

The Human Language Model

Lane Schwartz

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22 October 2014

The Human Language Model

A Re-examination of the Proper Role of Humans & Machines in
Interactive Language Translation 34 years after Kay (1980)

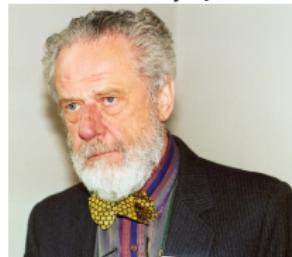
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The world is badly in need of translators. Almost nobody denies this. The number of pairs of languages between which translations must be made and the number and types of documents involved is constantly increasing.

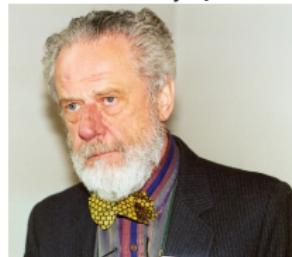
Martin Kay (1980)



“ But we are fortunate to be children of the age of computers and it is to them that we naturally turn. A computer is a device that can be used to magnify human productivity.

”

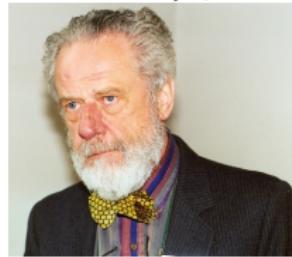
Martin Kay (1980)



“ Properly used, it does not dehumanize by imposing its own Orwellian stamp on the products of the human spirit and the dignity of human labor but, by taking over what is mechanical and routine, it frees human beings for what is essentially human.

”

Martin Kay (1980)



The Human Translation Model



CAT Tools

Bilingual Interactive Translation

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Monolingual Post-Editing

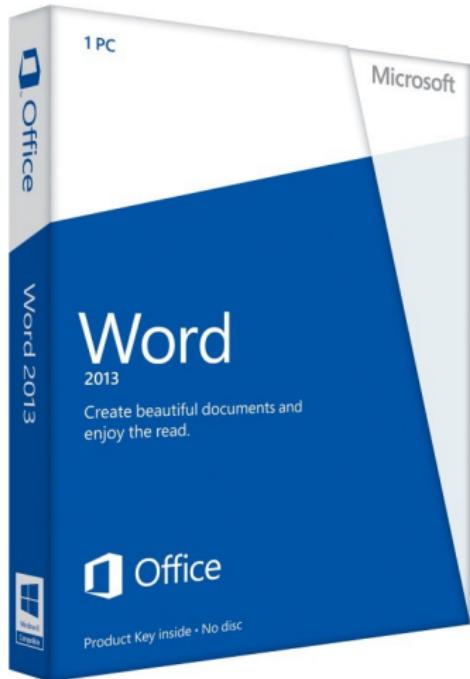
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A Way Forward

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The Human Translation Model



CAT Tools

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Monolingual Post-Editing

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A Way Forward

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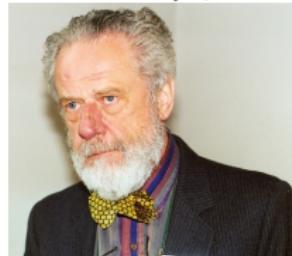
Bilingual Interactive Translation

Monolingual Post-Editing

A Way Forward

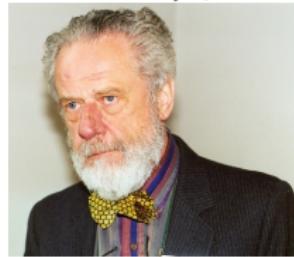
“ There was a long period — for all I know, it is not yet over — in which the following comedy was acted out nightly in the bowels of an American government office with the aim of rendering foreign texts into English.

Martin Kay (1980)



“Passages of innocent prose on which it was desired to effect this delicate and complex operation were subjected to a process of vivisection at the hands of an uncomprehending electronic monster that transformed them into stammering streams of verbal wreckage.

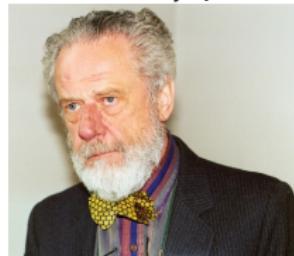
Martin Kay (1980)



“Simple tools that would have done so much to make the repair work easier and more effective were not to be had ...”

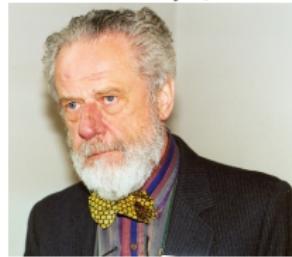
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Martin Kay (1980)

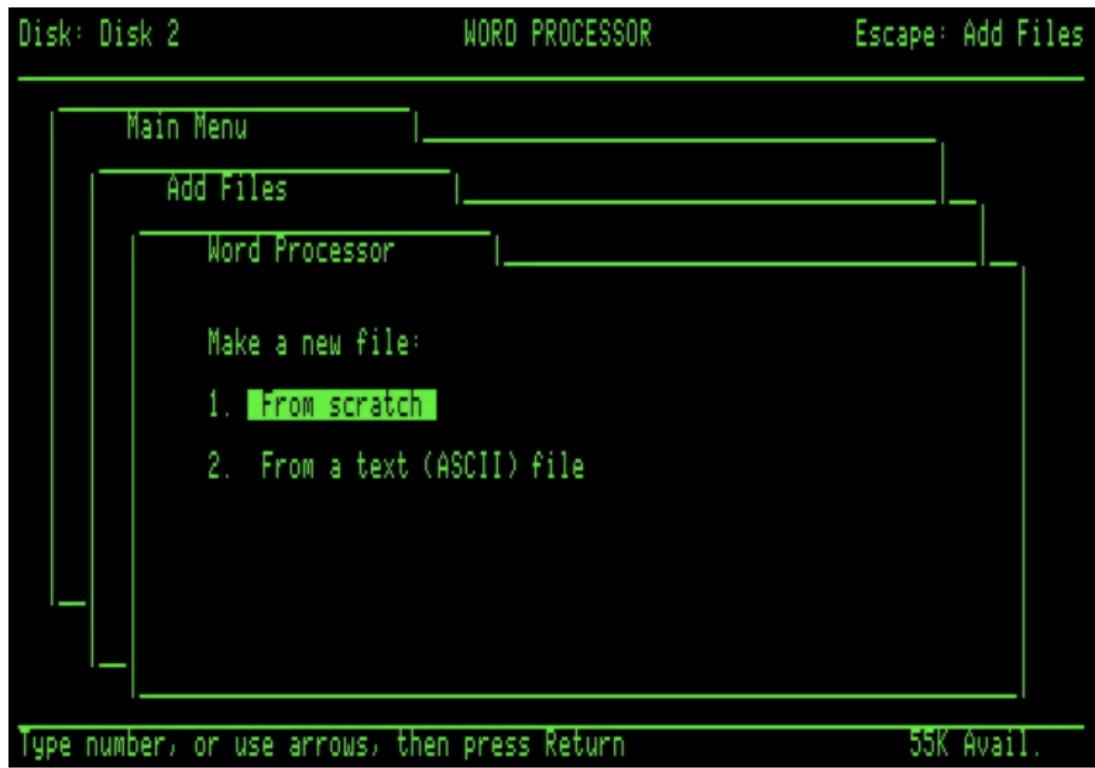


“...we can surely take a moment to wonder at the follies of the past and nostalgically to muse about what a kinder and more rational world would be like.”

Martin Kay (1980)



1980s word processing



Xerox PARC



CAT Tools

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Bilingual Interactive Translation

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Monolingual Post-Editing

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A Way Forward

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Lane Schwartz

Xerox PARC: WYSIWYG word processing

READY: Select operand or type commands

Last command was LOOK

{A_nsubsta...!_way_2} {Computer..._XEROX_2};S

Personal Distributed Computing The Alto and Ethernet Software

*Butler W. Lampson
Digital Equipment Corp., Systems Research Center*

Abstract

The personal distributed computing system based on the Alto and the Ethernet was a major effort to make computers help people to think and communicate. A complex and diverse collection of software was built to pursue this goal, ranging from operating systems, programming environments, and communications software to printing and file servers, user interfaces, and applications such as editors, illustrators, and mail systems.

1. Introduction

A substantial computing system based on the Alto [Thacker et al.

Computer Science Laboratory
Xerox Palo Alto Research Center
3333 Coyote Hill Road
Palo Alto, California 94304

XEROX

Glen J. Culler
608 Litchfield Lane
Santa Barbara, CA 93109

Dear Glenn:

This is a follow-up to earlier correspondence you received from Alan Perlis regarding the ACM Conference on the History of Personal Workstations. As you know, the conference is scheduled for January

CAT Tools

Chapter III

III - I - BUT DE L'ANALYSE SYNTAXIQUE

Dans le sens indiqué par V. YNGVE, l'analyse syntaxique associe à chaque phrase du texte un spécificateur structurale. En 1963, époque à laquelle le C. E. T. A. a commencé à s'occuper de syntaxe, ce spécificateur est représenté par une arborescence et correspond au niveau linguistique appelé "syntaxe de surface". En ce qui concerne la présentation de ces arborescences, deux écoles, fondées sur deux conceptions linguistiques différentes, s'affrontent et entrent en compétition. Il s'agit d'une part de la présentation sous forme de constituants immédiats et d'autre part de la présentation sous forme de dépendances. Bien que H. GAIFMAN ait montré en 1965 que tout langage describable dans l'un quelconque de ces deux systèmes l'est aussi dans l'autre [14], il faut croire que le problème philosophique demeure puisque le thème "constituency versus" a été l'un des sujets débats au cours de

Xerox PARC: WSIWYG word processing

READY: Select operand or type command

Last command was LOOK

{A,substa...[way,u]} {Computer... XEROX} \$

Personal Distributed Computing The Alto and Ethernet Software

Butler W. Lampson
Digital Equipment Corp. Systems Research Center

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The personal distributed computing system based on the Alto and the Ethernet was a major effort to make computers help people to think and communicate. A complex and diverse collection of software was built to pursue this goal, ranging from operating systems, programming environments, and communications software to printing and file servers, user interfaces, and applications such as editors, illustrators, and mail systems.

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CAT Tools: Machine Translation with Alignment Links

Chapter III

III - I - BUT DE L'ANALYSE SYNTAXIQUE

Dans le sens **indiqué par V.YNGVE**, l'analyse syntaxique associe à chaque phrase du texte un spécificateur structurale. En 1963, époque à laquelle le C. E. T. A. a commencé à s'occuper de syntaxe, ce spécificateur est représenté par une arborescence et correspond au niveau linguistique appelé "syntaxe de surface". En ce qui concerne la présentation de ces arborescences, deux écoles, fondées sur deux conceptions linguistiques différentes, s'affrontent et entrent en compétition. Il s'agit d'une part de la présentation sous forme de constituents immédiats et d'autre part de la présentation sous forme de dépendances. Bien que H. GAIFMAN ait montré en 1965 que tout langage descriptible dans l'un quelconque de ces deux systèmes l'est aussi dans l'autre [14], il faut croire que le problème philosophique demeure puisque le thème "constituency versus a été l'un des sujets débattus au cours de

III - I - AIMS OF SYNTACTIC ANALYSIS

In the sense indicated by **V.YNGVE**, syntactic analysis associates with each sentence of a text a structural specifier. In 1963, at the time when the C. E. T. A. began to deal with syntax, this specifier is represented by an arborescence and corresponds to the linguistic level called "surface syntax". As far as the presentation of these arborescences is concerned, two schools, founded on two different linguistic conceptions, confront and enter into competition. It consists of one part of the presentation in the form of immediate constituents and another part of the presentation in the form of dependencies. Although H. GAIFMAN showed in 1965 that every language describable in one of these two systems is also describable in the other [14], it must be believed that the philosophical problem remains since the theme "constituency versus dependency" has been one of the subjects debated during the course of

CAT Tools: Dictionary and Concordance

Chapter III

III - 1 - BUT DE L'ANALYSE SYNTAXIQUE

Dans le sens indiqué par V.YNGVE, l'analyse syntaxique associe à chaque phrase du texte un spécificateur structurale. En 1963, époque à laquelle le C. E. T. A. a commencé à s'occuper de syntaxe, ce spécificateur est représenté par une arborescence et correspond au niveau linguistique appelé "syntaxe de surface". En ce qui concerne la présentation de ces arborescences, deux écoles, fondées sur deux conceptions linguistiques différentes, s'affrontent et entrent en compétition.

Il s'agit d'une part de constituents immédiats et d'autre part de dépendances. Bien que H. GAFMAN ait montré en 1965 que tout langage descriptrible dans l'un quelconque de ces deux systèmes l'est aussi dans l'autre [14], il faut croire que le problème philosophique demeure puisque le thème "constituency versus structure" a été l'un des sujets débattus au cours de

III - 1 - AIMS

In the sense of V.YNGVE, syntactic analysis associates with each sentence of a text a structural specifier. In 1963, at the time when the C. E. T. A. began to deal with syntax, this specifier is represented by a tree and corresponds to the linguistic level called "surface syntax". As far as the presentation of these trees is concerned, two schools, founded on two different linguistic conceptions, compete against each other. It is a question of immediate constituents and dependencies. Although H. GAFMAN showed in 1965 that any language describable in one of these two systems is also describable in the other [14], it must be admitted that the philosophical problem remains since the "constituency versus structure" theme has been one of the subjects debated during the course.

CAT Tools: Terminology Management

Chapter III

III - I - BUT DE L'ANALYSE SYNTAXIQUE

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III - I - AIMS OF SYNTACTIC ANALYSIS

In the sense of V. YNGVE, syntactic analysis associates with each sentence of a text a [2 structural description]. In 1963, the time when C. E. T. A. started concerning itself with syntax, this [2 structural description] took the form of a tree and corresponded to the linguistic level called "surface structure". As for the [presentation] of these trees, two schools, based on two different linguistic conceptions, confronted one another and began to compete. On the one hand there was the [presentation] in the form of immediate constituents and, on the other, the [presentation] in the form of [dependency]. Bien que H. GAIFFMAN ait montré en 1965 que tout langage describable dans l'un quelconque de ces deux systèmes l'est aussi dans l'autre [14], il faut croire que le problème philosophique demeure puisque le thème "constituency versus dependency" a été l'un des sujets débattus au cours de

CAT Tools: Terminology Management

Chapter III

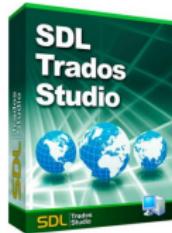
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Computer Aided Translation



CAT Tools

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Bilingual Interactive Translation

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Monolingual Post-Editing

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A Way Forward

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References

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CAT Tools: Machine Translation

The screenshot shows the Sunda Translator interface with two main windows: "Translation Results" and "Term Recognition".

Translation Results: This pane displays a sample document in English and its machine-translated version in Finnish. The English text is:

The Public Library of Science (PLoS) is a non-profit organization of scientists and physicians committed to making the world's scientific and medical literature a freely available public resource.

The corresponding Finnish translation is:

Julkisen tiedekirjasto (PLoS) on tiedemiesten ja lääkärien yleishyödyllinen yhtiö, jotka ovat sitoutuneet tekemään maailman tieteellisestä ja lääketieteellisestä kirjallisuudesta vapaasti saatavissa olevan julkisen resurssin.

Term Recognition: This pane shows the term "Julkisen tiedekirjasto (PLoS)" highlighted in the English text, with its corresponding Finnish translation "Julkisen tiedekirjasto (PLoS) on tiedemiesten ja lääkärien yleishyödyllinen yhtiö, jotka ovat sitoutuneet tekemään maailman tieteellisestä ja lääketieteellisestä kirjallisuudesta vapaasti saatavissa olevan julkisen resurssin." also highlighted.

Bottom Status Bar: The status bar at the bottom provides information about the document: All segments (69.27%), INS (30.73%), 0.00%, Chars: 225, and flags for US, FI, and EN.

- 2 **Finding a location for your photo printer**
Place the photo printer on a flat, clean and dust-free surface, *of direct sunlight* [pt11](#).
- 3 Allow at least 12 cm clearance from the back of the photo printer.
- 4 When connecting power or USB cables, keep the cables clear of the photo printer.
- 5 For proper ventilation [ph14](#), make sure the top and back of the

printer

One who makes prints.

The operator of a printing press or owner of a printing business.

(context: computing: lang=en) A device, usually attached to a computer, used to print text or images onto paper. Also see plotter.

[More>>](#)

CAT Tools: Concordance

Concordance - DGT EU DE-EN Jan2012 (99 hits)

Search << Previous Next >> Clear Options... Close Help

Inverkehrbringen

Vorbehaltlich anders lautender Bestimmungen dieses Abkommens erfolgen die Einfuhr und das Inverkehrbringen gemäß den im Hoheitsgebiet der betreffenden Vertragspartei geltenden Gesetzen und Verordnungen.

Unless otherwise provided for in this Agreement, importation and marketing shall be conducted in compliance with the laws and regulations applying in the territory of the Contracting Party of importation.

Created on: 2012-01-05, 16:35 Created by: Kevin-PC\Kevin Changed on: 2012-01-05, 16:35
Changed by: Kevin-PC\Kevin

Die Gemeinschaft lässt die Einfuhr und das Inverkehrbringen in ihrem Gebiet von Weinen mit Ursprung in Kanada zu, die gemäß

The Community shall authorise the importation and marketing in its territory of wines originating in Canada produced in accordance with:

Created on: 2012-01-05, 16:35 Created by: Kevin-PC\Kevin Changed on: 2012-01-05, 16:35
Changed by: Kevin-PC\Kevin

Kanada lässt die Einfuhr und das Inverkehrbringen in seinem Gebiet von Weinen mit Ursprung in der Gemeinschaft zu, die gemäß

Canada shall authorise the importation and marketing in its territory of wines

Ready.

CAT Tools: Terminology Management

Getting Started Finding a location for your photo printer	 91%	Erste Schritte Geeigneten Aufstellungsplatz für Ihren Fotodrucker finden	H
Place the photo printer on a flat, clean and dust-free surface, in a dry location, and out of direct sunlight. Allow at least 12 cm clearance from			LT

CAT Tools



Bilingual Interactive Translation



Monolingual Post-Editing



A Way Forward

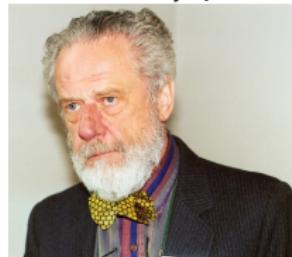


References

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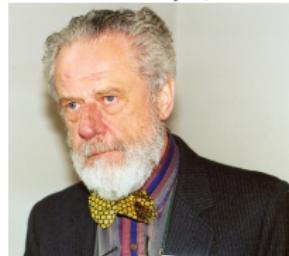
I want to advocate a view of the problem in which machines are gradually, almost imperceptibly, allowed to take over certain functions in the overall translation process.

Martin Kay (1980)



“First they will take over functions not essentially related to translation. Then, little by little, they will approach translation itself.”

Martin Kay (1980)



“ “ *The keynote will be modesty. At each stage, we will do only what we know we can do reliably. Little steps for little feet!* ” ”

Martin Kay (1980)



Bilingual Interactive Translation

CAT Tools

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Bilingual Interactive Translation

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Workshop on Interactive and Adaptive Machine Translation

Monolingual Post-Editing

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A Way Forward

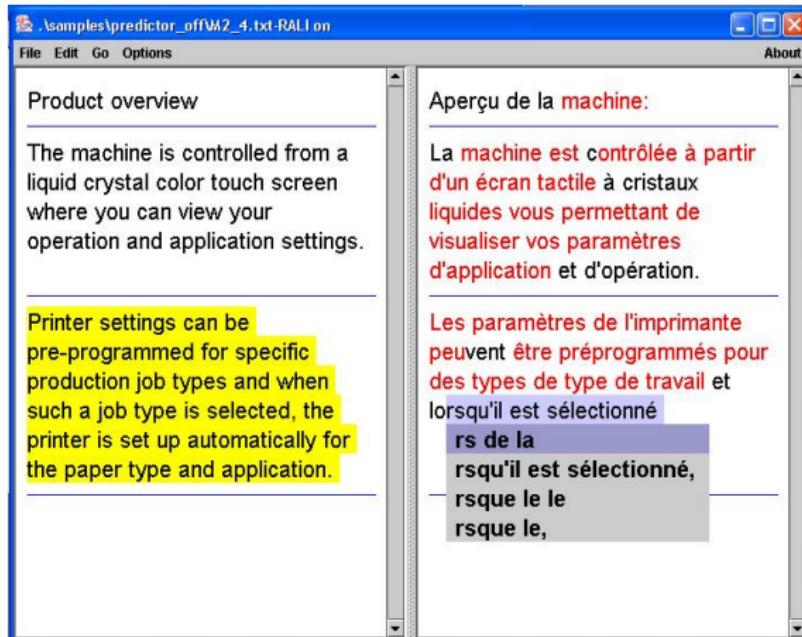
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References

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Pop-up typing completion

TransType (Langlais et al., 2000; Barrachina et al., 2009)



Visualization of Translation Options and Edit Distance

Caitra (Koehn, 2009)

[1] Sarkozy à la rencontre des pêcheurs en colère

[2] Avant de s'envoler pour les Etats-Unis, Nicolas Sarkozy va faire un détour par la Bretagne.
[3] Face à la démonstration de force des pêcheurs qui ont fortement perturbé lundi les accès de plusieurs ports bretons et normands, le président de la République a décidé de se rendre mardi matin au port du Guilvinec, dans le Finistère, pour y rencontrer leurs représentants.
[4] Ces derniers ont promis de l'accueillir "dans un esprit constructif" et espèrent qu'il "viendra avec des propositions concrètes".

[1] Sarkozy à la rencontre des pêcheurs en colère >>

Sarkozy at the meeting of fishermen to angry meet (8 edits)

Sarkozy to meet

enter save



Sarkozy à la rencontre des pêcheurs en colère
Sarkozy the meeting the fishermen angry
in the meeting the fishermen in anger
to the fishermen angry
the meeting of the fishermen angry
the meeting of as
the meeting by
the of in the anger,
to at however,
at by however

Visualization of Confidence Measures

Casmacat (Alabau et al., 2014)

The screenshot shows a window from the Casmacat software. At the top, there is a source sentence in English: "With a cholera epidemic raging, and more than 1m earthquake survivors still living in tents, there were fears that turnout would be low." A yellow box highlights the word "earthquake". To the right, a target sentence in Spanish is shown: "Con una epidemia de cólera virulentos, y más de 1 millón supervivientes del terremoto que siguen viviendo en tiendas de campaña, existen temores de que la participación será baja." Below the sentences are four buttons: ITP, T+, DRAFT, and TRANSLATED (which is highlighted in blue). Underneath the source sentence, there is a "Translation matches" section containing the same English sentence again. At the bottom of the window, there is a toolbar with fields for "Source match", "Target match", "Replacement", and checkboxes for "Case sensitive" and "Regular expression". There are also buttons for "Replace" and "View Rules". At the very bottom, there is a progress bar showing "0%" and "Total Words: 281", along with other performance metrics.

With a cholera epidemic raging, and more than 1m **earthquake** survivors still living in tents, there were fears that turnout would be low.

Con una epidemia de cólera **virulentos**, y más de 1 millón supervivientes del terremoto que siguen viviendo en tiendas de **campaña**, existen temores de que la **participación** será **baja**.

ITP T+ DRAFT TRANSLATED

Translation matches

With a cholera epidemic raging, and more than 1m earthquake survivors still living in tents, there were fears that turnout would be low.

Con una epidemia de cólera **virulentos**, y más de 1 millón supervivientes del terremoto que siguen viviendo en tiendas de **campaña**, existen temores de que la **participación** será **baja**.

In the event, a lot of Haitians wanted to vote but were prevented from doing so by disorganisation.

Source match Target match Replacement Case sensitive Regular expression Replace View Rules

Progress: 0% Total Words: 281 To-do: 281 Speed: --- Words/h Completed in: ... Reset Document

Rating Segment Confidence

TransCenter (Denkowski et al., 2014)

Talk 1 (practice)			Pause	Submit	?
	Source	Translation	Rating		
1	Muchas gracias Chris. Y es en verdad un gran honor	Thank you so much, Chris. And it's truly a great honor	5 - Very Good	▼	
2	tener la oportunidad de venir a este escenario por segunda vez. Estoy extremadamente agradecido.	to have the opportunity to come to this stage twice. I'm extremely grateful.	Rate Translation	▼	

Vertically interleaved layout

Green et al. (2014a,b)

À équiper le centre de formation Studeo qui est accessible aux personnes à mobilité réduite et dont nous travaillons à la réalisation dans le cadre de l'institut Jedlička, avec l'association Tap, et ça depuis six ans.

To equip studeo training centre which is accessible to people with reduced mobility and we work to achieve in the framework of the Institute jedlička, with tap, and been there for six years.

Des enseignants se rendent régulièrement auprès des élèves de l'institut Jedličkův et leur proposent des activités qui les intéressent et les amusent.

Teachers regularly visit Jedličkův Institute students and offered them activities of interest to them and having fun.

Les étudiants eux-mêmes n'ont pas les moyens de se rendre à des cours, nous essayons de les aider de cette manière.

The students themselves cannot be required to attend courses, we are trying to help themselves cannot

themselves could not themselves do not

Dans le cadre de l'institut Jedlička, nous transférerons ce projet dans un nouveau institut Jedlička, nous transférerons ce

themselves cannot afford

Translation completion with source lookup

Green et al. (2014a,b)

To equip studeo tra...
reduced mobility and
Institute jedlička,

Des enseignants se rendent régulièrement aupr...
proposent des activités qui les intéressent et les

Teachers regularly visit Jedličkův
activités regularly visit them and
conduct ongoing

Les étudiants make regular us les moyens
aider de cette are regularly

Suggestions:
■ **routinely**
■ **steadily**
■ **regular**
■ **regularly**

CAT Tools

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Workshop on Interactive and Adaptive Machine Translation

Bilingual Interactive Translation

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Monolingual Post-Editing

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A Way Forward

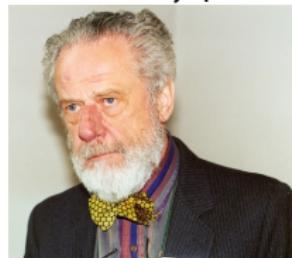
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References

Lane Schwartz

“ To translate is to re-express in a second language what has been understood by reading a text. ”

Martin Kay (1980)

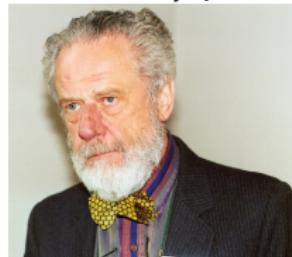


“

Any purported solution to the problem that does not involve understanding in some sense is, at best, ad hoc.

”

Martin Kay (1980)



Monolingual Post-Editing

CAT Tools

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Bilingual Interactive Translation

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Workshop on Interactive and Adaptive Machine Translation

Monolingual Post-Editing

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A Way Forward

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References

Lane Schwartz

Monolingual Post-Editing

(Callison-Burch, 2005)

The screenshot shows a web browser window with the title "Linear B: Post-Editing Translations". The URL in the address bar is <http://www.linearb.co.uk/nist2005/XIA20050105.0130.html>. The main content area displays three sentences for editing:

There are 10 sentences in this article. Please edit their translations so that they make sense and are good English.

Please edit this translation:

Emphasize that Turkey would reject any pressures to press for recognition of the Cyprus

Please edit this translation:

Ankara Jan 12 (AFP) - The head of the Turkish Government Tayyib Rajab Wednesday that Ankara would reject any pressures had exercised by the European Union to press for recognition of Cyprus, in two weeks ago Summit of Heads of State and Government of the European Union who will determine the opening of accession negotiations with Ankara or not.

Please edit this translation:

The station in the Te television that "the EU can do that by imposing new conditions on us Cyprus.

Monolingual Post-Editing

(Mitchell et al., 2013)

Bearbeiten

Klicken Sie auf den Text um diesen zu bearbeiten:

Lösung für Windows XP nicht mehr Windows Updates von geschieht - ComboFix.exe -----
- Website www.bleepingcomputer.com/download/combofix / und laden Sie ComboFix.exe ausführen. Sehr viel Geduld. Es geht aber wie 100 Phasen und Neustarts, aber es funktioniert. Ich habe für mich! ----- Benutzer NICHT combofix ausgebildet ausführen, ohne Hilfestellung, es ist ein leistungsstarkes Tool, das kann zu Problemen mit dem System Selbst die Schöpfer Staat und nicht, um sie auszuführen ich hatte, System wieder nach der Ausführung combofix und andere Tools, aber ich bin in den richtigen Bereich zu tun. Und es ist nicht zu 100 Phasen, Thread Ersteller kann nicht einmal das richtig.

Aktueller Satz zum Bearbeiten:

Lösung für Windows XP nicht mehr Windows Updates von geschieht - ComboFix.exe

| ↻ 🔍 ABC

Zurück Weiter

Kommentare ?

Aufgabe fertigstellen Richtlinien für später speichern

Monolingual Translation Options

(Callison-Burch, 2005)

Linear B: Visualization Tool
<http://www.linearb.co.uk/nist2005/segment1.html>

اردوغان	پیوک	بان	ترکیا	سترفشن	ای	ضغوطات	لھٹھا	علی	الاعتراف	باقرمن
ardogان	پیوک	بان	ترکیا	سترفشن	ای	ضغوطات	لھٹھا	علی	الاعتراف	باقرمن
ardogan	affirms stresses emphasize confirms emphasizes	that that the to , that that ,	turkey of turkey by turkey , turkey turkey ' s	reject will reject refuse not accept would be	any no of any i . e . meaning	pressure to pressure up to pressure	urge it urge and urge it urging urge them to	on to on the for to the	recognition recognition of recognize recognized recognition of the	cyprus cyprus , to cyprus on cyprus cyprus and
ardogan ,										

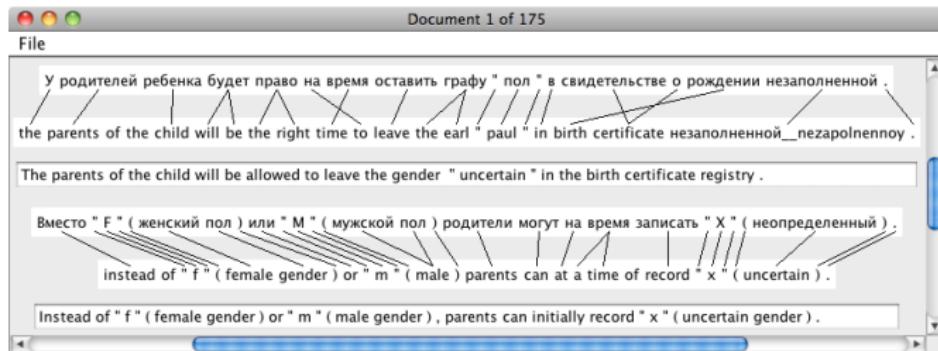
Monolingual Translation Options

(Koehn, 2010)

the	the	مجلس	النواب	الأميركي	اعتمد	الخميس	قانوناً	يطلب	يسمح	القوات	المقاتلة	من	الأميركية	في	موعد	الcasas	من الأول	بريل	
the us house of representatives				adopted	thursday	legally	calls for the withdrawal of	combat troops	us	the us from iraq	the latest	the first of	from april						
the us house of representatives				the	thursday ,	law													
	the us house			adopted the	thu	the legally													
it was	us house of representatives			was adopted	thursday ,	the law	demands withdrawal of	troops	fighter	the us	from iraq	the latest	the first of	from april					
he was	the us house			adopted by	thursday 's	a law	calls for withdrawal of	combat forces	forces	us	from iraq in	i	april						
he	us house			adopted by the	on thursday	a legally	calls for the withdrawal	of	the fighter	the us	no later than	first	on april						
earlier ,			us	adopted a	on thursday ,	by law	demands the withdrawal of	troops		of	in the	not later than	first of						
was				, was adopted	thursday the	legally ,	demands withdrawal of			from									
it was the				adopted ,	thu ,	the legal	calls for withdrawal			iraq									
earlier , the				adopted , the	thursday , a legally @-@		demands the withdrawal			of the									
2008 ,	متحدباً	مرة	جديدة	الرئيس	جورج	بيش	الذى يعارض	يتمدد	موعد	of the									
defying	once	new	president george w. bush,	which opposes the	no date has been set for the														
the 2008	defiant	once again	president george bush	who opposes	no date has been set for														
2008	challenging	again	the new				which opposes	no date has been set											
	a defiant	the first					, who opposes the												
	in defiance of	once again ,					, who opposes												
	, challenging	once again the		president george bush , who	opposed to setting any			date .											
	in defiance	for the first time a new		president george w. bush 's	which opposes			date .											
in 2008 ,	defying the	again		us president george w. bush	opposed to			date .											
	challenging the	time					who opposes the												
	, defying	once again , the					opposes												

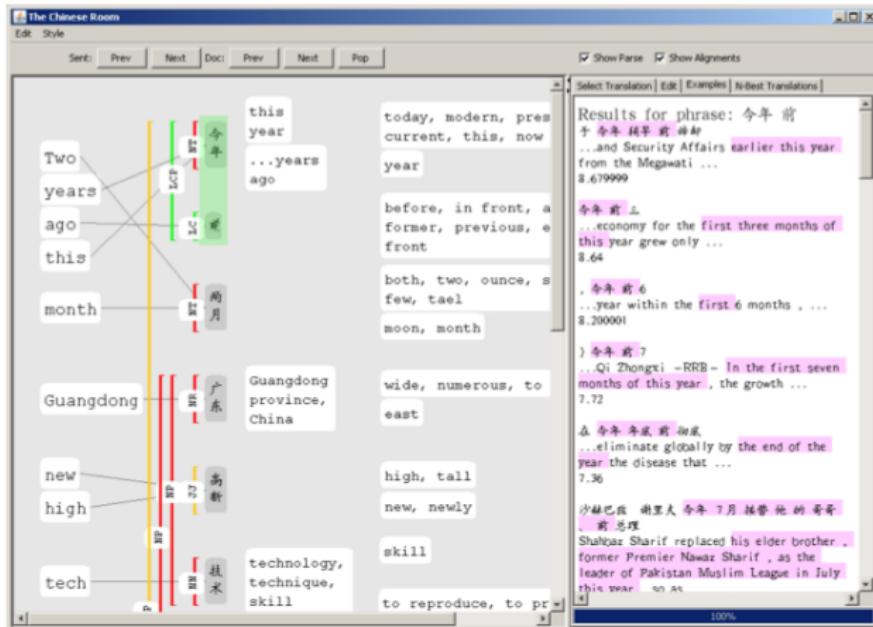
Monolingual Post-Editing with Alignments

(Schwartz et al., 2014)



Monolingual Post-Editing with Alignments

(Albrecht et al., 2009)



A Way Forward

CAT Tools

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Bilingual Interactive Translation

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Monolingual Post-Editing

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A Way Forward

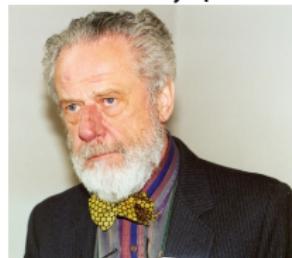
oo

References

Lane Schwartz

“ The difference ...from a user's point of view is that here the translator has his say while the translation is underway whereas previously he had to wait. ”

Martin Kay (1980)

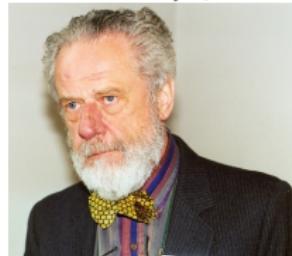


“

If this scheme can be made to work, as I claim it can, its many advantages are collectively overpowering.

”

Martin Kay (1980)



A Way Forward

- Commercial CAT Tools
- Research MT Systems
- Research Interactive MT
- Monolingual Translators

CAT Tools
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Bilingual Interactive Translation
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Monolingual Post-Editing
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A Way Forward
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References

Lane Schwartz

A Way Forward

- Commercial CAT Tools
 - Research MT Systems
 - Research Interactive MT
 - Monolingual Translators
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- TM & MT integration
 - Dictionary
 - Concordance
 - Terminology Management

A Way Forward

- Commercial CAT Tools
- Research MT Systems
- Research Interactive MT
- Monolingual Translators
- cdec
- Joshua
- Moses
- Phrasal
- ...

A Way Forward

- Commercial CAT Tools
 - Research MT Systems
 - **Research Interactive MT**
 - Monolingual Translators
-
- Interactive typing completion
 - Partial translation MT extensions
 - Visualization of confidence measures

A Way Forward

- Commercial CAT Tools
- Research MT Systems
- Research Interactive MT
- Monolingual Translators
- Machine translation model
- Human language model
- Decoding shared between human and machine

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