensible than the original Farmer story. The Themeless narrative was also harder to recall. Subjects recalled 80% of the propositions in the good story, but only about 58% of those in the Themeless story.
<table>
<thead>
<tr>
<th>Measure</th>
<th>Themeless Text</th>
<th>Coherent Story</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehensibility</td>
<td>5.0</td>
<td>9.7</td>
</tr>
<tr>
<td>Rating (of 10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Propositions</td>
<td>.58</td>
<td>.80</td>
</tr>
<tr>
<td>Recalled</td>
<td></td>
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</table>
Why is this? Why is the coherent story remembered better? I think it is because the episodes in the coherent story are more interconnected with one another than the same episodes in the Themeless story. Each action in the coherent story is connected sensibly to other actions which it enables or causes, and all are connected in memory overall to the goal of the Farmer. In contrast, the Themeless story is a disjointed series of arbitrary actions connected only by their order of mention. People forget whole episodes of it and misorder what they do recall.

Consider another set of interesting phenomena predicted by the story grammar. Earlier I mentioned that the story grammar assigns a hierarchical description to the different propositions of a story. To illustrate, consider the hierarchy in Figure 1, which is one of Thorndyke's stories called, "Circle Island." Numbers in boxes refer to individual propositions in the text. Propositions 1 through 10 supply setting information; propositions 13-16 give the theme or goal of the protagonist, which was to get an irrigation canal built, and lines 17 through 27 relate a series of action episodes, to pass a vote on the issue. Proposition 31 describes the frustration of the top goal, and 32 through 34 give the resolution of the plot, that Civil War seemed imminent. There are four levels to the Circle Island hierarchy. Such hierarchies suggest a natural hypothesis: propositions that are higher up in this hierarchy should be more structurally important or salient to the reader than propositions at lower levels. We have looked for and found evidence for this structural salience in three behavioral indices.

The first index comes from simply asking judges to rate the structural importance of the propositions to the overall plot and content of the story. The results for two of our stories are shown in Table 3. We found indeed
Figure 7. Hierarchical structure assigned by the grammar to propositions in the Circle Island story.

STORY: CIRCLE ISLAND

EVENT

GOAL

THEME

SETTING

LOCATION

LOC OCC LAND GOVT

11

12

13

14

15

16

SUBGOAL

EPISODE

CONVINC

SENATE

31

30

29

28

26

25

24

SUBG ATTL OUTC

SUBG ATTL OUTC

RESOLUTION

STATE

EPISODE

OVCME

ATTEMPT

PASS

22

21

20

19

18

17

VOTE
Table 3

Importance ratings for propositions at various levels of the hierarchy for two stories. (0 to 10 scale)

<table>
<thead>
<tr>
<th>Level</th>
<th>Farmer Story</th>
<th></th>
<th>Level</th>
<th>Circle Island</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>7.8</td>
<td></td>
<td>1</td>
<td>7.1</td>
</tr>
<tr>
<td>2</td>
<td>7.0</td>
<td></td>
<td>2</td>
<td>6.6</td>
</tr>
<tr>
<td>3-7</td>
<td>6.9</td>
<td></td>
<td>3</td>
<td>6.9</td>
</tr>
<tr>
<td>8-12</td>
<td>5.9</td>
<td></td>
<td>4</td>
<td>5.9</td>
</tr>
<tr>
<td>13-16</td>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
that the average ratings were monotonically higher for those propositions at the upper levels of the hierarchy.

As a second index, you can ask people to summarize a story. You might imagine that a summary would pick out the more important highlights of a story, deleting, collapsing, and compressing others. Therefore, propositions high in the hierarchy should show up more often in people's summaries. In one of Thorndyke's experiments, after subjects had studied and recalled a story, they were asked to write a brief summary of it. To control for memory differences between propositions when the summary was requested, we calculated the probability a proposition was mentioned in the summary conditional upon its having been recalled earlier. Figure 2 shows the data, which indicates that the higher a recallable proposition was in the structural hierarchy of the story, the more likely it was to be included in the summary.

The third consequence of the structural salience of a proposition should be its recall. Items high in structural salience should be recalled better. Indeed, there is strong support for this idea. Figure 3 illustrates this effect for the Circle Island story: propositions at the higher levels of the story are more likely to be recalled. The control subjects in this slide read a random scrambling of the text sentences: the flatness of their recall function means that in the absence of a plot the propositions at different levels of the good story do not differ in their inherent memorability.
Fig. 2  Conditional probability that a statement was in the summary given that it was recalled plotted against its level in the hierarchy.
Fig. 3 Percentage recall of propositions according to their hierarchical level in the normal story, for the separate kinds of texts.
The propositions at the higher levels of the hierarchical tree are probably remembered better for several reasons. First, they receive more attention because they fill basic categories and may be called to mind several times to relate to other things as a story is read or mulled over, with the result that they are established in memory at greater strength than are the propositions of lesser importance. Second, the categories of the story framework—the basic constituents—serve as abstract retrieval cues to prompt recall of the items filling their slots. We can imagine the subject prompting his recall by asking himself, "What was the setting? Who were the characters? What were their goals? Their actions and outcomes?" The lower in the hierarchy a given proposition, the less likely it is to be cued for recall by its chain of parent constituents. We may think of this effect as due to "associative distance". This "cueing-distance" hypothesis supposes that the retention loss is partly one of losing retrieval pathways for lower-order information; this suggests that cueing recall of lower-order events should produce a large boost in recall even at long retention intervals. Our experiments show that cueing can substantially revive memory of these lower-level propositions.

These hypotheses imply that lower elements of the story tree will be forgotten sooner than the upper elements. We may imagine the bottom "leaves" of the tree withering away over the retention interval. Forgetting should thus make the "levels effect" on recall more pronounced over time. As a consequence, recall of a story overtime should look more and more like a summary of that story. This point, that recall approaches a summary, is reminiscent of Bartlett's notion of progressive "schematization" of a memory over time.
So, to summarize, I have claimed that simple stories have a definite structure, that some of our general knowledge about stories may be captured in a story grammar, that texts which violate such rules are poorly comprehended and poorly recalled, that propositions of a story can be assigned to different levels in a hierarchical description, that elements high in this hierarchy seem more important to the meaning of the story, they tend to appear in summaries, they tend to be recalled more often, and are forgotten more slowly, with the consequence that over time recalls tend to look progressively more like summaries. So those are some of the claims made from the perspective of story grammars.

I've now sketched the "story grammar" approach to story comprehension. It describes the syntax of a good plot structure. And that is okay so far as it goes. But the syntax of a plot structure is surely not the whole story about story understanding. Story grammars say nothing about the contents that fill the abstract categories; yet this is the flesh and blood that fill out the plot skeleton in an interesting way. Hollywood would never buy a bloodless plot skeleton. Moreover, many of the psychologically interesting things that go on during story comprehension are keyed to the content.

Consider just one way content considerations intrude upon the grammar of plot structures. A grammar of story constituents must be supplemented with a long list of required relationships among the contents that fill the slots of the abstract framework. Table 4 lists some needed content relations. For example, the theme of the story must be the major goal of the major character, rather than a minor whim of a minor character; moreover, the actions must be seen both as plausible in the context and as relevant to the goals. Texts which violated such relations would be nonsensical or
<table>
<thead>
<tr>
<th>Theme</th>
<th>Must Fit</th>
<th>Major Goal/Hero</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actions</td>
<td>&quot;</td>
<td>Setting</td>
</tr>
<tr>
<td>Actions</td>
<td>&quot;</td>
<td>Relevant to Goal</td>
</tr>
<tr>
<td>Actions</td>
<td>&quot;</td>
<td>Characters</td>
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<tr>
<td>Characters</td>
<td>&quot;</td>
<td>Setting</td>
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<tr>
<td>Outcomes</td>
<td>&quot;</td>
<td>Actions/Setting</td>
</tr>
<tr>
<td>Final Outcome</td>
<td>&quot;</td>
<td>Initial Goal</td>
</tr>
<tr>
<td>Resolution</td>
<td>&quot;</td>
<td>Match Outcome/Goal</td>
</tr>
</tbody>
</table>
incoherent. But in order to state such selectional restrictions, such as that actions must be plausible in the setting, we require much more world knowledge than grammars typically have.

Even with these additions, however, the unadorned story grammar would still be deficient because it ignores the critical role that inferences play in understanding. Story grammars are written only in terms of the surface propositions of the text; that is, the terminal nodes of the structural trees are filled by actual sentences. This assumes that all necessary parts of a story are explicitly stated. Yet, it seems obvious that important parts of a story may not be expressed at all but only implied. For instance, goals are often not expressed but are inferred from actions; often the causal linkage between events is implied without being stated. In such instances, people use the text as a clue to infer what is going on "between the lines", so to speak. Although story grammars accord no status to such inferences, they seem intimately connected to the structure as well as to the meaning of the story. We would like an account of story-understanding which recognizes the role of these inferences.

Now, the inferences we draw from events in a story depend upon our knowledge of objects, persons, actions, and events as it is carried into the story context. Therefore, an adequate account of story comprehension should recognize how world-knowledge is used in directing inferences made while reading. That turns out to be a very tall order.

A possible way to fill the order makes central use of the notion of frames, a concept similar to psychologists' notions of schemata or framework, and which has been developed most recently by Marvin Minsky of MIT and by Terry Winograd and Danny Bobrow in Palo Alto. A frame is a large memory structure which represents our knowledge about some large domain of the
world. It is like a concept, specifying features of objects that fit the frame, except it organizes our knowledge about more complex collections of information. We have knowledge frames for objects, for coherent collections of objects, for actions, and coherent collections of actions. We use the frames from our memory to create internal descriptions of new objects or events we encounter. We speak of "instantiating" a frame when we fill in its variable features or slots with the values of the thing before us. For example, you used your general frame for "Lecture Room" along with observations of this room to construct an internal model of it. That model enables you to close your eyes and answer questions about the room, such as where the exit doors are, about how many people are here, how far are you from the speaker, and so on. Similarly, when you go to a baseball game, you call up your baseball frame from memory and proceed to instantiate its elements in terms of the players and events you see before you. This framework is the background allowing you to distinguish major from minor events and to understand their significance.

Now, the frame for a baseball game is known in fair detail by most of us. I would also claim that we know some general frames for simple stories, for folktales, myths, riddles, and so on. People in our culture, as a result of hearing many hundreds of simple stories, have probably abstracted a common frame or set of inter-related frames that characterize prototypic stories and variations on these.

To relate this notion to story grammars, we can think of the story grammar as a set of good guesses about the categories or slots in our story frame. These slots would be filled by particular objects and events as we
instantiate the general frame according to the particular story we're reading. Moreover, the general frame would stipulate semantic relations among the category-fillers, such as those I listed in Table 4.

These abstract story frameworks serve two important functions: first, we use them to comprehend and interpret new stories as we hear them; second, we use them to guide our remembering a story we've heard or to retell a series of real-life episodes that we believe constitutes a story.

Now, as I've indicated, an abstract story framework does not provide you with the content-specific knowledge you need to understand particular events in stories. For this, you must rely upon your knowledge-frames aroused by the objects, actions and events of the story. As each is mentioned, your memory brings the corresponding knowledge frame into readiness, so that you expect and are prepared to hear about any of a set of items associated within that frame. These expectations direct our inferences and help flesh out the movie scenario the text is about. You're usually not aware of these expectations except when they are violated in the text, much as a competent speaker is not aware of monitoring speech inputs for their grammar. But these expectations are the iceberg-tip of the memory frames aroused and made active by the context of a story.

Let's consider just a few ways your knowledge frames appear in terms of expectations aroused as you listen to a story. I've listed some in Table 5 along with some concrete examples. A first simple use of world knowledge is that when the author refers to a standard object, we expect its necessary features to be present and respected. We expect horses to have hooves, water to be wet, fire to be hot. These features are relevant to human actions involving the object, e.g., you can't jump into water and not get wet. If the
TABLE 5

KNOWLEDGE FRAMES FOR

1. Objects (features + relations among features) rooms, horses, chairs, people, ...
2. Collections (subobjects + relations) rooms in a house, items in a kitchen, ...
3. Actions (enabling conditions, result) buy, request, hit, walk, ...
4. Action Scripts (segments, reason, "what ifs") visit dentist, eat in restaurant, attend party, ...
author violates these, either he's into fantasy or is using words to mean only what he wants them to . . . which prevents communication.

Second, we expect coherent collections of objects to stay together in stories as in life. For example, we expect our fictional detective to find a butcher knife in the kitchen and weed poison in the garden shed, not the reverse. Violation of such expectations is marked as peculiar and may provide a clue to be explained in a detective story.

Third, we expect an action to be carried out only if its preconditions are satisfied, and we expect it to have it normal result. For example, an act of "buying" requires a buyer, a seller, a transfer of ownership of some item in exchange for some gain to the seller; the result is a change in possessions. Most of the preconditions are given in the setting. The setting—whether fantasy or reality, whether past, present or future times—tells us the limitations the author intends to place upon the actions of his characters. The actions of the story must be seen as plausible within these constraints. For example, a man can jump 10 feet high on the moon but not on earth; you can buy a gourmet meal in a French restaurant but not while marooned on a desert island. You can water ski only if you've got a motorboat, waterskis, and a body of water. The setting is a set of conditions which provides support for or enables some behaviors and outcomes and prevents others. These enabling conditions must be honored by the storyteller if the text is to be coherent. By giving a setting and a problem, the storyteller has deliberately painted the hero into a corner, and we are invited to enjoy seeing how he gets out of the bind. But giving the hero the ability to perform all actions instantly, like Superman does, makes for rather dull stories. The only suspense about Superman stories is whether Superman will get to the
scene of the crime on time to prevent the villain doing lots of damage.

Fourth, we also expect that a standard activity in a story will involve its normal sequence of subparts. We have all learned hundreds of recipes for conventional activities, such as brushing our teeth, placing a phone call, cashing a check, eating in a restaurant, and so on. Such action recipes are cultural stereotypes. They are what Roger Schank and Bob Abelson have called "situational scripts. A script has a standard sequence of actions, a normative purpose, a number of branch points where things can go wrong to frustrate you, and prescriptions on what you can do if frustrated at a given point. For example, going to a dentist involves a standard sequence. The stereotype is: going to his office, checking in and waiting, entering the workroom, having your teeth examined, having them repaired, and then leaving.

A storyteller can point to and call up such scripts from the reader's memory in different ways, using just a few words. In doing so, he may mention only a few segments, yet the reader assumes that all the unmentioned actions in the standard script have been performed. For example, a later statement of the story may refer to one of the unmentioned segments--such as sitting in the dentist's chair--without causing confusion about reference. We have done some experiments in our lab which show that readers rapidly forget precisely which segments of a stereotyped activity have been mentioned in a story. When our subjects recall later, they tend to give a more or less random sample of action segments from the stereotype, including many that were not in fact mentioned.

Although situational scripts such as these are clearly called in from memory to aid our comprehension of stories, a story is more than a sequence
of stereotyped scripts. As we noted before, there must be a protagonist, trying to solve some interesting problem or achieve a goal by applying a plan within the constraints of the story setting.

It is at this point, in describing the main characters, that the storyteller invites us to call in and use our knowledge of human personality, of what motivates people to act the way they do. The knowledge used in understanding characters is commonsense psychology, such as the idea that motives precede actions, that actions are performed for their expected consequences, that human motives comprise a simple list like duty, love, greed, curiosity, desire for success, and that interactions follow simple principles such as reciprocity. Reciprocity is the idea of doing unto others as you believe they're trying to do unto you. It underlies the revenge motif that's so prevalent in stories, whereby the hero gains revenge upon some offending villain.

Our research group has been working on the hypothesis that the motive and goal of a character provides a powerful focus around which the reader organizes his understanding of that character's actions and assesses their relative importance. Events come to be interpreted according to their relevance to the character's plan for satisfying his motive. In particular, his motives guide the inferences we draw from his actions. As one instance, a character's motive can easily over-ride the conventional reason for him or her engaging in some activity. For instance, a woman in love with the dentist might make an office appointment to see him for reasons other than to have her teeth fixed.
How could we show that a reader's knowledge of a character's motive organizes the way he understands the text? We did an experiment to examine this question. Justine Owens and John Black, two of my research students at Stanford, and I designed the experiment diagrammed in Figure 4.

We had four groups of subjects read a bland, neutral text under one of four conditions—two with no particular character in mind, and two with a rather unusual character in mind. The neutral text was a sequence of five situation scripts; making a cup of coffee; visiting a doctor; attending a lecture; going shopping in a grocery store; and attending a cocktail party. These were stereotyped vignettes of a bland, boring nature, each about seven sentences long. For instance, here's the script for "Visiting the Doctor":

"Nancy went to see the doctor. She arrived at the office and checked in with the receptionist. She went to see the nurse who went through the usual procedures. Then Nancy stepped on the scale and the nurse recorded her weight. The doctor entered the room and examined the results. He smiled at Nancy and said, 'Well, it seems my expectations have been confirmed.' When the examination was finished, Nancy left the office."

Now, that's hardly exciting literature, but it proved entirely serviceable for our research. Subjects in the Neutral Control Condition read the five neutral episodes with only the name of the main character, called Nancy or Jack. Other subjects read a three-line description of the character plus her problem as background just before they read the neutral episodes. I'll describe the experiment just for the pregnant-Nancy strand since the Wrestler Jack strand was similarly constructed:

"Nancy woke up feeling sick again and she wondered if she really were pregnant. How would she tell the professor she had been seeing? And the money was another problem."

College students who read this sketch interpret Nancy to be an unmarried coed who's afraid she's pregnant as a result of an affair with her college
NEUTRAL CONTROLS
Dull Nancy  Dull Jack

CHARACTER CONDITION
Pregnant Nancy  Wrestler Jack

ACTION SCRIPTS
1. FIX COFFEE
2. VISIT DOCTOR
3. ATTEND LECTURE
4. GO SHOPPING
5. COCKTAIL PARTY

(24-hours later)
RECALL SCRIPTS

RECOGNITION TEST

Fig. 4
professor, and that she's concerned about how to confront him and pay for the probably abortion. Note that very little of this was said; Nancy could just as well be a happily married woman who's overjoyed at her pregnancy but slightly troubled that she'll have to cancel an educational movie she's been directing with a college professor at the studio. Though it fits the facts just as well, the happy pregnancy script is definitely not a dominant idea for college students.

Our subjects read the scripts, then returned the next day to recall them and to take a recognition test. The interesting comparison, of course, is that between recall by subjects in the Character Condition versus those in the Control Condition. The results showed that the character-plus-problem given just before the story had a whopping effect on performance. A simple, though simplifying, summary is to say that most episodes were interpreted and recalled in terms of their relation to Nancy's pregnancy and its consequent problems. This was despite the fact that the scripts being recalled were colorless and unemotional.

What are some of the interpretive distortions you might expect in recall? Here are just a few examples: Because Nancy is said to have awakened feeling sick, most subjects interpreted this as the morning sickness of early pregnancy, so they recalled Nancy as getting up in the morning and coming downstairs to fix her breakfast coffee. None of that was in the text. The four succeeding episodes are interpreted as successive scenes within Nancy's day, with appropriate bridging connectives. Thus, subjects will say that after breakfast, Nancy went to the doctor to check whether she's pregnant. Ambiguous phrases like "the nurse went through the usual procedures" receive definition in memory in terms of
pregnancy tests. And the doctor's marvelously vague remark, "My expec-
tations have been confirmed" becomes twisted into "Your fears have been
confirmed" or simply the declaration "You're pregnant." Subjects recall
that Nancy hurried from the doctor's just in time to make her class lecture
which is given, of course, by none other than the culprit-professor himself;
and the question that Nancy couldn't ask him at the end of his talk was
decidedly not about the contents of his lecture. Subjects forget the grocery
episode. Also, in subjects' recall, the professor who Nancy sees at the
cocktail party but doesn't get to speak to is the self-same scoundrel who's
now avoiding her. None of these specifics were said; they are all inter-
pretive intrusions.

The interpretations and distortions are completely different if the
main character is a young man named Jack who's worried that he's not heavy
enough to make the wrestling team. With Wrestler Jack, the neutral
statements in the scripts take on entirely different significances. For
example, subjects remember that the doctor told Jack how well he was
gaining weight; they remember more about all the food in the grocery
shopping episode; and their recall of the cocktail party amounts to a
listing of the hors d'oeuvres that Jack ate there. These are all items
relevant to his goal of gaining weight.

I've been emphasizing the distortions in recall related to the
character. In the Control Conditions, of course, there are no differences
in what was recalled for Dull Nancy versus Dull Jack. They are functionally
ciphers.

I've been citing qualitative results. What about some quantitative
measures of recall? Some are shown in Table 6. First, subjects in
<table>
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<th>Recall Measure</th>
<th>Character Condition</th>
<th>Neutral Control</th>
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<tbody>
<tr>
<td>Number of Scripts (of 5)</td>
<td>3.7</td>
<td>2.5</td>
</tr>
<tr>
<td>Text Propositions</td>
<td>29.2</td>
<td>20.2</td>
</tr>
<tr>
<td>New Inferred Propositions</td>
<td>15.2</td>
<td>3.7</td>
</tr>
</tbody>
</table>
the Character Conditions recall significantly more scripts, and recall them more often in correct order. As a result, they recall more true propositions actually stated in the text. We may conclude that the concept of a character-plus-his-problem serves as an integrating focus allowing the reader to relate and glue together the successive events of what is otherwise a very disjointed narrative. The character-plus-problem appears to act like a retrieval cue.

Moreover, as you can see in Table 6, subjects in the Character Condition wrote down about 4 times as many new propositions that were not in the text as did the Control subjects. Practically all of these were the character-related inferences I mentioned before.

The results discussed so far refer to the subject's free recall. But similar effects appeared in the recognition memory test. Here, subjects rated on a 7-point scale their confidence that each test sentence was stated explicitly in the scripts they had read the day before. Over half the test items were inferences; some were highly plausible given the character's perspective, for example, for pregnant Nancy, "The doctor said "Nancy, you're pregnant"; whereas other statements were rather implausible from that perspective, e.g., "Nancy wanted to talk to the teacher about her grades." Table 7 shows the relative recognition ratings for the various inferences, where a large number means that the subject thought he'd seen that sentence in the text.

In comparison to the controls, subjects who read the text from the perspective of pregnant-Nancy gave many more false positive recognitions to test
<table>
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<tr>
<th>Inferential Test Items</th>
<th>Character Condition</th>
<th>Neutral Condition</th>
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<tbody>
<tr>
<td>Character-Appropriate</td>
<td>.76</td>
<td>.04</td>
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<tr>
<td>Neutral (Script Fillers)</td>
<td>.80</td>
<td>.78</td>
</tr>
<tr>
<td>Character-Inappropriate</td>
<td>.19</td>
<td>.43</td>
</tr>
</tbody>
</table>
statements consistent with this perspective, gave an equal number on
inferences not related to the character's problem, e.g., Nancy read a mag-
azine while waiting to see the doctor, and gave many fewer false positives
to statements inconsistent with this perspective. Moreover, our other
experiments indicate that these effects occur during the reading and learning
of the material, rather than simply affecting the subject's response-bias
or willingness to agree to any plausible statement during testing.

So, what can we conclude from this study? We find that if the reader
has the concept of a specific character trying to resolve a specific
problem, then he uses that as an organizational framework for interpreting
actions and events in the story—for deciding what is relevant and
important, for inferring what must have happened between the lines and why.
That framework helps to integrate separate episodes of the text, and it
serves as a retrieval prompt for recall. The character's problem provides
the reader with a "point of view" which, like rose-colored glasses,
influences the way he sees the world inside the story. And that, of course,
determines the meaning he derives from the text.

I'll review the points of my remarks.

First, simple stories have a definite structure which is so regular
that one is tempted to write a simple grammar to describe the general class
of episodes in problem-solving stories. This simply stipulates the necessary
parts of a story and states general rules for analyzing human actions accord-
ing to plans and goals.

Second, if a text violates some of the critical rules—in particular
by leaving out the theme or main goal of the central character—then the
text seems less coherent, is harder to learn, and is forgotten more readily.

Third, the grammar assigns propositions of the story to a hierarchy. Elements at the higher levels in this hierarchy were judged to be more important components of the story; they are more likely to be remembered and to be included in summaries; since details are forgotten, over time the recall of a story tends increasingly to look like a summary of it.

Fourth, the story grammar must be supplemented to include semantic relationships among its category fillers and to deal with the role of inferences in story understanding. I suggested that the notion of frames provides the flexibility and power needed to represent the amounts of knowledge people use when understanding text.

Fifth, I mentioned several ways in which we use our knowledge about objects and actions to develop expectations and to read between the lines of stories, as though we were inferring and constructing a full-blown movie picture from just a few cryptic stage directions.

Sixth, the notion of a character with a motive provides a strong focus for interpreting and organizing the events in which that character participates. We showed that people who read neutral scripts with a possible character and motive in mind altered their interpretation of the scripts and distorted their recall of them to be consonant with that character's motives.

Finally, I'd like to note that these are only beginning steps in analyzing what is one of the most sophisticated achievements of man's
cognitive machinery, that is, how he understands coherent text. We've made some progress. I think there is every reason to expect that further studies in this area will forge a better understanding of the mind. And that, after all, is what psychology is all about.
Note

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