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Advances in Machine Translation Research in IBM

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Abstract

IBM is engaged in advanced research and development projects on various aspects of machine translation, between several language pairs. The activities reported on hero are all parts of a rather large-scale, international effort, following Michael McCord's LMT approach. The paper focuses on seven selected topics: recent enhancements made in the Slot Grammar formalism and the specific analysis components; specification of a semantic type hierarchy and its use for verb sense disambiguation; incorporation of statistical techniques in the translation process; anaphora resolution; linkage of target morphology modules; methods for the construction of large MT lexicons; and interactive disambiguation.

1 Introduction

This paper reports on a sel of advanced research and development projects, coordinated under one international framework, being carried out in various IBM centers in Europe and the USA. The projects tackle various aspects of machine translation, and the achievements are demonstrated by working prototypes. The presentation of this work in MT Summit III will include examples from our three major prototypes at this time: English-German, German-English, and English-Spanish, (Work is also underway on five other language pairs.)

The underlying technical approach follows that of the LMT system by Michael McCord. In the basic LMT design, translation is accomplished through four major steps (all implemented in Prolog): lexical analysis, producing clauses describing inflected and derived input words and their transfers; source syntactic analysis, producing an internal representation showing both surface structure and deep (logical) relations; transfer, divided into a compositional phase which produces a data structure isomorphic to the output of source analysis but having target (base) words and target features, and a restructuring phase which produces a target surface tree; and finally target morphological generation, producing the target sentence (or phrase). The system includes a large shell with language-general functions.

The overall LMT architecture is described in detail elsewhere [McCord 85, 89a,b]. Here we concentrate on a few selected topics, representing interesting recent enhancements to the original LMT design.

The one central guideline we follow is to maintain a reasonable balance between advanced research goals and practical possibilities. Thus, while we seek solid methodological grounds and linguistic motivation, we do not neglect issues such as coverage, performance, and an open software design. It is our belief that in an extremely complex area such as MT the only way to produce significant results is to have a comprehensive, long-term, perhaps even ambitious research plan, implemented in small steps in practical, working prototypes.

2 New Features in Slot Grammar

Source analysis in this project is done with Slot Grammar (SG) [McCord 80, 90]. SG is characterized by (a) the systematic use of slots (grammatical relations) and slot frames in the lexicon and the grammar rules, and (b) a rather large language-general *shell* dealing with coordination, extraposition, punctuation and parse evaluation. No phrase structure rules ate used. Instead, grammar rules are divided modularly into *slot filler* rules, slot *ordering* rules, and *obligatory slot* rules, plus some minor types of rules dealing with language-specific aspects of constructions treated in the shell, such as coordination. The parser is basically a bottom-up chart parser and uses the (numerical) parse evaluation rules to prune the parse space (during parsing).

The original work on SG was done in the late 1970's, and the system was one of the earliest thoroughly lexicalIst computational grammars. SG was revised a few years ago, and implemented in a logic-programming framework. This version of SG, and the overall LMT approach, were presented in MT Summit II [McCord 89b]

*The authors represent larger groups in the IBM centers in the United States, Germany, Spain and Israel, collaborating on this effort. Credit for contributions is due to G. Arrarte, E. Bentur, A. Bernth, B. Bläser, B. Carranza, I. Dagan, S. Lappin, H. Leass, M. Neff, U. Rackow, T. Redondo, D. Segev (Ben-Ari), A. Storrer and I. Zapata. Specific references are made in the paper to major individual contributions. The mail address of the technical leader of the coordinated projects is: Mori Rimon, IBM Scientific Center, the Technion City, Haifa 32000, Israel.
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In the current paper we comment on a number of recent improvements.

(1) *Or-slots.* There is a systematic treatment of slots with parameters that are formally disjunctions of symbols representing syntactic characteristics of the filler. The SGs for English, German, and Danish, and their lexicons, have been revised to use or-slots. This allows greater expressive power in the lexicon.

(2) *Lexical erasure rules.* Such rules are used in a pre-parse pass to heuristically remove (probably) incorrect lexical analyses, based on local context.[1]

(3) *Pre-editing facilities.* The user can mark the input string selectively with brackets < ... > (to any degree) to force parsing choices and disambiguate the input. "User" in this context can also apply to tools (such as the interactive disambiguator described in Section 8), which may introduce such marks in their output.

(4) *Fail-soft parse facility.* A method for producing "fitted parses" for unparsable inputs (similar to that in [Jensen/Heidorn 82]) has been developed for SG. The translation phases which follow source analysis can handle such pieced-together analyses.

(5) *Flexible format of analysis output.* A network representation of the source analysis output (created after the parse, and stored as a set of Prolog unit clauses) allows easy exploration of the entire data structure, sometimes needed for target word selection and other translation tasks.

(6) *Large lexicons.* The English SG is interfaced to the UDICT lexicon [Byrd 83], [Klavans/Wacholder 89], which has over 60,000 lemmas, by heuristics that convert UDICT's feature bundles into SG-style entries. The Spanish SG has a similar interface and heuristics for a lexicon which combines information from the Collins Spanish-English Lexical Data Base and from a project of Spanish document verification and composition [Casajuana et al. 87], [Rodríguez et al. 90]; when completed, it will contain about 40,000 lemmas. Similar volumes are now available for German-English. For lexicons and lexicon tools in this project, see Section 7.

(7) *Inferential lexical disambiguation.* We use techniques from a more general research program, reported in [Bernth/Lappin 91], to resolve word sense ambiguities based on inference from world knowledge. (The ambiguity and the resolution are in terms of target word selection.) In that program, meaning postulates are expressed in pseudo-natural language, containing variable symbols for sub-phrases. Parsed forms of the rules are then used in an inference system.

(8) *Treatment of idioms.* Idioms are stored in the lexicon as pseudo-natural language strings, containing variable symbols much as in item (7) above. These strings are parsed during lexical preprocessing and used to build patterns and transformations which "normalize" the idiom, in a post-parse step. Transfer rules refer to the normalized trees, (Work in progress by Schwall, McCord. and Neff).

Slot Grammars are available (at different levels of coverage) for English, German, and Danish; work has started on Spanish and Hebrew versions.

3 Semantic Types

One of the problems for MT consists in the fact that there- are no one-to-one correspondences between source and target lexical units, even when morpho-syntactic ambiguities have been resolved. The sense representation required for target word selection has to be seen as a special issue in the field of semantic ambiguity representation: sense mappings are language-pair specific. Also, the sense disambiguation required for purposes other than target word selection can require finer distinctions than needed here. For the purpose of sense disambiguation in the specific context of target word selection, the LMT system incorporates a facility to formulate selectional restrictions over complements (slots) or heads as conditional tests. (In fact, the facility is more general, allowing examination and tests of any part of the parse.) These tests are called during transfer, only when the translation-relevant ambiguity is identified,

The selectional restrictions for verbal slots are formulated by means of semantic types that are hierarchically related. The SemType hierarchy [Breidt 90], inspired by [Dahlgren 88], was constructed;[2] Dahlgren's hierarchy is supposed to reflect the "everyday knowledge" of ordinary people *(folk taxonomy)* and is not intended to capture scientific structuring of the world. Our SemType hierarchy has been created in a combined inductive-deductive process: starting with a preliminary hierarchy (mainly based on [Dahlgren 88] and [Zelinsky-Wibbelt 88]), then enriching it with concepts necessary for selectional restrictions, as found by an investigation of the most frequent German-English vocabulary. In its current version, the hierarchy consists of 42 types and allows for formulation of strong restrictions by the method of multiple attachment and cross classification. The experiences with this SemType hierarchy have shown good practical results so far; we will soon start an intensive evaluation phase, and will also study the adaptability to specific text domains.

As an example for the use of the type hierarchy for target word selection, consider the transitive form of the German verb *abreißen.* It can be translated into English as ¡ear *off or t*ear *down* (or *pull down).* This ambiguity can be resolved by a rather rough formulation of selectional restrictions. The first reading allows a subject of the semantic type non-stationary or real-event, and a direct object which is non-selfmove (this implies non-stationary). The second reading selects a physical or a sentient subject and a direct object with the

[1] Cf. [Marshall 83], [Herz/Rimon 91], about the disambiguation power of local constraints in general.

[2] Work done in the Heidelberg center.

cross classified type stationary & lion-living. This is demonstrated by the following sentences:

"Die Sekretärin *hat* das alte Kalenderblatt *abgerissen."*
"The secretary *has torn off* the old calendar page."

"Die Firma *hat* die Theodor-Heuss-Brücke *abgerissen."*
"The company *has torn down* the Theodor Heuss Bridge."

As can be seen from this verb example, the selectional restrictions will not give a definite and unambiguous semantic description of the complements themselves: the type assigned to a complement will remain as coarse as possible in order to capture a target verb ambiguity. The advantage of cross classification, as demonstrated by the direct object requirement of the second reading of *abreissen,* is that instead of introducing new concepts, atomic concepts can be combined to complex categories. Lower structure and domain-specific concepts can be added easily. [3]

In case of collocational or idiomatic use of complements, the SemType approach does not apply; here the treatment of idioms described in Section 2 comes in. The combination of both approaches yields good results for the compositional and non-compositional translation of constructions.

4 Statistical Considerations

Natural language processing techniques, based on statistics drawn from large corpora, have received considerable attention in the last few years. In our approach[4], statistics is a valuable source for enhancements of linguistic considerations; it does not replace linguistics. We use statistics for various types of disambiguation, as an alternative or a complement to semantic methods, in cases where such methods require too much coding of knowledge. The use of corpus information also helps in tuning an MT system to prefer common interpretations found in real texts.

One type of useful data is statistics on lexical relations, i.e. co-occurrences of specific words in certain syntactic relations (such as subject-verb, verb-object, adjective-noun, etc.). The usefulness of such data for the problem of target word selection is demonstrated in the following example of translation from German into English, taken from the current German press:

"Es wurde auch die *Vorstellung begraben,* man könne mit den Ideen und Ideologien des 19. Jahrhunderts die ganz anderen Probleme des 20. Jahrhunderts *lösen."*

This sentence contains three ambiguous words that have more than one possible translation into English: *Vorstellung, begraben* and *lösen.* Without having information which is the right translation for each word in this context, one would get alternative translations for the sentence, such as:

"But also the *idea /picture /performance /presentation* was *abandoned / relinquished / buried / ended* that one could *solve / resolve / remove / cancel* the totally different problems of the 20th Century with the ideas and ideologies of the 19th Century."

The statistical data on the frequency of lexical relations in very large English corpora (tens of millions of words) enable us to select automatically the correct translation for the three cases (see [Dagan/Itai/Schwall 91]). The words *idea* and *abandon* were selected because they cooccurred in the 'verb-object' relation significantly more times than all other alternative combinations; similarly for the verb *solve,* which appears frequently with the noun *problem* in the 'verb-object' relation.

A large-scale experiment was conducted to test the performance of the statistical method, selecting the English translation for 105 ambiguous Hebrew words taken arbitrarily from the broad domain of foreign news in the Israeli press. The results of the experiment are very promising, as the statistics were applicable for about 70% of the ambiguous words, and the selection was then correct for 92% of the cases.

The statistics on lexical relations is also used successfully to resolve ambiguous references of the pronoun 'it' [Dagan/Itai 90]. Similarly, we intend to use these statistics on lexical relations for syntactic disambiguation, preferring parse trees which correspond to frequent relations

A different kind of statistical data relates to the frequency of various syntactic structures. This data is used to estimate the probabilities of production rules in a probabilistic model of grammar, and by that to select the most probable parse (and intermediate partial parses) for a sentence. (Cf. similar work for Context Free Grammars such as [Fujisaki *et al.* 89].) We have started to develop and implement a probabilistic model for Slot Grammar in order to capture also this kind of information and improve the current ranking mechanism of the parser.

5 Anaphora Resolution

Previous sections described considerations based on syntax, semantics and statistics. The anaphora resolution component demonstrates how different levels of processing can act together in an effective way.

The multi-strategy approach for resolution of anaphora in this project focuses on two cases: pronominal reference and interpretation of definite noun phrases.

The core of this component is a discourse-based procedure, RAP [Leass/Schwall 91]. *Discourse History is* built up in the course of processing a text; it contains entities introduced in the text, as well as assertions about them. Indefinite descriptions invoke new entities, as do definite descriptions for which no antecedent can be found. A *salience weight* is associated with each entity, providing

[3] Work on type consistency checking is now in progress (by Storrer, Breidt, and Schwall).

[4] The research on statistical methods for disambiguation is done partly within the PhD dissertation of Ido Dagan in the Technion, Haifa.

a measure of its level of foregrounding. No inferences relying on world or domain knowledge are made here.

For resolution of pronominal reference, we first filter out antecedents not compatible with the pronoun morphologically (number and gender agreement) or syntactically. This deterministic procedure is based on a syntactic filter, operating at a sentence level on SG parse output [Lappin/McCord 90]. It contains three algorithms, of which we currently use the first two. One algorithm identifies the set of pronoun-NP pairs in a sentence, for which coreference is syntactically excluded. The second algorithm identifies the possible NP antecedent binders for reflexive pronouns and reciprocal noun phrases. The third algorithm generates interpretations for a central class of elliptical verb phrase structures,

Following the deterministic filtering, a heuristic procedure is applied. First, based on a salience threshold and constraints imposed by selectional restrictions on verbal complements, the search space is further reduced. Empirically and linguistically motivated heuristics (such as recency, subject emphasis, accusative object emphasis, matrix clause preference, etc.) then serve to rank candidates and, when possible, to select the one most appropriate referent in the list. If no candidate is found, the search is repeated without a salience threshold.

For interpretation of definite noun phrases, we use constraining information on their modifiers (e.g. adjectives and relative clauses). The semantic type hierarchy and selectional restrictions on verbal complements described in section 3 provide further constraints. Salience weighting and the search heuristics are used in a similar way as in the case of pronominal reference resolution. If no referent is found for a definite noun phrase, a new entity is created.

The third dimension of anaphora resolution (in addition to the deterministic filtering and the discourse-based heuristics) is statistical. The idea here is to evaluate the list of candidates which RAP produces using methods described in section 4 above, and to generate weighted plausibility measures. The integration of the statistical considerations with RAP is underway at this time (joint work by the Haifa and Heidelberg centers). When completed, it will add a dimension that is usually missing in comprehensive anaphora resolution packages (cf. [Carter 87], [Carbonell/Brown 88], for example).

6 Linkage of Target Morphology Modules

Being a basic building block in all natural language processing applications, modules that handle morphology (analysis and/or generation) are available for many languages. Since morphology can be quite complex, it makes economical sense to reuse such modules for new applications.

In this project we took advantage of a comprehensive effort of classification and specification of Spanish words, undertaken in the Madrid center in the period 1983-88. The idea behind that effort is that, although Spanish has a complex, irregular morphology, it is possible to define a simple set of rules governing the inflection of words according to a system of inflection models (paradigms). In the framework of that project[5], such morphological classes were defined and a large number of Spanish words were classified accordingly. After slightly restructuring this classification according to the logic of LMT, a final set of 183 word classes (paradigms) was defined - for verbs (105 classes), nouns (50) and adjectives (28).

The open design for LMT lexical organization allows for various methods of hooking in target morphology modules. In the case of Spanish, we found it best to include morphology markers in the bilingual lexicon. Thus, when a target word is selected in the transfer phase, it is passed to the generation module along with this marker, telling its paradigm class, and the morphological features (tense, mode, person, number, gender, etc.). This method is simple, efficient, flexible (e.g. allows easy handling of cases where the same target lemma may have different morphological characteristics depending on its sense), and it reduces the number of lexicons in the system. It can be described as *Lexicon Driven Morphology* [6].

In another situation, when translating from English into Hebrew, it was found more convenient to keep an already available morphological module as-is, and interface to it through a simple set of Prolog predicates.

7 Construction of Large MT Lexicons

The construction of lexicons for multilingual MT systems constitutes a major challenge. It is an extremely labor- and cost-intensive task, requiring significant (multilingual) linguistic skill. Therefore, special attention is being paid in the framework of our project to methods for (a) reducing the cost of developing lexicons, (b) increasing reliability, (c) allowing the use of the lexical data in different versions of prototypes or even in various syntactic systems, and (d) reusing the MT lexicon information for Machine Assisted Human Translation tools. Significant progress has been made in the automatic access of available machine readable dictionaries, both monolingual and bilingual. The bilingual Collins dictionaries English-German, German-English, and English-Spanish have been converted to the corresponding Lexical Data Bases using a separately developed general-purpose Dictionary Entry Parser. The English-German LMT system has been augmented by an access module (COLLEG) which supplements the coverage of hand-coded lexicons with real-lime access to the lexical data base (converting data stored in such data bases to the required lexical entry formal, on the fly). The access module includes a language-pair independent shell component COLLXY, that makes it easily adaptable for other language pairs for which a machine readable dictionary is available. The shell together with modified versions of the English-German access rules provide

[5] A system for verification and composition of Spanish documents, which contains a ground dictionary for Spanish as well as morphological and synonym modules [Casajuana et al. 87], [Rodríguez et al. 90].

[6] Although this method was applied first to generation morphology, it is now being extended to analysis morphology in the Spanish Slot Grammar.

real-time access also for the German-English (COLLGE) and English-Spanish (COLLES) systems. A background batch dictionary generation option of the COLLXY access program allows the data from the lexical data base to be loaded as an auxiliary lexicon in LMT format and accessed directly by the translation system.[7]

However, lexical information derived from machine readable dictionaries is, in many cases, neither complete nor sufficient for MT purposes. Therefore, and with the objectives set above in mind, an additional set of lexicon tools was developed[8]. This set of tools, LOLA (**L**inguistic-oriented **L**exical Database **A**pproach), provides (a) a relational bilingual database managed via a database management system; (b) a convenient user interface for hand-coding and modification; (c) a conversion program for loading Lexical Data Base entries into the relational system in the required format; and (d) purpose-specific generation tools. The information from the machine readable dictionaries is first loaded into the lexicon database of LOLA, where, in a second step, it can be modified and augmented through a convenient user interface. Then the generation program converts the content of the database into the lexical entry format used in the translation system. This separation helps avoid notational mistakes, typical for hand-coding, as well as undesirable strong dependency between the general lexical data and the specific (and changing) format of lexical entries in the translation system.

In addition to the standard advantages that a database management system offers (multi-user access, automatic consistency and integrity checks, definition of various data views for different users), the skillful use of the relational model in the design of the LOLA database allows for independence of data base design from the current lexical entry format, and storage of additional lexical information that is available in machine readable dictionaries and may be used in later versions of our MT prototypes. Transfer-independent information can be reused for other language-pairs as well as for other NLP applications. The reversibility of the data for the two directions of one language pair, as well as the general reusability for multilingual translation, will be further investigated.

[7] This paragraph summarizes an application of ongoing research in machine-readable dictionaries and lexical data bases (Mary Neff, Hawthorne Research Center). See [Neff/Byrd/Rizk 88] for a general description of the Collins-based Lexical Data Base; [Neff/Boguraev 89] for the Dictionary Entry Parser; [Neff/McCord 90] for COLLEG. The English-German and German-English Lexical Data Bases and COLLEG software were developed at Hawthorne; COLLGE and COLLES resulted from collaborative efforts between the Hawthorne lab and the Heidelberg and Madrid centers, respectively. The English-Spanish Lexical Data Bases were built at the Madrid center, and work continues there on COLLES; both efforts are partly for the PhD dissertation of Isabel Zapata in the Universidad Complutense, Madrid.

[8] Work done in the Heidelberg center - see [Bläser/Schwall/Storrer 90]

8 Interactive Disambiguation

Natural languages are rich in ambiguities of different sorts, some inherent to a given source language, others only manifested in the context of translation in!o another language. As demonstrated in previous sections, special attention is paid in this project to automatic disambiguation, using syntactic, semantic, and statistical methods. Yet there are cases where all these methods fail - partly because some sentences are ambiguous even for human readers, and partly because some knowledge needed for automatic disambiguation may be missing in the system. In these cases we resort to interactive disambiguation.

Our approach, which can be described as *Interactive Disambiguation by Rephrasing* [9], is based on several assumptions: (a) Ambiguities are frequently a consequence of a delicate balance in the structure of the sentence, a balance which can be disrupted even by minor changes; (b) it is easy for a human reader to decide whether or not a paraphrase of a sentence preserves the original meaning; (c) it is not necessary for a system to fully understand the source of an ambiguity in order to identify it and decide whether or not it may be preserved on translation.

Interaction is done in natural terms - presenting the user with paraphrases corresponding to the different tentative interpretations of the ambiguous source sentence. Thus, for example, the sentence

"Old filters and valves should be replaced."

yields two paraphrases:

(a) "Old filters and old valves should be replaced."

(b) "Valves and old filters should be replaced."

And the sentence

"The management requests control information."

is paraphrased as:

(a) "The management requests the information."
(b) "The requests control the information."

The identification of ambiguities is done by examining the data structure produced by the Slot Grammar based parser. The user selects the correct interpretation, and his/her decision is evaluated and then reflected in that data structure, to be forwarded to the next phase of translation. It is also possible to replace the original sentence by the unambiguous paraphrase, if the user so wishes.

To make interactive disambiguation a useful tool, user interaction should be minimal and as friendly as possi-

[9] The original idea was presented in [Ben-Ari/Berry/Rimon 88], In parallel to the practical development oí the disambiguation component for the IBM project, Danit Segev (Ben-Ari) is further pursuing more theoretical questions as part of her work an a PhD dissertation in the Technion, Haifa.

ble. The following are the principles of our approach; (a) source language terms are used whenever possible; (b) technical linguistic terms are avoided; (c) the user is prompted only for untranslatable ambiguities (the p-reservability of an ambiguity on translation depends on the target language(s) under consideration), (d) the user is not prompted for problems that can be solved by automatic means (e.g. semantic and statistical) in other phases of the translation process; and (e) repetitions are avoided as much as possible.

The place of user interaction in the translation process depends on the operational environment. In some circumstances ¡t can be seen as "the last resort" for disambiguation, coming into the picture when all other methods do not provide a clear-cut resolution. But one may also consider interactive disambiguation as a pre-process - a writing aid (rather than a post-editing tool). In such an environment, where the text author is available (and may even be an occasional mono-lingual user) it is very important to carry out all interaction in source language terms. In situations where the source text is to be translated into more than one target language, this approach represents obvious savings.

9 Sample Translations

The following are a few examples, illustrating the operation of our prototypes. The examples demonstrate some of the problems and solutions discussed above.

Example 1: German into English

G: Der Chef setzte die Debatte für 3 Stunden aus.

E: The boss adjourned the discussion for 3 hours.

Example 2: German into English

G: Der Mann setzte mit seiner Arbeit aus.

E: The man interrupted his work.

Example 3: German into English

G: Muß ich warten, bis die Versicherung die Kosten anerkennt, ehe ich meinen Wagen reparieren lasse?

E; Must I wait till the insurance company accepts the costs before 1 have my car repaired?

Example 4: German into English

G: Der Benutzer packt die Systemeinheit, den Bildschirm und die Tastatur aus. Er schließt die Tastatur über ein Tastaturkabel an die Systemeinheit an und stellt ihre Höhe mit Hilfe der Stützen ein.

E: The user unpacks the system unit, the screen and the keyboard. He attaches the keyboard by a keyboard cable to the system unit and adjusts its height with the help of the feet.

Example 5: English into Spanish

E: Record the model number, system-unit serial number, and key serial number.

S: Anote el número de modelo, el número de serie de la unidad central y el número de serie de las llaves.

Example 6: English into Spanish

E: Slide the drive toward the front of the system unit until it touches the cover plate.

S: Deslice la unidad hacia la parte frontal de la unidad central hasta que toque la placa frontal de la cubierta.

Example 7: English into Spanish

E: Slide the assembly fully into the system unit until the metal fins on the assembly bracket are pressing against the rear of the system unit.

S: Introduzca el conjunto completamente en la unidad central hasta que las aletas metálicas de la pieza de sujeción del conjunto estén presionando contra la parte posterior de la unidad central.

Example 8: English into Spanish

E: If the above items are correct and the testing programs on the Reference Diskette found no problem, have the system unit and option serviced.

S: Si los elementos arriba descritos son correctos y los programas de prueba en el diskette de consulta no detectaron ningún problema solicite servicio técnico para la unidad central y la opción.

Example 9: English into German

E: Slide the assembly fully into the system unit until the metal fins on the assembly bracket are pressing against the rear of the system unit.

G: Schieben Sie die Baugruppe vollständig in die Systemeinheit, bis die Metallplättchen auf dem Konstruktionsrahmen gegen die Rückseite der Systemeinheit drücken.

Example 10: English into German

E: If the above items are correct and the testing programs on the Reference Diskette found no problem, have the system unit and option serviced.

G: Wenn die obengenannten Punkte korrekt sind und die Testprogramme auf der Referenzdiskette keine Störung fanden, lassen Sie die Systemeinheit und die Systemerweiterung warten.

Example 11: English into German

E: If the screen shown in step 2 on page 7 appears, follow the instructions on the screen and select *Test the computer.*

G: Wenn der Bildschirm, der in Schritt 2 auf Seite 7 gezeigt wird, erscheint, folgen Sie den Anweisungen auf dem Bildschirm und wählen Sie *den Computer testen.*

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