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M-PIRO project

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Motivation

Museum exhibits available in electronic form (Internet, CDs)

However:

- ▶ Limited number of pre-written descriptions for different target groups
- ▶ descriptions expensive to maintain/translate
- ▶ repeated information
- ▶ no coherence of descriptions

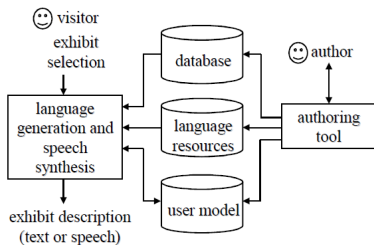
Goal

- ▶ enhance informal learning
- ▶ store information in a language- and visitor-independent manner
- ▶ dynamically produce personalized spoken/textual descriptions

M-PIRO: Main features

- ▶ based in ILEX natural language generation system (descriptions for a Web-based jewellery electronic galley)
- ▶ uses small fragment of text and database fields to generate descriptions dynamically
- ▶ adaptive user modelling for personalised information presentation
- ▶ multilingual generation from a single source
- ▶ improved speech synthesis
- ▶ authoring of the single source through the use of symbolic authoring techniques

M-PIRO: System architecture



- ▶ visitor selects exhibits by clicking images (in virtual reality this is done automatically by approaching them)
- ▶ the system retrieves from the database all the relevant information
- ▶ the output is generated using natural language generation and speech synthesis
- ▶ for the natural language generation they are used mostly domain-independent information (i.e lexicons, grammars, rules) and some domain-dependent

M-PIRO: Ontology

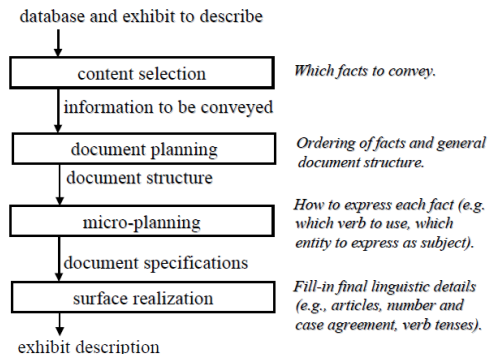
The screenshot shows the M-PIRO authoring tool interface. On the left, there is a 'Database' tree view showing a hierarchy of entity types: Basic Entity Types, Exhibit, Vessel, Statue, Kouros, exhibit 2, Generic Kouros, Imperial-portrait, Coin, Historical-period, archaic-period, classical-period, hellanistic-period, roman-period, Place, Country, and City. Below the tree is a 'Legend' section with 'Basic Types' and 'Entity Types'. On the right, the 'Statue' entity configuration is shown in a table with three columns: 'User-defined-fields', 'Filler-types', and 'Set-valued'. The table lists various fields and their corresponding filler types and whether they are set-valued.

User-defined-fields	Filler-types	Set-valued
creation-period	Historical-period	<input type="checkbox"/>
sculpted-by	Sculptor	<input type="checkbox"/>
current-location	Place	<input type="checkbox"/>
previous-locations	Place	<input checked="" type="checkbox"/>
exhibit-style	Style	<input type="checkbox"/>
made-of	Material	<input type="checkbox"/>
exhibit-height	Dimension	<input type="checkbox"/>
creation-time	Date	<input type="checkbox"/>
exhibit-depicts	String	<input type="checkbox"/>
exhibit-purpose	String	<input type="checkbox"/>

Below the table are three buttons: 'Add new field', 'Remove selected field', and 'Rename selected field'.

- ▶ super-types vs sub-types ("statue" vs "kouros")
- ▶ inheritance process (features passed on from super-types to sub-types)
- ▶ built-in data-types("string", "date")
- ▶ "exhibit-depicts" and "exhibit-purpose" are short texts that are used in dynamic generated descriptions as they are.

M-PIRO: Natural Language Generation



Natural Language Generation: content selection

Three scores taken into account:

interest how likely is for a visitor to find the fact interesting

importance how important is for the museum to convey particular information

assimilation to what extent the information is assumed to be known

Natural Language Generation: document planning

- ▶ organizes the overall document structure
- ▶ specifies the desired sequence of the facts
- ▶ specifies the rhetorical relations of the facts (e.g contrast, explanation or result)
- ▶ some domain-dependent planning rules (e.g a description of a coin should be followed by descriptions of two sides, and then there should be information about the material and style)

Natural Language Generation: micro-planning 1/2

- ▶ language-dependent
- ▶ how a phrase is expressed in each language (e.g "sculpted-by" relation should use the verb "to sculp" in passive with the subject of the verb being the statue and the object being the sculptor)
- ▶ specifies alternative ways to express relations in order to allow the tailoring of the descriptions according to the visitor type (e.g "to sculp" vs "to create")

Natural Language Generation: micro-planning 2/2

- ▶ determines which facts can be grouped together in order to have a more natural and meaningful description (e.g. "This vase dates from approximately 550 BC and was found in Attica" instead of "This vase dates from approximately 550 BC. It was found in Attica.")
- ▶ determines the correct referring expressions for each entity

Natural Language Generation: surface realization

- ▶ language-dependent
- ▶ producing appropriate wordforms (e.g verb tenses)
- ▶ placing the various constituents in the correct order
- ▶ based on large-scale domain-independent grammars that capture all appropriate linguistic information

From text descriptions to speech

- ▶ more useful in virtual reality tours
- ▶ very important: speech is produced from text generated by computers, allowing the speech synthesizer to exploit additional features that are not provided after extra work (e.g phrasal boundaries, rhetorical relations between phrases).
- ▶ **Result:** improved prosody (e.g **I** have the dog -not you-, I have the **dog** -and not the cat-)

Symbolic authoring

- domain authoring** information about the domain, available entity types, their fields, domain-dependent language resources (designing database)
- exhibit authoring** enter particular entities (e.g. artist, sculpture) and fill the appropriate fields (populating database)

Symbolic authoring: domain authoring 1/2

Statue-noun : Greek-specific information

Base form:

Grammatical gender: Masculine Feminine Neuter

Countable: Yes No

Stress on: Last Penultimate Third-last syllable

Not inflected 3-endings noun Anisosyllabo

Inflection: Neuter in -os Other neuter
 Ancient-like Other

Check the boxes modify the default suggestions

Spelling	Singular Nominative :	<input type="text" value="ἄγαλμα"/>	<input type="checkbox"/>
	Singular Genitive :	<input type="text" value="Ἀγάλματος"/>	<input type="checkbox"/>
	Singular Accusative :	<input type="text" value="ἄγαλμα"/>	<input type="checkbox"/>
	Plural Nominative :	<input type="text" value="Ἀγάλματα"/>	<input type="checkbox"/>
	Plural Genitive :	<input type="text" value="Ἀγάλματων"/>	<input type="checkbox"/>
	Plural Accusative :	<input type="text" value="Ἀγάλματα"/>	<input type="checkbox"/>

Step 1 construct the hierarchy of entities and define fields.

Step 2 specify the nouns that will refer to the entity (e.g statue - statua - ἄγαλμα)

Step 3 morphological components are provided automatically

Step 4 specify verbs to express relations, tense, voice


Step 5 specify order of facts

Symbolic authoring: domain authoring 2/2

exhibit 2

Fields	Filters
creation-period	archaic-period
sculpted-by	unknown
current-location	nat-arch-athens
previous-locations	unknown
exhibit-style	unknown
made-of	unknown
exhibit-height	1.94 (m)
creation-date	~700 (BC)
exhibit-depicts	Click to edit
exhibit-purpose	Click to edit
name	unknown
image	c:\m-pire\images\ex2.jpg

Preview text for selected field



This exhibit is a kouros. It was created during the archaic period and dates from circa 700 BC. It is 1.94 metres high. It honours the memory of Kroisos, a young man who died in battle. Today it is located in the National Archaeological Museum of Athens, which is in Greece.

- ▶ domain authoring is a trial-and-error process
- ▶ domain authors enter exhibits, generate descriptions and if necessary add more fields or new words to express these fields until the description is natural enough.
- ▶ previews are available in order to facilitate this procedure

Usability evaluation of authoring tool

Task type	Scores
i. Correcting database information for existing exhibits.	10 A
ii. Adding more exhibits of existing types.	4 A, 5 B , 1 C
iii. Adjusting user modelling parameters to affect the semantic content and surface form per visitor type.	6 A, 3 B, 1 C
iv. Previewing texts in different languages.	6 A, 1 B, 1 C, 2 D
v. Correcting errors in the surface form, caused by errors in the lexicon or micro-plans.	1 A, 4 B , 4 C , 1 D
vi. Adding new types of exhibits and corresponding micro-plans and lexicon entries.	4 B, 6 C
vii. Creating a new M-PIRO application.	2 B, 6 C , 2 D

- ▶ 10 third-year computer science undergraduates
- ▶ they were asked either to use it or build a mini-M-PIRO (e.g cars, mobile phones)

Conclusions

- ▶ multilingual descriptions with no extra work/time/costs
- ▶ tailored descriptions make tours more interesting
- ▶ authoring tool available for curators to configure new collection

Future work

- ▶ virtual reality
- ▶ evaluation of usability of M-PIRO
- ▶ allow the database to be filled automatically by existing databases of museums
- ▶ educational software, video games(?), on-line catalogues

Touring Machine: M-PIRO's descendent

- ▶ built by 2 students from Athens University of Business and Economics mentored by Dr. Androutsopoulos
- ▶ web-application and mobile-application for tours in the actual place
- ▶ 1st prize in Greek finals of Imagine Cup 2010
- ▶ <http://touringmachine.cs.aueb.gr/>

References

I. Androutsopoulos, V. Kokkinaki, A. Dimitromanolaki, J. Calder, J. Oberlander. and E. Not. *Generating multilingual personalized descriptions of museum exhibits – The M-PIRO project*. Proc. 29th Conf. on Computer Applications and Quantitative Methods in Archaeology, Gotland, Sweden, 2001.

I. Androutsopoulos, J. Oberlander, and V. Karkaletsis. *Source authoring for multilingual generation of personalised object descriptions*. 2007