[From: *Translating and the Computer*, B.M. Snell (ed.), North-Holland Publishing Company, 1979]

THE ESSENTIAL SKILLS TO BE ACQUIRED FOR MACHINE TRANSLATION

Margaret Masterman
Cambridge Language Research Unit
Consultant on contract to the European Commission
Luxembourg

It is exceedingly timely that there should be, at this seminar, a high-level scrutiny of the relations between "translator" and "machine": because, as we all know, there is also a world-wide expansion of the need to translate. Owing to improvements in telecommunications, the earth is becoming a global village; but in every house of the village, the inhabitants still speak each their different language, and this fact affects both individuals and corporations.

In particular, the European Commission is confronted with an escalating translation problem; and that for an exceedingly honourable reason. For, whereas the historical solution for the "problem of Babel" was for there to be, on a naked imperialist basis, one "language of dominance" belonging to the nation which had conquered the other nations in the course of founding its empire - with all other languages, belonging to the nations which had been conquered, "languages of servitude" - the European Commission, by its articles, has created the new conception of "Linguistic equality". Every language of a member nation, within the Commission, is to be regarded as the equal of every other; and every important Commission document is to be issued in every Commission language with no one statement of it being regarded as a translation of any other.

The establishment by law of this linguistic equality, on this scale, is something new; like the first step of the first astronaut on the moon, it is a "step forward" for the whole human race.

However, such global steps forward tend to be both expensive, and also to require the development of new technology; and the step taken by the Commission is no exception to the general rule. For both it is the case that it makes the translation problem more urgent (there are 72 language pairs between which to translate): and it is also the case that, within a space of, say, two years, this step has caused *a* need for new technical skills; namely, the skills needed to enable the translator to be genuinely assisted by the machine, in order that a genuine man-machine combination shall enable the speed and range of reliable translation to increase.

The current difficulty, however, is that the nature of these skills is not yet understood. The reason for this lack of comprehension is two-fold. The academic world, on the one hand, has not yet conceded that machine translation is emerging as a specialist discipline in its own right: for academics, "M.T." is still a, probably disreputable, off-shoot of linguistics: (the more so as this downgrading covers up the fact that linguistics, predominantly, examines only a limited corpus of unilingual material, and

therefore lacks any adequate technique for examining the interrelations between two or more whole languages). The data-processing world, on the other hand, sees machine translation as just a special sort of data-processing: the fact that two whole natural languages, (at least) are involved in it, and in what, for data-processors, is a new and unique way - all this passes the systems-analysts by.

The result of this double failure, within the existing specialities, to grasp the unique nature of the problem, has caused a bifurcation of the two interests involved, with machine translation itself falling down the gap between the two. It is not going to be until the human translator makes himself felt, not only as user but also as designer and as manual-writer, that further progress in obtaining a genuine man-machine translation interaction is going to be made. And therefore the translator must insist, forthwith, on coming into this new discipline, on an equality with the programmer and in a dual capacity, actively as well as passively: and, to this end, on being provided with the detailed knowhow which he requires.

After what I have said, it will come as no surprise to learn that, since the nature of the problem is not recognised, the knowhow for solving it is also not there. Over the long run I think it is the academics who will bear the blame for this; because (it will be said) they both reacted too slowly to the pace of technological change, and also failed to observe the emergence of a new "hard science" of transforming meaning. But, in fact, the current situation is as much the responsibility of those who are too close to the technology as of those who, through other academic preoccupations, are too far away.[1] For those who are too close, the programmers, are predominantly thinking about the nature of language, and the nature of translation, only by writing actual machine translation programs, to which they then append notations intended only for fellow programmers: and so they see the material which they are handling, namely language, only through "the veil of the machine".[2] These programmers, in my view, are indeed bringing to light new facts about language about which academic linguists are going to have to take note, though without realising that they are doing so; if I did not think this, I would not think that M.T. was a discipline in its own right. But it is exceedingly difficult for the academic linguists to find out what these facts about language are, because, even when the programmers do express themselves in discursive prose they use phrases like "part of speech", "syntactic transformation", "multiple meaning", "dictionary structure" to refer back to characteristics of the M.T. programs which they themselves have written, and to nothing else.[3] Whereas the academics specify their use of all these same phrases by referring back to many and various literatures; those of general linguistics language-teaching, philosophy, mathematics, content analysis, psychology of language, Artificial Intelligence and computational linguistics,[4] but never to an acknowledged literature of Machine translation <u>per se</u>. So, within this highly multi-disciplinary academic world, quite apart from already existing difficulties of comprehension caused by the multi-disciplinary nature of linguistics itself, we now have a new way in which, when the systematic study of multilingualism or bilingualism is in question, two sets of people can unknowingly "talk through" one another: namely, by use of a whole range of terms relevant to translation, used by programmers to refer to M.T. programs, and by linguists to refer to academic specialist literatures.

And, to cap all, there is the ordinary language barrier to cross, as

Bruderer's comprehensive bibliographies[5] abundantly make plain. To understand fully the currently available material on Machine Translation, the would-be "expert" has first to make himself fluent in German, Russian, French, English, Italian, I.B.M. Assembly language, and Chinese ....

.....

Since all this variegated possibility of confusion exists, and since none of us can do anything overnight to remove it, it seems to me that two clarifications are above all necessary; that is, if the translator is to move, within this new discipline, into a central position; as the needs of the situation require that he or she should.

I. The first clarification is to determine what the essential basic mechanism of M.T. is, as opposed to the many ways in which this basic mechanism can be sophisticated.

In this regard, the first distinction to be made is between M.T. programs proper, and programs for unilingual automatic syntactic analysis, which are different. A unilingual automatic syntactic analysis program, in one language, backed on to a unilingual automatic synthesis program, reversed in structure from another unilingual analysis program designed for the target language, and with an unknown area between them labelled "TRANSFER", this is not a genuine M.T. program, because it has no specification within itself of any basic M.T. mechanism, to form the centre of it. C'est magnifique, as the French general said of the charge of the Light Brigade, mais ce n'est pas la guerre. And yet, from the time of the 60s, such structures have been put forward on paper as being "academic M.T.", or "linguistics-based M.T.", whereas any system founded on the basic mechanism (and which therefore, as a mechanism, can be relied on to work) is castigated as being "only commercial M.T."

This confusion is clearly cardinal, and must be resolved.

II. The second clarification which has to be made is to determine priority of aim in the use which is to be made of any system of M.T.

In this regard, the first distinction which has to be made is between a) fast batch-programmed bi-lingual M.T. and b) machine-aided online pre- and post-edited M.T.

a) Fast batch-programmed bi-lingual M.T., at its best, goes from some source language which is "esoteric" (in that it is known to a few Western politicians and scientists) to a language which is politically and scientifically "open" (which usually but not always means English). The prototype of this first kind of M.T. is the Russian-English SYSTRAN, and the philosophy behind it is "Better a faulty translation, most of which is comprehensible than a totally opaque foreign document in an unintelligible script".

b) Online, machine-aided, pre- and post-edited M.T. is much slower and more expensive than the first kind; but the output of it should be indistinguishable from the best human translation. The prototype of this second kind of M.T. is the machine-aided translation program of Loh[6], where the machine assists the man to translate mathematical texts from Chinese into English, to a standard which enables these same translated texts to be acceptable without further change to specialist libraries.

A specimen of untouched batch-programmed SYSTRAN output - though not, alas, from Russian - is given in Appendix A (1), and a specimen of Loh's machine-aided output in Appendix A (2). The two strategies which have produced these two vary widely; you can opt for either, but you cannot pursue both at the same time, since whichever one you opt for will determine the whole subsequent trend of the design of your system. Contrary to expectation, also, it is the second type of system, rather than the first, which already shows signs of becoming interlingualised; as can be seen overall by looking at the flowchart reproduced in Appendix C (2).

.....

In the space left, I will now try to say a little more about the two types of clarification specified above, and about the human translating skills which their development needs.

I. In another paper[7] I have gone further into detail than I can here in describing the essential mechanism of M.T. and in characterising also the differences of orientation between a bi-lingual M.T. program with its often crude but unique output, and a unilingual automatic syntax analysis program with its tendency to generate many sophisticated alternatives. The fact that most, though not all, M.T. programs include unilingual syntax-analysis of the source language, and that many automatic syntax-analysis programs were originally intended to become incorporated within full systems of M.T. has tended to obscure the basic truth that the heart of any M.T. program, no matter of what kind, has got to be a 1-1 bi-lingual dictionary match. You can design a crude M.T. program without any syntactic analysis at all[8,9,10] and a considerably sophisticated one without any explicit use of semantics[11] : but you cannot have a mechanical translation program which does not mechanically translate; and experience has shown that the essential mechanism for producing such translation is a 1-1 bi-lingual dictionary match operative between some source and target units of some kind.

History has tended to obscure this fact. In the '60s for instance, would-be machine translation program designers used to consider it sufficient to output many possible variants in the output language of each word in the input language. These multi-outputting M.T. programs were interesting comments on the translation-relation, but, as experience showed, the outputs were not translations: those who were meant to benefit by them could not use them. It was not until Peter Toma, in SYSTRAN, (following in this matter on Gilbert King of I.B.M.) succeeded in causing a machine to output one, and only one, coherent output text from each input text, and moreover (unlike the output from King's system, which used no syntax) an output which was very much more often right than wrong, that Machine Translation came of age as a technology to be reckoned with in its own right (i.e. as a skill to be distinguished from other skills).

However, if the essential and central "brute-force" mechanism of M.T. is conceded to be a 1-1 dictionary match, two fundamental questions immediately arise. The first is: if crude M.T. is a 1-1 dictionary match, how do we sophisticate it? The second is: if M.T. is in its essence such a match, what is the relation, if any, between mechanical and human translation?

A moment's reflection will show any human translator that indeed a 1-1 dictionary match can quite easily be sophisticated. To make the match, the machine has first to be given the boundaries of the unit of text to be matched; which is why the easiest form of match is word for word, since in

this match the machine can "bound the match" by the spaces on each side of the word. But the match can be extended to match longer stretches of text than a word; it can be truncated to match shorter stretches of text than a word. It can be made conditional i.e. made to change consequent on the result of one or more tests, and this is where syntactic testing comes in. And it can be transformed from a 1-stage match to a 2-stage match or an N-stage match by a match, say, into a neutral or interlingual semantic notation and out again. But throughout any M.T. program, however complicated, the first requirement is that the program must never lose the match. Moreover, inspection of M.T. systems design shows that each variety of match leads the program to a corresponding variety of dictionary, since each dictionary has to be classified for "idiomaticness" in a particular way. So skill in M.T. consists in sophisticating matches, and variegating dictionaries, and in carrying both this sophistication and this variegation as far as they will go.

An overall view of a considerably variegated set of matches with differing dictionaries is shown in the SYSTRAN flowchart in Appendix C (1); but for more detail the reader is again referred to my other paper.

This whole M.T. matching activity is, of course, very different - and in particular it is different at first sight - from the high-level associative skill employed by the human translator. For human translation, at its best does not operate on the principle of finding a match, but on the principle of finding a counterpart. The human intuitively associates a piece of thinking, in a second culture (the counterpart) with an initial piece of thinking, to be translated from a first culture - and to do this he has to have knowledge of both cultures as well as of both languages. Once this fact about the high-grade nature of the skill required for the best and highest form of translation be admitted, it becomes evident at once that any 1-1 match in mechanical translation, however sophisticated, can only be of use against one common background; probably even more narrowly within one common shared situation. So for a machine translation system to operate effectively the two users of it, handling respectively the input and the output, must not differ in anything except language. Under such shared circumstances, however, the mechanical translator can indeed be of genuine service, if only because of its indefinitely extensible memory for cliches, acronyms and jargon. And, as well, it can serve as an analytic instrument, teaching us more about the nature of translation itself.

II. Comprehension of the real built-in nature of the limitation, as of the potential of M.T., moreover, at once throws light on M.T.'s two alternative methods of development: a) fast batch-programmed M.T., operating ideally without human pre-editing or post-editing between two languages; and b) online pre- and post-edited, and potentially multi-lingual M.T., which incorporates human skill and intuition into at least one stage of the actual M.T. process. It is normally thought that these two contrast even more than they do, in that the first of them, fast batch-programmed M.T., makes no use whatever of human intuitive intervention, whereas the second, online machine-aided translation, makes primary use of the human being, and only secondary use of the machine; but this judgment is wrong. Both methods of M.T., in fact, make use of the intuitively translating human being: batch-processed M.T. before and after the M.T. process; online M.T. also in the middle of it. In SYSTRAN the area of interest in the text to be translated can be specified by the input typist by inserting a control card which will specify a topical glossary for it; and, as well, the standard of a piece of defective output can be pushed sharply up by writing

particularised, context-sensitive programs to produce high-level translations of particular stretches of the text, and then re-running the program so that the input text can benefit from its specially oriented dictionary. It is sometimes thought, by sponsors such as Pankowicz [12], that this process of orienting dictionary to text is illegitimate. I cannot see why. The object of having a machine to produce translation, after all, is not (as with chess) to take part in international M.T. competitions, but to produce usable translations. If this is achieved by putting money and effort into teaching already trained translators to program particularised dictionary entries in a MACRO-language (and even more important, to use their trained judgment to choose which such entries to program) not only are they taking steps, at one remove, to supplement the machine's low-grade skill by their high-grade skill, they are doing something more, which is very interesting: namely, producing a machine-readable bi-lingual data-base which is context-sensitive (something new in linguistics). And it is subsequent examination of this which may quite possibly enable us to make explicit facts which are at present only subliminally known about the translation relation itself.

In Appendix B, this process can be seen going on. For first (in B 1) we see the authorised E.E.C. translations of a set of phrases, produced by trained human translators; then (in B 2) the raw SYSTRAN output for the same phrases; and lastly (in B 3) a sample of the many additional dictionary entries required to make B 2 approximate more nearly to B 1.

The second method b), where M.T. is used online and with pre- and post-editors, has already shown that it can produce output of much higher quality than that of batch-programmed M.T.; as can be seen by looking at Appendix A 2. But this second method can be cost-effective, that is it can pay for itself, only if one of two background situations obtain. The first of these is that, by using the machine online, knowledge is made internationally accessible which would not be accessible otherwise; for instance, by translating specialist mathematical papers from Russian, Greek, Arabic or Hindi, where the nature of the script, let alone of the language, constitutes a "knowledge-barrier" which scientists just cannot pass. The second background situation which justifies the expense of online M.T. is the interlingual one. The Translation Institute at Brigham Young University, Utah, has the aim of translating the Mormon texts online into 500 of the world's languages,[13] and this, I think, is a particular foretaste of more general things to come. Moreover, this type of program also requires a new high-level translation skill: namely that of pre-editing an input text by inserting into it cardinal structural features of the output language in machine-readable form. This is no mean feat as any translator, even a highly-trained one, will find if he or she will make the effort to try it. And here is the potential of it. It is easier to learn, once for all, to mark in, on the input, "neutral" structural features which can then be used to synthesise ANY output language than it is to keep adjusting and varying your conception of what has to be pre-edited in as you keep on altering your target language. And again, as in the first case, that of programming particularised dictionary-entries, there is a research potential implicit in developing this interlingual skill, which is that of bringing to bear the trained intuitive skill of translators, to help us discover more about what a cardinal structural notation, neutral as between N output languages, really is.

.....

In conclusion, in order to gather together the rather scattered argumentation of this paper, I will list the basic skills which the human translator needs, if he is to participate, on an equality with the programmer, in the development of man-machine interaction for translation. The need for these skills, in the form in which I will now give them, emerges from consideration of the two basic clarifications which I suggested earlier; but I do not think that I have as yet made sufficiently clear what I think they are.

They are the following:

Firstly, the translator has to acquire the ability to see translation as a mechanical process sophisticating itself from a basic 1-1 bi-lingual match: namely, of the simplest case which it is possible to imagine of the translation-relation. This skill requires the further capacity, both to assign boundaries and shapes to translation units in any language, and also the classifying ability to assign to these units, once found, markers which will specify the nature and degree of any translation unit's "idiomaticity" - that is, the way and the extent to which it differs from the basic 1-1 match. This classifying effort is cardinal to M.T. since a corresponding type of classification has to be made, in each case, of a type of dictionary, each type of dictionary has to handle a specific type of "idiomaticness" - as can be seen by looking, yet once again, at the flowchart in Appendix C 1.

This first skill is no mean skill in itself; but the translators could acquire it.

Secondly, the translator must learn to recognise classes of awkward translation-situations - "knotty problems" - which will require special dictionary entries to solve them. He must then become able to write flowcharts of these dictionary-entries; it will only take him about an hour to do this last, since the comments on the flowcharts can be made in his own words; the programmers will then be pleased to turn them into patterns of coding. But recognising the awkward translation-situations: there lies the skill.

When a special type of awkward translation situation keeps on recurring (as occurs, for instance, when English past participles have to be distinguished from English past tenses of finite verbs) then the flowcharts dealing with this phenomenon cease to be only those of individual dictionary-entries and become general syntactic disambiguation routines (called in SYSTRAN "homograph routines").

Once all the awkward translation-situations have been identified and solved syntactic analysis for machine translation - which also, incidentally, becomes very abstract - reduces to almost nothing; whereas if the knotty translation-problems have not first been identified and solved, syntactic analysis by machine cannot be done at all.

So this second skill is cardinal, if machines are to translate; and it is only skilled and trained translators who can supply it. When it comes to gaining bi-lingual, or multi-lingual, or omni-lingual, insight into the "knottiness" of knotty translation problems, such unilingual people as philosophers, computational linguists, mathematicians, the Artificial Intelligentsia, systems programmers, all alike founder: we are nowhere.

The third skill which the translator requires for machine translation is the ability both to pre-edit and to post-edit machine-readable text: but to describe this last skill further would require a treatise in itself, so I will have to leave further specification of it for now.

What the human translator has, however, here and now to ask himself or herself - that is before he or she is any older - is:

"How many of these skills which have been outlined above are likely to be irrelevant to, or even detrimental to, my already acquired high-level intuitive skills as a translator; and how many, on the contrary, are likely to be enhancements of, or intensifications of, these same skills which I already have?"

If the first, then, clearly, the translator must not touch the machine; which means, I think, that machine translation will never really develop. But if the second, then, in the end, even when it comes to the improvement of human translating, a period of interaction with a machine may become something which a translator, in these technological days, very much needs. And the machine itself may then end up as "the translator's best friend".

For machine translation is not a piece of black magic; neither is it a "black box" embodying a fraud, calculated to deceive (or, more likely, to affront) the public. It is a bi-lingual extension of word-processing: but because it is contrastive, as between languages, we can use the high-level new skills which its realistic development requires that translators should acquire, to discover - also contrastively - what the "deep-structure" of the translation-relation really is: and that is something which has remained wholly unknown, up to now.

REFERENCES

1. Hutchins, W.J. (1978) Progress in Documentation, Journal of Documentation, Vol 34, No. 2, ppl19-159.

2. Cincioni, Internal Document of the European Commission.

3. Toma, Peter. (1978) Sprache und Datenverarbeitung (Niemeyer, La Jolla 1/1977). Extract from Peter Toma's article on SYSTRAN translated into English by Frank Knowles, University of Aston, Birmingham.

4. Knowles, F.E. (1978) The Study of Languages and Linguistics - its Context and its Ethos, Inaugural Lecture, University of Aston, Birmingham.

5. Bruderer, Herbert E. (1977) Literaturschau, pp763-4. (Handbuch der Maschinellen und Maschinenunterstützten Sprachübersetzung, Verlag Dokumentation, München. (Other bibliographies can be obtained from this institute.

6. Loh, S.C. (1976) Machine Translation: Past, Present and Future, ALLC Bulletin, Vol. 4, ppl05-113.

7. Masterman, Margaret. The Essential Mechanism of Machine Translation, (unpublished paper for the British Computer Society, January 1979)

8. King, G.W. (1959) Final Report on Computer Set AN/GSQ-16 (XW-1), Vol.VI, Information Coding and Format. (IBM Research Center, Yorktown Heights, N.Y.

9. Nancarrow, P.H. (1978) 48,000 characters in search of a system (paper read at the Fifth International Symposium on Computers in Literature and Language Research, University of Aston, Birmingham.)

10. Goshawke, Walter. Spoken Languages Universal Numeric Translation (SLUNT) (unpublished paper obtainable from the Social Science Research Council, Survey Archive, University of Essex, Wivenhoe Park, Colchester Essex C04 3SQ. SLUNT is a method of computer translation for all spoken languages through a specially invented intermediate language, Number Language, consisting of numerals.

11. Vauquois, B. (1977) L'évolution des Logiciels et des Modèles linguistiques pour la traduction automatisée (Groupe d'Etudes pour la Traduction Automatique - GETA, Grenoble)

12. Pankowicz, Zbigniew L. (1978) Evaluation of Machine Translation, a position paper, p4. (paper read at a seminar at the European Commission in Luxembourg.

13. Lytle, Eldon G. et al. Junction Theory and Application, Vol.1, No. 1 (Translation Sciences Institute, Brigham Young University, Provo, Utah, U.S.A.)

APPENDIX

A) Comparative M.T. Specimen Outputs

1) SYSTRAN unedited English - French output
2) Loh's Chinese - English online machine-aided output

B) The SYSTRAN Authorised Customs Vocabulary Translation Test

1) The E.E.C. authorised multilingual translations
2) Raw SYSTRAN output of the same phrases
3) Specimen dictionary entries made to correct the errors (marked by ticks) in 2

(N.B. This very interesting experiment was carried through by Ian Pigott and Peter Wheeler.)

C) Overall Comparative Schemata showing the Two Strategies for M.T.

1) SYSTRAN translation schema, showing the centrality of variegated dictionary machine
2) Brigham Young Translation Institute, overall schema for multilingual translation of Mormon Church texts.

Appendices A (1), B and C (1) are published by permission of the European Commission.

APPENDIX A (1)

SYSTRAN unedited English - French output

THIS WAS A YEAR , THEN , IN.WHICH THE COMMUNITY CONSOLIDATED ITS COHESION IN.THE.FACE.OF THE ECONOMIC AND SOCIAL CRISIS AND BEGAN TO STAND TOGETHER IN DEALING.WITH EXTERNAL DIFFICULTIES .

CECI 3ETAIT UNE ANN3EE , PUIS , O2U LA C$COMMUNAUT3E A CONSOLID3E SA COH3ESION FACE 2A LA CRISE 3ECONOMIQUE ET SOCIALE ET A COMMENC3E 2A RESTER ENSEMBLE CONCERNANT DES DIFFICULT3ES EXTERNES .

IN.RESPONSE.TO THE FAR-REACHING ECONOMIC AND POLITICAL CHANGES OF RECENT YEARS , TRUST BETWEEN THE MEMBER STATES , BOTH IN THE COMMUNITY INSTITUTIONS AND AT THE MANY POLITICAL COOPERATION MEETINGS , BEGAN TO REASSERT ITSELF , SHAKEN THOUGH IT WAS BY NEW COMPLICATIONS ARISING FROM DOUBTS ENTERTAINED BY SOME COUNTRIES AS TO THE COMPATIBILITY OF THEIR NATIONAL INTERESTS WITH THOSE OF THE COMMUNITY .

EN R3EPONSE AU LOIN- ATTEIGNANT DES CHANGEMENTS 3ECONOMIQUES ET POLITIQUES DES ANN3EES R3ECENTES , LA CONFIANCE ENTRE LES C$ETATS MEMBRES , $$$ DANS LES INSTITUTIONS COMMUNAUTAIRES ET AUX NOMBREUSES R3EUNIONS POLITIQUES DE COOP3ERATION , A COMMENC3E AU REASSERT LUI-M4EME , AGIT3EES BIEN QU' ELLE AIT 3ET3E PAR DE NOUVELLES COMPLICATIONS SURGISSANT DES DOUTES ENTERTAINED PAR QUELQUES PAYS SELON LA COMPATIBILIT3E DE LEURS INT3ER4ETS NATIONAUX AVEC CEUX DE LA C$COMMUNAUT3E .

CONFRONTED BELATEDLY WITH THE EVIDENCE OF ITS OWN POVERTY IN ENERGY AND RAW MATERIALS , EUROPE TOOK UP THE CHALLENGE AND FACED UP.TO THE ECONOMIC AND SOCIAL PROBLEMS ARISING FROM IT .

CONFRONT3E BELATEDLY AVEC L' 3EVIDENCE DE SA PROPRE PAUVRET3E DANS UNE 3ENERGIE ET DES MATI2ERES PREMI2ERES , C$EUROPE A PRIS LE D3EFI ET FAIT FACE JUSQU' AUX PROBL2EMES 3ECONOMIQUES ET SOCIAUX SURGISSANT D! LUI .

THE RESULT WAS THE REALIZATION OF HOW URGENT IT IS TO ADJUST TO CHANGED CIRCUMSTANCES BY ADOPTING MORE EFFICIENT METHODS AND AIMING HIGHER IF SOCIETY IS TO BE TRANSFORMED AND THE BUILDING OF EUROPE TO CONTINUE .

LE R3ESULTAT 3ETAIT REALIZATION DE COMMENT URGENT IL DOIT AJUSTER 2A A CHANG3E DES CIRCONSTANCES EN ADOPTANT DES M3ETHODES PLUS EFFICACES ET EN VISANT PLUS HAUT SI LA SOCI3ET3E EST 4ETRE TRANSFORM3EE ET LA CONSTRUCTION DE L' C$EUROPE POUR CONTINUER .

THE RECESSION WHICH HIT THE COMMUNITY IN THE MIDDLE OF 1974 IS NOT YET OVER .

LA R3ECESSION QUI FRAPPENT LA C$COMMUNAUT3E DANS LE MILIEU DE 1974 N'EST PAS ENCORE PLUS DE .

HOWEVER , IT NOW SEEMS THAT THE WORST IS BEHIND US .

CEPENDANT , ELLE SEMBLE MAINTENANT QUE PLUS MAUVAIS EST DERRI2ERE NOUS .

ACTION TAKEN BY THE COMMUNITY ENABLED THE TREND TOWARDS WIDESPREAD PROTECTIONISM AND THE EMERGENCE OF CONTRADICTIONS BETWEEN THE GOALS SET BY THE MEMBER STATES IN THEIR ECONOMIC POLICIES TO BE HALTED .

L' ACTION PRISE PAR LA C$COMMUNAUT3E A PERMIS LA TENDANCE VERS UN PROTECTIONISM TR2ES R3EPANDU ET L' 3EMERGENCE DES CONTRADICTIONS ENTRE LES BUTS PLACE PAR LES C$ETATS MEMBRES DANS LEURS POLITIQUES 3ECONOMIQUES 2A ARR4ETER .

THE OUTCOME OF THE DECEMBER MEETING OF THE EUROPEAN COUNCIL BEARS WITNESS TO THE WILLINGNESS OF THE NINE , DESPITE ALL THE DIFFICULTIES , TO WORK FOR JOINT SOLUTIONS AND PRESS AHEAD WITH BUILDING EUROPE .

LES R3ESULTATS DE LA R3EUNION D3ECEMBRE DES OURS DE C$CONSEIL EUROP3EEN T3EMOIGNENT AU WILLINGNESS DES NEUF , EN D3EPIT DE TOUTES LES DIFFICULT3ES , POUR TRAVAILLER POUR DES SOLUTIONS CONJOINTES ET POUR PRESSER EN AVANT AVEC LA CONSTRUCTION C$EUROPE .

APPENDIX A (2)
Loh's Chinese – English online machine-aided output

ON THE TRANSGRESSION OF CHARACTERISTIC FORMS

WU GUANG-LEI
(PEKING UNIVERSITY)

(RECEIVED DEC. 5, 1974)

FIBRE BUNDLE THIS KIND STRUCTURE, HAS THE FUNDAMENTAL IMPORTANT SIGNIFICANCE IN DIFFERENTIAL GEOMETRY, WHICH NOW LOOKS VERY OBVIOUS. THIS VIEWPOINT IS RAISED BY CHERN SHEENG-SHEN IN THE 40S, FIRST EXPRESSED IN DETAIL IN A SHORT PAPER [1] WRITTEN BY HIM CONCERNING THE Gauss-Bonnet FORMULA IN 1944 : LET *X* BE A COMPACT RIEMANNIAN MANIFOLD, THE UNIT VECTOR ON X FORM A SPHERE BUNDLE *Y*. THE " TOTAL CURVATURE " OF RIEMANNIAN MANIFOLD *X* CAN BE EXPRESSED AS A CLOSED DIFFERENTIAL FORM Δ ON *X* . THE COHOMOLOGY CLASS OF Δ CORRESPONDS TO Euler CHARACTERISTIC NUMBER. CHERN FIRST POINTS OUT: THAT THERE EXISTS A DIFFERENTIAL FORM Π ON THE SPHERE BUNDLE *Y* SUCH THAT $d\Pi = \Delta$, AND Π RESTRICTED ON THE FIBER THEN SHOWS THE FUNDAMENTAL CLASS OF THIS FIBER. THIS PROPERTY OF THE DIFFERENTIAL FORM Δ IS THEN CALLED THE TRANSGRESSION, Π IS CALLED THE TRANSGRESSION FORM OF Δ. THE MAIN POINT IN THE PROOF OF CHERN SHEENG-SHEN IS TO CONSTRUCT A TRANSGRESSION FORM IN DETAIL. HERE IT FURTHER SHOWS ALSO THE APPLICATION AND POWER OF E. Cartan METHOD. IN 1959, Eells GENERALIZED Gauss-Bonnet FORMULA TO Stiefel-Whitney CHARACTERISTIC CLASS[4].

IN 1942 , Понтрягии GENERALIZED Gauss SPHERICAL MAPPIN6, INTRODUCED Понтрягии CHARACTERISTIC CLASS [6]. HE PROVED IN 1944 THAT Понтрягии CHARACTERISTIC CLASS OF REAL COEFFICIENTS CAN BE EXPRESSED BY THE POLYNOMIAL OF RIEMANNIAN CURVATURE[7].

IN 1946 CHERN SHEENG-SHEN INTRODUCES CHERN CHARACTERISTIC CLASS[2] ON THE COMPLEX MANIFOLD. AND ALSO PROVED THAT THE TRANSGRESSION IS ALSO THE CHARACTERIZATION OF THIS CHERN CLASS.. LATER THIS THEORY IS GENERALIZED TO THE GENERAL FIBRE BUNDLE[3].

APPENDIX B (1)

The E.E.C. authorised multilingual translations

	Source
4. F ristourne totale ou partielle des droits **E total or partial drawback of duties**	**Traité CEE art. 10,1**
5. F alléger les formalités imposées au commerce **E to reduce formalities imposed on trade** **to *reduce trade formalities - GUD***	**Traité CEE art.10,2,1**
6. F trafic entre les Etats membres **E trade between member states**	**Traité CEE art. 10,2,2**
7. F Etat membre exportateur **E exporting Member State**	**Traité CEE art.10,2,2**
8. F union douanière **E customs union**	**Traité CEE chap.I,titre**
9. F élimination des droits de douane entre les Etats membres **E elimination of customs duties between Member States**	**Traité CEE chap.I,sect.1**
10. F droits de douane à 1'importation et à 1'exportation **E customs duties on imports and exports**	**Traité CEE art.12**
11. F les relations commerciales mutuelles **E trade with each other**	**Traité CEE art.12**
12. F les droits de douane à l'importation sont progressivement supprimés **E the customs duties on imports shall be progressively abolished** **... *shall be progressively eliminated - GUD***	**Traité CEE art.13,1**
13. F période de transition **E transitional period**	**Traité CEE art.13,2**

14.	F droit de base sur lequel les réductions successives doivent etre opérées E basic duty to which the successive reductions shall be applied	Traité CEE art. 14,1
15.	F droits de douane à caractère fiscal E customs duties of a fiscal nature	Traité CEE art.17,1
16.	F abaissement de 1'ensemble des droits E reduction of customs duties as a whole	Traité CEE art. 17,1,1
17.	F les droits sont abaissés de 10% a chaque palier de réduction E the duties shall, at each reduction, be lowered by 10%	Traité CEE art.17,1,2
18.	F taxe intérieure E internal tax	Traité CEE art.17,3
19.	F commerce international E international trade	Traité CEE art.18
20.	F réduction des entraves aux échanges E lowering of barriers to trade	Traité CEE art.18
21.	F droits du tarif douanier commun E duties in the Common Customs Tariff	Traité CEE art.19,1
22.	F territoire douanier E customs territory	Traité CEE art.19,1
23.	F droit appliqué E duty applied	Traité CEE art.19,2,2
24.	F calcul de la moyenne arithmétique E calculation of the arithmetical average	Traité CEE art.19,2,2
25.	F le tarif des pays du Benelux E the tariff of the Benelux countries	Traité CEE art.19,3,d

26.	**F les listes de positions tarifaires font l'objet de l'annexe I du présent traité** **E the lists of tariff headings are set out in Annex I to this Treaty**	**Traité CEE art.19,5**
27.	**F droits applicables** **E duties applicable** ***duties chargeable - GUD***	**Traité CEE art.20,1**
28.	**F l'harmonie interne du tarif douanier commun** **E the internal consistency of the Common Customs Tariff**	**Traité CEE art.21,1**

APPENDIX B (2)

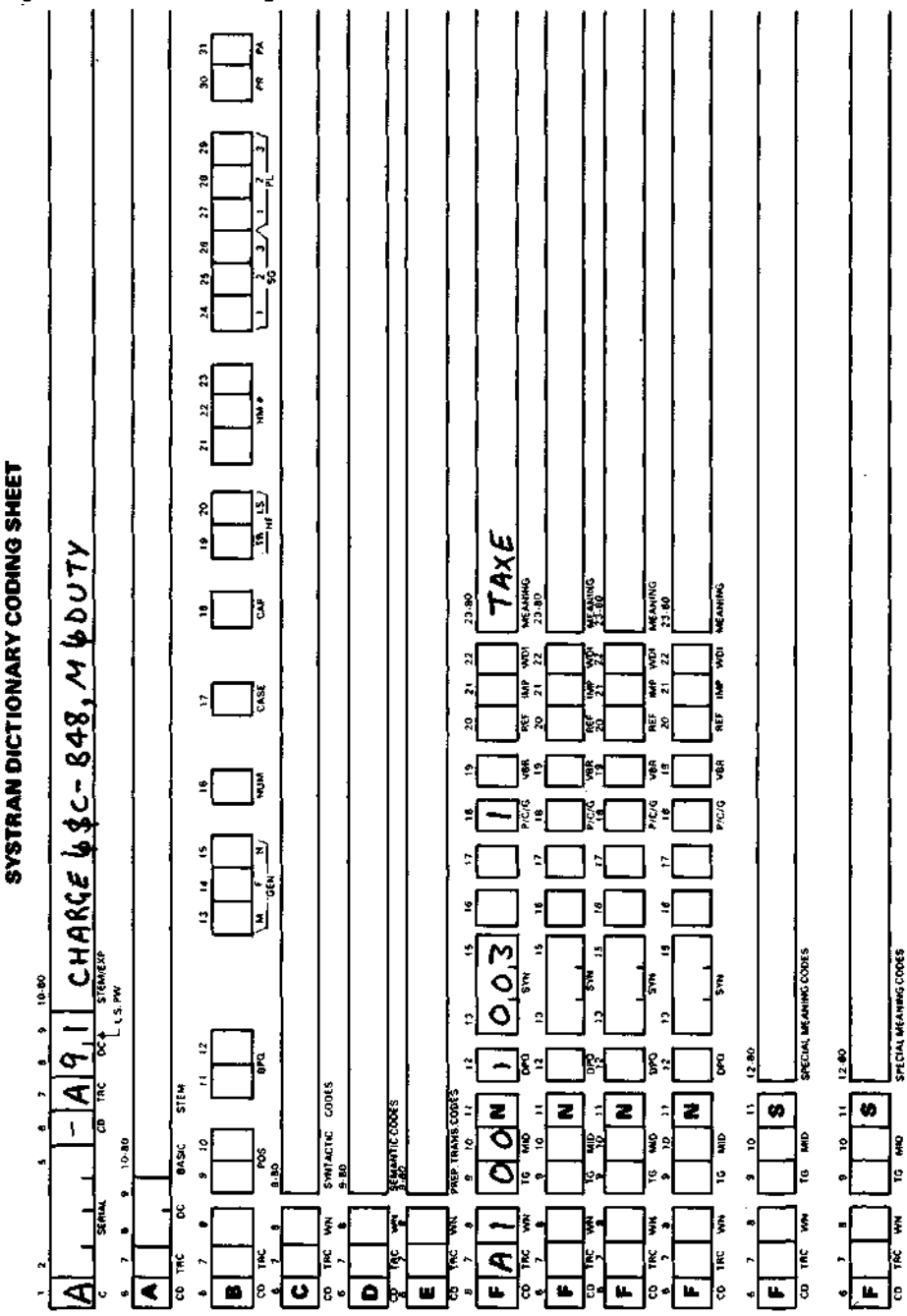
Raw SYSTRAN output of the same phrases

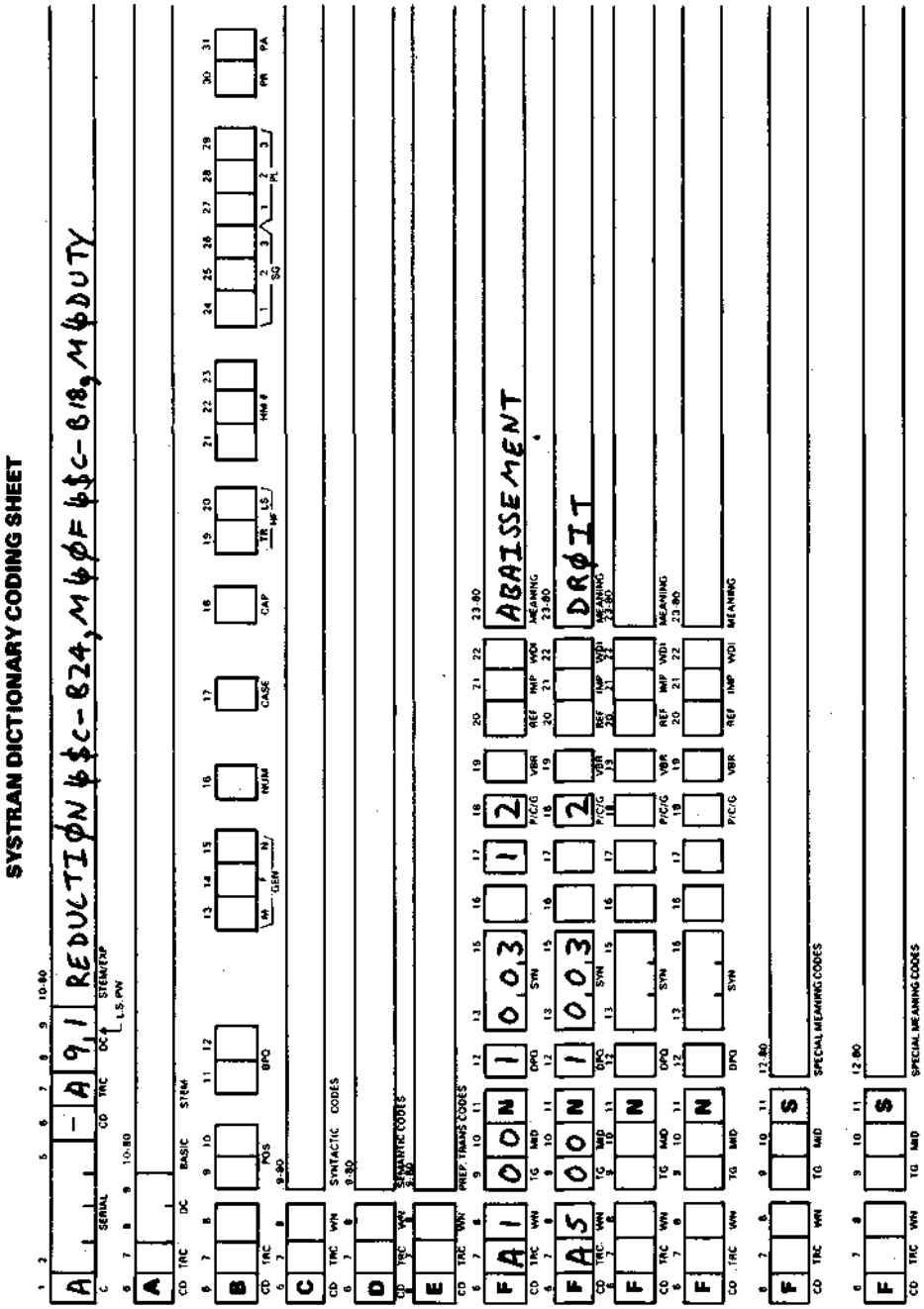
1 CUSTOMS DUTIES AND CHARGES HAVING EQUIVALENT EFFECT .
FONCTIONS ET CHARGES DE DOUANE AYANT UN EFFET 3EQUIVALENT .
2 TOTAL OR PARTIAL DRAWBACK OF DUTIES .
D3ESAVANTAGE TOTAL OU PARTIEL DES FONCTIONS .
3 TO REDUCE FORMALITIES IMPOSED ON TRADE .
POUR R3EDUIRE DES FORMALIT3ES IMPOS3EES AU COMMERCE .
4 TO REDUCE TRADE FORMALITIES - GUD .
POUR R3EDUIRE DES FORMALIT3ES DE COMMERCE - CC$GUD .
5 TRADE BETWEEN MEMBER STATES .
COMMERCE ENTRE LES C$ETATS MEMBRES .
6 EXPORTING MEMBER STATE .
C$ETAT MEMBRE EXPORTATEUR .
7 CUSTOMS UNION .
UNION DOUANI2ERE .
8 ELIMINATION OF CUSTOMS DUTIES BETWEEN MEMBER STATES .
3ELIMINATION DES FONCTIONS DE DOUANE ENTRE LES C$ETATS MEMBRES .
9 CUSTOMS DUTIES ON IMPORTS AND EXPORTS .
FONCTIONS DE DOUANE SUR DES IMPORTATIONS ET DES EXPORTATIONS .
10 TRADE WITH EACH OTHER .
COMMERCE AVEC LE CHAQUE AUTRE .
11 THE CUSTOMS DUTIES ON IMPORTS SHALL BE PROGRESSIVELY ABOLISHED .
LES FONCTIONS DE DOUANE SUR DES IMPORTATIONS SERONT ABOLIES PROGRESSIVEMENT .
12 TRANSITIONAL PERIOD .
P3ERIODE DE TRANSITION .
13 BASIC DUTY TO WHICH THE SUCCESSIVE REDUCTIONS SHALL BE APPLIED .
DEVOIR DE BASE AUQUEL LES R3EDUCTIONS SUCCESSIVES SERONT APPLIQU3EES .
14 CUSTOMS DUTIES OF A FISCAL NATURE .
FONCTIONS DE DOUANE D' UNE NATURE FISCALE .

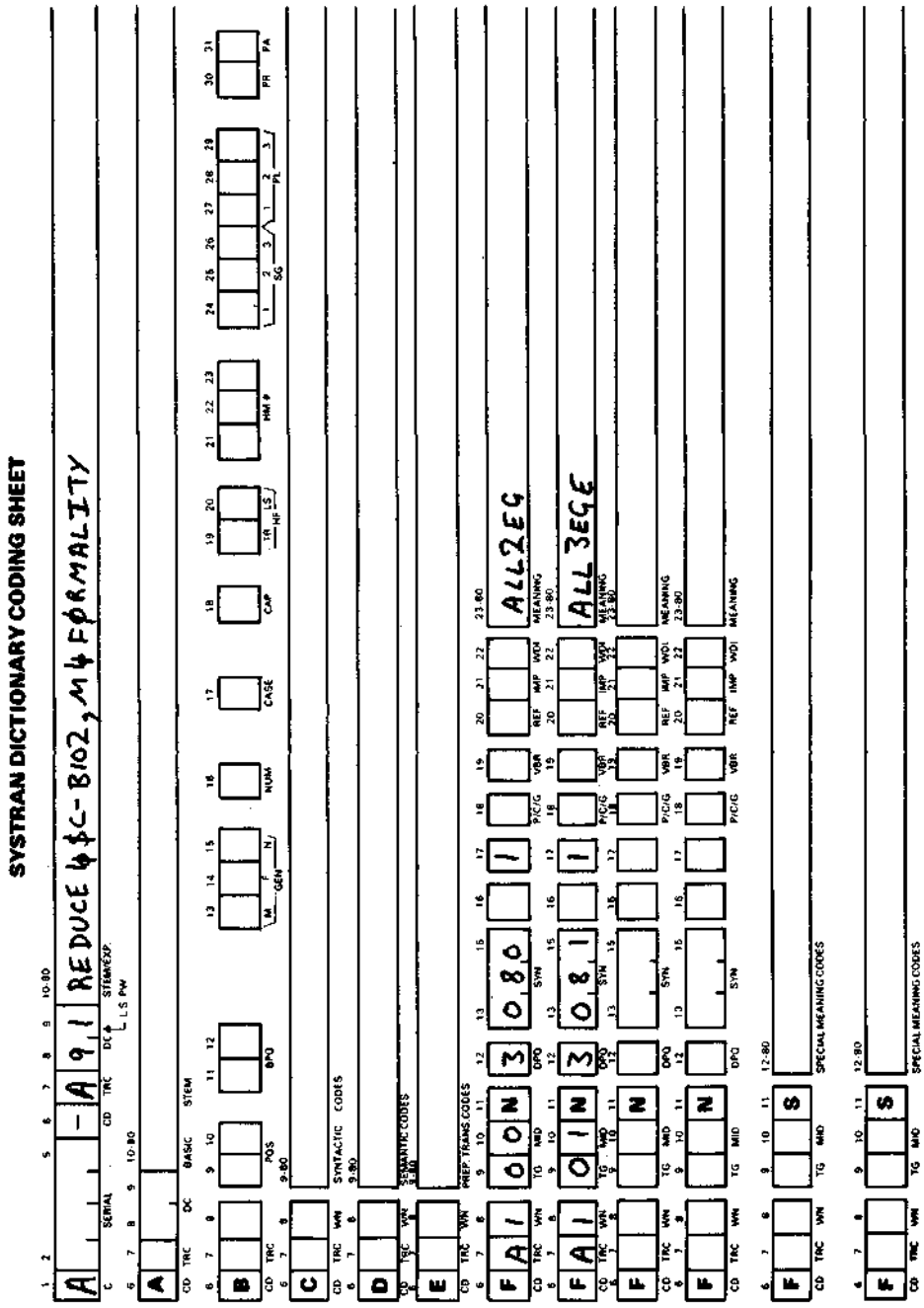
15 REDUCTION OF CUSTOMS DUTIES AS.A.WHOLE .
R3EDUCTION DES FONCTIONS DE DOUANE DANS SON ENSEMBLE .
16 THE DUTIES SHALL , AT EACH REDUCTION , BE LOWERED BY 10% .
LES FONCTIONS , 2A CHAQUE R3EDUCTION , SERONT ABAISS3EES PAR 10% .
17 INTERNAL TAX .
IMP4OT INTERNE .
18 INTERNATIONAL TRADE .
COMMERCE INTERNATIONAL .
19 LOWERING OF BARRIERS TO TRADE .
ABAISSEMENT DES BARRI2ERES 2A VENDRE .
20 DUTIES IN THE COMMON CUSTOMS TARIFF .
FONCTIONS DANS LE TARIF DOUANIER COMMUN .
21 CUSTOMS TERRITORY .
TERRITOIRE DOUANIER .
22 DUTY APPLIED .
DEVOIR APPLIQU3E .
23 CALCULATION OF THE ARITHMETICAL AVERAGE .
CALCUL DE LA MOYENNE ARITHM3ETIQUE .
24 THE TARIFF OF THE BENELUX COUNTRIES .
LE TARIF DES PAYS DU C$B3EN3ELUX .
25 THE LISTS OF TARIFF HEADINGS ARE SET.OUT IN ANNEX I TO THIS TREATY .
LES LISTES DES TITRES DE TARIF SONT PR3ESENT3ES 2A L' ANNEXE C$I DE CE TRAIT3E
26 DUTIES APPLICABLE .
FONCTIONS APPLICABLES .
27 THE INTERNAL CONSISTENCY OF THE COMMON CUSTOMS TARIFF .
LA CONSISTANCE INTERNE DU TARIF DOUANIER COMMUN .
28 DEGREE OF PROCESSING UNDERGONE BY THE VARIOUS GOODS .
LE DEGR3E DE TRAITEMENT SUBI PAR LES DIFF3ERENTES MARCHANDISES .

APPENDIX B (3)

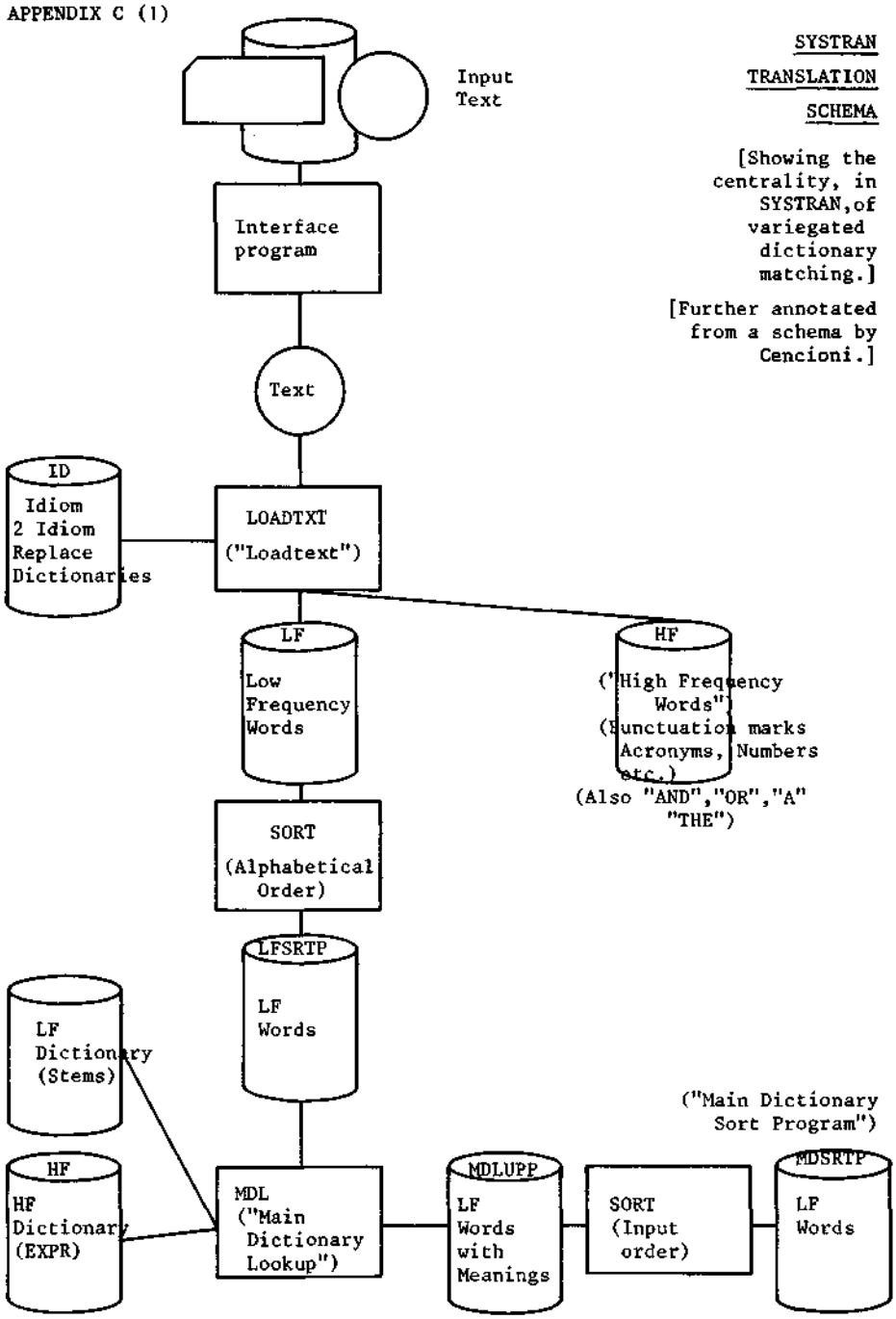
Specimen dictionary entries made to correct the errors.




SYSTRAN DICTIONARY CODING SHEET
A - A 9,1 REDUCTION $C-B24,MØF $C-B18,MØDUTY
SERIAL
STEM/ENP
L.S. PW
BASIC STEM
POS
GEN
NUM
CASE
CAP
SYNTACTIC CODES
SEMANTIC CODES
PREP. TRANS CODES
FAI ØØN 1 003 1 2 ABAISSEMENT
FAS ØØN 1 003 2 DRØIT
SPECIAL MEANING CODES


SYSTRAN DICTIONARY CODING SHEET
A - A 9 1 REDUCE ϕ $C- B102, M4 FORMALITY
A
B
C
D
E
F A I O N 3 0 8 0 1
F A I O I N 3 0 8 1 1
F N
F N
F S
F S
ALL2EG
ALL3EGE
SPECIAL MEANING CODES
SPECIAL MEANING CODES

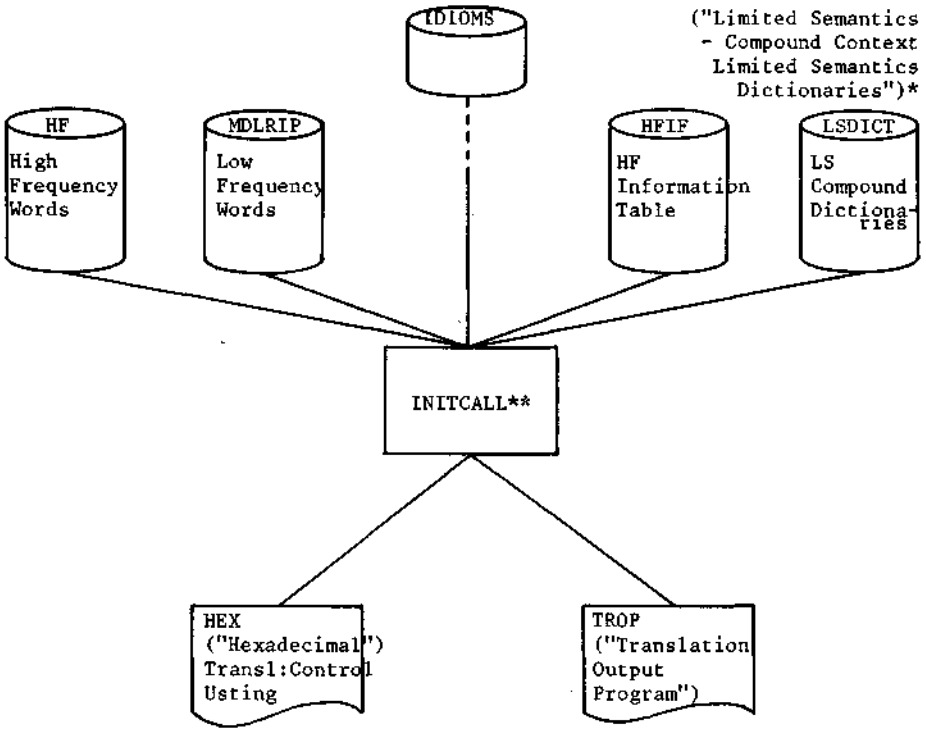
APPENDIX C (1)



SYSTRAN TRANSLATION SCHEMA

[Showing the centrality, in SYSTRAN, of variegated dictionary matching.]

[Further annotated from a schema by Cencioni.]



* It is this dictionary which contains the particularised, context-sensitive translations.

** The INITCALL module controls both the homograph syntactic disambiguation routines and the five syntax-analysis passes, together with some semantic disambiguation routines.

APPENDIX C (2)

Brigham Young Translation Institute, overall schema for multilingual translation of Mormon Church texts.