ABSTRACT: Responding to the continuing conflict between behavioristic and rationalist/cognitive approaches to language and language development, some relationships between those two paradigms are explored. First, it is shown, by comparing terms employed in the opposing systems and by specifying their common underlying conceptual scope, that many of the assumed contrasts are more terminological than substantial. Having demonstrated underlying conceptual similarities, complementarities in strengths and emphases of both approaches are noted. Next, an integrative paradigm is suggested that explains language development from the perspective of skill learning. This perspective subsumes the basic concepts of both antagonistic approaches and incorporates their complementary strengths to fully explain the complex processes involved in the acquisition of language skills. The social implications of the two opposing theories and of the integrative approach are briefly discussed. It is concluded that an integration of the conceptual and empirical potentials of the two antagonistic conceptualizations of language development is needed and possible, once the emphasis on contrasts, which is exaggerated through contrasting labels, is overcome.

Continuing controversies as to the conceptualization of language and language acquisition could easily produce the impression that profound and unbridgeable differences exist between the major approaches to this topic. These contrasting conceptualizations have been most commonly represented as "behavioristic" versus "rationalist/cognitive" conceptualizations. Some of the central relevant concepts of these schools will be specified below in the course of the discussion, although it cannot be attempted to describe either or both of them exhaustively. In contrast to the predominant emphasis upon differences, conceptual homologies and similarities in approaches will be emphasized or even overemphasized to compensate for previous divisive characterizations and -- hopefully -- to build a bridge between both approaches across which communication and crossfertilization can begin. It is suggested that we cannot allow ourselves to remain frozen into the adversary legacy of the past fumbling and one-sided attempts at describing the complex phenomenon of language acquisition/transmission. In those areas, where differences in emphases do exist, the two major approaches appear to be mainly complementary and, consequently, both are needed for the full explanation of language and language acquisition. This complementarity will be exemplified in a preliminary manner by describing language acquisition as skill acquisition.

The presentation will be developed in three steps: First, the most general approaches to language in the opposing paradigms will be scrutinized and conceptual

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equivalences will be exhibited that are hidden by the terminological contrasts between the two paradigms. Then, in a more restricted approach, teaching/learning phenomena observed in first language transmission/acquisition will be focused upon and the congruence and complementarity of the two major approaches for the explanation of these processes will be elucidated. This will be done by employing a skill transmission/acquisition perspective. Such a perspective, necessarily, entails both theoretical approaches since skills are behaviors, or at least are expressible as behaviors, but they rely upon knowledge and neurological structures that need to be established through learning before they can be expressed behaviorally. Finally, it will be attempted to evaluate whether and how much each of these three approaches has contributed and can contribute to the practical tasks of language training, whether it is remedial or second language instruction.

THE TWO MAJOR CONCEPTUAL APPROACHES, THEIR UNDERLYING SIMILARITIES, AND THEIR IMPORTANT COMPLEMENTARITIES

In accordance with the recent controversies in the field, the two contrasting conceptual approaches of Skinner (1938, 1957) and Chomsky (1959, 1965) will be considered. Those two major figures, however, obviously do not represent the entire range of pertinent conceptualizations. In the behavioral field, Baer and associates (Guess & Baer, 1973; Guess, Sailor, & Baer, 1978) and Salzinger (1978, 1979) as well as many others have made important contributions. Staats (1971, 1974, 1975), though he originated in the behavioral camp, has endeavored repeatedly to build bridges between the two opposing approaches. His extensive conceptual innovations can only be alluded to here. The reader is especially referred to his latest magnum opus (Staats, 1983), which provides a most convincing argument against the "separatism" prevailing in psychology.

The rationalist/cognitive field is even more diverse and encompasses many rather autonomous contributors. It could even be argued with much justification that it is impermissible to subsume the seemingly very distinct conceptualizations of the nativistic school of Chomsky and the cognitive/developmental school that generally derives its roots from Piaget. The famous debate between Piaget and Chomsky (Piattelli-Palmarini, 1980) certainly would support this argument. A tripartite comparison, ranging from Skinner over Piaget and Vygotsky to Chomsky, might certainly remain a challenging task for future analysis. For the present goals, a bipolar comparison appears not only sufficient but even preferable since it contributes to the clarity of exposition. Once Skinner's and Chomsky's approaches are reconciled, Piaget's constructivism can easily be shown to build a most useful bridge between nativist and environmentalist conceptualizations. Vygotsky's socio-historical theory could easily be seen as anticipating Bandura's (1986) social learning theory as well as the skill learning paradigm to be elaborated below.
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Since the behavioristic conceptualization (Skinner, 1938, 1957) was formulated earlier and is more clearly circumscribed, and since Chomsky’s formalism has its roots in behaviorism through Bloomfield (1933) and Zelig Harris (1951), behavioristic terms will mostly be chosen as a starting point and they will then be compared with similar conceptualizations in the cognitive/nativistic field. This sequence, however, does not imply any presupposition as to order of importance or degree of assumed correctness or fittingness of either of the two opposing conceptualizations.

Terminological contrasts, conceptual similarities

To begin with the most central term, the label 'behaviorism' is in itself an anathema for many cognitive psychologists and results in conditioned aversive reactions. The same cognitive psychologists, however, are increasingly turning to 'pragmatically' oriented approaches to language behavior and language acquisition. The contradiction entailed in these two reactions, the aversive one to everything that sounds 'behavioristic' and the positive one to 'pragmatic' studies, seems to have escaped most investigators. Since the Greek root of the word 'pragmatic,' prato, means 'to act, to behave,' the 'pragmatic' approach is a 'behavioristic' approach at least in its terminology, even if different word-roots are employed to describes this 'practical,' that is, functional orientation. That the similarity goes much deeper than mere terminology will be demonstrated immediately below.

Skinner’s (1957) central concept in interpreting 'verbal behavior' is the 'operant,' that is, the behavioral act that leads to specifiable consequences. The same principle was expressed, briefly after Skinner but quite independent of him, by Austin (1962) who pondered 'how to do things with words.' From this source and also more directly from Wittgenstein (1953), the functional approach spread into all 'pragmatic' approaches to language. It is equally found in a behavioral conceptualization when Baer (1983) emphasizes that "the best mothers are functional" (p. 145) as in several 'pragmatic' theories (Bates, 1976; Moerk, 1977a; Ochs & Schieffelin, 1979). In the perceptual/cognitive field, E. Gibson (1982) specifies in the subtitle of her discussion of 'affordances' that this concept represents 'a renascence of functionalism.' The concept of 'affordances' with all its functional implications derives from the previous work of J. J. Gibson (1979, 1982) and emphasizes the behavioral potential of environmental givens. Anderson (1980, 1981, 1982), when developing his theory of cognitive skill acquisition, specifies already in his titles that he is concerned with goal-directed cognitions, that is, skills that are applied for some purpose. 'Purposiveness' is also a central feature of Skinner’s 'operant' (Smith, 1986, p. 289).

An essential convergence, ranging from perceptual theories to cognitive conceptualizations, to explanations of language, and to behavioral approaches, seems, therefore, to exist. It suggests that functional conceptualizations reflect best a broad
range of human cognitive functioning and behavior. The functional emphases in the field of language study have ancient predecessors. Protagoras and Plato in ancient Greece specified a variety of functions of language. Cicero did the same in Rome. And the 'organon model' formulated by Buhler (1934) goes directly back to Aristotle. The Greek term 'organon' translates as 'tool,' or if Skinner's Latin inclinations are preferred, as 'operant.'

A very important contribution of Skinner (1938, 1958) was the development of the concept and the methodology underlying behavioral 'shaping.' In 'shaping,' environmental influences guide the subject from initially crude and imperfect responses in a stepwise sequence and with successive approximations to the goal response. Large leaps between steps will make the shaping less effective if not impossible. The reader, versed in the concepts of cognitive psychology, will immediately remember the 'optimal level of discrepancy' (Hunt, 1965) that needs to be maintained for successful progress from lower levels to higher levels of cognitive performance. Bruner's (1983) 'scaffolding' entails very similar concepts. These are even more closely specified in the 'task sequencing' described by Bruner's student, Greenfield (Greenfield & Lave, 1981). Again from a quite different source, namely Vygotsky, stems the idea of 'the zone of proximal development' (Vygotsky, 1978; Wertsch, 1984). According to this conceptualization, the subject is only able to progress in a stepwise fashion from more primitive to more advanced performances. The same gradualness is found in naturalistic first language acquisition and in modern approaches to second language teaching. Whatever the specific terms and whatever the underlying theoretical rationale, the approach to the teaching of new and more complex performances appears to be astonishingly similar if not identical in the behavioristic and cognitive fields.

In the last few references, an even broader rapprochement is entailed. With Vygotsky (1978), whose thinking is anchored in Karl Marx, and his student Luria (1979), the socioeconomic environment is stressed as being highly influential for cognitive development, and therewith also for language and nonverbal behavior. Whether it is the increasing influence of these Russian conceptualizations in present American thinking (Cole & Maltzman, 1969; Wertsch, 1979, 1983) or whether the relatively autonomous cross-cultural studies originated by Bruner and his students are considered (Bruner, Olver, & Greenfield, 1966), environmental shaping of human cognition and behavior is their basic presupposition. This presupposition is broadly accepted in cognitive psychology and its applications, such as enrichment programs and remedial language training. Meichenbaum's (1977) system of 'cognitive behavior modification' is another indication of the obliteration of the old antagonisms and the convergence necessitated by practical considerations.

The trend towards emphasizing the environmental shaping of cognition, language, and behavior, discussed above, might appear to have led far away from Chomsky's nativistic and universalistic stance. Yet, underlying this terminological discrepancy, there lurk astonishing similarities between Skinner and Chomsky. As
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is well known, Skinner's system relies extensively upon 'emitted responses.' The nature and origin of these responses are, however, minimally explored. They seem to be presumed as innate, as suggested by Skinner's (1966, 1975) repeated emphasis on phylogenetic aspects. Those innate emitted responses are secondarily subject to environmental shaping. In a very similar manner, although for a more restricted domain, Chomsky posits innate syntactic deep structures, which are selectively realized due to the influences of the mother tongue the child is born into, that is, due to environmental influences.

If these formulations are carefully considered it is seen that both Chomsky and Skinner posit initially innate patterns that generally are species specific and presumably universal for members of each species. While neither provides any neurological or genetic evidence for these assumptions, both sketch out a similar first cause. Thereafter, both assume extensive environmental shaping. Since this formulation might appear astonishing as applied to Chomsky, a quote shall justify it:

Universal grammar is part of the genotype specifying one aspect of the initial state of the human mind and brain...the language faculty assumes the character of a particular grammar under the triggering and SHAPING (my emphasis) effect of experience. (Chomsky, 1980, p. 82).

Chomsky not only employs Skinner's term, he even argues strongly for environmental influences upon language acquisition, and he logically needs to since the specific languages children acquired are very diverse indeed. Such diversity could not be derived from universal innate principles.

Chomsky is more prone to analyze the structures underlying verbal 'performance,' i.e., behavior, in detail, whereas Skinner focuses upon the conditions leading to change in the organism's use of these structures. Is Skinner a hidden nativist and Chomsky an environmentalist? Skinner (1966) affirms as much in his debate with Konrad Lorenz (Lorenz, 1965). Chomsky's concept of 'surface structures,' that are different from the presumably innate deep structures and that are established through interactions with the child's language environment, certainly entail a strong environmental emphasis. In spite of his nativistic terminology, including the postulate of a 'language organ' (Caplan & Chomsky, 1980), he appears to approach increasingly conceptualizations that are pertinent for environmental analyses. His recent emphasis on abstract surface structures ('S-structures') and his derivation of meaning from these abstract surface structures (Chomsky, 1980) has moved considerably closer to an empiristic approach as contrasted with his previous unsubstantiated rationalistic speculations. Certainly 'organs' are necessary prerequisites for learning. Nobody could learn to play piano sonatas without hands, ears, and brain structures. Yet none of these organs guarantees an innate knowledge of piano sonatas. It seems Chomsky confounds necessary and sufficient conditions in his argument.
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Complementarities between the two opposing systems

Very few examples of complementarities can be mentioned within the present brief discussion although many could be articulated if the topic were investigated in detail. The most promising complementarity appears to lie in the diverging emphases and mutual short-comings of the two systems. The behaviorists are singularly uninterested in the fine-grained structures of behavior and the Chomskyan linguistic approach almost completely neglects the transformations that are found in verbal behavior in the course of learning and development. It is well known that Skinner focused predominantly upon contingencies and changes in these contingencies. The response or 'operant' itself, in contrast, is often of minor interest. Skinner (1953, p. 87) specifies: "It is the operant as a class of behavior rather than the response as a particular instance, which is conditioned." Whether the rat presses the lever with the left paw, the right paw, or its mouth is often not even specified in the behavioral record of 'lever pressing.' Adams (1984) analyzes this short-coming of the behavioristic approach in much more detail than can be attempted here. This short-coming can be remedied by exploring skilled behavior and skill acquisition. A focus upon response classes only is completely unsatisfactory in the realm of verbal behavior, where the structure and the form of the utterance, whether it is a primitive cry or an elegant bon mot, is of primary interest. The contingency, in contrast, i.e., when the bon mot is emitted, often is considered unimportant by posterity or completely lost when an utterance is transmitted over generations, as in the case of proverbs and quotations.

Chomsky's system, especially his more recent formulations with their detailed emphasis upon surface structures (Chomsky, 1980), together with other rhetorical/linguistic systems fill this gap left by behavioral approaches. Even if Chomsky neglects the dynamics of change, the structuralist-transformationalist tradition could and does provide the conceptual tools to describe in detail the verbal input as it influences the topography of the child's verbal output. Such tools are needed to explore the specific environmental causative influences, the immediate and delayed effects they have upon the surface structures of the utterances, and the changes in the underlying 'competence,' i.e., in language skills.

A combination of both approaches will allow the investigator to describe both the structures of the behaviors in question and also the dynamics that lead to the changes in these structures. These changes are certainly obvious in the progress from the single-word utterances to the complex and elaborated sentences, paragraphs, essays, and books produced by competent speakers.

A related complementarity lies in the contrast between the two approaches in level of analyses. Skinner and most behaviorists, in their disinterest in the topography of behavior, refer to the 'operant' as an undifferentiated unit. Linguists, in contrast, have finely differentiated various layers of language performance. These are the phonemes, morphemes, sentence constituents,
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paragraphs, etc. They have, thereby, performed molecular analyses, as contrasted to the behaviorists' molar analyses. Such differentiations are, certainly, of greatest importance in any exploration of complex skills and the learning of those skills since skills are acquired and built-up in a gradual and iterative manner by combining smaller components into larger sequences. In the same manner, as a person does not 'learn to ski' but learns to keep his balance, to snow-plow, etc., so a child does not 'learn a language,' but learns to articulate sounds, to combine them into words, words into sentences, etc. In the learning process itself, the learner does not suddenly progress to the imitation and production of long sentences starting from zero, but he combines already learned molecular units into somewhat larger ones in very gradual and successive approximations to the goal response, that is, complex and elaborated verbal behavior. As Carol Chomsky (1969) has shown first, and as Nelson (1977) has recently summarized, these approximations take around 20 years of a child's life. To become an outstanding performer who wins literary awards takes much longer.

Other complementarities pertain to the linguists' almost exclusive focus upon the individual and his competence, whereas the behavioristic and learning approaches choose a more sociopsychological and interactional emphasis. This latter strategy permits a focus upon learning from models (Bandura, 1986) and upon possible (imitative) performances without clearly established competence (Clark, 1974; Speidel & Nelson, 1989). Considering this last contrast from a different angle, the sociopsychological approach implies diverse possible levels of processing, whereas the linguistic approach presumes always processing upon the level of deep structures in addition to the surface structures. By employing such a multilevel conceptualization it was possible to explain the acquisition of the Subject - Verb - Object structure by means of environmental input and filial learning (Moerk, 1992a, Chap. 6). The child abstracted a prosodic three-element structure from environmental input before she was able to express the full semantic structure. That is, the underlying pattern, or a 'deep structure' was learned from input that employed the 'multiple exemplar' principle, as formulated by Baer and associates (Guess et al., 1973; Guess et al. 1978).

The above discussion of complementarities is certainly not exhaustive, but it might indicate how valuable an integration of the antagonistic approaches would be for the further exploration of language behavior and language acquisition. However, the differential labeling habits that arose from the diverse historical roots of the two schools and from their competing claims for exclusive legitimacy and for predominance, resulting in a deceptive 'distinctiveness of cues,' led the protagonists to overlook the communalities and to overemphasize the differences that exist. The resulting acrimonious controversies almost resemble those reported from the early centuries of the common era when Christian sects argued violently over definitions of the Trinity or the specification of the human nature of Jesus. These animosities have a very immediate negative consequence. The 'true believers' in each field
treat the publications of the opposing camp as if they were put on the *index librorum prohibitorum*, that is, they remain blissfully unaware of the very real progress and the very real contributions the opposing paradigm has made and will continue making. Instead of cooperation and mutual enrichment, disregard of the other's contribution and self-impoverishment prevail. Such impoverishment necessarily has profoundly negative effects on language training approaches.

The following sketch, applying a skill-learning approach to first language acquisition, suggests the explanatory power that can be gained by eschewing ideological blinders and by integrating the entire range of theoretical conceptions and factual evidence.

**FIRST LANGUAGE ACQUISITION AS SKILL LEARNING**

Certainly, I cannot attempt to explore the wide-ranging relationships between language acquisition and skill acquisition in full detail. The literature in either field is large. For skill acquisition, Holding (1981), Kleinman (1983), and Sage (1984) provide recent surveys and summaries. For cognitive skill acquisition, Anderson (1980, 1981, 1982) and Colley and Beech (1988, 1989) represent excellent sources. For language acquisition and environmental factors influencing it, Rondal (1985) and Moerk (1992b) provide perhaps the most comprehensive recent summaries. Only programmatic comparisons will be sketched out here. A somewhat more extensive discussion has been provided by Moerk (1985) and related but different approaches can be found in Fischer and Corrigan (1981). Pertinent ideas go back as far as Lashley's (1951) famous paper and are rooted in Bartlett's (1958) use of motor skills as a metaphor of thinking ability. As will be seen from the analyses presented below, many of Bruner's seminal studies (e.g., Bruner, 1971, 1973, 1981, 1983), both in the field of motor development and language development, are closely related to the ideas presented and they have influenced their formulation.

One major restriction, though substantially unjustified, will be maintained to confine the range of topics covered. Skill learning as well as language learning entails two complementary aspects: The perceptual skills needed to analyze the patterns in the modeled behavior and the motor-skills to produce it. Whitehurst and Vasta (1975) have analyzed the relations between the two by proposing their CIP (comprehension: imitation: production) hypothesis. They assert that a model's speech first has to be comprehended before it can be imitated; and the latter comes before spontaneous production. Anderson's (1982) differentiation of a 'declarative stage' in cognitive skill acquisition before the 'procedural stage' reflects the same basic dichotomy. Facts in the skill domain have to be first interpreted, in the 'declarative stage,' before they can be applied in performances. In-depth analyses of this declarative aspect would have to explore whether only one level of comprehension exists or if multiple levels, based upon multiple levels of processing, need to be differentiated. A vague 'comprehension' of the situational function of
an utterance might be much less effective in supporting the reproduction of the
same utterance than the analysis of all morphemes, the diverse levels of
constituents, and the relationships between them.

Perceptual skills need also to be honed in order to differentiate finely the
feedback resulting from the performance of skilled behavior and to regulate and
adapt the latter. This might be feedback intrinsic in the performance and
concurrent with it, or it might be augmented feedback that is normally provided at
the end of the performance. This terminal feedback can in turn be feedback as to
the results of the performance (knowledge of results) or it can be feedback as to the
performance (knowledge of performance) as discussed by Sage (1984). The contrast
between those two types of feedback and between the entailed perceptual skills is
often encountered in the bewildered statement after a failed performance: "I don't
know what I am doing wrong." That is, knowledge about unsatisfactory results is
combined with ignorance about performance aspects that cause these results. Sage
(1984) discusses the extensive pertinent research in great detail and this cannot be
repeated here. Its importance is systematically realized in all skill training, as
evident in the provision of trainers and the use of technical means to provide
augmented feedback, such as video feedback (Newell & Walter 1981). Such
perceptual skills are presupposed in any discussion of the child's use of feedback and
the mother's providing of linguistic feedback. Children's self-corrections involve it
too.

In both the skill-development literature and the field of first language
acquisition, the questions pertaining to the perceptual aspects have been largely
neglected. To explore them, one would need to turn to research on pattern
abstraction and feature differentiation, as well as to the rather neglected field
pertaining to one's awareness of one's own language production that often leads to
self-corrections. The inclusion of all these topics would lead too far astray from the
present purposes. The discussion, therefore, will be mainly restricted to the output
or 'the performance aspect' of skill acquisition, although the topics on feedback and
the storage of patterns certainly relate, at least indirectly, to perceptual questions.

Several major aspects of skill acquisition and skilled performance, as known
from and explored in the field of motor skills, will be briefly described and
compared with the phenomena known from first language acquisition. Since
exhaustiveness cannot be the goal, other investigators might arrive at different
selections as to what might be the most important dimensions for comparison.

*Skills are patterned structures of behavior that are decomposable;* more complex skills are constituted of smaller subroutines

The relationship between the subroutines and the larger ones is additive and
epigenetic. Adams (1984) specifies that "the process of acquiring new skills is a
matter of constructing new wholes out of existing parts, and so the availability of
parts is crucial to the evolvement of complex movement sequences" (p. 14). Bruner (1973) expresses the same idea by discussing how subroutines are combined in skill acquisition into larger routines. Everyday experience with children and adults, certainly, supports this insight.

The parallels to language acquisition need barely be mentioned: Infants, in their first vocal approximations to their mother tongue, babble first monosyllabically, then follow reduplications of these single syllables, and later bisyllable and polysyllable babbling appears. Closer to language, one finds the one-word stage preceding the more-word stages. Both syllables and sentences are structured and rule governed. Second language learners who learn a foreign language in the natural, conversational manner and not based upon grammatical pattern drills, begin also with small meaningful units and combine them only gradually into longer syntactic patterns. The homology between general skill acquisition and language acquisition in this respect, therefore, can be taken for granted.

Models demonstrating the skilled behavior patterns contribute greatly to skill acquisition

This fact is so obvious that it barely needs support from the research literature. Applications in sport training, where live demonstrations (Feltz, 1982) and filmed ones are broadly employed are common. Gould and Roberts (1981) provide an extensive review. Bandura’s (1977) well-known research on social learning and 'modeling' reflects the same principles and specifies applications in many areas. It can be assumed, therefore, as established in the acquisition of motor skills and social skills which are, of necessity, behaviors.

In spite of recent controversies, the evidence in the field of language acquisition is equally strong. Certainly, there exist abundant reports of filial verbal imitations since Lewis (1936/1975). Then there is McCarthy’s (1964) categorical conclusion: "The mere fact that the child learns the language of his environment is evidence of the importance of imitation" (p. 517). This conclusion appears equally poignant and logically convincing as when it was first drawn. Admittedly, there was a decade in the meantime when nativistically oriented approaches attempted to deny the effects of modeling and imitation in language acquisition. This brief deviation, however, has been overcome now, as shown by the valuable contributions in Speidel and Nelson (1989).

Bandura’s differentiation of the acquisition of a behavior from its performance and a more extensive analysis of the perceptual aspects of skill learning indicates that much of this controversy was based upon a misconception. Some investigators conceived imitation as superficial performance only, following the model immediately and echoing it passively. Yet, much can be learned by observing skilled performances even without reproducing these skills immediately or in their entirety, as Bandura (1977, 1986) has argued and shown consistently. Delayed and partial
imitations must, therefore, be included in the study of language acquisition. Even in more immediate imitation, the child is certainly selecting and reconstructing the modeled items since skills cannot be copied passively. That is, progressive imitations will often not be identical imitations. These solutions of the existing controversies have been discussed in great detail by Snow (1983), Moerk (1985a), and the contributors to Speidel and Nelson (1989). As soon as a memory span for models above a few hundred milliseconds is accepted and as soon as the child's processing of the input is not excluded by definition, imitation can be shown and can be seen again as an important device in language acquisition. Studies by Bloom, Hood, and Lightbown (1974), Moerk (1977), Moerk & Moerk (1979), Ninio and Bruner (1978) and Snow and Goldstein (1983), besides many others, support this conclusion. This feature of the acquisition process appears, therefore, identical in both the broader domain of skill learning and the more narrow one of first language acquisition.

**The importance of feedback or "knowledge of results"**

In the field of motor learning, closed-loop theories have been argued extensively (e.g., Adams, 1971; Schmidt, 1975). Closed-loop learning processes are error-sensitive and error-corrective. The responsiveness of goal-directed behavior to errors, that is, deviations from the goal, is known from everyday experience. In sports-training, videotape replay is broadly employed to demonstrate to the performers the errors in their performance (Newell & Walter, 1981). The principle is also universally found in operant conditioning, if reinforcement and non-reinforcement are conceived informationally, as signals for correct and incorrect performance, respectively. No further detailed evidence needs to be adduced for the domain of skill learning.

Again, in regard to language acquisition, the nativist emphasis of the last decades raised doubts or even denied the presence and the effectiveness of both positive and negative feedback. Since negative feedback was in many conceptualizations either a necessary condition or, at least, a very conducive condition for language learning, this denial of the existence and effectiveness of feedback was a welcome basis for the denial of learning processes generally. Again, the controversy cannot be explored in detail. Brief summaries of the resolution have been provided by Moerk (1986) and by Rondal (1985). Moerk (1983a, 1983b, 1991), Hirsh-Pasek, Treiman, and Schneiderman (1984), Demetras, Post, and Snow (1986) and Penner (1987) have provided some of the pertinent factual evidence. A more extensive discussion of the older evidence is also contained in Moerk (1977). These studies show that positive and negative feedback to the child's language performance can be found with considerable frequency. Both types of feedback have impressive immediate (Slobin, 1988) and delayed (Ruke-Dravina, 1977) effects in improving the child's language behavior. Caretakers provide this feedback by
imitating, improving, and expanding the child's utterances, and they thereby present a 'corrected audio-replay' of the child's performance.

**Skills are acquired gradually and the performance is improved iteratively**

It would appear that the evidence for gradual skills acquisition and refinement, whether applying to relatively simple skills or to outstanding performances in sports or the arts, is so obvious that no substantiation is required. Yet, since long-term studies of skill acquisition are relatively sparse in the literature, the report of Grossman (1959) might prove impressive: In an industrial study, he found that, even with the comparatively simple skills of cigar making, improvement continued after 3 million trials and two years of practice.

Again, in the field of first language acquisition, controversies were predominant during the recent decades. In attempts to support nativist emphases, a miraculously fast acquisition of language was emphasized (McNeill, 1970). McNeill and many of Chomsky's followers suggested that, at the age of four, children had more or less completed their language acquisition process. This conclusion certainly could have been shown immediately to be incorrect by every elementary school teacher. Nevertheless, this assertion was maintained for a considerable period of time in spite of the early report by C. Chomsky (1969) that progress in the mastery of language rules proceeded at least into the teens. Nelson (1977) too has recently shown that it proceeds throughout the second decade of life. Anybody familiar with higher levels of verbal skills, as shown in literary productions, will know that it proceeds much longer. Life-span intelligence testing (Horn, 1982) would suggest that it possibly never ends as long as the person maintains his/her intellectual capacities.

The iterative levels of language development have been described concisely by Nelson (1977). Besides the stepwise progress from the one-word stage to the two- and more-word stages, followed by the gradual integration of bound morphemes, such levels exist later too. Up to the age of 4 years, children generally form only simple sentences. After a transitional stage with some embedding between 4 and 6 years, most transformations are acquired between 6 and 10 years. Advanced skills appear even later. An iterative process that proceeds very gradually from lower to higher levels is found in language acquisition as well as in the acquisition of other complex skills.

**Repeated trials and frequency of trials are important in skill acquisition**

This topic has been partially covered in the preceding section since gradualness necessarily entails repetitions. The old adage "practice makes perfect" has been confirmed by extensive research in skill learning. Holding's (1965) summary of the pertinent findings is still valid today. Grossman's (1959) findings
as to improvements after millions of trials pertains centrally to practice and its intensity. Everyday experience also provides abundant and overwhelming evidence. It takes years and many thousands of trials and hours of exercise to acquire a complex skill, whether this is competition skiing or the playing of violin concertos. The evidence in the field of motor skill learning, therefore, can be considered as conclusive.

In the field of language acquisition, controversies that prevailed during the last decades are gradually resolved through a new emphasis upon data, as contrasted to preconceptions. First there are the early word counts of Bell (1903) and Brandenburg and Brandenburg (1919), exhumed by Moerk (1986), reporting that their children employed around 15,000 words per day. The recent report of Moerk (1983b) complements this emphasis on intensity of training. He estimated that several millions of informative linguistic items are entailed in maternal input per year. Wagner (1985) reports between 11,700 and 37,700 utterances per day produced by preschool children. Similar evidence is contained in most of the existing transcripts of mother-child interactions. If these transcripts contain several hundred filial utterances per hour and generally even more maternal ones, an even cautious extrapolation would arrive at thousands of utterances per day. Add to this that most utterances entail several words, in addition to bound morphemes and other grammatical rules, and one arrives easily at tens to hundreds of thousands of linguistic rehearsals during one day only. And this proceeds over five, ten, or even twenty years before a high level of mastery is attained -- as the flawed compositions of our college students prove only too clearly.

The positive effects of input frequency upon acquisition have been demonstrated by Moerk (1980) based upon Roger Brown's (1973) data. Forner (1979) selected somewhat different data from Brown's study and found very similar evidence for frequency effects. Rondal (1985) summarized a wider range of pertinent findings. From a minimal level, Snow and Goldfield (1983) have shown that repetition of a model, that is, a performance frequency of at least 1, leads to better retention over longer intervals than non-repetition. Moerk (1986) has provided evidence that massed initial rehearsals of a new linguistic item lead to retention. Minimal rehearsal, as contrasted to massed rehearsal, considerably decreases the probability that the item will be retained over a longer period (Moerk, 1991).

The effects of rehearsal have, of course, been explored in memory research for over a hundred years. Kleinman (1983) and Sage (1984) provided concise and excellent summaries of the pertinent research. They differentiated carefully results pertaining to performance during the training from those pertaining to learning as ascertained after an interval. The preponderant finding is that spacing is superior for immediate performance (Dunham, 1976) but that minimal differences between massing and spacing are found in respect to learning. Estes (1978) even argued
that a certain degree of massing is advantageous in initial learning since it is conducive to the acquisition and permanent storage of items.

The pertinent evidence can be taken as established in the fields of motor skill acquisition and for most types of learning generally. It is increasingly being shown to apply to language acquisition. But finer distinctions need to be made: In many motor-skill training tasks, from which the advantage of spacing is reported (Dunham, 1976), the intervals between trials were measured in seconds and large numbers of trials were massed in such a densely presented manner. Also, in experimental massing the repetitions are generally identical and quite often they are not meaningfully tied to everyday concerns.

In contrast in naturalistic skill acquisition, the trainee is in control and can stop when he/she desires. He/she is strongly motivated through extraneous factors to acquire the skill, and will either spontaneously try minor variations in his performance, or environmental contingencies, such as a changing slope when learning to ski, will force him/her to make those variations. These naturalistic conditions apply, obviously, in the case of first language acquisition. The problem of massing within sessions and therewith of fatigue and boredom is alleviated or eliminated since the children are in control and most of the observed massing is based upon the initiative of the children. They would end the episode if they were fatigued or bored. Intervals between trials are not within the range of a few seconds, but at least in the range of tens of seconds and they soon extend to one or more minutes. These intervals again are flexibly controlled by the children. The number of "massed" repetitions before the first longer spaced interval is more in the range of three to at most ten rehearsals. This is much lower than in the typical motor training laboratory research. Finally, in conversations between children and their caregivers, the newly introduced item is generally repeated with changes, e.g., included in diverse sentence frames, and it is reemployed "functionally," that is, for practical purposes. These indications as to differences between experimental and naturalistic conditions probably provide the solution to the controversy of whether spacing or massing is preferable.

Under these conditions, a certain degree of massing will counteract forgetting (Estes, 1978) and will strengthen the memory trace leading to the long-term retention of the newly acquired items. Anderson (1980) argued similarly from the point of view of cognitive skill acquisition that the delay between feedback and the utilization of the feedback in the next trial must not be too long so as to assure that the feedback is still in active memory. This argument too implies relative massing of trials that are interspersed with feedback. Even with well established skills, a warm-up period has mostly been found to have positive effects (Simon, 1979). Warm-up is one form of massing since it helps to bridge the interval between trials. It would appear from these comparisons that also in these last respects, the homologies between skill acquisition generally and language acquisition specifically are quite convincing.
Skills are employed "functionally"

As the preceding paragraphs have argued, much motivation for skill acquisition and massing of training comes from the extraneous motivation the learner has. With this argument, the discussion, obviously, has returned to the point summarized in section one of this essay. Both language and other skills are employed as "operants", "functionally," or "pragmatically." Since in any complex situation the individual can not rely upon "emitted behaviors" to reach his/her goals, the skills have to be learned or "shaped" over many trials (depending upon the complexity of the skill). If what the behaviorists labeled "reinforcement" is reconsidered as "informational feedback" or "knowledge of results," then the underlying homologies are obvious in spite of many terminological differences.

THE IMPLICATIONS FOR SOCIAL PROBLEMS AND SOCIAL PRACTICES

A lengthy treatise would be required to elaborate fully all the implications of the above theoretical considerations for the common social problem of language delay/language disturbance and the practices to solve it. As is well known, the number of children with language delay and other language problems is large indeed. Estimates range widely, depending upon definition and the ages considered. For serious language disturbance, requiring speech therapy, the minimal estimates are .5 percent of the population. Including language delay in early childhood, the estimates rise up to 15 percent. When these problems of oral language are gradually overcome during the elementary school years, problems in the mastery of literacy arise. Crystal (1987) estimates that 2 to 3 percent of school children experience more serious problems with literacy. In some populations these percentages are probably a good deal higher.

These two kinds of problems, however, are not unrelated. As Scarborough (1990) summarized recently, oral language deficiencies often precede problems of literacy and they seem to be a causal factor in its development. In addition to problems children experience in their native language, those that arise from migration of people of all ages have to be considered. Such migrations often require the rather quick acquisition of a foreign language. Entire subgroups of the U.S. population have difficulties in handling this task, which then produce secondary difficulties, either in acquiring literacy or job skills and in obtaining jobs with growth potential.

Well-established and proven methods to train language skills at diverse ages and with persons of diverse backgrounds would therefore be an important social resource. Humankind, at least since the time of the Romans and probably much earlier, has striven to achieve efficiency in language training. Therefore both the need and the awareness of the need are established. The scientific response to this situation, however, has not been very satisfactory. Until recently, the task largely
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has been left to the practitioner while scientists engaged in rather unnecessary theoretical controversies. Consequently, it seems that neither the behavioristic nor the rationalistic method are fit optimally to provide the basis for such training. In order to train a skill, both the structure of the skill and the way (or ways) it is compiled from sub-skills in the course of learning have to be well-described. And, of course, effective learning procedures that are closely fit to the contents to be taught and learned must be identified.

After an originally enthusiastic reception of Chomsky's work in the educational community, soon doubts began to be raised as to the value of this system for practical applications. Lamendella (1969) considered transformational grammar irrelevant for second language training. McLaughlin (1978) quite closely agreed with this judgment. More generally, including first-language acquisition, Deutsch (1981) emphasized that questions as to "the processes and mechanisms that are underlying children's progress... seem to have been neglected within the framework of Chomsky's ideas" (p. 3). Since such mechanisms are most central for teaching and learning, he concluded that we have to go "beyond those [questions] generated or stimulated by Chomsky's ideas" (p. 3). Craig (1983) agrees with this judgment that transformational theory has had little impact on the procedures used by clinicians to facilitate language growth. In accordance with this trend, which began almost immediately after the publication of Chomsky's (1965) "classic" (cf. Lamendalla, 1969), recent books in language training, whether a first or a second one, show minimal traces of Chomsky's theories. Even more, some of the most recent reports on 'Strategies for First Language Teaching' (Nelson, 1989) and on 'Teachability and Second Language Acquisition' (Wong Fillmore, 1989) refer to Chomsky and his system only in a quite disparaging manner. Nelson, e.g., remarks "that their [the transformationalists'] assumptions about language-specific, biologically given mechanisms and the limited impact of input variations within a language rests upon rhetoric and repeated restatement of similar claims rather than upon any plausible pattern of data" (p. 297). From reading the claims of these nativist authors, declaring that all children acquire the same level of language skills independent of input, it is quite obvious that they had never heard about the facts of language delay, language handicap, and social class differences in language skills. An omission of factual evidence indeed.

But the problem with Chomsky's approach is more systematic and not only due to a neglect of empirical studies. The more Chomsky stresses 'competence' and neglects 'performance,' the more he promotes an agnostic approach to language training and learning. And the more he stresses a 'language organ' (Caplan & Chomsky, 1980), that is, neural centers as the main causal factors in language mastery, the more he implies a defeatist stance in regard to remedial language facilitation.

On the other side, the instrumental utility of a behavioral approach is well-known in all theoretical camps. Lovaas's work (Lovaas, 1977) with autistic
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children is of long-standing duration and recent reports indicate an astonishing degree of effectiveness. One of the most consistent approaches is Baer's, who trained an entire school of language trainers. Extensive work, still being performed at the University of Kansas, is direct evidence for it. But it has also been transplanted to other situations, such as in the innovative studies of Warren and Anne Rogers-Warren, recently publishing as Anne Kaiser, (Warren & Kaiser, 1986a, 1986b; Warren, Rogers-Warren, Baer, & Guess, 1980). Relatively autonomously, Whitehurst and his students (Whitehurst, et al., 1988; Whitehurst & Valdez-Mecach, 1988) have produced a steady flow of reports of successful language interventions that are based upon behavioral principles. To enumerate all the pertinent work, an entire book would not suffice. Fey (1986) has provided a quite comprehensive survey of the literature up to the early 80s.

Nevertheless, the situation is not as clear-cut as the above remarks might make it appear; as if linguistic approaches were fully insufficient and the behavioral approach were fully successful. As argued above, topographically new behaviors have to be acquired in the case of language learning and emitted behaviors cannot account for the new structures. All the behavioral approaches rely, therefore, much on modeling and imitation. Additionally, the school of Baer and associates has also placed much emphasis upon generalization of behaviors learned through imitation (Warren & Kaiser, 1986b; Warren et al., 1980), its repeated non-occurrence, and the need for specific training to attain it. However, modeling and imitation are principles foreign both to the classical and instrumental conditioning paradigm and they have not yet been convincingly integrated into a behavioral approach (cf. Kymisis & Poulson, 1990). The classical behavioral approach does, admittedly, have the concepts of stimulus- and response-generalization, but it is highly questionable whether flexible language performance is based upon the same principles as those simple forms of generalizations. An identical label might easily hide profound process differences in these two domains.

Bandura's (1986) conceptualizations of learning through modeling and his description of 'abstract modeling' appear to come closer to capturing the processes involved. But, as is known, Bandura (1986) chose for his book the subtitle 'A social cognitive theory.' 'Abstract modeling' is very close to rule learning or at least pattern learning. Pattern learning is one aspect of perceptual learning in the vein of Gibson (1979). It appears, therefore, that the behavioral approach, in relying on imitation and generalization to establish new topographies of behavior, employs principles that are quite remote from its basic postulates. This, in turn, would suggest that the practitioners of the behavioral approach themselves have realized that it is not sufficient for effective language intervention.

The rather neglected skill-learning approach is fully focused upon training and learning. It combines an interest in the product that has to be acquired with that in the steps that lead to its acquisition. It might therefore prove helpful for the solution of this social issue. Anderson (1982), in developing a skill-learning model,
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matched the input to his computer model with that of his son and found comparable outcomes in the performances of both. Since the learning procedures had to be specified in great detail in the computer model, no recourse to mysterious innate capacities was needed. Additionally, since the input to both systems as well as their output had to be described in great empirical detail, the topography of the learned verbal output could be carefully related to the topography of the input information.

Unsystematic influences of the skill-learning approach are already found in training and remedial programs (e.g. Brainerd & Pressley, 1982; Winitz, 1983). 'Processes' and 'task analysis' are emphasized in these edited volumes. Data-based training as well as accountability for outcomes, i.e., feedback, is stressed. Thoroughly empirical and fully outcome-oriented approaches in behavioral language training force the therapist carefully to specify the target behaviors (Hegde, 1986) and to redefine them if the outcome does not accord with the expectations (Guess & Baer, 1973). These approaches come close to the skill-training principles discussed earlier. Warren and Kaiser (1986), by focusing on 'incidental language teaching,' approximate the master-apprentice relationship of real life skill training and learning from a behavioristic perspective. Anzai and Simon (1979), by exploring 'learning by doing,' stress something similar from a cognitive perspective, although focusing on the learning side. Nevertheless, it appears that there exists no single study -- including the writer's previous approximations (Moerk, 1986, 1991) -- that fully incorporates the rich experience of skill training with the task and principles of language training. Such an integration would prove more helpful in solving the far-reaching social problems of language deficit than an insistence upon terminological differences and paradigmatic conflicts as they were described above.

CONCLUSION

When Skinner (1957) asserted that speech and writing were forms of behavior, he certainly was correct. And when Chomsky (1959) responded that this behavior was 'rule-governed,' he too captured an important phenomenon because all complex behavior can be DESCRIBED through 'rules.' It could easily be asserted that even in simple cases of conditioning there exists evidence of rule governed behavior: When a signal is presented (the "stimulus"), the subject has learned that it has to produce a specific behavior (the "response") in order to obtain a result (the "positive or negative reinforcement"). A strong case for 'rule-governed behavior,' always within the verbal repertoire of the Chomskyan linguist, could be made when considering studies employing intermittent reinforcement: The subjects respond for prolonged periods -- and often even more intensively -- without reinforcement because they have acquired the expectation of reinforcement based upon the abstraction of the above-stated 'rule,' that is, the contingency pattern. In a similar manner, college students often produce response patterns over long periods of time
that are not in accord with the prevailing reinforcement contingencies because they have formulated a rule and test it.

Careful consideration indicates that the term 'rule' has been used in the above paragraph and in most of the literature with widely differing meanings. The two uses in the first sentences are simply labels for unknown and unexplored processes. In conditioning, the abstraction of the temporal contingencies of the if-then variety, as seen by the experimenter, could be represented as a descriptive rule; whether it is prescriptive for the subject cannot be decided until further evidence is established. The last type of 'rule,' as used and described verbally by the college student if he is asked, is a prescriptive rule and only it 'governs,' or 'controls' in Skinner's terminology, the behavior.

When Chomsky transcended the distributional analysis of behavioristic linguistics, proceeded to transformational analysis, and emphasized the "generativity of language" he was correct too since all skills are "generative" in adapting to changing circumstances. Skinner could have told him so had he focused more closely upon the structure of the specific responses produced by his subjects. As Skinner and the behaviorists have shown -- admittedly often in oversimplified animal experiments -- and as Chomsky certainly knows and demonstrates with every one of his utterances, those rule-governed behaviors are not performed randomly in time and space, but they are tied to specific ecological and psychological variables, that is, they are stimulus-dependent and "functional."

The task of science is to try to describe this complex set of regularities in an optimal and exhaustive manner. It will have to specify WHEN speech is produced, that is, specify the stimulus conditions. Then it will have to ascertain WHAT speech is produced, that is, specify the content of the response. Those two questions have recently been the focus of research in the subfield labeled pragmatics or pragmalinguistics. Finally, science will have to elucidate the HOW of speech, that is, the structure or style of the response, or the structure of the skilled behavior, in more general terms. This was the focus of syntactically oriented linguistics and of stylistics. Even in this last case, the insight is growing that the form of an utterance might be the result of diverse processes: it could be a simple rote formula, or it could be constructed by following linguistic prescriptions. It appears difficult to find any rational criterion to argue which of these approaches might be more important or which one should be studied to the exclusion of the others.

Certainly, different domains will have to be focused upon in the attempt to specify these various regularities. Diversity in domain might also entail diversity in methods. One important difference is comprised in the types of skilled and rule-governed behavior focused upon under the diverse paradigms. It appears that in Skinner's studies of relatively simple animal behaviors, the gap between the basically innate and largely species-specific "emitted behaviors" and the final responses, transformed through shaping, is relatively small. Skinner and his
followers, when focusing upon simple behaviors, can, therefore, more easily afford to be "closet-nativists." In verbal behavior, an enormous gap exists between the primitive "emitted behaviors" of crying and cooing including the earliest stages of babbling (since it is known that babbling in the later stages is already influenced by the sound patterns of the infant's mother-tongue) and the final advanced verbal utterances. Anybody concerned with language development, and that should include Chomskyan linguists, will have to focus, therefore, much more intensively upon the learning processes and the environmental variables influencing them. This is an absolute prerequisite for the scientific explanation of this enormous change from "emitted behavior," that is innate structures, to the behavior that is a result of decade-long shaping.

A combination of the tool sets provided by the two competing paradigms might be conducive to achieve these tasks. The linguist can contribute refined descriptive tools with which to capture the exact features of the skill-structure reflected in verbal behavior. The behavioristic and social learning psychologist can contribute the analytical tools to explore the environmental influences that result in the manifold transformations from the primitive, but fully functional, cry of the newborn to the advanced and complex structures reflected in the verbal behavior of the adult. Once the many homologies between both approaches are recognized, the representatives of the two schools might be less hesitant to utilize the contributions that can be derived from the seemingly antagonistic paradigms. This integration of the two tool sets has already been performed in part in the field of skill transmission and acquisition. Research on language transmission and acquisition, pertaining to both theoretical and applied aspects, might profit extensively from becoming familiar with the descriptive and explanatory tools offered by both paradigms. The present brief essay intended to raise and highlight these issues, though it could obviously not aspire to settle them.

REFERENCES


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