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ABSTRACT

This paper expands on schematic theory through a review of recent work in the field of semiotics. Content and formal schemata are shown to be grounded respectively in perceptual (abductive) and indexical (inductive) strategies of inference. A third kind of schemata is based on deductive generalization and referred to as abstract schemata. All three kinds of schemata are examined in relation to active interpretations of photographs, video comprehension, and discourse comprehension. It is argued that comprehension language acquisition and language use are invariably grounded in true narrative representations. These are explained and differentiated from several degeneracies, namely fictions, errors, and lies. Implications for literacy, language acquisition, and teaching are considered. Results from empirical studies conform to the prediction that abstract schemata are more powerful than formal schemata, which in turn are more powerful than content schemata. (Contains 22 references.) (Author/MDM)

Connecting Formal and Content Schemata: Some Results of Recent Work in Semiotics

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ABSTRACT

Content and formal discourse schemata are shown to be grounded respectively in perceptual (abductive) and indexical (inductive) strategies of inference. A third kind of schemata is based on deductive generalization. The third kind may be referred to as abstract schemata. All three kinds of schemata are examined in relation to active interpretations of photographs, video comprehension, and discourse comprehension. It is argued that comprehension language acquisition, and language use are invariably grounded in true narrative representations. These are explained and differentiated from several degeneracies—fictions, errors, and lies. Implications for literacy, language acquisition, and teaching are considered. Results from empirical studies conform to the prediction that abstract schemata are more powerful than formal schemata which in turn are more powerful than content schemata.

Background on Schemata

A **schema** is a way of looking at states of affairs in experience (including literature, films, or other vicarious experiences). Schemata supposedly help us to make sense of states of affairs in our experience.[1] Schemata have varying degrees of similitude to what have been called **scripts**, **scenes**, **scenarios**, **plans**, and **frames** of reference. They are also very much like the abstracted commonalities of **memories**, **fictions** (of various sorts and degrees especially including the **imagined** variants such as **fantasies**, **dreams**, etc.), and bear certain resemblances to the common underlying elements even of dreams, illusions, hallucinations and the like. A commonly used example of a schema (cf. Schank, 1975) is a restaurant scene where we expect to order something to eat, and to pay for it.

In the last ten years or so a framework has been developed for differentiating **content schemata**—those which pertain to the particular facts of a situation—from **formal schemata**—those which pertain to the underlying structure of one or more similar situations. Carrell (1984) also used the term **rhetorical schemata** as a cover term for the various kinds. She says,

[1]This paper began as a talk to be presented at the meeting of the American Association of Applied Linguistics in Baltimore, Maryland which took place on March 8, 1994 at the Lord Baltimore Hotel. It has been revised and expanded, not in its intent, but in its content on account of the fact that the original presentation was only 20 minutes plus 10 minutes for questions and discussion. As a result, some explanations that could not be included in the talk are presented here, and some evidences likewise that had to be omitted from the oral presentation are explained more completely here. The author can be reached by conventional mail at the Department of Linguistics, University of New Mexico, Albuquerque, New Mexico 87131-1196, or by electronic mail at 'JOLLER@BOOTES.UNM.EDU'. Or inquiries and comments may be addressed directly to the author by telephone at 505-856-6078 his home and main working number or at the university at 505-277-6353.

for example, that **formal schemata** can be defined as 'background knowledge of the rhetorical structures of different types of texts' (1984, as reprinted in Oller 1993a, p. 192).

Our Purpose Here

It is the aim of this paper, to expand the theory of schemata. The end in view is logical comprehensiveness along the lines of Charles S. Peirce. I must add here, however, that unless one were willing to examine and reflect deeply on several thousands of pages of Peirce's writings, one would search his work in vain for the particular applications that are made of it here. Nevertheless, the semiotic theory to be presented (an expansion of ideas given in the last chapter of the 1993 edition of *Methods that work: Ideas for literacy and language teachers*) sharply differentiates not only the two kinds of schemata that Patricia Carrell (1984) and others have been speaking of, but also a third kind of schemata, namely an abstract variety.

It will be argued on strictly logical grounds that these three kinds—content, formal, and abstract—are exhaustive. (It is not claimed, however, that they are always independent in their effects or that they can always be sharply differentiated at their boundaries.) Then, I'd like to discuss some of the evidence that shows that these distinct kinds of schemata are genuinely involved in language acquisition and use and with differing results. It turns out, if the underlying premises are correct, that the three categories of schemata to be distinguished are arranged as a strict and completely general hierarchy. Content schemata are less general (and thus less powerful) than are formal schemata which in turn are less general (and thus less powerful) than abstract schemata.

The Peircean Perspective

My deeper objective is to show a range of applications of the theoretical perspective that I have been working on for some years, together with a growing number of doctoral students, and a few other scholars. Though it is true that our main mentor really is Charles Sanders Peirce (who lived from 1839 until 1914), we would be carried far from the main purpose at hand if we were to introduce his life and work. A partial view, however, can be found in Joseph Brent's biography of Peirce which appeared in 1993 (from Indiana University Press). Oddly, its publication was suppressed for thirty years (by custodians of the Peirce archives at Harvard), apparently on account of its shocking content, though whether it was judged to be damaging to Peirce or to Harvard is difficult to say. A closer view of Peirce's thought and personality can be gained from his own words in *Reasoning and the logic of things* as edited by Kenneth Laine Ketner and published by Harvard University Press in 1992. This book contains a series of lectures given by Peirce in 1898 introducing his thought to non-mathematicians. But the ideas to be presented here must be judged on their own merits and the extent to which they have benefited from Peirce's special genius is another matter.

The first step in building up our own perspective is to lay down some definitions. The arguments on the theoretical side are essentially mathematical (purely axiomatic). Still, they can be subjected to empirical testing and in that vein are regarded more as hypotheses than may seem to be the case in the manner of their statement. However, since the aim is to achieve comprehensive generality without compromising the specificity of any particular case to be accounted for, it is inevitable, I suppose, that the theory will seem grandiose and its author over-ambitious. As to this unsavory appearance, as I said at the meeting in Baltimore (see footnote

1 above), I readily admit that my stated objective seems presumptuous. In fact, I believe that from the very beginning of these efforts it must have seemed more that way to me than it could have to anyone else. I say this because, until I began to understand Peirce's thought and more particularly what he called his **methodeutic,** I never dreamed that the problem I address today (or any other like it) could possibly yield up its secrets to any mortal. But, I was glad to find out from Brent that Peirce called his method **pedestrianism**. Upon reflection, I understood why he called it that because he had insisted on beginning with premises concerning which he had no reasonable doubt and adding none whose necessity he could not prove. That is, his method was that of an intellectual plodder who boasts no ability other than the doubtless capacity to put one mental foot ahead of the other, so to speak. Therefore, begging the reader's indulgence, speaking for my own part, damn the selfish ambitions and the selfish fears that accompany them, let us walk humbly forward one careful step at a time. If we do not make any great leaps or disregard any reasonable doubts, we should not, it is hoped, have any great falls.

The True Narrative Case

We begin with what I have called the **true narrative case**. This case, as shown in Figure 1, is what I have earlier called the process of **pragmatic mapping** and what Peirce calls **valid abduction**. Figure 1 gives a diagrammatic view of the essential elements. It turns out that all other classes of representations (those that are not true narrative cases) are either dependent upon true narrative cases or are degenerate precisely to the extent that they depart from or cannot be related to true narrative cases. These findings are summarized here but have been published in greater detail in Oller (1993b). After the theoretical distinctions that are needed have been introduced, then, we will consider several experimental studies that show the power of the theory.

Here is an example of a true narrative representation. At the meeting in Baltimore (cf. note 1 above), I had intended to throw a certain plastic felt-tip marker into the air and to attempt to catch it. I had considered tossing up either my gold Cross pen or pencil, but I had rejected this idea when I realized that I might easily bend the point or dent one of them if it should fall on a hard table or floor. But, upon searching my surrounds for the blue felt-tip I had decided to throw, I could not locate it. (Later, after the lecture, it turned up in my inside left coat pocket where I had put it thinking I could easily find it there at the beginning of the talk.) Tom Scovel was up offering me a pen as were several other persons when I decided to go ahead and toss one of the gold Cross items into the air. But I moved quickly and tossed up my pen before any of those generous friends reached me with their pens in hand. Alas, I watched the thing fly upward six or seven feet from my hand and wondered if it

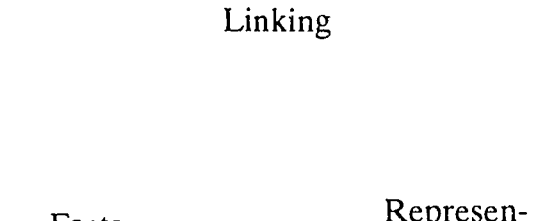

Figure 1. The underlying logical structure of every ***true narrative case.***

would come down where I could catch it. Lo and behold, it did, and I caught it. The pen was none the worse for the experiment.

Now this example is a true narrative case. It is true that *I tossed the pen into the air and caught it.* How do I know this? Or why can I not reasonably doubt that it is true? As the figure suggests, the facts of any true narrative case are known mainly through a series of sensory-motor impressions of changing states of affairs in the world of experience. I heard (and felt) the clip on the pen snap as I pulled it from my pocket. I felt my arm move as I tossed the pen into the air. I saw and felt the pen leave my hand, saw it go up into the air, and saw and felt it as I caught it on the way down. These sensory-motor impressions might be doubtful if taken out of context, but in the total context of the experience then at hand (now just a memory), there is no reason for doubtfulness about the truth of the impressions. Of course, the sights, sounds, and tactile impressions of the facts in question were largely iconic as are the memories that I call up now in thinking about them. That is, the representations of the sensory-motor type are copies of shapes, textures, densities, weights, colors, movements, resistances, etc., of the objects spoken of in the true narrative representation (that *I tossed the pen into the air and caught it*).

But, as if this were not enough, there is more positive evidence that helps to determine the truth of the representation in question. I also remember contemplating the act in advance, debating whether to throw the Cross pen or the blue felt-tip, and so on. It is true that I even considered various *other* alternative actions that might have served to exemplify a true narrative case. Then, in addition, I remember tentatively choosing and planning which one I would use and then re-deciding the case on the spot in favor of the Cross pen (because it was handy and I could not find the blue felt-tip in the welter of objects I had arranged on the table and near the overhead projector just before beginning my talk). Then, I remember deliberately moving my hand in such a manner as to throw the pen. This action and the memory traces it left behind in me are both different than any sensory-motor impressions created in my observers at the lecture. The other persons present did not move my hand so as to throw the pen. I did that part of my own free will. I remember various hypothetical possibilities considered beforehand, the choice that I had intended to make, and the one that I finally ended up making by tossing the Cross pen up in the air. I remember concentrating diligently on catching it too. It was not hard to do so, but the effort still left a trace in my memory that could not be found in Andrew Cohen's recollection or in Wilga River's because they did not make that particular effort to catch my pen. I did. That is, the efforts in question were indexically linked to me (as the agentive cause) and to them only as observers. The efforts were efficiently caused by my intentions and actions. (Had I failed in my efforts to toss up the pen up or to catch it, I could not now say with any reasonable certainty that I caused those events. But I did not fail. I threw up the pen and caught it too. I played an essential role in causing then and there the events reported here and now.) With respect to the facts in the true narrative case, the narrator is not always the indexical producer of the facts in themselves, but the narrator is always the indexical cause of the linking of the facts in question with the abstract representations (that is the words or signs) that constitute the narrative statement itself.

Since I was the actor producing the events on the one hand *and* the narrator describing them on the other, I was doubly involved in the creation of the true narrative case in question. I caused certain events to be such as they were (the tossing up of the pen and the catching of it). Luck and gravity together with the material elements of my body and the physical structure of

the pen (notably its mass) and the spatio-temporal context all conspired to help me succeed in my intentions, but all the physics in the world could not change the contribution that I made by choosing to do what I did. Further, and even more efficiently (with less help from physics), I caused the utterances that I spoke to assume the shape of the statement that I had just tossed my pen into the air and caught it. So, indexically speaking, in my own person (especially in this body sitting here pecking at these keys), I was involved in causing the true narrative case to be as it was, there, that day in Baltimore.

But, there is still more evidence that the representation in the example is a true case. Because I speak English, I know what I mean when I say that *I tossed my pen into the air and caught it*. That meaning could as easily be expressed in any other language of which I might gain sufficient knowledge. In fact, it could be expressed in a great variety of ways in English. I could assume the view of another observer. For instance, it is true (I believe) that Wilga Rivers, for instance, saw and noted that *John Oller threw his pen into the air and caught it*, and I am certain she could say this in French. Or, Tom Scovel, being bilingual in English and Cantonese, could say it in either of those languages, and I believe in Mandarin. Andrew Cohen could say it, I believe, in Hebrew, Portuguese, Spanish, and in several other languages. Sima Paribakht (who was also there) could say it in English, Farsi, French, and I don't know what other languages. Yet, the meaning would remain (provided the differences in viewpoints were properly taken into account) just about as it was when I said, *I tossed my pen into the air and caught it*. Further, if any language users should understand the meanings involved (regardless of the language used), they would also understand about equally perfectly the kinds of deliberations I say that I engaged in before throwing the pen into the air. Therefore, the true narrative case is one whose meaning can be more or less fully specified in a limitless variety of propositional forms. Therefore, knowing English since I was a child, I am not at all doubtful that the way I expressed the facts conforms quite perfectly to the way language users everywhere would understand the case. So, I have the symbolic evidence (at a fully abstracted level) that the true narrative case is valid with respect to the purported meaning of the linguistic form, *I tossed my pen into the air and caught it*. In short, the symbolic meaning conforms as perfectly as it purports to conform to the facts as I first performed them (as an agent-actor) and later represented them to be (as a narrator).

With respect to the weight of the item tossed, the force used, the persons present, the ime of day, etc., all the particular then and there facts of that context in the Lord Baltimore Hotel (at about 10:15 am on March 8, 1994), much is undetermined, yet the only part that the representation purported to represent was that I tossed up the pen and then caught it on the way down. That part is about as well determined as it could be. In fact, the case is *relatively* perfect in its determination as will be shown in a negative way when we come to examining various degenerate (less perfect-ed) cases momentarily. Summing up, then, the meaning of the linguistic utterance (*I tossed up the pen and caught it*) is well determined by the represented facts. It is actually difficult to imagine any way that the facts could become better determined by any conceivable method than they already were, back then on that day in Baltimore. The facts were determined first (as shown in the left side of the diagram in Figure 1) by the sensory-motor experience of those who observed the events. Secondarily (as shown in the upper middle part of the diagram), the facts were determined by being pointed out by the representations that accompanied them on that occasion (or shortly afterward) singling out (indexing, like a pointing

finger) the tossing of the pen into the air and the catching of it when it came down as particular facts of interest. That is, the facts were pointed to or indexed by various representations but especially by certain uses of the words *I*, *my*, *pen, tossed*, *caught* and the like. Such terms, used in a certain way, singled out certain aspects of the factual context for attention. In a tertiary manner, as is shown in the right hand side of the diagram, the particular meanings of the linguistic forms in question, e.g., of *I*, *my*, etc. were determined by the material facts (that is the events, persons, relations, etc.) in that context then and there. Taken out of that context, in fact, the same terms would become so indeterminate with respect to their meaning as to be almost uninterpretable. For instance, *I* could refer to absolutely any speaker in any context. The word *pen* could as easily be used to refer any pen real, imagined, or non-existent. And so on. That is to say, a representation without any particular facts to determine its meaning by definition *must be* relatively less well-determined with respect to its meaning than a true narrative case which is largely determined by the material facts that it singles out for attention.

I have shown on a purely axiomatic basis (following Peirce, especially what he called his 'logic of relatives'; cf. Ketner 1992, p. 68) that true narrative representations have three logical perfections that are not found in any other kinds of representations (cf. Oller 1993b). They are (1) the determinacy perfection just illustrated with respect to our example (grounded in the iconic aspect of the facts as known through sensory-motor perceptions), (2) the connectedness perfection (grounded in the indexical links between the facts and their representations), and (3) the generalizability perfection (grounded in the symbolic meaning of the representation abstracted from its particular factual context). It turns out that true narrative cases are more determinate with respect to their meaning than are any others. They are better connected with the material world of space and time, and they provide the only well-determined basis for achieving meaningful generalizations.

Degenerate Cases by Degrees

So far we have examined the positive evidences for the relative well-formedness of the true narrative case. Equally effective is the examination of the negative side of the same question. By looking at degenerate cases, we uncover equally strong evidence of the uniqueness of the true narrative case. In fact, there are just three main categories of degenerate cases that purport to represent the sort of particular facts found in the true narrative case. They are respectively, fictions, errors, and lies. We examine each in turn.

The underlying logical structure of all fictions is shown in Figure 2. In a fictional case, e.g., I imagine myself grabbing the tractor of an eighteen-wheeler by the front axle and lifting it into the air over my head. The facts as represented are fictional. They are virtual as is shown

Linking

Represen-
tation

Figure 2. Fictions as a first degree of degeneracy from the ***true narrative case***.

in Figure 2 by the broken-line of the circle and the outline printing of the word 'Facts' as it is shown there. What is missing is the material that would give the tractor weight, spatial dimensions, and that would, presumably, prevent its being gotten into the room in Baltimore, never mind my lifting it over my head (unless it were, say, a small toy). Still, the representation is properly linked with the purported 'facts' (that is, with a virtual meaning), so the other two elements in the figure are just as they would be in a true narrative case.

However, with the true narrative case, the meaning of the representation can be indefinitely refined by referring to the facts at hand. That is, the color of the gold Cross pen, its weight, it length, breadth, the scratches on it, etc., could be described in finer and finer detail by a suitably positioned observer operating with appropriate equipment and methods. But, with the imagined eighteen-wheeler the case is very different. We are completely dependent on the representation to determine the facts that the representation purports to represent. If the color is not specified in the representation, it cannot be determined by examining the purported facts. Nor can we determine the dimensions of the thing, whether is it a snub-nosed cab or has a sloped hood, whether it has a wind-spoiler or not, etc. We cannot determine whether the thing is a toy or not. In short, our knowledge of what is intended by the representation, in any fictional case, is largely indeterminate.

The logical structure of fictions includes many useful propositional forms such as hypothetical inferences, predictions about future events, expectancies, contrary-to-fact conditionals (e.g., *If X were the case, but it is not, then, Y would have to also be the case, but it also is not*), and a host of others. Because in fictions only one degree of the triad is virtualized and some of that part is determined by the representation. However, the determination of the facts in the case of fictions comes exclusively from the representation. Therefore, for any language learner who does not already understand the representation per se, fictions provide a poor basis for finding out the meanings (and thus the grammatical structure) underlying the surface forms of the representation. For this reason, approaches such as are found in *Methods that work* (Oller 1993a) are always grounded in cases that have the true narrative structure (e.g., Asher's TPR, Rassias's dramatic approach, my dad's pragmatic approach, etc.). Fictions can be made sufficiently similar to true narrative cases if they are instantiated with action, drama, or other sensory-motor representations to determine the meanings of the linguistic representations at hand much as true narrative cases would. It is interesting that in fictions the missing element is the essential sensory-motor part (the iconic aspect of the material facts) and its spatio-temporal connectedness to the rest of the continuum. It is for this reason that writers of fiction must be reminded by their teachers, editors, and would-be readers, to supply the sights, sounds, smells, etc., so that the reader at least will have the illusion of being dragged through the events of the story.

Errors involve a second degree of degen eracy. With errors (which must include the special cases of illusions, hallucinations, and the like), as is shown in Figure 3, it is the linking of facts with representations that has gone wrong. As a result, the facts that ought to be represented are not and the representations given (or taken for true) are also not as they should be. I think I see a ground-squirrel by the side of the road, but it is a piece of cardboard from a nearby construction site turned just so that it accidentally looks like a squirrel sitting up on his haunches. The facts are other than I represent them to be and when corrected the representation must be other than the one I at first settle upon as true. But, the linking of the purported facts with the representation taken to be true is understood to be correct. Hence, an error is even more difficult than a fictional case to use as a basis for language acquisition. No doubt it is for this reason that error correction rarely resuits in any great advance in the language teaching context.

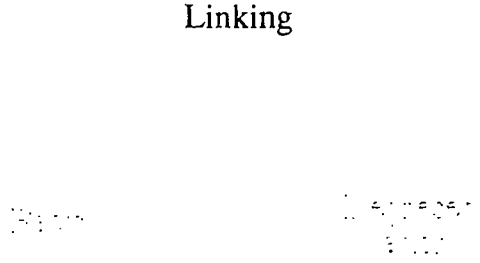

Figure 3. Errors as a second degree of degeneracy from the ***true narrative case***.

A third degree of degeneracy is found in the case of a deliberate deception (Figure 4). In this instance, the indeterminacy reaches a limit relative to all those cases that resemble the true narrative cases sufficiently to be mistaken for one of them. Lies, it turns out, are degenerate in all three aspects. The facts (as might be perceived or imagined iconically) are not as the representation at hand purports to make them out to be. The representation (as a symbolic description) does not truly correspond to the facts that do obtain. Further, the linking (the indexical part of the act of representing) has been deliberately corrupted by the producer. For instance, the serpent said they would not die, but they did. Now a lie, or any representational form that is degenerate in the manner of a lie, e.g., the pretense of asking permission to go somewhere from someone who has no right or desire to regulate our going there, is a poor basis for language teaching. The only thing that is less determinate than a lie is nonsense. With nonsense there may be a resemblance

Figur· 4. Lies as a third degree of degeneracy from the ***true narrative case***.

to the surface form of a representation, but the rest of the structure of the true narrative case is missing. But, any kind of representation whose meaning remains inaccessible to the learner might as well be nonsense.

One consequence of all the foregoing is that true narrative cases provide a greatly superior basis for language instruction. In fact, it can be proved logically that they provide the only possible basis for successful language acquisition. This is shown throughout the latest edition of *Methods that work* (Oller 1993a) but especially in the final chapter. Summing up what is developed there in somewhat greater detail, in constructing any true narrative case, we cannot dispense with our bodily position in the space-time universe. In fact, to the extent that we have any physical (material) existence we know of this existence through our senses (chiefly through the **icons** they present to our consciousness). In addition, we are situated bodily in the world so that our location and the motions of physical bodies around us is **indexed** (by significant bodily movements and gestures) relative to defined locations in the apparent external space-time continuum. Beyond this, we classify, name, and refer to perceived objective situations via **symbols** (mainly of the linguistic kind) that articulately represent those states of affairs as facts of experience. We interact with the physical world across time exclusively through actions that ultimately result in true narrative cases. This interaction involves an indissoluble linking of representations on the one hand with the material world on the other. It comes out from our theory that fictions, errors, illusions, hallucinations, lies, false generalizations, or generalizations of undetermined meanings, are all dependent on true narrative cases. Not only do these degenerate cases *not* provide a basis for questioning the existence of true narrative cases (or the existence of a material world), on the contrary, they are prima facie evidence that some true narrative cases must exist. Otherwise, we could not tell a fiction from an error or either of these from a lie, or any of them from a true case.

Of course, it must be noted that there are various popular skepticisms that purport to show that the physical world has no reality whatsoever and that there is no logical basis for supposing that there even is a real world of experience that is common to different observers. That argument has been thrashed through in other contexts (cf. Oller 1989), and I, for one, come down on the side of Albert Einstein, John Dewey, and Charles Sanders Peirce rather than the side taken by the famed British skeptics David Hume and Bertrand Russell. Peirce, I believe, gives the best argument against skepticism though the same view in essence was expressed independently by Einstein. It is, in a nutshell, that all arguments claiming to justify doubtfulness about an external world must be formulated by a person who stakes off some ground within that self-same world. The position taken, then, is inherently and irremediably self-contradictory. It is a logically absurd position. For this reason, Einstein did not hesitate to say that 'everything depends on the degree to which words and word-combinations correspond to the world of impression' (in Einstein 1956, p. 112).

Yet he noted that there is a natural gulf that separates the realm of words from that of sensory impressions. He wrote in his critique of Hume and Russell that 'we have the habit of combining certain concepts and conceptual relations so definitely that we do not become conscious of the gulf—logically unbridgeable—that separates the world of sensory experiences from the world of concepts and propositions' (1944, p. 287). This gulf can be readily appreciated through an example. Imagine that you and I are Mongolians who don't know any English. We simultaneously bite into peanut-butter sandwiches for the first time. Now, if we

were English-speaking Americans having this same experience, we might be apt to refer to our experience as *biting into peanut-butter sandwiches*, but there would be absolutely nothing at all in the experience itself to suggest just these words to us as Mongolians who know no English. We would not be apt to exclaim suddenly, *By George! How about that! Peanut-butter sandwiches!* The fact is that the connecting of abstract symbols (such as words in a particular language purport to represent) with particular facts involves the crossing of Einstein's 'unbridgeable gulf'.

Einstein's Gulf

We cross it. But how? How do we make the connection between the abstract realm of ideas and the concrete realm of hard objects? The principal mystery to be accounted for is the apparent connectedness of mental representations, active bodily experience, and the physical world. With respect to particulars (that is, the unrepeated events of space and time—the *hic et nunc* of every person's individual experience—this body, these other bodies, this place, these chairs, walls, this floor, this ceiling, these paraphernalia, etc., just here and just now, or rather then and there in Baltimore) we literally *sense* (or think we do) the continuity across time. And yet, it is easy to prove that in the *hic et nunc* of ordinary experience, *the* most distinctive character is constant change. Permanence of objects, and thus, continuity itself is a peculiar mystery. It seems that the present is transformed into the past exactly as the future arrives, but just what is it that enables us to make this connection? It cannot be the shear sameness of the past and future or else we would not have the constant sense of motion and change that marks our present experience.

So it is that we come across the first mystery of connectedness. How come it is that the new experience arriving every normal waking moment of our lives is not altogether surprising or completely uninterpretable? It turns out that the present is partly determined by the past, and in its turn partly determines the future. Yet the determinacy is not complete or else the future would have to be precisely the same as the past. What I know about the present is a function in large measure of what I have experienced in the past (the true narrative representations that I have already constructed), what I perceive to be going on now, and what I expect about the future.[2] Hence the first level of connectedness is owed to perceptions as the present moment moves into the past and the future becomes the present. We call this level **perceptual**. It can be diagrammed as shown in Figure 5.

[2]Some have argued that this is a merely western point of view, but that argument fails. The peculiar facts under consideration are certain hypothesized universals of physics, physiology, and psychology and are little affected, if at all, by any cultural or experiential overlay. They are materially and logically determined.

Past, present, and future come together through representations as we ride through time actually straddling Einstein's gulf. Our mind at least is chiefly occupied with representations while our physical body and our feet are planted in the material world. While the realm of material facts meets the realm of representations precisely at the point where the perceived present slides into the past, at the point where the perceived present meets the future, the material world is (relative to our perceptions of it) not yet materialized. Therefore, as shown in the diagram (Figure 5), the material world as known to us stops right where the present meets the future. What lies on the other side of that point of demarcation is merely our expectations concerning what lies ahead of us (e.g., the road ahead of our vehicle as we drive along or the path ahead of our feet as we put one foot before the other). Those expectations are very real, as representations per se, but they are mere fictions until they are linked with the material facts that seem to be emerging into our present tense experience.

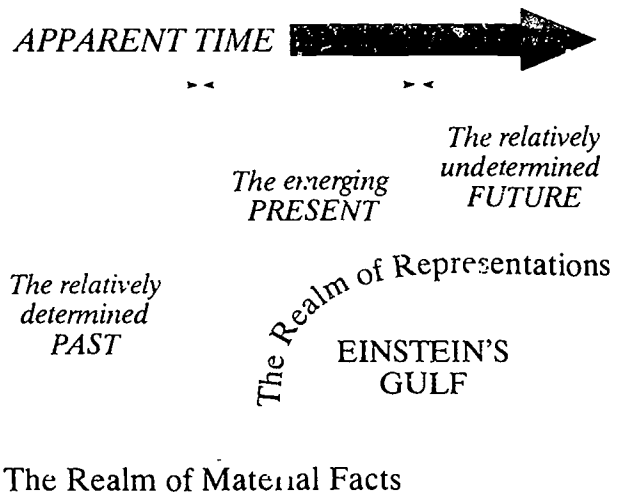

Figure 5. The temporal flow of experience: the merging of the representational realm with that of the material world.

Yet, if our world were totally determined only by such perceptual information, there would be little hope of our linking the present objects, events, qualities, etc., of any particular perceived fact with other facts like it that have occurred at some point distant in time but that are not linked in any perceivable way with this perceived present moment. How do I know that Wilga Rivers is the same person that I met years ago and that she has enjoyed a continued existence in the interim? I have not perceived her for long periods during all the time that has elapsed since our first meeting just under 25 years ago. Therefore, I must *infer* her existence in the interstices (during the long periods when I could not perceive her bodily existence through any particu-

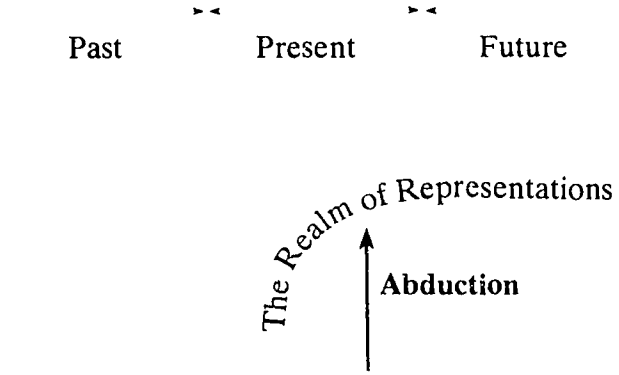

Figure 6. The nature of abductive inference.

lar icon of sensation). I must fill in the blanks in the perceptual cloze test. This act of inference, since it concerns a non-repeated particular object, namely, the unique individual of the world known as Wilga Rivers is a very basic inference and is grounded in perception. Peirce called this kind, **abduction** or **abductive inference**.

Abduction occurs at just the point where a particular fact, a certain material state of affairs, is linked with a distinct and articulate representation. This linkage involves all of the elements of the **true narrative case**. It also involves a crossing of Einstein's gulf as shown in Figure 6. At its most basic and elementary level, the abductive inference merely supposes the continuous existence in a consistent form of its object. It is an inference to temporal continuity. However, the abductive inference enables a higher sort of generality and a higher degree of continuity than can be justified by perception operating in the here and now all by its lonesome. How do I know that Dr. Rivers is the same Rivers that I first met in Cambridge, England in the summer of 1969? How do I know that she is the same Rivers that I had various conversations and correspondence with since then?

In order for these other occasions to be brought under the same cognitive umbrella, for all of them to be collectively classed as occasions of meeting or talking with Dr. Rivers, I must index the several cases. To do this involves an act on my part as a representor and experiencer. It involves setting up a correspondence between the perceived events (the face, voice, accent, etc.) on a plurality of occasions yet with a single index that connects all of those occasions both to Dr. Rivers and to me. The inference (or generalization) now takes in one or more whole classes of cases; namely, in this inference, all those cases indexed as instances of contact with Dr. Rivers. This kind of inference, then, is what Peirce called **induction** or **inductive inference** (Figure 7). Also, whereas abduction is neither probable nor improbable, having a likelihood of just about exactly 0, induction with its counting, measuring, indexing, and classifying, affords judgments of a probable nature. Each of the indexed cases is always, excepting the errors that may intrude, a particular true narrative case.

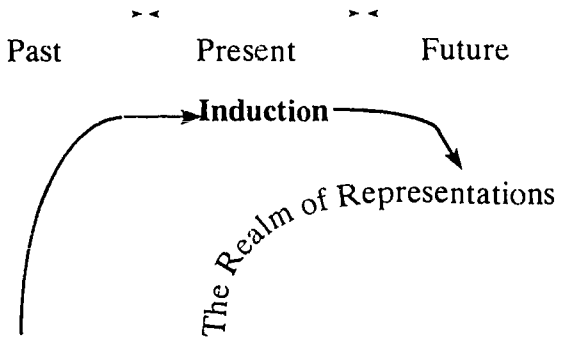

Figure 7. The nature of inductive inference.

But, I know much more about human beings such as Dr. Rivers and all the rest of us are than either abduction or induction could possibly tell me. For instance, I know that if we are human beings, we are just as mortal, as Socrates, Xanthippe, John Candy (who died during our meetings in Baltimore), and the rest of the human race. Now, I make a connection not just abductively between continuities that I can perceive (at least part of the time), and not just between future expectations (inductively derived) and particulars I have already

classified and indexed as the same in some respect or other, but I further make a generalization about all possible cases of a particular kind. This involves a new kind of inference which Peirce identified as **deduction** or **deductive inference**. Here, as Peirce showed, the leap takes us across all spatio-temporal barriers into the non-temporal realm of abstract meaning (Figure 8).

Deduction applies not only to all of the material realm of ordinary experience, but it applies to the abstract representational realm and thus achieves a kind of ultra-natural status. It moves our thought so far beyond the limits of the material world as to make it incommensurable with that world. Symbolic representations are the essence of deductions. Indexes are the essence of inductions, and abductions are the essence of icons.

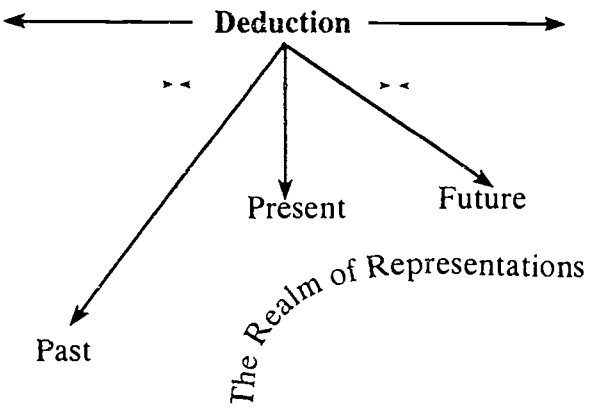

Figure 8. The nature of deductive inference.

With this much as background, we can see that there must be three kinds of schemata as shown in Figure 9. First, there are **content schemata** that are based mainly on the results of abductive judgments about particular facts and states of affairs. These schemata are concerned with particular arrangements of things in the world as it is known to us through our perceptions. These schemata are the perceived relationships that obtain in a particular context of experience. For instance, if I had looked at Andrew Cohen who was sitting there in that context in Baltimore more or less directly in front of me, I would have seemed to perceive the same bodily object for as long as I looked in that direction. Even if I had walked around him and seen him from various perspectives, he'd have seemed to be the same bodily object though viewed from different angles.

Content schemata are structural to the extent that they involve complexes of particular things, qualities, events, etc., in particular relationships, e.g., Andrew's eyes are in the same relation to his nose as the last time I saw him, and so on.

Second, there are **formal schemata**. These are the result mainly of inductive connections established across distinct states of affairs that are indexed as being similar in some respect. For instance, at breakfast on the morning of the talk in Baltimore, Andrew was wearing a suit that looked very different from the running togs he'd had on during our six mile run earlier that same morning. Yet, I correctly judged the two distinct occasions to involve meeting with and talking with the same guy even though I could not have perceptually verified his existence in the interim between our run and breakfast or between then and the talk that he attended later the same morning. The similarities of the indexed facts as judged by induction are dependent upon their structures and arrangements abstracted to some degree from the particular facts of any given context. Andrew's changing from his running duds does not make him into someone else. The structures remain relatively invariant in spite of the fact that the perceptual surrounds in which they are found differ radically from one occasion to the next. The clothing and context was different in each case for the meetings with Andrew, but he was the same guy.

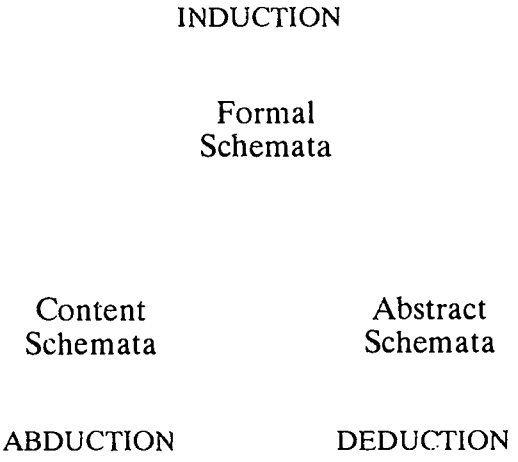

Figure 9. Three kinds of schemata and the distinct kinds of inference upon which each of them mainly depends.

Formal schemata are mainly dependent on inductive generalizations. For instance, with respect to the familiar restaurant case, if a certain restaurant won't seat people unless they are wearing shoes, or formal clothing, etc., this would be part of the content schema suited to that particular restaurant. One may require you to carry your bill to the cash register, another may require you to ask the waiter for it. With respect to particular cases, these are content schemata, but if they are generalized to many cases that are similarly indexed, the information becomes integrated into a formal schemata applicable in greater or lesser degree to all those other cases. It is important to see that this must be an advance since it involves all of the *relevant* information already obtained from the content level *plus* a further integration that generalizes to a larger class of cases and from there it enables us to launch a judgment about particulars not yet encountered.

Abstract schemata constitute a third class. These carry the inductive integration to the completely general (and abstract, non-material, non-syntacticized) level of pure symbols (in Peirce's sense of them). It would, for instance, in our restaurant case allow us to infer that if restaurants are businesses that aim to make a profit they must generally charge more for their services than those services cost the owners. (Note that in the case of a restaurant that is a front for money-laundering by, say, the Mafia, the generalization does not apply specifically because

the 'restaurant' is merely a front. It isn't really just a restaurant. The real money-making business behind it involves drugs, pornography, prostitution, etc.) Deductive inferences give us a great deal of information about all restaurants that could not be acquired by merely examining or auditing the records of however many individual cases we might gain access to by whatever methods might be available to us. Deductive inferences are not derived from the particulars of any given case, but are, to the extent that they are grounded in correct definitions of symbols, implicit in all possible cases to which the symbol might be validly applied. Thus, with deduction, yet a higher level of integration is achieved beyond the inductive level. Now the conceptualization reaches such a degree of integration and completeness that if the definition of the symbol is sound, the inferences drawn from it must be equally valid. Except for the definitions upon which they are based, deductions, unlike abductions and inductions, are relatively impervious to errors. If John Candy was like other mortal men, it was certain that he would eventually die. This is not something we know by experience nearly so much as it is a part of the definition of what it is for something to qualify as a human being.

The three levels illustrated are, respectively, (1) positive and accidental at the abductive level, (2) both positive and negative and with some degree of probability at the inductive level, and (3) completely abstract, general, and axiomatic and therefore necessary at the deductive level. Content schemata are owed mainly to the accidents of history. Where we were born, what culture or society we grow up in, etc. *They just involve what is (or what appears to be).* They are determined mainly by the positive accidents of history. They are for this reason mainly spatio-temporal judgments that account for themselves in the phenomenal present. Formal schemata involve a higher degree of determinacy. They are probabilistic. That is, they enable judgments about proportions of some range of facts observed in the past as contrasted with what can be expected in the future. *They relate what is (and what is not) to what is likely (or unlikely) to be.* As a result, induction is concerned mainly with existing states of affairs as contrasted with whatever states do not obtain. It is scientific thought as applied to experience. It is dualistic as concerning what is and what is not. Abstract schemata by contrast concern everything that is contained within the meaning or definition of a symbol, proposition, argument, or discourse. *They take all that possibly could be (as known through the symbols available) and relate it to whatever must be (if those symbols hold true).* As a result, as Peirce showed in many different ways, the abstract level of the symbol reaches from outside of time and space into the material world and yet is itself neither temporal nor spatial in its compass. It comes nearer to our ideas of eternity, infinity, continuity, and universality than to anything known through our senses in the material world. It involves what Peirce called a 'thirdness' beyond the duality of opposing forces clashing in the material realm.

Hence in relative degrees of theoretical power, the connectedness afforded by deduction, is higher than any afforded by induction which in turn is higher than any afforded only by abduction. As a result we are in a position to formulate some interesting hypotheses about language acquisition and use, and especially about all kinds of discourse processing, and the effects of various kinds of schemata. We must predict, for instance, that **formal schemata** will, other things being equal, have greater power than **content schemata** in facilitating discourse comprehension and hence language acquisition etc. We must also expect that, other things being equal, **abstract schemata** involving symbols and their definitions, will be the most powerful

level of all. In fact, Peirce showed them to be at a maximal degree of both generality and determinacy.

Experimental Applications

All of the foregoing relative to my own intellectual pilgrimage expands upon the **episode hypothesis** and what I had earlier called the **expectancy hypothesis** (Oller 1983). Now, I will describe several experiments, very sketchily (though they are all published or about to be and can be examined in detail by anyone who wishes to do so), and I will show how they bear out the expectations just stated. It should also be noted that there are many other similar studies that might be mentioned, but the ones singled out here are chosen both because they are ready to hand and because they provide clear evidence of the predicted effects. However, there is no doubt that many other empirical studies could interpreted in ways that illustrate much the same contrasts. The ones selected here, also, have fairly direct bearing on one or another aspect of language acquisition.

Formal (and Abstract) Versus Content Schemata: the Giardetti Research

First, we will consider some experimental evidence that the comprehension of iconic representations depends in large measure on both formal and abstract schemata that enable us to determine the content of the icons that we are perceiving. We can focus attention experimentally on the iconic (content level) by examining the comprehension of photographs where the captions and any other printed texts (the symbolic aspect of these representations) have been removed. In such an approach converted into a suitable experimental method, the problem set for the experimental subjects is to determine what it is that they are looking at in various photos. The study to be considered was a spin-off from a dissertation by J. Roland Giardetti (1992) reported by Giardetti and Oller (in press).

An experiment was designed to investigate certain hypotheses about the comprehension of photographs. The pictures originally appeared in various articles over a span of about sixteen years (between 1974 and 1989) in *National Geographic*. Skipping over many details (which can be examined in the published article and or the dissertation itself), 123 subjects were asked to categorize each of 30 photos into one of 6 proto-typical and very general categories in a multiple-choice format. Subjects were given a brief orientation with previously selected exemplars of photos falling to the center of each of the broad proto-type categories. (These had been selected in advance by Giardetti and had been linked up with the photographs with the help of two different panels of expert judges.) Three of the thematic categories pertained to manufacturing themes (production, transportation, and technical communications) and three pertained to human themes (emotion or affect, thought or mental activity, and psychomotor skills).

The results actually showed the photos to be divisible into groups (in more than one way) according to the relative determinacy of their content. For instance, in two of the 30 photos, the object of interest is literally being pointed to, looked at, and touched by someone in the photograph. In these cases, determining what the photo is about (i.e., agreeing on its classification into one of the 6 general thematic categories) is helped by the indexical act of pointing which is actually included in the photo. In one case a man is pointing at a satellite dish on a roof top (a photo generally classed as pertaining to technical communications) and in

another a man and two women in white coats are pointing to a model of a human skeleton in what appears to be a laboratory or anatomy classroom setting (generally judged by Giardetti's subjects as pertaining to the mental activity of teaching). In these cases, certain objects of interest are indexed by the pointing of subjects in the picture. The camera is also obviously taking in those same objects of interest. In various other cases, the content of the photograph is categorically (symbolically) determined either by some familiar element in the picture itself, such as a priest's robe (he is at the center and foreground of the photograph, bending toward, reaching out to, and speaking with a woman and child) or the space shuttle, or by words printed on something in the picture identifying the nature of the object in view (e.g., the word *Speak* visible on a 'Speak & Spell' keyboard). In these cases, either a symbolic element in a linguistic form or some symbolic icon (the priest's robe) helps subjects determine thematic content. Each of the 22 photographs having one or more of these formal or abstract schematic elements to aid in identifying its theme was classed as 'transparent'.

The remainder of the photos, a smaller set of just 8, were treated as a separate subscale which we called 'opaque'. These remaining eight photographs involve content for which no attending formal or abstract schema could easily be made out. Nothing in the photo is specifically being pointed to, or if it is, it is off screen so to speak. No especially familiar object is prominently centered in the photo so as to be specifically pointed to by the camera or by anyone in the scene. The activity or scene depicted may itself be indeterminate, e.g., an aerial shot with oil tanks in the foreground looks vaguely out to sea with more than one ship in view at various loading docks. There is no apparent movement in the photo (no moving tractor or stream of cars on a bridge at night as in two other photos) to draw the attention of the photographer or any viewer of the picture. For example, in one of the opaque shots a disassembled model of some sort is spread out on the ground on canvass sheets. In another some women are sitting around on what could be someone's living room floor with some fabrics or skins on their laps and a TV in the background. In yet another, some men in bathing suits are launching a boat into heavy waves and pointing to something off to one side of the photo that is not within view of the camera.

The mean agreement score on the categorization of the 'opaque' subscale by the 123 subjects was .416 as against a mean of .787 for the 'transparent' items. (That is, the 123 subjects agreed with the way these items were classed by a panel of expert judges about 42% and 79% of the time, respectively.) The contrast here between 'opaque' and 'transparent' photos was highly significant by an appropriate analysis of variance ($p < .001$). What the effect shows, I believe, is a sharp contrast between iconic representations that are relatively well supported by formal (indexical) and abstract (symbolic, especially linguistic) schemata, and ones that are

not so well supported.[3] This shows is that the benefit gained from formal and abstract schemata can be measured at the content level of iconic representations.

I will mention a more subtle effect observed in the Giardetti research. Another variable examined in the Giardetti study was the impact of color versus black and white renditions of the photographs. For the purposes of the experiment, color was actually subtracted from the photographs by reproducing them in high quality black and white variants. Again, skipping over unnecessary details (ones that may be examined in the published article), color had no effect on the 'transparent' photographs, but on the 'opaque' ones it contributed to a small but statistically significant ($p < .031$) gain in scores. Now color is an iconic aspect of the sensory-motor information represented in the photographs. It clearly falls at the 'content' level with respect to our definitions of schemata. The proportion of agreement gained when color was added back into the equation was .078 (that is, the 61 subjects randomly assigned to judge the thematic content of the color variants of the 30 photos agreed with each other and with the expert judges 7.8% more of the time than did the 62 subjects randomly assigned to view the same 30 photos in high quality black and white copies). This is a 'content' effect owed to enriching the sensory-motor image itself. However, contrast this with the much greater gain of .371 (37.1%) that can be attributed to formal and abstract schemata (that is, the amount of contrast observed between the 'transparent' photos versus the 'opaque' ones), and our theory gets some support: adding help from formal (pointing) and abstract (linguistic and other conceptual) schemata into the photographs has greater impact than merely improving the quality of the sensory-motor images (the content schemata, e.g., color versus black and white) as such. In particular, with respect to the specific effects measured, it would appear that the higher level schemata (formal and abstract) produce a contrast that is nearly 5 times greater than the gain produced by adding color at the strictly content level.

In addition, there was evidence that the linguistic (symbolic and abstract) elements haphazardly appearing in the pictures were more influential than any other formal (indexical) elements (e.g., a person pointing to or touching some object in the picture). The four pictures that included a printed word or two (e.g., the name of a ship-line, *NORDANA*, the word *Speak* in the 'Speak & Spell' toy, the words *Sportsclub* and *Darmstadt* on a gymnastics coach's shirt, and the words *Hepburn, Toronto, Canada, 405 Tonnes* that can be made out on a piece of heavy equipment in one of the photos) produced the highest agreement scores of all 30 photographs (.869). The next highest agreement was achieved on the 'transparent' items with familiar content (.769), and the lowest, of course, on the 'opaque' items (.417). Here we see the three distinct schemata defined by our theory in exactly the predicted arrangement as shown in Figure 10.

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[3]It is important to note here that Peirce showed the iconic type of representation always to be degenerate with respect to its qualities. This can be seen in many ways. A picture of a baby, for instance, could be almost anyone. It is not qualitatively very faithful to the adult that the baby may have grown up to be. Also, perceptions are always incomplete. We never see all of any scene that is before us. Parts of the scene are obscured by other parts. (For instance, I cannot now see the outside of my house from where I am seated at the kitchen table working on my laptop.) Further, it is a mathematical fact that any surface can be transformed into any other by degrees and in an infinitude of distinct ways. For this reason, as Peirce pointed out, all icons more or less resemble absolutely all of the possible states of affairs that they might be used to represent. Thus, icons need to be supported by other kinds of representations if they are to be made determinate with respect to what they are icons of.

To test more stringently the hypothesis that abstract schemata, as provided in linguistic discourse or text, produce higher agreement scores, the Giardetti test (the same 30 photos) could be given to a group of subjects similar to those in his dissertation research but who were also allowed to read the captions of the photos (or the whole articles from which the pictures were excerpted). The clear expectation is that the latter group would achieve a significantly higher degree of consensus on thematic classifications than was achieved by the 123 subjects who only saw the photos.

At any rate, it is clear that distinct effects of content, formal, and abstract schemata can be discerned at the level of iconic representations and that those effects conform in a very general way to the expectations gained from the proposed semiotic perspective.

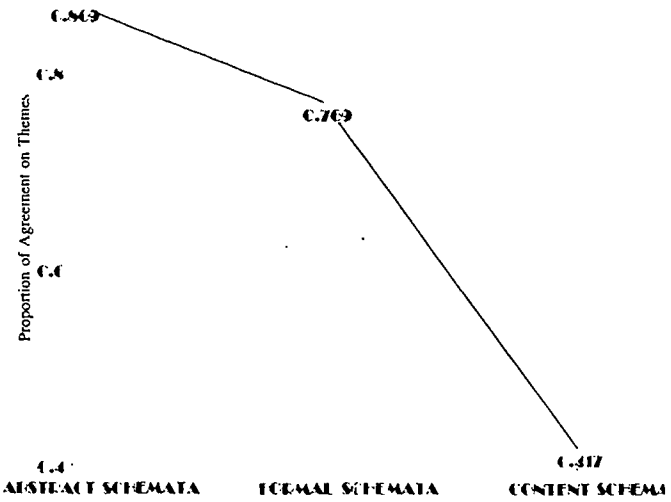


Figure 10. The predicted and observed relation between abstract (symbolic), formal (indexical), and content (iconic) schemata in the Giardetti data (cf. Giardetti and Oller, in press).

Content Versus Formal Schemata in Video: Tudor and Tuffs (1991)

Second, we have evidence that the indexical linking of oral discourse to moving pictures (a voice-over with video) also conforms to the predictions of the theory. The second study to be examined comes from a pair of Belgian researchers who studied the comprehension of an 8 minute video-tape (an off-air recording by the British Broadcasting Company on the possibility of privatizing the roads of Britain) by students of English as a second language. Again, skipping over many of the details since the research is published, one group of subjects ($n \cong 41$) received 20 minutes of advance preparation concerning the specific facts of the video, e.g., names of persons and places, while another group ($n \cong 33$) received the same amount of advance preparation but concerning the nature of the problem addressed in the video, e.g., the pros and cons of privatizing the road system. The first group was identified as the 'content schemata' group since the

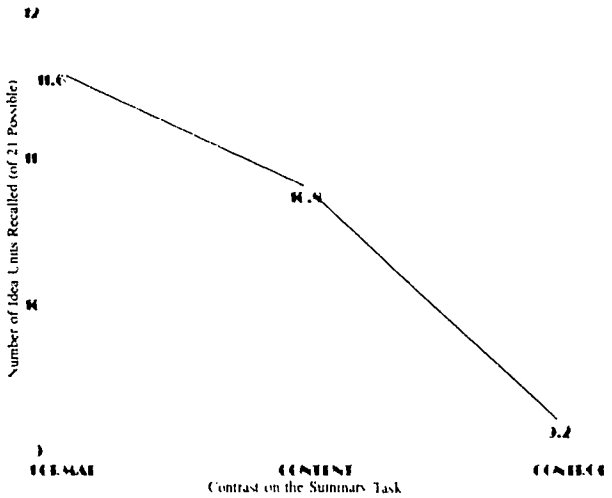


Figure 11. Tudor & Tuffs (1991): The contrasts on summaries (in Oller, 1993, p. 254).

preparation focused on the specific factual content of the video. The second group was identified as the 'formal schemata' group because their attention was directed to the logical character of the problem, e.g., what consequences would follow from privatization. Yet another group ($n \cong$ 34), identified as controls, received no advance preparation at all before seeing the video. After viewing the video all three groups were tested. They were asked to summarize the video, to respond to certain comprehension questions, and to recall specific elements. Figure 11 shows the resulting contrasts on the summaries generated and Figure 12 shows the contrasts on comprehension questions given immediately after the viewing and a week later.

Again, without going into any detail, the results conform to the expectations generated by our theory. The group given the content preparation did better than subjects given no preparation at all (the controls), and the group given the formal preparation did better than the content group. While not all of the contrasts between the formal and content groups were significant, the overall pattern was exactly as predicted by the theory. Also, I suppose that if the various tasks were summed, the overall contrast between the formal and content groups *would* be significant and as predicted.

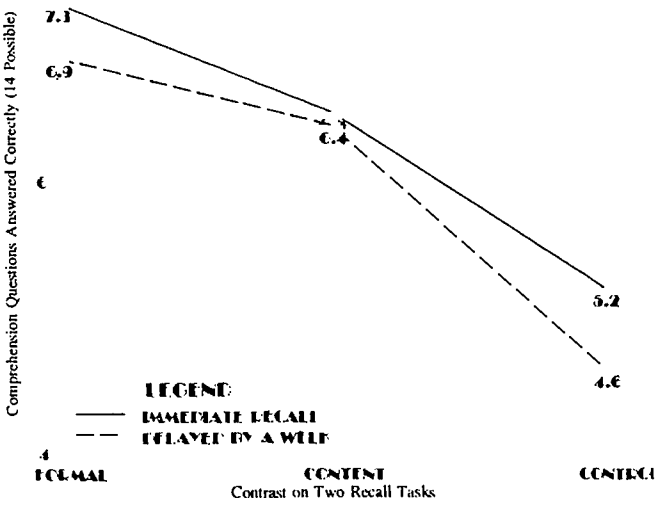


Figure 12. Tudor & Tuffs (1991): The contrasts on immediate and delayed recall as judged by comprehension questions (in Oller, 1993, p. 254).

Content Versus Formal Schemata: Chihara, et al. (1994)

Another study showing a contrast between the effects of content schemata and formal schemata appears in Oller and Jonz (1994). The results in question are also summarized in *Methods that work* (Chapter 20 of the 1993 edition). The research actually began, however, in 1969 at UCLA and was extended in 1975 and 1976 to Japanese learners of English as a foreign language by Tetsuro Chihara. However, the theoretical distinctions that we are considering now had not yet been developed sufficiently to motivate some of the comparisons that would only be made much later. In any case, the original study involved two narrative texts (one about a guy named Joe going off to college, and another about a fellow named Nicholas going off to visit his uncle in Greece). Each text was converted into two rather different cloze tests. Two of the tests were created by deleting about every 5th or 6th word from each passage. Then, these tests were scrambled into two more cloze tests. The procedure was to divide the two texts roughly into thirds. Then, the first sentence of the last third was placed first, the first sentence of the second third, next, and so on until two new (scrambled) cloze tests were constructed for each passage. Our prediction was that this procedure would make the cloze test more difficult. That is, subjects would benefit

from the normal arrangement of the narratives in each case and this would show up in higher scores on the normally arranged cloze tests.

Analysis shows that the normal arrangement of a narrative benefits mainly from the formal schemata of that particular narrative. For instance, when Joe is getting ready to go, his mother makes him do a bunch of things he doesn't want to do. When he finally gets on the train and it pulls out of the station, we correctly suppose that he must be relieved to be on his way at last. The expectation that Joe will be relieved when he gets going would not necessarily be appropriate to another narrative, yet it is inferentially suggested by the facts of this one. The connections that we infer between all the things he has to do that he does not want to do and this final result, however, are formal ones. They involve both abductive and inductive generalizations. There are also some deductive aspects to our comprehension of the narrative, but the main structural relations that make it a story are abductive and inductive. We form expectations about what will follow from what has preceded. This is the essence of a formal schema as we have defined the term above.

Another prediction tied to the effect of the formal schemata underlying the two narratives was that subjects would gain increasing benefit from those schemata as they advanced in proficiency. To test this hypothesis (and the contrast between the normal and scrambled variants), it was desirable to eliminate any effect that might have come from prior acquaintance with the content of either text. Therefore, all the subjects who were tested (71 beginning, 66 intermediate, and 64 advanced students of EFL at the Osaka YMCA, and 41 native speakers of English at the University of New Mexico) on one passage in its scrambled version and the other in its normal arrangement. This design enabled us to eliminate any effect of practice or learning owed to working through one text or the other during the experiment itself and thus to distribute the effects owed to the scrambling procedure equally over the two passages and over all four groups of subjects. (This aspect of the design is crucial and is one that has been botched by several groups of researchers who have attempted to replicate our results; cf. the last chapter of Oller and Jonz 1994 for a detailed discussion.) The outcome was as predicted (see Figure 13) and the growth pattern across the four groups has been shown (in the re-analysis reported in Oller and Jonz 1994) to be linear and with significant contrasts across each of the adjacent levels. That is, intermediates benefit from the formal schemata underlying the two narratives more than beginners, advanced

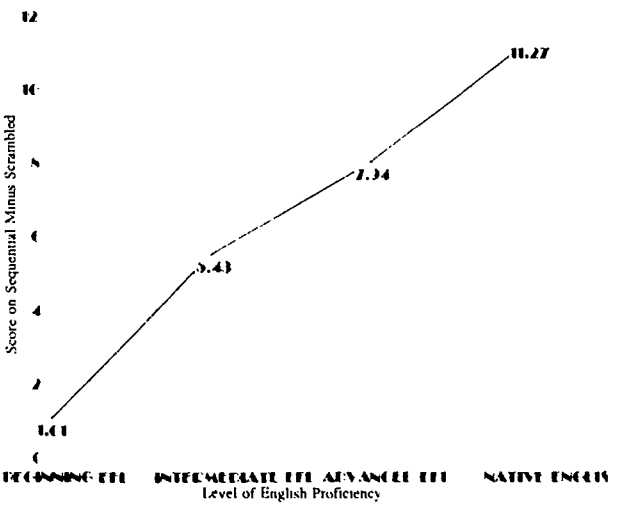


Figure 13. Results from Chihara et al., 1994 showing the effects of scrambling a narrative on four groups of increasing proficiency in English (in Oller and Jonz, 1994, p. 142).

EFL learners benefit more than intermediates, and natives more than advanced EFL students. Therefore, the expected effect of the narrative (formal) schemata was just as predicted.

In addition, in the two decades following Chihara's original research, the basic design was replicated and extended in various applications to distinct groups of non-native speakers and to various groups of native speakers of English. One of the findings of these extensions showed that in at least two separate studies Japanese learners found the text about Nicholas going to Athens somewhat easier than the text about Joe going off to college. However, Thais, Haitians, and Florida Hispanics (who were learning English as a second language) generally found the Joe text a bit easier. Again, skipping many details which are given in Oller and Jonz (1994), we see evidence of a contrast in the response to particular content schemata (the Joe text versus the Nicholas one) that was apparently owed to cultural background. This observation would later be followed up in several research studies (see especially Chihara, Sakurai, and Oller 1989). We will look at one of these in a moment (see the discussion of research by Al-Fallay, below), but here it is only essential to note that again we found that the contrasts owed to content schemata were relatively smaller than those owed to formal schemata. Here, unlike the case of Tudor and Tuffs, we were examining printed texts without overt iconic supports. That is, we were working within the realm of abstract linguistic symbols.

Formal Versus Abstract Schemata: Oller, Yü, et al. (1994)

A third set of studies aimed to extend the design of Chihara, et al. (especially the 1977 version) to a study of the information gained from working through a cloze test over a narrative as contrasted with the information gained from working through a scrambled variant of the same text. The reason for examining this question is straightforward. As odd as it may seem, most language instruction is based not on the sort of formal structures that are found in narratives (or in all our ordinary experience), but on linguistic structures cut loose from nearly all of their material contextual supports. Isolated sentences are commonly used to illustrate grammatical principles or to instantiate paradigms conforming to particular grammatical rules. Or, in more recent years, if there is a conversation, it is apt to be dropped out of the blue sky with no particular lead-in or follow-up. People are apt to agree to go to the movies in their conversation but without deciding which one, when, or where they will meet. That is, the typical language lesson is apt to be constituted by isolated, detached, and effectively scrambled elements drawn more or less at random from the kinds of texts and discourses that are common to ordinary experience. Therefore, proving that language learners get more benefit from studying normally arranged narratives than from studying scrambled variants has immediate and obvious implications for language teaching. Spelling out the most obvious one, if students learn more from materials conforming to a story-line, then language teachers ought to *use* materials with a well-developed story-line to teach from. It turns out that procedural texts (telling how to do something) and expository reports, provided they are grounded in facts, also have the requisite structure (cf. Walker, Rattanavich, and Oller 1992).

In the series of experiments in question, literate native speakers of English and literate non-natives were studied. In all the cases examined, provided only that the learners were well beyond the beginning stage (just as we had learned from the Chihara research—see Figure 13 above), a dramatic contrast was observed between the scrambled and normal version of the texts. However, to study the information *gained* from performing one or the other task, each subject

was given a second pair of tests to do on a second occasion of testing (usually within an hour or a day of the first test period). On the first occasion, subjects completed the Joe or Nicholas passage in its normal narrative version and the corresponding text in the scrambled version. As before, provided the subjects were fairly advanced (as was true in all cases examined by us), we found that the normal narrative arrangement produced higher scores than the scrambled variants (averaging over the two texts). In fact, the scores differed by about 6% on the whole for the least proficient non-natives (favoring the normal narratives) and by a little more than 11% for the most advanced native speakers.

On the second occasion, the same subjects completed the scrambled version of the text they had worked through on the previous occasion in its normal version and the normal version of the text they had worked through on the previous occasion in its scrambled variant. If nothing had been learned on the first occasion, the second occasion should have looked exactly like the first. But this was decidedly not the case. On the basis of our theory, we predicted that the information gained from the normal narrative worked through on the first occasion would transfer almost lock-stock-and-barrel to the second occasion. We also predicted that essentially nothing of significance would be gained by studying the scrambled version on the first occasion. Essentially nothing would transfer from that experience to the testing on the second occasion.

The findings are summed up, omitting unnecessary details, in Figure 14. In every single study (see Chapter 20 of *Methods that work* for a summary of some of the main studies and Oller and Jonz 1994 for a more complete discussion), we found as predicted that the experience of working out cloze items in a normally structured narrative produces a profound effect on the second occasion when that same narrative is presented in its scrambled form. While, on the other hand, working through a scrambled narrative produces no significant effect on the working out of cloze items in the same text when it is arranged in its normal narrative order. The upshot is clear: in teaching languages we are generally wasting our time and that of our students by asking them to study bits and pieces of nonsense dropped out of the blue sky. We ought to take advantage of the powerful generalization that occurs from studying normally structured narrative-type discourse. Furthermore, Oller (1975) had shown that this benefit is not limited to narratives per se but applies about equally to expository and procedural texts of various types.[4]

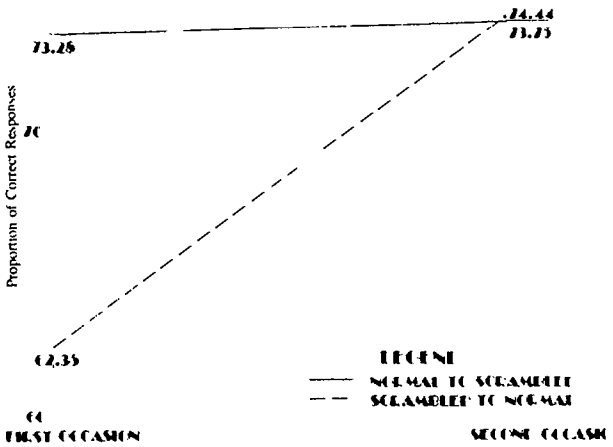


Figure 14. A rough schematic summary of results achieved by Oller, Yü, et al., 1994 (in Oller and Jonz, 1994): These are from native speakers of English.

[4]Of course, as Jon Jonz has shown, there are some descriptive texts (ones Gary Cziko had termed 'encyclopedic') which are essentially unordered lists of facts, and these, as a result, are not very susceptible to any effect owed to scrambling (cf. Jonz's several chapters and Chapter 13 by Cziko in Oller and Jonz, 1994).

With respect to the contrast between formal and abstract schemata, it would appear that the formal schemata of either narrative (the Joe or Nicholas text) has its impact on the first encounter as shown in the left side of Figure 14. However, this formal effect is so generalized that it applies to the same surface forms (sentences in this case) even if they are scrambled. In fact, in our design (see Figure 14) if the normal narrative was encountered on the first occasion (see the upper mark at the left side of Figure 14) when the scrambled variant appears on the second occasion (the mark to the right side of Figure 14 connected to the first one with a solid line), subjects remember the story-line and apply it to make sense even of the scrambled sentences.

That is to say, the benefit of the content schemata underlying the particular narrative (either Joe or Nicholas) is generalized even to the scrambled case by the formal arrangement of the particular factual elements of either case into a coherent narrative. The reader, apparently, produces a formal schema that corresponds to the story-line. Once it has been constructed (by comprehending the narrative), the formal schema can be applied then even to a relatively nonsensical (scrambled) variant of the text.

When the abstracted formal schema is applied to a relatively nonsensical case, it provides evidence of a still higher level. It shows that the subject has a concept of the story that is somewhat independent of the surface arrangement of the sentences. Otherwise, how would the subject be able to understand the story when its sentences are presented in a scrambled order? The apparent ability of subjects to make sense of a text that has been deliberately corrupted by scrambling shows that they have an underlying concept of the story that is quite abstract. They must have a concept that is not dependent on any particular syntactic arrangement of the surface forms. In short, they must have created an abstract schema of the story. One that is, in a sense, non-syntacticized. It is unordered relative to any particular surface forms, but nevertheless can be used to order any bizarre arrangement (or simply new paraphrase) of surface forms relative to the underlying abstract schema (i.e., the understood facts of the story and their connections). This last effect moves us clearly into the realm of an abstract schema which has become relatively independent of the particular arrangement of the surface forms of the given text. However, this last result is shown more dramatically and more independently of the particular materials studied in each of the two remaining studies yet to be examined.

Formal Schemata Versus Abstract Schemata: the Taira Research

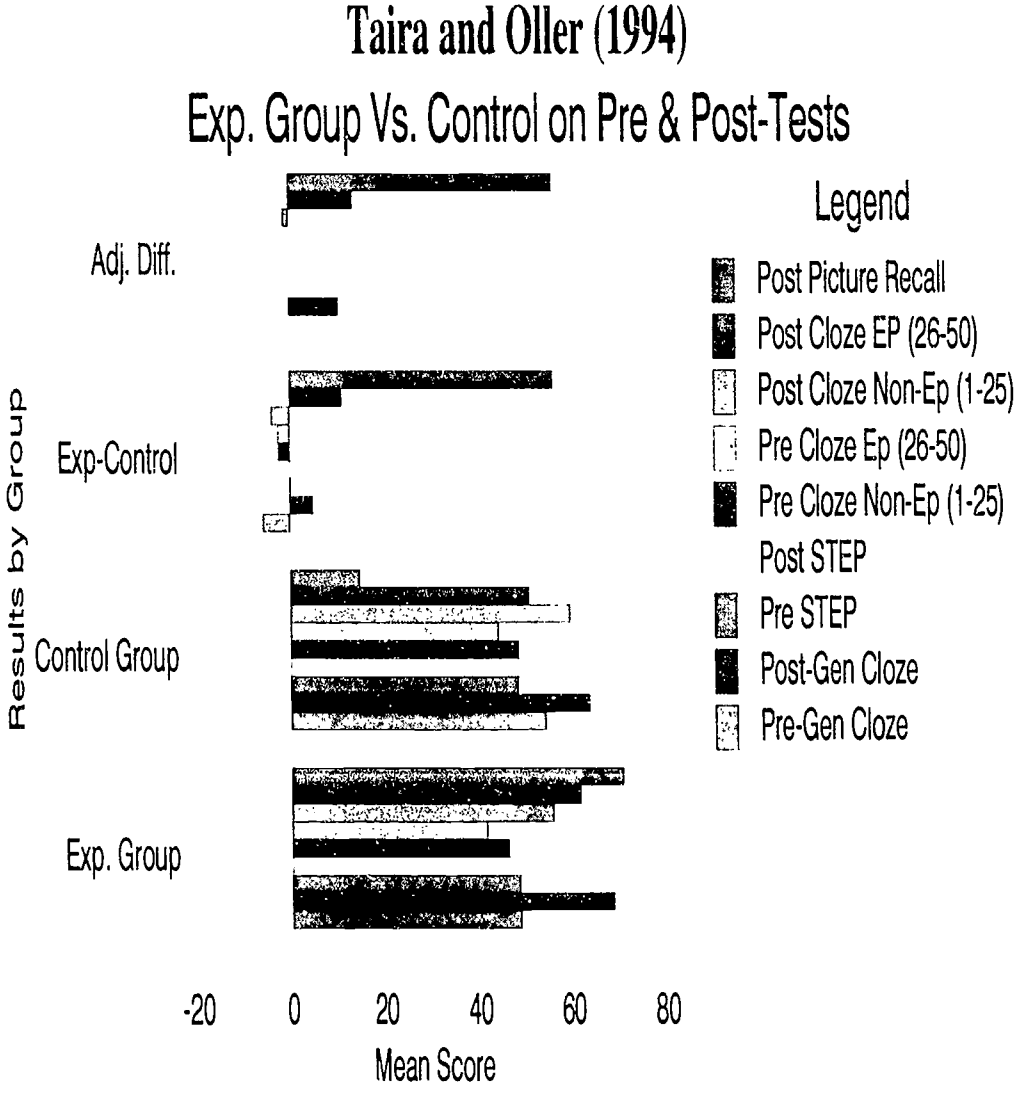
The fourth research approach to be examined was conducted by Tatsuo Taira with computer assisted language learning. It had been hypothesized years ago (back in the 1960s by my dad, John W. Oller, Sr.) that episodically organized materials are bound to be superior to non-episodic variants of the very same materials. This idea was implicit in the writings of John Dewey who got his notion about the temporal connectedness of experience from Peirce. At any rate, my dad say that a series of lessons organized in the manner of a soap opera, or the chapters of a novel, would be easier to comprehend, to learn from, and to gain a grounding for grammatical intuitions, than any non-episodic arrangement even of the very same structures. The reason for this is simple. An episodic arrangement affords a higher level of structure from which to launch our comprehension. It provides a richer formal schema. The narrative itself, the story-line, is a schema imposed on top of, so to speak, all the other formal schemata that are contained within it. Remove that higher level and a great deal will be lost.

But, this idea had not been tested beyond the level of relatively brief narratives and a few other kinds of texts (cf. Oller 1975) until Taira developed an experimental design assisted by computerized instruction. He designed his whole research project especially for the purpose of testing the long-term effects of episodic organization. His research employed 96 students of English as a foreign language studying in a computer assisted language learning context in Okinawa, Japan. It required the construction of a series of lessons grounded in a narrative. His story was about father going off to New York and later being joined there by his family from Japan. He also developed a parallel series of vignettes identical to the narrative series except for the fact that the story-line had been removed. Again, all of this work is published (cf. Taira 1993a-b; also Oller and Taira 1994) so we will skip over many details.

Subjects were pre- and post-tested on various measures and were tested on both variants of the materials used in the computer assisted language instruction after thirteen 90-minute lessons on the computer over the course of an entire semester. The experimental group (n = 48) was exposed to a series of connected conversations forming a story (presented in various CALI cloze formats accompanied by still pictures on screen and various other learning aids) while the control group (n = 48) got essentially the same exposure to the same conversations but in a random order where the story-line was essentially non-existent outside of any particular conversational vignette. To remove the story-line from the vignettes presented to the controls, about all that had to be changed was the names of persons and places in the various conversations. Also, the sequential arrangement of the conversational vignettes was different between the episodic and the non-episodic versions.

The results showed that students in the experimental group outperformed the control group on essentially all measures in the post-test condition except that there was no significant contrast on the non-episodic materials studied by the controls but not studied beforehand by the experimental subjects. What was most interesting to us, and what showed sharply an effect of the experimental subjects' developing knowledge of the underlying abstract grammar of English, was that the experimental subjects performed significantly better than the controls on post-tests that were completely independent of the experimental design. In particular, the experimental subjects outperformed controls on the post-STEP (a standardized English placement test widely used in Japan for college entrants) given at the end of the semester. This result, combined with the results of the pre-testing, showed that the experimental subjects had apparently reached beyond any formal schema tied specifically to the episodes they studied and had generalized to English materials found in test content they had (presumably) never seen before.

All of this is summed up in Figure 15. The bottom portion of the bar graph shows the performance of the experimental and control groups on the various pre-and post-tests. The figures on which the bars are based are given in the table at the bottom. As before, since the results in question are published in detail elsewhere, we concentrate here on just the relevant facts. For our purposes, the most important contrasts are shown in the adjusted differences between experimental (the episodic group) and controls (the non-episodic group) shown at the top of the bar graph. The most dramatic contrast was between the two groups with respect to their recall of the order in which the pictures were presented that accompanied the various conversations in each series of lessons. As expected, the group exposed to the episodically organized materials recalled the sequence of pictures much better than did the group exposed to the same conversations (and the same pictures) but with the story-line removed.



	Exp. Mean	Control Mean	Exp-Control	Adj. Diff
Pre-Gen Cloze	48.81	54.46	-5.65	
Post-Gen Cloze	68.75	63.86	4.89	10.54
Pre STEP	48.7	48.54	0.16	
Post STEP	73.57	68.15	5.42	5.26
Pre Cloze Non-Ep (1	46.17	48.58	-2.41	
Pre Cloze Ep (26-50	41.67	44.25	-2.58	
Post Cloze Non-Ep (	55.92	59.75	-3.83	-1.25
Post Cloze EP (26-5	61.75	50.75	11	13.58
Post Picture Recall	71.09	14.84	56.25	56.25

Figure 15. Taira & Oller in Oller and Jonz, 1994: CALI and episodic organization (formal vs. abstract schemata).

The second bar at the top of Figure 15 shows that the experimental subjects (with pre-test scores taken into consideration) outperformed the controls on the episodically organized post-test materials. The third bar from the top shows that the controls barely (but not significantly) outperformed experimentals on the non-episodic cloze materials that the controls has studied during the semester. The fourth bar shows that the experimental group excelled on the post-STEP test (a contrast that was statistically significant), and the fifth shows that they also prevailed on the post-general cloze test. (In each post-test contrast, the corresponding pre-test was used as the logical co-variate to set the two groups equal at the start.)

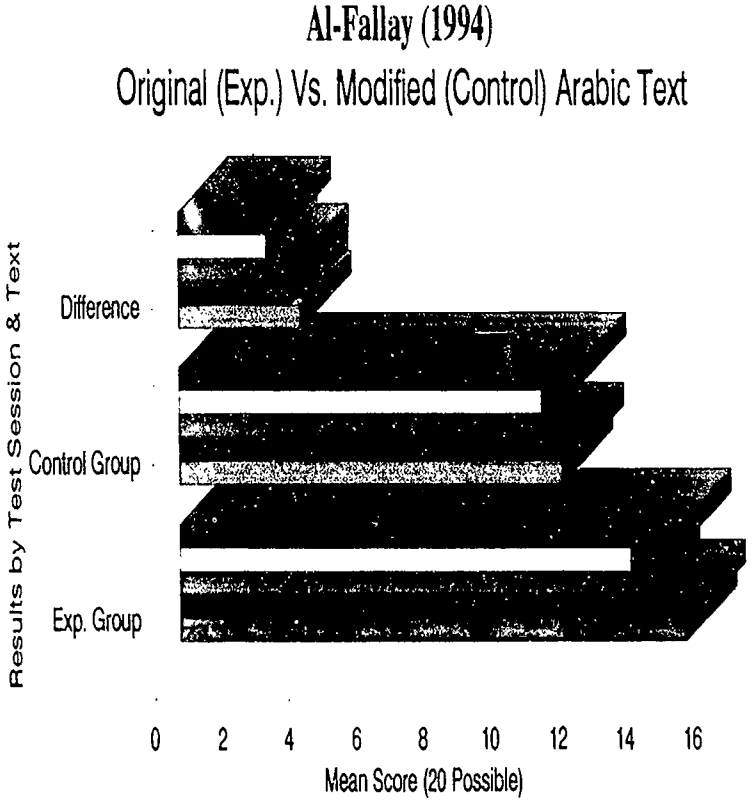
Thus, we see persuasive evidence of the superior power of the abstract schemata the experimental subjects were apparently able to generate on the basis of exposure to episodically organized discourse as contrasted with the disjointed vignettes that the control subjects were exposed to. This result is apparent in two ways: first, we see it in the equal performance of experimentals on the non-episodic variants of the materials that were specifically studied by the controls (but not by the experimentals), and second, we see it in the post-test contrast on a widely used measure (STEP) that was independent of the materials studied by either group. This last result, I believe is most important, and has never been demonstrated previously to my knowledge. But, it has been replicated in a very different setting with a different design as we are about to see.

Formal Schemata Versus Abstract Schemata: Al-Fallay (1994)

The fifth and last study to be examined was actually a follow-up of two prior research projects. It is a doctoral dissertation by Ibrahim Al-Fallay completed in 1994. One of the studies it followed up was the study by Chihara, Sakurai, and Oller (1989) which is mentioned but not discussed above, and the other was the Taira study just discussed in the previous section. The point of Chihara et al. (1989) was to assess the impact of deliberately changing the cultural content of a text to see if this adjustment would affect cloze scores of a particular subject population (Japanese women in a junior college there). The texts used were the by now familiar Joe and Nicholas narratives. All that was changed in either of them were a few place names, the names of persons, and one or two personal interactions were changed to conform to the expectations of Japanese subjects. For instance, instead of *Joe* and *Nicholas* male Japanese names were used and instead of Joe kissing his mother (a nearly incestuous act in the eyes of Japanese), he just hugs her at the train station, and so forth. As surprising as it may seem, these minor content adjustments, to conform to the culturally-based content schemata of Japanese subjects, were sufficient to produce a gain of about 6% over the same texts presented in their unmodified variants.

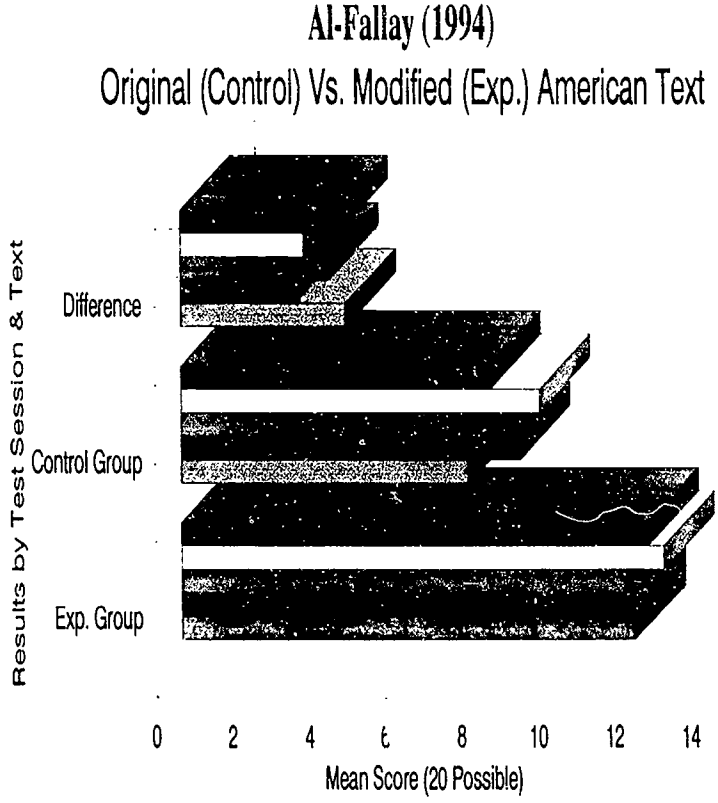
Al-Fallay thought about these results and those of Taira and wondered if he could not replicate both with Arab students of EFL in Saudi Arabia. He worked with two narratives. One was based on an unfamiliar story about a man riding a donkey into town but sitting on it backwards (told roughly in the style of an Aesop's fable but constructed in an Islamic context). The other narrative was a similar story about people on a trip originally written in English. Each of these was adapted. The Arabic story was translated into English leaving the original context unmodified for one version and, then, adjusted to American cultural expectations for the other version (changing names of persons and places and events, e.g., Christmas versus Ramadan, to conform to American rather than Arab expectations). Similarly, the story originally written in

English was adapted so as to fit Arab expectations. As a result two versions were produced of each story. One version was constructed to fit American expectations and the other to conform to Arab ideas. Otherwise, the two versions of each story were identical. Each version was presented in five distinct segments over the course of a quarter to different groups of subjects. In fact, every subject in his experimental group (n = 37) did 5 cloze tests over the unmodified (un-Americanized) version of the Arab story as well as 5 cloze tests over the Arabized version of the American story. The control group (n = 37), by contrast, did five cloze tests over the original American story and the Americanized version of the Arab story. The results of the contrast between experimental and control subjects on the Arabic text in both its versions are given in Figure 16. The contrasts across all five occasions favor the text in its Arabic form rather than the Americanized variant. Figure 17 gives the same results for the American story and its Arabized variant. Again the results favor the Arab variant in all five cases.



	Exp. Mean	Control Mean	Mean Difference
Session 1	15.08	11.43	3.65
Session 2	15.32	11.76	3.56
Session 3	13.97	10.38	3.59
Session 4	13.46	10.81	2.65
Session 5	14.92	11.84	3.08

Figure 16. Al-Fallay (1994): Arabic text.



	Exp. Mean	Control Mean	Mean Difference
Session 1	11.89	7.54	4.35
Session 2	11.89	8.89	3
Session 3	11.65	7.76	3.89
Session 4	12.65	9.41	3.24
Session 5	12.24	8.11	4.14

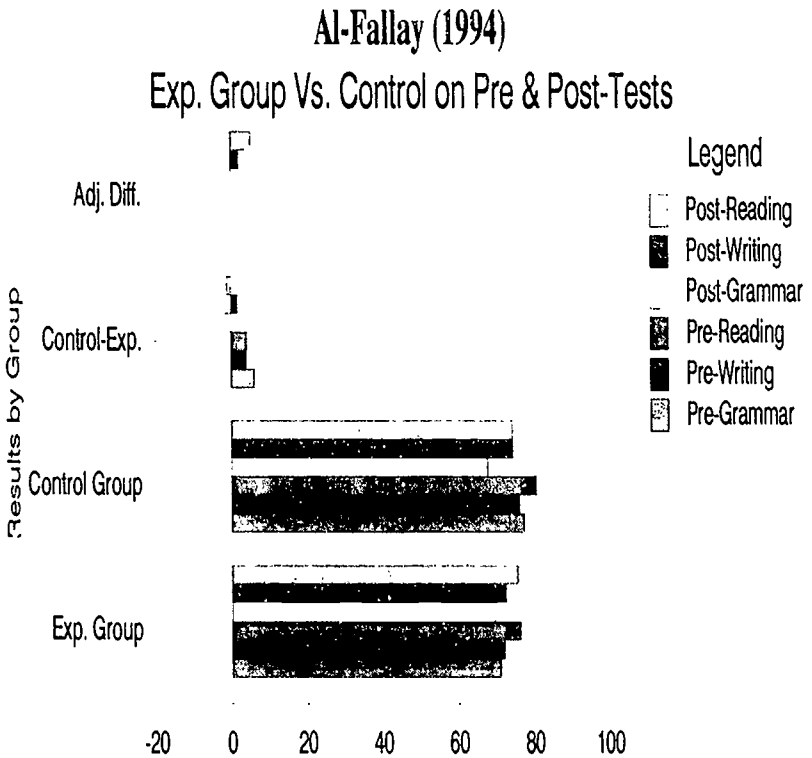
Figure 17. Al-Fallay (1994): American text.

More important to our considerations here is the fact that the benefit gained by working through content arranged according to the formal schemata characteristic of the Arab world generalizes to material not studied. This is shown in the contrasts of pre- and post-tests given in Figure 18. Contrasts were possible on three post tests for which corresponding pre-test scores were available. The relevant contrasts are shown at the top of Figure 18.

The first bar shows the significant contrast favoring the experimental group on an independent reading test. The second bar favors the experimental group, but not significantly on a writing test. The third bar favors the experimental group significantly on a grammar test.

By comparing pre-test scores on independent measures, Al-Fallay was able to show that the two groups were equivalent starting out, but that they differed on the scores achieved throughout the instruction in such a manner as to favor the experimental group on every single

contrast. More importantly, he found not only the predicted contrast between the Arab and American versions of each story throughout the entire quarter, but by examining pre- and post-testing, as in the Taira research, he found that the gains owed to his modest cultural adjustments apparently produced a generalized effect on the post-test condition even in materials never seen before by his subjects. That is, the subjects who benefited from the minor cultural adjustments throughout the quarter simply acquired more English. I take this last result to be evidence that the experimental group was developing the abstract schemata necessary to the comprehension and production of English texts in general.



	Exp. Mean	Control Mean	Control-Exp.	Adj. Diff
Pre-Grammar	71	77.19	6.19	
Pre-Writing	71.95	76	4.05	
Pre-Reading	76.25	80.43	4.18	
Post-Grammar	69.4	67.67	-1.73	8.52
Post-Writing	72.4	74.29	1.79	2.26
Post-Reading	75.45	74.24	-1.21	5.44

Figure 18. Al-Fallay (1994): Pre/post-test contrasts on independent measures.

In Sum

While many subtler aspects of the theory remain to be articulated and tested, it would appear from this excursion that the main outlines are correct. Content schemata have some impact on the processing of discourse whether it be in that preliminary iconic phase that we know as perceptual awareness or whether it be in that much more developed phase that we know through abstract symbolic (usually linguistic but always discursive) form. Formal schemata, based in inductive reasoning and the indexing of particular cases by linking them to abstract concepts, have a still greater impact than content schemata. Finally, abstract schemata, grounded ultimately in concepts abstracted and generalized so as to transcend any particular context of experience, have the greatest impact of all. While I will not trouble the reader with any further abstractions here, it is worth noting that from the Peircean perspective it can be proved axiomatically that the sort of abstract schemata I have defined here set a limit on any that are attainable. (No abstraction can be more abstract than a fully symbolic one.) Likewise, it can be shown that the particular (non-repeatable and strictly individual) facts of any actual context of experience are as particular as any facts whatever can get. Therefore, the theory is, in a strictly logical sense, complete. The formal schemata complete the picture as shown in Figure 5 above by connecting the most abstract realm to the most concrete.

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