

DISCUSSION-PANEL II, FRIDAY AFTERNOON

*OSWALD (to KING):* I'd like to start the ball rolling by asking Mr. King what kind of language program he thinks it would take to make this computer work.

*KING:* You mean, how do we get the machine loaded? One of the points I wanted to make is that you have to have some idea of the kind of equipment you're going to have to put this on when you prepare your information. I think also that once some theoretical basis has been established much of this can be done mechanically, too. I think we ought to give some thought to using the machines themselves to manipulate the lexicon of the source material.

*DOSTERT:* In your paper, Mr. Oswald, you seem to deplore the fact that your advocacy in 1952-53 about what you now call idio-glossaries had been overlooked. It has not really, at least not by us here, since we have decided to start with one of the fields of science, namely, chemistry—and in that field in organic chemistry. We are indeed following the tracks you were tracing several years ago, accumulating a glossary of what we call "general language", that is, the items that will recur in any given text, regardless of the technical field area in which we are operating, and then the special glossary, peculiar either in form or in usage to that particular field. We have in mind, if our research continues, to investigate texts in the field of physics, let us say, or mathematics and medicine, so that in due course we shall accumulate a series of specialized glossaries or dictionaries for several technical fields.

*RABINOW:* I would like to comment on this. It is very easy to take a section of one of these plates and make one of your idio-glossaries just by having a particular area,—as you see, the capacity is very large. Also, I should have said that you don't need a binary input. With each plate with twenty-six positions you can put in letters directly and come out with letters in the alphabet. The mechanics get more complicated, if there are 26, and it's not as efficient area-wise as binary.

*OSWALD:* May I ask one question about your system, Mr. Rabinow? What prevents friction in this mechanical operation?

*RABINOW:* The plates don't touch. They are about 1/16" apart.

*OSWALD*: No friction on the wires hanging down?

*RABINOW*: They just swing. The wire is a spring and—as a matter of fact if you use the right materials and don't stress them too much, their life is infinite. The plates are very cheap, by the way. Etched completely in small quantities these would cost \$18.00 apiece; in large quantities a dollar or two. So you can throw away the whole set of plates if you like. It means, of course, that you have to repunch the whole set of holes, but this can be done by machinery too.

*GARVIN*: I would like to comment on Mr. King's paper. I was just wondering about the storage routine, because in the 1954 experiment and in our present work we envision only one permanent storage, plus one temporary storage. Now I see that in King's routine there is a permanent storage, then it goes into temporary storage, then it goes back into another storage and then out. I am not quite clear as to why there has to be a double lookup. That is to say, on the one hand a lookup for identification of morphological and semantic elements, and on the other hand a separate one for identification of translations.

*KING*: I think in the early model of the system there is no particular reason to have the two memories. One could make do with both of them, but this complicates the intermediate high-speed storage. If we try to make a fairly sophisticated translating system the dual would be just more economical and convenient. This means, for instance, if we were looking up a word like "DE" in French, which means almost anything, if we try to get all meanings (I counted 54 in my short investigations) we would impose a tremendous amount of material on our operations.

*NEWMAN*: First of all, I wanted to say that Jack Rabinow's statement of thinking in terms of a picture may possibly clear up some of the thinking as to the way we are going to use our "Ruly English". We are going to take the thoughts and put them in the form of a picture and then verbalize that picture. To get back to Mr. King's use of "container", I don't think the container is going to be one of our ruly words, because as we pointed out in one of our early reports, many nouns and many name-things are given to items because of the use to which they are put. We are going to look for more structural terminology. "Sack", for instance, could be 'paper sack', + 'closed tube', + 'coffee container'.

*KING:* But I think you are throwing away the wonderful thing about the English language. When I say “sack” I don’t have to say all these other words.

*NEWMAN:* I know, but if you’re going to the question of information retrieval, we have to identify, whether you call it a sack, or a poke, or a bag—no matter what the word is, we have to take that thought and put it in terms of a picture, and verbalize that picture in such a way that no matter how you verbalize it it will be the same language. In that way, you can take these different things, like a coffee poke, a coffee bag, and a coffee sack, and get, when you itemize it, the same item with the series of descriptives which will include the same terms.

*KING:* Yes, but you can take the word “sack” and blow it up with all this descriptive material that I don’t have to say. Then you’re going to take a coffin and say this is a container with such-and-such properties!

*NEWMAN:* But we don’t plan to use the word container. We’re going to use a whole series of words to describe specific concepts or things.

*KING:* But I’m just saying that you make life harder by ‘translating’ one word into many words.

*NEWMAN:* Well, this part of the feature may not help you in machine translation. The emphasis that I put here in my talk was on the interrelational concept and the idea of distributing your action words between the items that were being described. And I think that in this area machine translation can be helped by using that approach.

*OSWALD (to HEASLY):* Is there any possibility in the foreseeable future that your Intelligent Machines will be able to scan any kind of print line by line?

*HEASLY:* Well, they’re scanning print now. Scanning line-by-line is what we are doing on a machine used by a government agency where we’re reading teletype line-by-line, recognizing alphabetic and numerical characters and some hand-drawn edit marks. One of the things we are not interested in at all is handwritten texts in English or foreign languages. But I don’t think that is a problem for you either.

OSWALD: No, I'm only concerned with the printed texts. Is there any hope that the machine will be able to recognize a reasonably limited variety of printed characters?

HEASLY: Yes, I think, in view of our present techniques, if the quality of character is pretty good, we may not care too much about the variants, such as between one type face and another, or between one type size and another, or variations in pitch due to justification and various other typographical characteristics. On the other hand, if the material is not well printed, if for example it is something from a poorly inked mimeograph machine, we would have trouble. Applying it to a particular problem is another question. But in general I think that there is hope, and before a millenium! We have read already varieties of type-size of the order of three to one and varieties of type style from a fine Gothic to a rather fancy bold Roman, all in the same program. But this was good material, and in this particular case it was restricted to numeric digits. I think this will give you an idea of the scope of our outlook at this time. We are doing some experimenting on sorting mail. In that operation we just look for some things. We take the position that there is much redundancy, and place names are probably more redundant than anything. We just look for some characteristics and we don't even require all of the characteristics that we know would normally be necessary to recognize a particular character. We just look for some things that are easy to detect and we say, if we get this characteristic and a couple of characters later we get something else, then we can recognize the name of a city accurately, even though we may not have recognized all of the individual characters which composed it.

RABINOW: I'd like to make a comment on this. If you tie one of the memories to your reader rather than to your translator, you could always give perfect copy if your error rate was less than say 1%. The reader could then say, "This word makes sense and this one doesn't". With words, this makes perfectly good sense, except in very special cases.

HEASLY: Unfortunately most of the work has been on information that is really random in nature. The teletype copy we are reading is not plain language.

RABINOW: Could I ask an embarrassing question? What are you reading teletype for?

*HEASLY:* The answer is that in this particular application they tried using other techniques, such as using a perforated tape which also had the characters typed on it. Then it had the editors splice the tape and that sort of thing, and they found that they just got no production out of the editors at all. What they do now in this operation is to have the material come in on a digital teletype, the editors edit it with their red pencils and give it to the key punch operator to put it back in digital form again.

*KING:* What kind of an input have you thought of for this set-up?

*HEASLY:* A scanner. We say scanning first, and then this incredible whirl of the machines.

*DOSTERT:* I have one general comment to make about the papers read by Mr. Crossland and Mr. Mueller on the one hand and the papers by Mr. King and Mr. Rabinow. When we listen to the papers on the linguistic side, the paper on word decomposition (we have called it "splitting" here) and the syntactic or grammatical analysis in Mr. Mueller's paper, one is struck with the complexity of the operations described and wonders at the volume of explanation required to instruct the machine to perform the complex operation described in decomposition and in syntactic grammatical analysis. On the other hand, the papers by Mr. King and Mr. Rabinow suggest that the storage possibilities and rapidity of search are almost limitless in their promises. It seems to me that the time may not be too far away for the practical consideration of the economy of the two basic techniques of multiple entries—increasing the number of one-to-one equivalents—as against analytical program instructions. We have had considerable discussion on this problem in our seminar. We have not come to any formal or definite conclusion yet. It seems to me that this is a basic problem in the research, whether or not the linguists should strive to formulate exhaustively the syntactic and lexical operations for programing instructions, or whether they should not rather be prepared to accept the more simple technique of storage. This is not, of course, the time to resolve the question. I am merely raising it as a fundamental point in the whole problem.

*RABINOW:* I think this is a case of the tail and the dog wagging each other. If the tail is the memory, and it is big enough, it may very well wag the dog. If we can give you any word you like with any combination of any other word—we could even put two words in simultaneously, so that BIG CAT appears, or BLUE CAT—we could

then give you groups of words if you like. It is just a question of economics. Which is better—to combine them in the logic or combine them in the machine. If the machines get powerful enough, and I know that International Telemeter makes some very powerful optical machines, then it has much better sense to do it by brute force—look up the whole phrase—the whole sentence, if it's a common enough sentence.

*KING:* To make really good idiomatic output I think the emphasis is going to have to be on elaborating the answers, rather than cutting them down. We should not give too much thought to that problem now. In these early days we do want to have simple, single meanings to the fullest extent possible.

*HODGE (to NEWMAN):* This is really not a question, but I am just curious to see the application of this to a patent application.

*NEWMAN:* I can assure you, we would too. This is one of the milleniums we hope will not be forever. As a matter of fact, one of the projects I have in mind is to take a patent specification and do this. In order to do it, though, we have to create a vocabulary, which is very slow in its creation. I might state here that possibly I am flying under false colors. I am not a linguist. I am an engineer and I have been thrown into this thing, and possibly I am cutting across a lot of things that a linguist might worry about because I know not where I tread. However, I do feel that in this business of getting a single word unit to mean a specific thing, that we can clarify a great many things that we speak of very ambiguously in a normal way, and allow the context to tell us really what we are saying.

*RABINOW:* I disagree quite entirely with your approach to the problem of simplified speech. Whatever the duties of the Patent Office, which very often covers more than an inventor thought of, even more than the attorney thought of, many years later you discover the importance of a thing that was done. I'd hate very much to have you change my language, even though it might be better, because it might not be the thing I thought of, and I think that with your simplified speech you won't get any place. Actually, if anything, speech is not accurate enough—it needs more words. And I don't think you could define things precisely. To give your example back to you about the stiffness of a beam vs. the stiffness of a watch spring, I disagree first technically very much that there is any difference. It may very well be that the beam is stressed much more than the watch

spring and that it is actually much more resilient in any technical term. In any case, we take my words and you start to change my meaning. I am very skeptical that much can be done to improve the language by using your special words.

*NEWMAN:* Well, let me give you two sentences which occurred to me earlier, because I thought something like this would come up. Take two ideas: “To get hives from berries” or “to get seeds from berries”. Now those two *froms* are entirely different *froms*. To get *hives* from berries is a sort of a cause-result “from”, and to get the seeds from berries is a *whencefrom-fromwhence* type of from. Now, I understand, at least from one translator, they said the ideal translation was the ability to tie the ambiguities in the source language into another ambiguity in the target language. If this is the case, this is not what we’re trying to hit. But what we’re trying to do is, if you will, to pre-edit the source language and transliterate it into a target language in which its meaning is clear.

*LEHMANN (to GARVIN):* I am curious about the MT notation that you propose here. We have had the problem, as you know, in linguistics of a variety of notations. Is any effort being made to develop a uniform notation for the analysis of linguistic material for mechanical translation?

*GARVIN:* Actually, we have no notation for the linguistic analysis because it is not to be incorporated into the actual translation code. What we have is notation for what we expect a translating program to accomplish and this is, as I tried to say, not linguistic analysis, although it is *based* on linguistic analysis.

*LEHMANN:* I am referring to the former days when linguistic terminology was being built up, after which there was considerable revision of terminology.

*GARVIN:* We have found that since there aren’t any complete descriptions of Russian except in traditional grammars and in a few other sources that we have available, we use traditional terms. We say, “instrumental” and “genitive” and “singular” and “plural” and let it go at that, if this is what you mean. For our purposes this is adequate because we are dealing with written Russian anyhow and what is a flaw in traditional Russian grammar, namely, to give the suffixes as written, is for our purposes an advantage.

*LEHMANN:* May I go on then to amplify this? Now, why did you choose a “P” then, for your decision point? Say, your symbols?

*GARVIN:* *Point* starts with the letter “P”, and *cue* starts with the letter “C”, so I use “P” and “C”.

*LEHMANN:* Do you suppose Cambridge uses the same notation?

*GARVIN:* They don’t have the same. I don’t know whether any existing translation research group has yet come to the point where they actually have recognized what their decision cues are and what code they are using to translate from a Russian text into English, therefore I couldn’t answer your question. I have a feeling that most machine translation discussion has been on a theoretical level and therefore has had no use for this. The Cambridge people are handling it on the basis of a primarily logical approach and they conduct various mathematical operations for which my symbols would be unsuitable. Now several other groups have worked in MT translation, but they have not gone into any extensive routine to resolve the choice problem; therefore they don’t need the “P”’s and “C”’s. Within our particular research group there are several other sub-groups in addition to the one that I have been working with, and they use somewhat different symbols simply because they formulate operations of a different nature with different symbols. I don’t think anybody has done exactly this on a general basis and therefore the problem of standardization of symbols has not yet arisen.

*DOSTERT:* This is in amplification of what Mr. Garvin just said in response to Mr. Lehmann. I think it would be premature now to think of standardizing codes, as they now emerge, because there is no uniformity even of theory among the several groups in different localities. There is not even theoretical uniformity within our own sub-groups here at Georgetown. We have deliberately encouraged diversity of approach, rather than to harness research to a pre-judged theory. Now we have three approaches. One calls itself the “experimental group”, which, speaking in general terms, proceeds empirically from the specific pattern to the general formulation. From a semi-analytical and semi-empirical approach, these staff members expect to formulate reasonably soon a series of generalizations which can be turned into machine instructions. Another group has developed a machine technique based on grammatical analysis of Russian, to resolve what may be called ‘internal structural ambiguity’, before proceeding with transfer based on diacritics matched with code

symbols on the target language. This is the “code-matching” technique. A third hypothesis was advanced by one of the members of the staff which, *so far as now known*, seems a purely empirical approach, i.e., sentence by sentence. The argument here is that exhaustive analysis of a series of sentences in a continuous text will yield general rules. Given the divergences in theoretical approach, at least as far as our own experience shows, it would appear premature to think of a standardized coding of the results of the investigations of the several groups.

*JESSE MANN (to AUSTIN)*: I would like to make just one short note on a syllogism that Mr. Austin correctly cites as a classic, and indicate a misconception that he quoted. It is frequently thought to be an Aristotelian syllogism. Actually, it has been long since pointed out that Aristotle always uses symbols (A., B., C., etc.) and that it was a mistake in the traditional thought that Aristotle formulated syllogisms of this type in which he would use a singular term in the minor premise, which was evidently far from his theory of logic. I would like to point out that at least Beech, of the University of Indiana, has written a book which he has called specifically “Intentional Logic”. I would like to get some amplification on the meaning of that statement.

*AUSTIN*: Well, logicians sometimes make a statement that the passengers of the Mayflower are the founders of Plymouth. Now, by intention they admit this all falls apart because passengers and founders are different, but by extension they can be made to be the same. I have not seen this book.

*MANN*: All I had in mind was that to frame a syllogism such as “to speak a language is good; to speak French is to speak a language; therefore to speak French is good”, but there you have no expressed reference. (I hasten to qualify that hastily with regard to any extension.) Or you could say in your slogan there, “To work is to play, therefore to play is to work”. I am just trying to make explicit the point that some intentional ends, it seems, will be necessary even in a logic. Even in the most abstract of formulae most of the formula-makers would not be willing to concede to your putting zeros in place of all the arguments. Perhaps I misunderstand. I understand that there are considerable difficulties in assigning some kinds of meanings, and I think you brought out very well the fact that you sometimes mistake sentences which have meaning for

sentences which don't. I don't mean that at all. I just mean that we can't say that any logic which seeks intension is childish, and that is because we have to have some intention.

*AUSTIN*: I still don't see the point of intention at all. Scientists construct logical existence and then find contents for the existence, and the contents will be intention.

*MANN*: The only point I'm making now is that I don't think the logician who forms systems would be content to substitute zeros for all elements in the system. He would hope, at least, that there was some intelligible content.

*AUSTIN*: Language would be like an algebra—a system. Then you would put in the meanings—the content of this system. I should perhaps not say “childish”; let me just say “difficult”.

*GARVIN*: I just wanted to make a comment as a transcendentalist-positivist in the sense that I think the direction has been at least in linguistics to use little terminological tricks—to go from transcendentalism to positivism. For instance, we now no longer speak of “meaning” when we are very positivist; we speak of “context classes”, and such as that. And likewise, I feel that this whole argument about intentional logic may perhaps be resolved by saying that in some way content is accommodated by different class membership, because if you look at the members of the class *passengers* as restricted by the class *of Mayflower*, and on the other hand the membership of the class *founders* and restriction by membership in the class *of our country*, etc., and you look at this in terms of possible members included in each class, then you have formulated your intention without using the word “content” and you have then shown that this is after all quite right. What I am driving at is that I feel that if you have a need for handling something in a formal way, then you do this, whether or not this is overtly formal or not. In other words, if I want to handle meaning, and if for some purpose or other I do not wish to be transcendent and say that this is a property of the mind, then I simply develop a formal system for handling meaning. For instance, I will say that meaning is equal pragmatically to either translation or paraphrase, and the general meaning of a given unit is that which all translations of this particular unit have in common and all paraphrases of this particular unit have in common. Or I will say that meaning is the class of all those units that can be substituted for the current unit, or I will say that meaning is that

set of relations into which this unit can be entered for purposes of whatever manipulation I want to do to it. And so to me this long argument about whether you are being this, that or the other thing, epistemologically, is rather trivial, because when you want to do things you have to be more positivist and when you want to explain things, I think you have to be more transcendentalist. Then you have to make up your mind on what you have to devote yourself to, and so I am a transcendentalist-positivist!

*MANN:* I merely wanted to insist, though, that even at the beginning of your process where you assign certain starting points, you are assigning meaning.

*DOSTERT:* Before we close, I want to correct an impression I may have given a moment ago when I said that in our own groups we had three different approaches to the problem of machine translation. This is deliberate and in any field of scientific investigation various hypotheses must be given complete freedom to be expressed and tested. When we can move from hypothesis to theory, and then to established facts, we are proceeding along perfectly valid methodology. In due course the data gathered by the various approaches may come together to some extent; some phases of it will not be susceptible of integration, but that is the methodology we are following. Diversity of approach to the solution of MT problems does create a measure of confusion, admittedly. Out of mutual challenges will come, we believe, the more effective formulation. Freedom of approach to problems is still the key to scientific solutions.