Twelve languages - one translation method

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In ERCIM news No. 22 of July 1995 (page 21) a new method is described called logotechnique (word processing). This method enables amongst others a fully automated language processing both for a query system in a single language and for machine translation. In the following we will illustrate machine translation according to this method by explaining how one sentence could be treated in all twelve languages of the thirteen ERCIM institutions. The fundamentals of the method will be described in a simplified manner and the translation specifications will be given. Finally, the translations will be presented.

Initially, the structure of each language itself must be identified [details: Rolland: Sprachverarbeitung durch Logotechnik. Bonn: Dümmler 1994]. In this way we obtain the relational structure of the language, i.e. the connection between the initial word and the dependent words in their specific relationships (e.g.: to buy -> what? -> computers, not: *to buy -> what? -> earthquakes). All relationships of the initial word result in the construction plan. Each word has such a construction plan. This plan thus comprises the initial word, and the relationships involved including the specific dependent words using their correct inflections. The word contents consists of the "special contents" and the "general contents", differentiated into "inflection" and "construction". The dependent words are grouped into "classes of meaning" according to their semantic similarity (e.g. furniture: table, chair, ...; device: computer, printer, ...) etc. Within the meaning classes each word is marked by the possible relationships; each relationship has a reference to the respective inflection. Therefore, construction plans, meaning classes and inflection groups have to be determined only once. Each sentence is an extract from the possibilities which are given by the construction plan including the references. All construction plans taken together are the explicit relational structure of the language. The construction plans labelled for natural language processing represent the "relation base".

Additionally, it is necessary to consider specific features of the language. E.g. a relationship may not only be concretized by a single word, but also by a subordinate clause, with or without an introductory conjunction or the like, but always with a predicate which has its own construction plan (e.g. to walk on -> in spite of what concession? -> although -> to be exhausted: They walked on although they were exhausted). Predicates include verbs, auxiliary verbs, modal verbs etc. Articles and possessive pronouns are dependent on the corresponding noun [R.e. pp. 83; 203]. In addition, each language has particular characteristics to be handled by rules. Rules also govern the word order.

When establishing a translation system it is necessary to create the link between the relation bases. Equivalents may be, e.g. a) a single word - a subordinate clause; b) active form - passive form; c) reflexive verb - phrase; d) article +noun - noun only etc.

If we assume that the relation bases of the twelve languages of the ERCIM institutions were explicitly available and had been linked by translation experts, we could have the following twelve language-units: German - English; English - Finnish; Finnish - French; French - Italian; Italian - Greek; Greek - Dutch; Dutch - Norwegian; Norwegian - Portuguese; Portuguese - Swedish; Swedish - Spanish; Spanish - Hungarian; Hungarian - German. The sentence, which is to be translated, reads as follows: "Mag sich auch die ganze Welt gegen die Wahrheit rüsten, so wird man doch ihren Sieg nicht verhindern" (Let the whole world rise up in arms against the truth, still its victory cannot be prevented). The construction plans of the verbs: "verhindern" (to prevent) and "sich rüsten" (to rise up in arms) would be included in the linked relation bases in all of the above languages. Now it is possible to identify the structure of the sentence according to the relation base in one language and look up the linked units in the other language.

If one needs the translation: German - Italian, but there are only the equivalents in the sequence: German - English - Finnish - French - Italian, a computer system can identify the corresponding sentence structure, beginning with German and continuing through English, Finnish, French and Italian. The system uses only the Italian word ordering rules for presenting the correct Italian translation in the final step. So an arbitrary language can be the source or target language. In the following, the twelve sentences are presented. Additionally the full set of tables can be retrieved at: http://www-ercim.inria.fr/tmp/rolland.rtf.

German		German - English		English - Finnish	
Initial language		*Initial sentence:* **Mag sich auch die ganze Welt gegen die Wahrheit rüsten, so wird man doch ihren Sieg nicht verhindern.**		*Initial sentence:* **Let the whole world rise up in arms against the truth, still its victory cannot be prevented.**	
German (+ rules) **construction plan** (main clause): verb: verhindern: wird verhindern who? man what(acc)? ihren Sieg with what certainty? nicht in spite of what concession? so doch with what concession? (mag) auch, wenn auch, ... -> predicate **construction plan** (of this predicate): verb: sich rüsten: mag sich rüsten who? die ganze Welt against what? gegen die Wahrheit	>	**English** (+ rules) **construction plan** (main clause): verb: to prevent can be prevented who? - what(nom)? its victory with what certainty? not in spite of what concession? still with what concession? (let) ... -> predicate **construction plan** (of this predicate): verb: to rise up in arms: let rise up in arms who? the whole world against what? against the truth	>	**Finnish** (+ rules) **construction plan** (main clause): verb: estää: voi estää who? - what(partitive)? sen voittoa with what certainty? ei in spite of what concession? kuitenkaan with what concession? vaikka ... -> predicate **construction plan** (of this predicate): verb: varustautua: varustautuisi who? koko maailma against what? totuutta vastaan (prep.)	>
German: **Mag sich auch die ganze Welt gegen die Wahrheit rüsten, so wird man doch ihren Sieg nicht verhindern.**		*Translation: English:* **Let the whole world rise up in arms against the truth, still its victory cannot be prevented.**		*Translation: Finnish:* **Vaikka koko maailma varustautuisi totuutta vastaan, ei sen voittoa voi kuitenkaan estää.**	

Finnisch - French		French - Italian		Italian - Greek	
Initial sentence: **Vaikka koko maailma varustautuisi totuutta vastaan, ei sen voittoa voi kuitenkaan estää.**		*nitial sentence:* **Que la terre entière s'arme contre la vérité, on n'empêchera pourtant pas la victoire de celle-ci.**		*Initial sentence:* **Per quanto il mondo intero si armi contro la verità, la sua vittoria non potrà essere evitata.**	
French(+ rules) **construction plan** (main clause): verb: empêcher: empêchera who? on what? la victoire de celle-ci with what certainty? ne ... pas in spite of what concession? pourtant with what concession? que ... -> predicate **construction plan** (of this predicate): verb: s'armer: s'arme who? la terre entière against what? contre la vérité	>	**Italian** (+ rules) **construction plan** (main clause): verb: evitare: potrà essere evitata who? - what(nom)? la sua vittoria with what certainty? non in spite of what concession? - with what concession? per quanto ... -> predicate **construction plan** (of this predicate): verb: armarsi: si armi who? il mondo intero against what? contro la verità	>	**Greek** (+ rules) **construction plan** (main clause): verb: mpor : ja mpor sei na empod sei who? kane v what(acc)? thn epikr ths thv with what certainty? den in spite of what concession? par” la aut with what concession? ak mh ki an ... -> predicate **construction plan** (of this predicate): verb: xeshk nomai: xeshk‰qe who? lov o k smov against what? en ntia sthn al jeia	>

Translation: French: **Que la terre entière s'arme contre la vérité, on n'empêchera pourtant pas la victoire de celle-ci.**		*Translation: Italian:* **Per quanto il mondo intero si armi contro la verità, la sua vittoria non potrà essere evitata.**		*Translation: Greek:* **Ak mh ki an lov o k smov xeshk‰qe en ntia sthn al jeia, par" la aut kane v den ja mpor sei na empod sei thn epikr ths thv.**	

Greek - Dutch

Initial sentence: **Ak mh ki an lov o k smov xeshk‰qe en ntia sthn al jeia, par" la aut kane v den ja mpor sei na empod sei thn epikr ths thv.**		*nitial sentence:* **Al wapent zich de hele wereld tegen de waarheid, men zal haar zege toch niet verhinderen.**		*nitial sentence:* **Selv om hele verden ruster seg mot sannheten, vil man likevel ikke kunne forhindre at den seirer.**	
Dutch (+ rules) **construction plan** (main clause): verb: verhinderen: zal verhinderen who? men what(acc)? haar zege with what certainty? niet in spite of what concession? toch with what concession? al ... ->predicate **construction plan** (of this predicate): verb: zich waperen wapent zich who? de hele wereld against what? tegen de waarheid	>	**Norwegian** (+ rules) **construction plan** (main clause): verb: forhindre: vil kunne forhindre who? man what (subordinate clause)? at den seirer with what certainty? ikke in spite of what concession? likevel with what concession? selv om ... ->predicate **construction plan** (of this predicate): verb: ruste seg: ruster seg who? hele verden against what? mot sannheten	>	**Portuguese**(+ rules) **construction plan** (main clause): verb: impedir: poderá ser impedida who? - what(nom)? a sua vitória with what certainty? não in spite of what concession? - with what concession? mesmo que ... ->predicate **construction plan** (of this predicate): verb: armar-se: se arme who? o mundo todo against what? contra a verdade	>
Translation: Dutch: **Al wapent zich de hele wereld tegen de waarheid, men zal haar zege toch niet verhinderen.**		*Translation: Norwegian:* **Selv om hele verden ruster seg mot sannheten, vil man likevel ikke kunne forhindre at den seirer.**		*Translation: Portuguese:* **Mesmo que o mundo todo se arme contra a verdade, a sua vitória não poderá ser impedida.**	

Portuguese - Swedish

Initial sentence: **Mesmo que o mundo todo se arme contra a verdade, a sua vitória não poderá ser impedida.**		*Initial sentence:* **Om också hela världen rustade sig mot sanningen, så kommer man ändå inte att kunna förhindra dess seger.**		*Initial sentence:* **Aunque el mundo entero se arme contra la verdad, no se impedirá su triumfo.**	
Swedish (+ rules) **construction plan** (main clause): verb: förhindra: kommer att kunna förhindra who? man what(acc)? dess segger with what certainty? inte in spite of what concession? så ändå with what concession? om också ... ->predicate **construction plan** (of this predicate): verb: rusta sig: rustade sig who? hela världen against what? mot sanningen	>	**Spanish** (+ rules) **construction plan** (main clause): verb: impedir: impedirá who? se what(acc)? su triumfo with what certainty? no in spite of what concession? - with what concession? aunque ... ->predicate **construction plan** (of this predicate): verb: armarse: se arme who? el mundo entero against what? contra la verdad	>	**Hungarian** (+ rules) **construction plan** (main clause): verb: akadályozni: udja megakadályozni who? - what(acc)? gyözelmét with what certainty? sem in spite of what concession? akkor with what concession? ha ... ->predicate **construction plan** (of this predicate): verb: fegyvert fogni fegyvert fog who? az egész vilag against what? az agazság ellen (prep.)	>

Translation: Swedish **Om också hela världen rustade sig mot sanningen, så kommer man ändå inte att kunna förhindra dess seger.**		*Translation: Spanish* **Aunque el mundo entero se arme contra la verdad, no se impedirá su triumfo.**		*Translation: Hungarian:* **Ha az egész világ fegyvert fog az igazság ellen, akkor sem tudja megakadályozni győzelmét.**	

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