SIMPLE SYSTEMS

When it pays to use NL generation

Some development guidelines

Some application systems

COSTS AND BENEFITS OF NL GENERATION

Requirements analysis

Elaborating a text corpus is crucial

Principled limitations in capabilities of the potential system become apparent

Alternatives to NL generation

Graphics	**conventional interpretations may be unwanted** **representing some relations impossible (causality, temperature)**
Mail-merge	**text patterns with open slots, easy to handle** **problematic concerning extendability and maintenance** **impossible to handle referring expressions and context variations**
Humans	**better text quality, clear responsibility** **systems gain in terms of consistency, being conform to standards,** **multi-linguality, and processing speed**

CORPUS ANALYSIS (I)

Requirements for generation

- **Input specifications**
- **Output texts**
- **How the output is dependent of the input**
- **Humans tend to overlook the necessity of background knowledge**
- **Sets of examples**

Corpus

- **Existing texts**
- **Typical and untypical cases, borderline cases**
- **Examining variations**
- **Analysis of dependencies**

CORPUS ANALYSIS (II)

Procedure – Determining the information content

- **Unchanged text parts**
- **Directly available data**
- **Data that require computation**
- **Unavailable data**

Measures to handle unavailable data

- **Making more information available**
- **Changing the texts to be produced**
- **Post-processing by human experts**

CORPUS ANALYSIS (III)

Determining a text corpus

Omitting text parts which are based on data to be computed

(if the computational effort is too high)

Improvement of readability

Avoiding mistakes

Conflicts between requirements

Consequences

Modified target texts (often shorter)

Influence on system usability

Considerable investment of time

CATEGORIES OF SYSTEM INPUT

Knowledge sources

heterogeneous, application dependent

numerical data, AI-knowledge representation, …

Communicative goal

purpose the text is supposed to accomplish (inform, convince, …)

User model

domain- and lexical knowledge

preferences

Discourse history

What has been said before

PEBA-II (Marisavlevic)

Application area

Conveys encyclopedic knowledge about animals

Combines NLG techniques with hypertext and pictures

System features

On the fly generation and formatting of descriptions from conceptual data

Adaptive to levels of expertise and context

Techniques

Text schema instantiation

Flexible combination of phrasings by using a phrasal lexicon, convering

- **single words (such as Yak) ,**
- **short-phrases (such as lifespan in captivity),**
- **full phrases (such as has a long shaggy coat which hangs to the ground like a fringe).**

Only those concepts are decomposed which require linguistic variation.

PEBA-II – EXAMPLE (I)

The Elephant

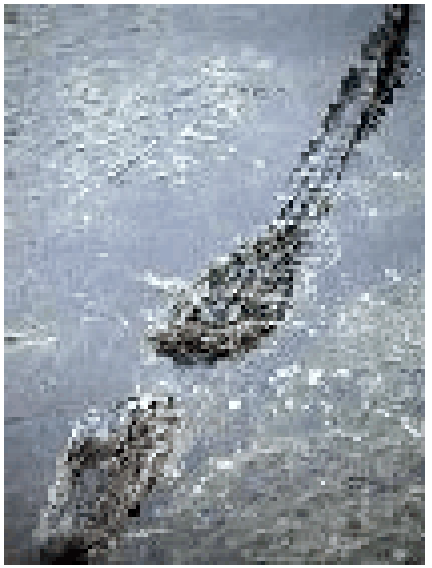
The Elephant is a type of PlacentalMammal that has a muscular trunk instead of a nose and upper lip.

The Elephant has the following subtypes: 1mi-nus8plus2minus40
- the African Elephant and the Indian Elephant.

The Elephant ranges from 2.5 m to 4 m in shoulder height. It ranges from 5000 kg to 7500 kg in weight. It has sparse and coarse body hair. It is grayish to brown in colour. It has tusks instead of upper incisors. It is a herbivore. It eats by detaching grasses, leaves, and fruit with the tip of the trunk and using it to place this vegetation in the mouth. It drinks by sucking water up into the trunk and then squirting it into the mouth. It has columnar legs.

This text is generated for the novice user level. If you would like the text for the expert user level click here.

PEBA-II – EXAMPLE (II)



The Alligator

The Alligator is a member of the Crocodylidae Family that has a broad, flat, rounded snout. It is similar in appearance to the related Crocodile. The Crocodile is a member of the Crocodylidae Family that has a narrow snout. The Crocodile is much longer than the Alligator (5.25 m vs 3.75 m). The Alligator has longer teeth on the lower jaw which cannot be seen when its mouth is closed whereas the Crocodile has one longer tooth on each side of the lower jaw which can be seen sticking up when its jaw is closed.

The Alligator has the following subtypes: 1minus8plus2minus40
■the American Alligator and the Chinese Alligator.

The Alligator feeds on fish, frogs, snakes, turtles, birds, mammals, and carrion. It can survive a wide range of temperatures, and is found in more temperate regions.

This text is generated for the novice user level. If you would like the text for the expert user level click here.

PEBA-II – EXAMPLE (III)

The Platypus

The Platypus is a type of Monotreme that has short legs with webbed feet for swimming.

The Platypus is about the same length as a domestic cat. It ranges from 5 cm to 6 cm in nose length. It ranges from 10 cm to 15 cm in tail length. It is about the same weight as a Rabbit (1.55 kg). It is dark brown on its back and silvery to light brown underneath. It eats insect larvae, worms and crustaceans. It is found in Australia. It lives in and near rivers and lakes. It is active at dawn and dusk. It lives by itself. It has an average lifespan in captivity of 17 years.

This text is generated for the novice user level. If you would like the text for the expert user level click here.

PEBA-II – CONTENT ORGANIZATIION (I)

Heading

The Echidna

Definition

The Echidna, also known as the spiny Anteater, is a type of Monotreme that is covered in stiff, sharp spines mixed with long, coarse hairs.

Compare and contrast **(with related animal)**

Although it is similar in appearance to the African Porcupine it is not closely related.

The African Porcupine is a type of Rodent that has long sharp spines, up to 50cm long, which cover its whole back and can be raised by muscles under the skin.

Like the African Porcupine, the Echidna has a browny black coat and paler-coloured spines. The African Porcupine is twice the length of the Echidna (80.0 cm vs 47.5 cm). The Echidna has an average weight of 4.5 kg whereas the African Porcupine has an average weight of 25.0 kg. The Echidna is a carnivore and eats ants, termites and earthworms whereas the African Porcupine is a herbivore and eats leaves, roots and fruit.

PEBA-II – CONTENT ORGANIZATIION (II)

Specializations

The Echidna has the following subtypes:

*** the short-beaked Echidna and**

*** the long-beaked Echidna.**

Further descriptions

The Echidna is about the same length as a domestic cat. It ranges from 2 kg to 7 kg in weight. It has a browny black coat and paler-coloured spines. It has a small head. It has a prolonged, slender snout. It has no teeth. It uses its extensible, sticky tongue for catching ants, termites and other small insects. It is a carnivore and eats ants, termites and earthworms. It has powerful claws allowing for rapid digging of hard ground. It is found in Australia. It is active at dawn and dusk. It lives by itself. It has an average lifespan in captivity of 50 years.

IDAS (University of Edinburgh)

Intelligent Document Advisory System

Application area

Technical documentation

(design, maintenance, and operations documents for technicians)

Driven by domain knowledge base and linguistic and contextual models

Help messages tailored to context and user

System features

Hypertext and object-oriented techniques

Degrees of cannedness in producing texts

Techniques

Classical NL generation architecture

Components with “short-cuts” (cannedness)

Simplified mechanisms according to functional needs

Technical documentation

The problem

Documentation is complex (e.g., aircraft design)
Producing technical documentation is time-consuming
Requires externally imposed writing standards
Multilinguality, maintenance, and update

Expected benefits of using NL generation techniques

Reducing costs in generation and *maintenance* of documents (even if partial)
Guaranteed consistency between document and design (maintenance!)
Guaranteed conformance to standards (e.g., stylistic guidelines)
Multilinguality (realistic with simplified language)
Tailoring to user expertise, vocabulars, and background knowledge
Multimodality (visual formatting, hypertext, graphics)

Use of NL Generation

Expected costs

1. **Knowledge base creation (domain knowledge)**
   additional information for communication - crucial!
   also supports consistency, correctness and completeness checks
2. **Knowledge base creation (linguistic knowledge)**
   may be reduced when parts are shared across applications
3. **Quality assurance**
   checking by users and post-editing
4. **Computation time**
   Response time for interactive systems may be critical

Issues addressed in IDAS

Reduced costs, guaranteed consistency, tailoring, multimodality

System functionality

Input

Basic questions

What-it-is, Where-it-is, What-are-its-parts, What-are-its-specs

What-is-its-purpose, What-does-it-connect-to

How-do-I-perform-the-current-task

Component

Part-of component hierarchy can be navigated

User task

Repertoire of tasks represented in a IS-A taxonomy

User expertise

Vocabulary known, action competence, stylistic preferences

Discourse

Salient objects, relevant for building referring expressions

System functionality – an example

Basic questions

What-it-is

Component

DC-Power-Supply-23

User task

Operations

User expertise

Skilled

Discourse

{VXI-Chassis-36, DC-Power-Supply-23}

Question:

What is the DC Power Supply?

Response:

It is a black Elgar AT-8000 DC power supply

System techniques (I)

Use of inheritance

- **Procedures for domain actions (e.g., for various domain objects)**
- **Linguistic knowledge (imperative from sentence)**
- **Domain objects organization**
- **Surface realization**

Content determination rules

- **Basic structure of the response (a schema)**
- **References to elements in the knowledge base addressed**
- **Hypertext follow-up buttons**

Simplified components for

- **Sentence planning tasks**
- **Syntactic and morphological rules**
- **Postprocessing for capitalization and punctuation**

System techniques (II)

Intermediate techniques

Canned text:

Remove any connections to the board

Embedded knowledge base references:

Carefully slide **[Board21]** ***out along its guides***

Textual case fillers:

REMOVE (actor=User, actee=Board21, source=Instrument-Rack1, manner="gently")

Case frames:

PUT (actor=User, actee=Board21, destination=Faulty-Board-Tray3)

Exaample screen – dependency of user expertise

For a skilled expert

What are the subcomponents of the ATE?
***The printer**
***The computer**
***The instrument rack**
***the DC power supply**
***the mains control unit**
***the test head**
MENU WHAT WHERE

For a naive user

What are the subcomponents of the ATE?
***The printer**
***The computer**
***The instrument rack**
***the black power supply**
***the silver power supply**
***the test head**
MENU WHAT WHERE

Example screen – dependency of task context

As a follow-up from the previous screen

What is the test head?

It is a Racal TH10 test head

MENU WHERE USE

Within a repair part task

What is the test head?

It is a Racal TH10-X test head with part number OPT-RT1

MENU WHERE PURPOSE SPECS

PARTS CONNECT

Evaluation and experience

User reactions

- **User performance quite encouraging**
- **Demands of better interface and extended coverage**
- **Finding information better and quicker than on paper documentation**
- **Additional graphics would be desirable**

Industrial reactions

- **Knowledge base creation effort underestimated**
- **Accuracy may be more important than text quality**
- **Conformance to standards and consistency rated high, tailoring low**
- **Benefits of multilinguality depend on needs (e.g., law)**

Lessons learned

- **Knowledge base sharing and integrated design**
- **Linguistically simple text, conform to standards**

ILEX (University of Edinburgh)

Intelligent Labelling Explorer

Application area

Illustrations of museum exhibits

(pieces of jewelry and their properties, relation to artists and styles)

Driven by domain knowledge base and content determination rules

Content tailored to session context and user

System features

Dynamic hypertext generation and opportunistic content determination

Context-dependencies for adaptations

Techniques

Classical NL generation architecture

Simple, opportunistically organized components

Motivations for History-awareness

Avoiding repetitions

Defining a term, etc.

Referring to objects

Depending on whether or not it has already been encountered
(*the Bungweh diamond* vs. *a piece called the Bungweh diamond*)

Reintroducing material previously encountered

For rhetorical purposes (e.g., comparisons)

Enhance presentations with references

Direct or indirect references to previously generated information
(*also* or *as already mentioned*)
Emphasizing contrasts

Example (1)

ILEX <| Jewels Help Exit |>

A Gold, Moonstone And Opal Necklace

Gold, moonstone, and opal.

Edward Spencer 1905 London

<picture>

Page: [1] Say More

This jewel is a necklace and was made by a British designer called Edward Spencer. It is in the Arts and Crafts style and was made in 1905. It is set with jewels. It features rounded stones; indeed Arts and Crafts style jewels usually feature rounded stones. Like most Arts and Crafts jewels, this jewel has an elaborate design.

Spenced was British.

Other jewels in this style include:

- **a Sybil Dunlop pendant-cross**
- **an Arthur and Georgio Gaskin necklace**
- **a Gaskins necklace**
- **a Jessie M. King waist-buckle**
- **a King pendant-necklace**
- **a King necklace**

Example (2)

ILEX <| Jewels Help Exit |>

The Sibyl Dunlop Crucifix

Silver, jewels, and silk.

Sibyl Dunlop 1925 Place of making unknown

<picture>

Page: [1] Say More

This jewel is also in the Arts and Crafts style. It is set with jewels. Arts and Crafts style jewels feature rounded stones, but this jewel uses faceted stones. It was produced by single craftsmen; indeed, Arts and Crafts style jewels were usually produced by single craftsmen. They usually demonstrate the artistic sensibilities of the wearer, but this jewel identifies the wearer as a Christian. Like most Arts and Crafts jewels, it has an elaborate design.

Other jewels in this style include:

- **an Arthur and Georgio Gaskin necklace**
- **a Gaskins necklace**
- **the previous item**
- **a Jessie M. King waist-buckle**
- **a King pendant-necklace**
- **a King necklace**

Input Specifications

Example

(defobject j-240384
:class jewellery
:subclass necklace
:designer king01
:made-for liberty01
:date (c. 1905)
:place "Birmingham"
:style arts-and-crafts
:material (gold enamel sapphire)
:case 1
:production limited-production
:qualities (has-festoons has-florals)
:bib-note "design illustrated in Liberty pattern book no 8809")

Major processing steps

Content selection according to priorities

Incremental text structuring on the basis of rhetorical relations

TEMSIS (an application of TG/2)
DFKI

Application

Reports on air pollution data

Driven by user specifications and pre-defined report skeletons

Context adaptation to data and message similarities

System features

Instantiation of pre-defined text structures

Multilinguality

Techniques

Opportunistic architecture

Non-standard interfaces between organizing content and expressing it

An example

Intermediate representation for a single message (sentence)

((COOP THRESHOLD-EXCEEDING)
(LANGUAGE FRENCH)
(TIME ((PRED SEASON) (NAME ((SEASON WINTER) (YEAR 1996)))))
(THRESHOLD-VALUE ((AMOUNT 600) (UNIT MKG-M3)))
(POLLUTANT SULFUR-DIOXIDE)
(SITE "Völklingen-City")
(SOURCE ((LAW-NAME SMOGVERORDNUNG)
(THRESHOLD-TYPE VORWARNSTUFE)))
(DURATION ((HOUR 3)))
(EXCEEDS ((STATUS NO) (TIMES 0))))

En hiver 1996/97 à la station de mesure de Völklingen-City, le seuil d'avertissement pour le dioxide de soufre pour une exposition de trois heures (600.0 μg/m³ selon le decret allemand "Smogverordnung") n'a pas été depasssée.

Grammar technique used (TG/2)

Technical properties

- **Context free categorial backbone**
- **Conditions on input (test predicates)**
- **Constraint propagation**
- **Right-hand side of rules are mixture of non-terminal elements and terminal elements (canned text for output without explicit representation)**

Processing

- **Top-down, left-to-right**
- **Backtracking possible, but applied sparsely (efficiency)**

Specifics

- **No explicit conceptual, rhetorical, semantic representation**
- **Input representation mixes all kind of specifications**

Assessment

Development

Elicit corpus and agree rather closely with customers

Design the intermediate representation

Adapt/extend TG/2 (some portions can be reused)

Application complexity

< 20 report structures, with up to about 12 components (messages)

About 100 rules in TG/2, 20 test predicates

Benefits

Partial reusability (e.g., temporal expressions)

Modeling flexibility (covering linguistic knowledge, domain conventions)

Processing speed (< 1 sec)

Multi-lingual extensions (later, English, Japanese versions, etc.)

Variations in wording (through defining conflicting rules and preferences)