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ISAAC in Chains: The Future of Communication Systems

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The current state of research into augmentative and alternative communication systems is reviewed, and various problems identified in the light of a model of communication which integrates the main variables. Four dimensions are defined, and used to characterize different approaches to handicap: structural, developmental, pragmatic, and technological. Certain limitations in recent research procedures are summarized, and the need for standardized guidelines is emphasized. A recommendation is made concerning the importance of case studies. Recent work in the field of vocabulary is cited as an illustration.

The chains, of course, are of our own devising—the inevitable constraints of our individual training and intellectual background, never more apparent than at an international, interdisciplinary conference, where the juxtaposition of multiple viewpoints in parallel sessions forces half-hourly crises of identity. A plenary session provides an opportunity to forget about discipline boundaries for a while, and to develop a shared awareness of the nature of our enterprise. In the present case, where the conference program provides such a remarkable range of empirical, experience-based studies from classroom and clinic, using a considerable variety of methods and approaches, the need for a sense of perspective is critical. All of us need to see the wood of which we are a part, as we plant and nurture our individual trees.

In developing such a perspective, it is essential to aim for an initial comprehensiveness of statement about the nature of communicative handicap, to which every conference participant would find it possible to relate. Such a statement can be achieved only by recognizing the multidimensional nature of the enquiry. Four dimensions appear to be central.

I The Adult Language

The structural properties of the adult language—spoken, written, or signed—define what is a theoretically maximal level of achievement for handicapped people. The progress of individuals towards this goal of course varies enormously, and individual circum-stances may promote the development of communicative systems using principles which are not those of the adult language; but ultimately it is necessary to interpret and measure individual levels of achievement by relating them to the adult norms of the community to which the handicapped person belongs. These properties provide a common *terminus ad quem* for all who are learning to communicate, regardless of handicap or teaching method; and they are inevitably and intuitively recognized by all investigators (even though there may be considerable variation in the investigators' ability to state explicitly and exactly what it is that they know). Figure 1 identifies the main components of language structure, as commonly represented (see further, Crystal, 1984).

II Development

The order of emergence of linguistic features in normal children provides a developmental yardstick which it is also impossible to ignore. Some notion of normal development is inevitably present in the minds of investigators—even though, again, the ability of individuals to make explicit statements about these norms varies greatly. Recognizing stages of development in sounds, grammar, vocabulary, and language use constitutes a well-established procedure for which there are numerous precedents in such fields as pediatric medicine and developmental psychology.

The ultimate aim is to provide a model of language acquisition which will define levels of complexity, and thus provide the most facilitating learning environment for handicapped people. At present, however, no satisfactory theory of linguistic complexity exists, notwithstanding the many attempts of psycholinguists to de-

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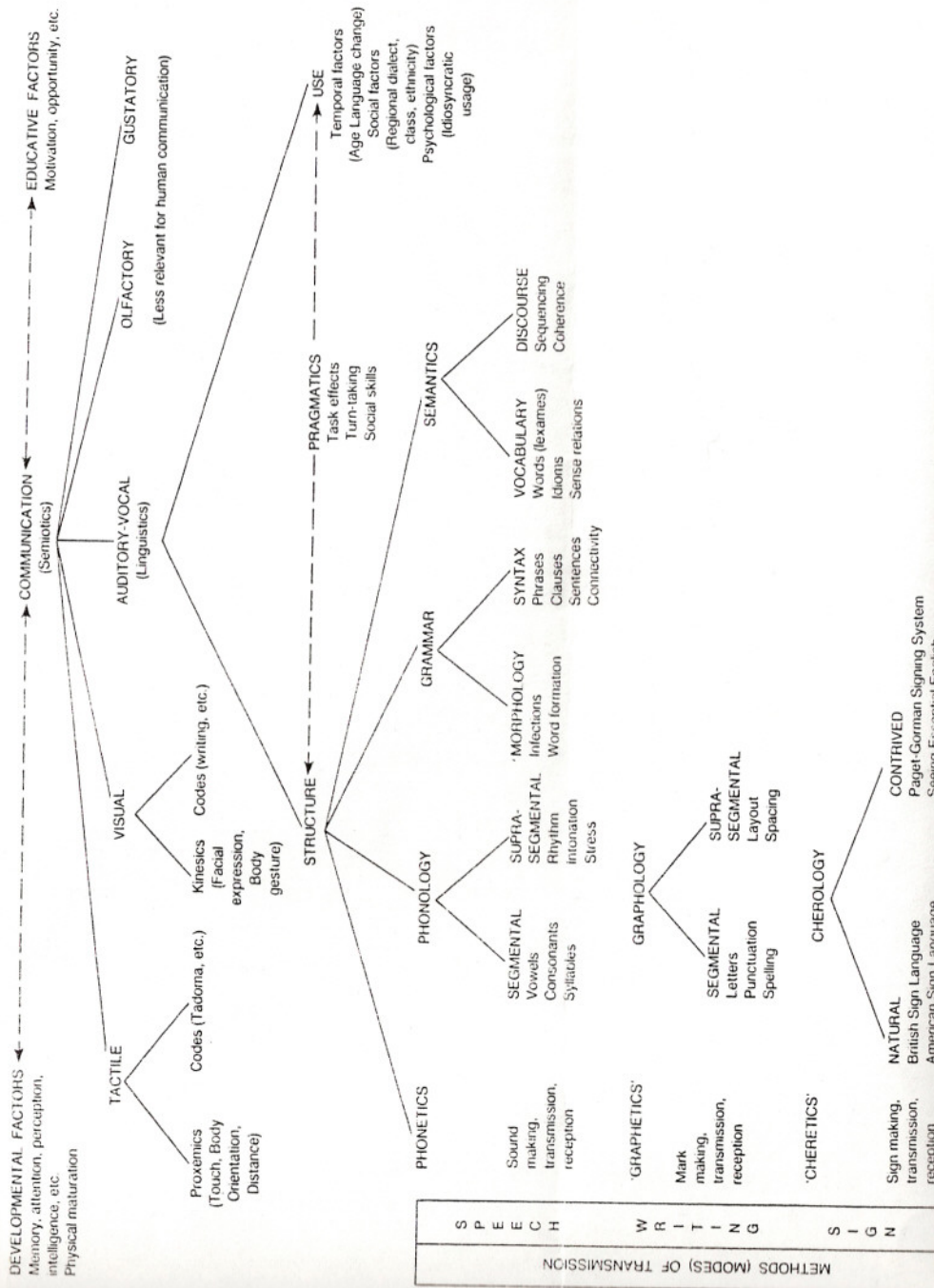
Figure 1. A model of human communication, emphasizing the structural properties of language. (Subdivisions within each category are illustrative only.)

velop one. There are too many factors whose role is still unclear—motivation being perhaps the least understood—and thus powerful developmental theories are lacking. It is possible to establish orders of emergence—though it must be appreciated that these do not always lead to explanations of development (having shown that one type of sentence precedes another in all children, we are still left with the question 'why?'). But even without an explanatory role, language acquisition studies are of considerable value, in that they can provide descriptive statements of great generality which can be used to prompt and guide techniques of assessment and intervention.

III Interaction

Until recently, it was felt that data from the handicapped person alone would suffice as evidence of the linguistic condition. If at the same time data were obtained about that person's interlocutor—a parent, sibling, teacher, clinician . . .—such information was felt to be an "optional extra." Today, the crucial role of interaction (often referred to as the "pragmatic" role) provides a third essential dimension for the investigation of communicative handicap. The study of (typically) adult-child interaction is more than an optional aspect of the enquiry: it is—or should be—a *sine qua non* of the whole enterprise, because it is a defining feature of the condition. To establish that a person is communicatively handicapped, it is first necessary to talk, write, or sign to that person, and see what kind of response is given. Without the dimension of interaction, there is no way of knowing whether a handicap is there or not. And without anticipating the effects of our intervention, it is not possible to determine the nature of the handicapped person's achievement. If we communicate in too difficult a way, we overestimate ability, and hinder a possible response. If someone fails to respond to what we have said, there are always two possible explanations: the inadequacy may be in them, or it may be in us.

IV Technology

In many contexts, the above three dimensions would suffice as a framework within which to integrate linguistic research. But in the context of the present conference, a fourth dimension is obligatory, for reasons that it would be otiose to give in present company. It is sufficient to state the obvious, that technological developments have come to define a set of communicative possibilities whose properties are independent of the three frames of reference discussed above. It has now become part of the professional appraisal of the handicapped person's situation, and a dominant constraint on techniques of intervention.

Dimensions and Theoretical Perspectives

These four dimensions—in summary terms, the structural, developmental, pragmatic, and technological—are obligatory elements in any approach to the diagnosis, assessment, or treatment of communicative

handicap. They do not provide an explanation of a handicap, in the sense of a diagnosis or treatment rationale, but simply provide the terms of reference for any description of a communicative situation involving handicapped people. It is, however, possible to use each of these dimensions as a means of generating different theoretical accounts of communicative handicap and intervention. Four main theories are suggested, accordingly.

1. A *structural* definition of handicap would focus on the relative ability of individuals to learn the sounds (letters/sign elements), grammatical constructions, and vocabulary of the linguistic system of their community, both in production and in comprehension; this is the traditional approach, dealing in such notions as "word order error" and "mispronunciation."

2. A *developmental* definition of handicap would relate the level of achievement of individuals to norms of language acquisition within the community (this to include the whole range from childhood to senescence); it would generate such notions as "delay" and "deviant development."

3. A *pragmatic* definition of handicap would focus on the relative ability of individuals to use linguistic features in various communicative settings (home, school, playground . . .), with a range of social functions (humor, solidarity, curiosity . . .); it would generate such notions as "communicative intention" and "carry-over."

4. A *technological* definition of handicap would focus on the relative ability of individuals to make use of specific kinds of technical aid in developing their communicative skills; it would generate such notions as "aid suitability" and "individual needs."

Application to AAC

There are enormous differences between these four theoretical perspectives, and treatment rationales differ accordingly. If an integrated theory of communicative development is ever to be devised, therefore, it is essential that proponents of each approach agree in broad terms about the way in which research should proceed. Without some common premises, it will never be possible to compare the results of different methods of intervention. But as I look at the field of augmentative and alternative communication (AAC)—very much as an outsider, but with sympathetic and constructive intent—I am struck by the way that some of the most fundamental premises of research procedure seem not to be routinely adhered to. For example, Udwin (in press) has carried out an analysis of 133 recent *AAC* studies. Comparisons were made in terms of the use of control groups, the provision of baseline data (concerning diagnosis, age, IQ, and level of language/communicative ability), outcome data, data presentation, description of training sessions, and reliability data. It was found, *inter alia*, that only 50% of the studies gave adequate outcome data; only 53% gave an adequate description of the training sessions; and, most remarkable of all, only 11% gave an adequate description of the handicapped sample's language status at the out-

set of the research. In the absence of such data, of course, it is impossible to make any real comparisons, or to approach the kind of replicability which is essential for progress in any field. An important role for ISAAC could well be to devise a set of guidelines for the writing of reports in this field which could be followed by researchers. There is nothing unusual in the provision of such guidelines: they are often encountered in other scientific domains (such as medicine).

This reference to medical science prompts discussion of a second point which needs to be recognized if a successful future of this field is to be assured. The early history of medicine displays a reliance on the meticulous analysis of individual cases, and in the course of time a vast amount of patient-oriented data was accumulated. The confident generalizations and recommendations of contemporary medical practice are founded on these case studies, and case studies do seem to have a pivotal role to play in the early years of a behavioral science. How could diagnoses and treatment regimes have developed to their current level without the meticulous descriptions of early practitioners? Certainly, several other fields have seen the importance of this way of proceeding, and have developed case study traditions accordingly (a recent example would be the neuropsychological approach to adult neurological disorders such as deep dyslexia and surface dyslexia; cf. Coltheart, Patterson, & Marshall, 1980).

The contrast with the present conference is striking, where there are many papers propounding models, and hardly any papers devoted to case studies. If this is representative, it does not augur well. I do not see how the field can progress without a core of descriptive studies to which its practitioners can routinely refer. It is not essential, of course, that these case studies be of *all* aspects of a handicapped person's linguistic, medical, psychological, social, and educational condition. It is perfectly proper for a single aspect to be selected for investigation—a particular structural, developmental, pragmatic, or technological property. The critical point is that whatever is selected is described meticulously, with sufficient background to enable comparisons to be made. And it is here where, once again, there is the need for standardized guidance, from a body such as ISAAC. I very much hope that the discussions taking place concerning ways of promoting an electronic data base to comprise information about communicative handicap will be fruitful. Any kind of "archive" would be invaluable, as it would help to identify gaps in coverage, and help to prevent duplication of effort—the perpetual rediscovery of the wheel, as researchers around the world randomly, but inevitably, repeat each other's investigations. There are now several precedents for this kind of enterprise in language, such as the CHILDES project in language acquisition studies (MacWhinney & Snow, 1985), or the lexical data bases currently being accumulated by several dictionary firms, or the kind of data base which has led to the world of computer diagnosis in medicine. The problems in clinical work are not to be underestimated, of course—not least, the problem of confidentiality, and the difficulties posed by the multidimensional nature of language—but they are not insuperable, if approached in a centralized, international, interdisciplinary way.

Certainly, it is only by enlisting the enormous technological power of our field that the problems which currently most hinder progress can be resolved. I refer here to vocabulary, which presents us all with an order of complexity which has no equal in grammar, pragmatics, or phonology, simply arising out of the number of items involved. Whereas in phonology we are dealing with tens of items, and in pragmatics with perhaps a hundred or so commonly occurring functional contexts, and in grammar with perhaps a thousand aspects of construction, in the field of vocabulary we are faced with a data base which needs to be able to cope with tens of thousands of items. There has in recent years been a regrettable tendency to underestimate the size of this problem—literally reflected in the gross underestimates which are routinely made about the size of a child or adult's vocabulary. We can see this most clearly in child language studies, where it is only recently that a proper data base has begun to be constructed, using appropriate recording techniques. For example, in a series of German studies reported last year (Wagner, 1985), radio microphones attached to children for the whole of their waking day recorded levels of vocabulary use far in excess of previous estimates. Table 1 shows the word tokens and word types for a group of these children during a single day's recording (taken from Crystal 1986, based on Wagner). How many other words are used by these children is anybody's guess,

TABLE 1: Word Token and Word Types Used in One Day's Recording by 10 Children[a]

	Total Number of Words (i.e., tokens)	Number of Different Words (i.e., types)
Katrin, 1 year 5 months	13,800	1,860
Nicole, 1 year 8 months	11,700	Not available
Andreas, 2 years 1 month	20,200	2,210
Carsten, 3 years 6 months	37,700	4,790
Gabi, 5 years 4 months	30,600	2,490
Frederik, 8 years 7 months	24,700	3,960
Roman, 9 years 2 months	24,400	3,630
Markus, 11 years 4 months	37,200	5,020
Christiane, 12 years 2 months	22,600	3,580
Axel, 14 years 10 months	22,900	3,040

[a] From Crystal (1986, p. 18) based on Wagner (1985).

but these figures certainly present in a particularly dramatic manner the gap between most people's expectations here and the reality. They also demonstrate the enormous gap between the vocabulary levels of normal children and those of many of the handicapped population.

Similarly, studies of the emerging lexicon in young children have begun to show that many of the early claims about the order of lexical acquisition have been premature. It is not possible to show much similarity between the order of emergence of words across children. Children who live by the seaside are likely to have more "sea" words in their lexicon; children who live on farms are likely to have more "farm" words. And even the "obvious" everyday vocabulary (such as "mummy" and "cup") shows considerable variability. Table 2 shows the first 50 words of three children (from Crystal, 1986, adapted from Stoel-Gammon & Cooper, 1984): there are only eight items in common.

I would thus be extremely cautious in accepting the claims of any proponent of a communication system who stated categorically that the vocabulary selection was based on developmental norms. There are as yet *no* developmental norms, at the level of individual items. That is the bad news. The good news, however, is that several important trends have been recognized as far as the emergence of semantic fields is concerned (see the summary in Crystal, 1981), and it is here that there is, in my view, considerable scope for *AAC* application. The notion of semantic field is likely to be of great fruitfulness when its potential is explored, both for guiding the selection and presentation of vocabulary in teaching situations, and for suggesting better methods of lexical organization and access on communication boards and other devices. We know from semantic theory that it is not the size of vocabulary which is critical, but the way it is organized into fields, through the use of sense relations. Two people may have exactly the same number of words, but one person may be much better at relating these words than the other, and thus at imposing a semantic structure on the environment. The need to tabulate vocabulary growth is extremely important, in terms of both production and comprehension, and is likely to provide the most complex (certainly the most time-consuming) aspect of any case study. But of far greater importance than large-scale and long-term lexical inventories is a close study of single areas of the lexicon, to establish the sense relations between words, and to determine the kinds of relationship which exist between semantic and cognitive development.

The field of vocabulary is truly vast, but it can be brought under control, through such notions as semantic field and sense relation, and thus made amenable to case study treatment and group studies. The study of the adult semantic system is sufficiently well advanced to provide more than enough guidelines about how to proceed. The technology can certainly cope with the kind of numbers and structural organization involved. What is lacking are the details of how individual handicapped children and adults produce and com-

TABLE 2: The First 50 Words of Three Children*

	Daniel		Saran		Will
1	light	1	baby	1	uh-oh
2	uh-oh	2	mommy	2	alldone
3	what's that	3	doggie	3	light
4	wow	4	juice	4	down
5	banana	5	bye-bye	5	shoes
6	kitty	6	daddy	6	baby
7	baby	7	milk	7	don't throw
8	moo	8	cracker	8	moo
9	quack (quack)	9	done	9	bite
10	cookie	10	ball	10	three
11	nice	11	shoe	11	hi
12	rock (NOUN)	12	teddy	12	cheese
13	clock	13	book	13	up
14	sock	14	kitty	14	quack-quack
15	woof-woof	15	hi	15	oink-oink
16	daddy	16	Alex	16	coat
17	bubble	17	no (no)	17	beep-beep
18	hi	18	door	18	keys
19	shoe	19	doily	19	cycle
20	up	20	what's that	20	mama
21	bye-bye	21	cheese	21	daddy
22	bottle	22	oh wow	22	siren sound
23	no	23	oh	23	grrr
24	rocky (VERB)	24	button	24	more
25	eye	25	eye	25	off
26	nose	26	apple	26	tick tock
27	fire	27	nose	27	ball
28	hot	28	bird	28	go
29	yogurt	29	alldone	29	bump
30	pee-pee	30	orange	30	pop-pop (*fire*)
31	juice	31	bottle	31	out
32	ball	32	coat	32	heehaw
33	whack (whack)	33	hot	33	eat
34	frog	34	bib	34	neigh-neigh
35	hello	35	hat	35	meow
36	yuk	36	more	36	sit
37	apple	37	ear	37	woof-woof
38	Big Bird	38	night-night	38	ban-ban
39	walk	39	paper	39	hoo-hoo (*owl*)
40	Ernie	40	toast	40	bee
41	horse	41	O'Toole	41	tree
42	more	42	bath	42	mimi (*ferry*)
43	mommy	43	down	43	s: (*snake*)
44	bunny	44	duck	44	ooh-ooh (*monkey*)
45	my	45	leaf	45	yack-yack (*people talking*)
46	nut	46	cookie	46	hohoho (*Santa*)
47	orange	47	lake	47	bye-bye
48	block	48	car	48	doll
49	night-night	49	rock	49	kite
50	milk	50	box	50	Muriel

* From Crystal (1986, p. 95) based on Stoel-Gammon and Cooper (1984).

prehend vocabulary, at different stages of development and in different interactive situations. Now is the time to discuss ways of standardizing the approach, to provide a sense of common direction for the many teachers and scholars working in this field. It is my hope that ISAAC will be able to stimulate growth in this and related areas, thus providing the subject of alternative and augmentative communication with the empirical foundation it sorely needs.

Acknowledgment

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