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Ontoterminology of Ancient Greek Garments

Maria Papadopoulou*, Christophe Roche*

*Equipe Condillac – Listic

Université Savoie Mont-Blanc

France

Maria.papadopoulou@univ-savoie.fr

Christophe.roche@univ-savoie.fr

<http://www.condillac.org>

Abstract. Our central research question is how to exploit textual, visual and material sources to broaden and deepen our understanding of the domain of ancient Greek dress. In answering this we used a highly interdisciplinary approach that brings together ontology engineering and linguistics and applies them to classics, dress history, material culture and cultural heritage studies. In this paper we describe the building of the first multilingual ontoterminology of the domain of ancient Greek garments, i.e. a terminology whose conceptual model is a formal ontology. For the modelling of the domain knowledge of ancient Greek dress we used Tedi (ontoTerminology editor), a new software environment, compliant with semantic web standards, specifically catering to the needs of terminologists and cultural heritage specialists researching and/or making use of terminologies of their respective fields. In what follows we present the basic steps towards the definition of the concepts of the domain in a formal language (i.e. not in natural language) by means of specific axes of analysis. We aim for very finely structured knowledge which can eventually support two types of queries: by means of words, but also by means of ideas (concepts). The outcome is a multilingual set of consistently¹ defined terms of the domain of ancient Greek dress. Our approach evidences the conceptual richness and complexity of this domain, while demonstrating the importance of having at the expert's disposal specialized software for the representation of complex domain knowledge and terminology.

¹ i.e. in accordance with domain knowledge.

Keywords: Ancient Greek dress, ontology, terminology, ontoterminology, knowledge representation and modelling, linked cultural heritage, ISO Standards on Terminology, Tedi (ontoTerminology editor) software, semantic web.

Introduction

In what follows we describe how we worked towards building the ontoterminology of ancient Greek dress. “Ontoterminology” is a new theoretical paradigm which combines the terminology of a domain with its ontology (conceptualization) [Roche 2012]. According to this paradigm, the definition of terms in natural language relies on the definition of concepts written in a formal language. “Ontology” here is taken in the sense of knowledge engineering, i.e. as a formal, or semi-formal, specification of a conceptualisation [Gruber 1992]. By “ancient Greek dress ontology” we understand an explicit modelling of the implicit conceptual domain knowledge conveyed by means of texts, images, and other unstructured data and organized in a coherent, unambiguous way. By “terminology of the domain of ancient Greek dress” we understand the set of verbal designations of the concepts of the domain, in compliance to the ISO standards on Terminology². The category “dress” comprises “clothing” (“vêtement”) as an “objet de consommation très lente” [Maus 1926, 53], as well as other forms of body modifications and adornment, such as jewellery, tattoos, cosmetics, hairstyles³. By “ancient Greek dress ontoterminology” we understand the combined conceptual modelling of the domain of ancient Greek dress with the set of linguistic designations of the concepts in this domain. While there exists a vast bib-

² The ISO 1087-1 Standard on the Vocabulary of Terminology defines a “term” as a “verbal designation of a general concept in a specific subject field”, a “concept” as a “unit of knowledge created by a unique combination of characteristics”, and a “characteristic” as an “abstraction of a property of an object or of a set of objects” [ISO 1087-1].

³ The alternative term “costume” (used in English and French) encountered in the literature is succinctly defined by [Leroi-Gourhan 1973] as follows: “on entend par costume les pièces de vêtement qui constituent par leur groupement fixe, la manière normale de se couvrir d’un groupe humain”. For a brief discussion of alternative English terms such as “appearance”, “adornment”, “ornament”, “clothing”, “apparel”, “costume”, and “fashion”, see [Lee 2015, 21]. In this paper we use the term “garment” in the sense of “clothing or dress for the body”.

liography dealing with the nomenclature of ancient Greek dress⁴, creating a machine-actionable model that accurately represents the knowledge of the domain has not been done before.

For the modelling of domain knowledge, i.e. the building of the conceptual schema of the domain, and the assigning of terms for the concepts of the domain we used Tedi⁵ (ontoTerminology editor), a new software environment specifically catering to the needs of both terminologists and domain specialists. The outcome is an ontoterminology of Greek dress consisting of two distinct, yet linked layers (one for the concepts and one for the terms of the domain), which can be searched separately, and whose data are both human and machine-readable supporting W3C exchange formats. At present the ontoterminology of ancient Greek dress comprises over 250 terms defined in English. The work towards populating and enriching it with more concepts, terms, objects, contexts and notes is ongoing. Our aim is to include the totality of ancient Greek dress terms in at least three languages: English, French and Greek.

This paper is organized as follows: in the first section we discuss the issues facing terminological research in the domain of ancient Greek garments. In section 2 we present the different approaches for representing domain knowledge in the domain of cultural heritage, i.e. vocabularies, thesauri and ontologies, as well as the paradigm of Ontoterminology. In section 3 we describe in detail the ontoterminology of Greek garments with Tedi, and, in the final section we present the major conclusions drawn and the future directions of our work.

1. The problem with Greek garment terms

Why wonder about Greek (and Latin) dress terminology? Clothing is a powerful cultural signifier and an integral part of the material culture of any cultural space. Material things, clothing items, in particular, are embedded with cultural meaning. Crossculturally and transhistorically, together with food and shelter, clothing is the response to the most basic human need from birth until death. Ancient Greek dress can be studied for its own sake (technique, material, decoration, price, value) or as a means towards making sense of the broader context it was produced and consumed in everyday life, society, religion, art, myth. Making meaning out of fragmentary, not overlapping bodies of evidence is a central task of experts on past cultures. The

⁴ To mention just a few: [Losfeld 1991], [Llewellyn-Jones 2002], [Cleland *et al.* 2007], [Gherchanoc and Huet 2012], [Lee 2015].

⁵ <http://ontoterminology.com/tedi>

Ontoterminology of Ancient Greek Garments

primary texts (inscriptions, ostraca, papyri) that have come down to us, are a valuable source of information on the material culture of ancient Greece; so is the material and visual evidence that belongs to the culture of ancient Greece. Pairing the words naming the objects that populate this world to the objects in the archaeological record or the objects figuring in the visual sources can advance our knowledge and understanding of this culture significantly.

The identification and classification of types proposed here aims to strike a balance between “emic” and “etic”⁶. An “emic” model explains the ideology or behaviour of members of a culture as would be defined by insiders. An “etic” model is based on criteria from outside a particular culture. In our approach, the “emic” side is the investigation of the conceptualization of the domain as would be provided by the very agents of this culture through the linguistic, material and visual traces that survive. The “etic” part is the subsequent focus on redescribing all these data through systematic, analytic, and comparative study of this particular dress culture and by identifying axes of conceptual analysis.



Figure 1. Greek garments (left to right): short chiton, exomis, himation, chlamys
<http://archeoimmapaola.blogspot.fr/2015/12/la-moda-nellantica-grecia.html>

⁶ The terms, derived respectively from “phonemic” and “phonetic”, were coined by [Pike 1971]. The emphasis on “emic” was critiqued by [Harris 1976]; [Harris 1979, 56]. Both terms have been widely used in anthropological linguistics and cultural anthropology (e.g. in researching Linnaean taxonomy and the cross-cultural genealogical grid), as well as in archaeology (e.g. regarding artefact classification).

Evidence from antiquity can often be accidental, not systematic. Knowledge about Greek material culture, especially garments, is often lacunary. Some periods are overrepresented, others underrepresented. Of the textile and garment culture of ancient Greece manifest in the textual and visual sources (vases, statues, gems, coins etc.) very few material traces of textiles have been preserved. Made of highly biodegradable materials, these textiles are often in such condition that it is extremely difficult to recognize the shape of the garment they once may have belong to. The efficient discovery of knowledge in the domain of Ancient Greek is hindered both by the fact that no native speakers exist and by the fact that a large number of textual and visual representations available is highly stylized, and cannot always provide airtight proof about the concepts or their designations.

Optimally, the terms we look for can be found in ancient Greek texts. In general, though, matching the objects to their names is not straightforward for Greek material culture in general, as the textual and object-based evidence are not coextensive. There are garments known from the visual sources, whose ancient name is not known, and there are terms in ancient Greek texts whose denotation is not known. Also, there are garment terms with multiple designations⁷. Furthermore, some well-entrenched terms designating ancient Greek garments have been shown to have been coined in modern (post-Renaissance) times, even though they give the false impression to be dating from ancient times, mainly because of their morphology. However psychologically justified, giving ancient things ancient-sounding names without cross-referencing from the textual record has been the source of considerable confusion⁸. Despite the limitations, consistent naming remains a *conditio sine qua non* for knowledge sharing, as well as building comparable typologies and classifications. Using terms consistently facilitates the communication between domain experts, enhances clarity and accuracy, and eases text-mining. The need for consistency in the use of terminology, has already been recognized by experts of the domain:

“Although the standard Greek and Latin terminology employed by scholars to describe ancient clothing may not be that which was used in antiquity to signify particular items of clothing, it is a useful vocabulary of dress,” affirms [Stears 2006, 226].

⁷ e.g. [Papadopoulou 2017, 65] on the term “mitra”: “Both descriptive and functional definitions of the mitra are confusing, because clothing items labelled as mitra come in many shapes and sizes and can be worn in different ways on different parts of the body. They fall into two main categories: headgear and bodygear.”

⁸ Research on ancient Greek dress has targeted terms falsely thought of as of ancient provenance, e.g. [Lee 2004] on “kolpos” and “apoptygma”, as well as the lack of ancient Greek terms for some of the garments known from the visual sources, e.g. [Roccas 2000, 238] on the lack of an ancient Greek term for “backmantle”.

[Delaporte 1981, 12] remarks that the fluidity of terms is a constant problem in studies about dress: “le flou terminologique ... règne dans les études consacrés au costume, et ... est peut-être une des causes des difficultés de communication entre chercheurs : flou dans les descriptions des pièces, avec abus des termes passe-partout, comme poncho ou sari, mais également imprécision en ce qui concerne les termes les plus généraux, costume, vêtement, habillement, que chaque auteur connote différemment”. Scholars have proposed different non-automated systems of classification for garments (e.g. [Balfet *et al.* 1984]; [Eicher *et al.* 1992, 18 table 1.1]). [Balfet *et al.* 1984] tried to solve the problem they term “un babélisme terminologique qui entrave la communication entre chercheurs” by suggesting a classification with the aim to “répondre au besoin d’un système de dénomination transculturelle des pièces vestimentaires”. It should be noted that no (semi-)automated classification systems for garments as cultural artefacts of past cultures exist to date.

Garments are not the only type of material culture lacking a consensual and consistent terminological system. As [Martin Doerr 2009, 476] aptly notes “despite the fact that automated classification is a long-established discipline of archaeology, there are no terminological systems that are widely accepted”.

2. Domain knowledge representation for cultural heritage concepts

2.1 Vocabularies-Thesauri-Ontologies for Cultural heritage

In this section we provide a brief overview of the most important approaches for information organisation and retrieval available in the cultural heritage domain. In order to organise the vast amount of information cultural heritage institutions have turned to the development of thesauri and other formal knowledge representation models (ontologies)⁹. Here below are listed some examples of thesauri for the domain of cultural heritage:

-The Unesco multilingual thesauri, now published with semantic web technologies, is an open source, controlled and structured list of terms used in the fields of education, culture, natural sciences, social and human sciences, communication and information¹⁰.

⁹ See [Roche *et al.* 2014] for a discussion about thesaurus and ontology in information science.

¹⁰ <http://skos.um.es/unescothes/CS000/html>

-The Getty vocabularies¹¹ contain structured terminology for art, architectural, and moveable objects, as well archival and bibliographic materials, and provide authoritative information for researchers in fee-free LOD formats (JSON, RDF, N3/Turtle, N-Triples).

-The Visual Resources Association ontology or VRA core in RDF allows for sharing with other Linked Data resources, such as the Getty vocabularies.

-The Iconclass vocabulary contains 28,000 terms for describing art and iconography¹².

-The Canadian Info-Muse classification system, largely based on the classification system for Parks Canada Service collections, itself based in part on The Revised Nomenclature for Museum Cataloguing, focusses on material culture objects in ethnology, history and historical archaeology museum collections¹³.

-The eHRAF World Cultures and eHRAF Archaeology of the Human Relations Area Files (HRAF) at Yale University are online thesauri designed specifically for cross-cultural research. They contain information on present and past aspects of cultures organized by culture and/or archaeological tradition.¹⁴ One of the indexed subject areas is clothing (290).

- The terminologies of the International Committee for the Museums and Collections of Costume (ICOM-Costume) cataloguing costume collections in museums, in four languages (English, French, German, Spanish) are applicable to “fashionable and unfashionable dress in the orbit of European culture”.

¹¹ <http://www.getty.edu/research/tools/vocabularies/> These include: the Art and Architecture Thesaurus (AAT) with 125,000 terms in the domain of culture the Union List of Artist Names (ULAN) with 220,000 entries of artist names and Getty Thesaurus of Geographic Names (GTN) with over 1,000,000 entries and the newly released Cultural Objects Name Authority (CONA) and Iconography Authority (IA). All Getty vocabularies grow through contributions from the user community.

¹² <http://www.iconclass.nl/home>

¹³ <http://www.musees.qc.ca/bundles/professionnel/guidesel/doccoll/en/classificationethno/index.htm>

¹⁴ <http://ehrafworldcultures.yale.edu/ehrafe/>; <http://ehrafarchaeology.yale.edu/ehrafa/>

Ontoterminology of Ancient Greek Garments

Men's Garments

- [Main Garments](#)
- [Outerwear](#)
- [Protective Wear \(against dirt or danger, not weather\)](#)
- [Underwear](#)
- [Supporting and/or Shaping Structures](#)
- [Night and Dressingwear](#)
- **Accessories Worn**
 - [Head](#)
 - [Hairdressing](#)
 - [Face coverings and additions](#)
 - [Above waist](#)
 - [At waist and below](#)
 - [Arms and hands](#)
 - [Legs and feet](#)
- **Accessories Carried**
[See Women's Garments](#)
- **Accessories Added to Body or Clothing for Ornament**
[See Women's Garments](#)
- **Accessories Used in the Care of the Person**
[See Women's Garments](#)
- **Accessories Used in the Care of Clothing**
[See Women's Garments](#)
- **Accessories Used in the Making and Adjusting of Clothes**
[See Women's Garments](#)

Infants' Garments

- [Main Garments](#)
- [Outerwear](#)
- [Protective Garments](#)
- [Underwear](#)
- [Supporting and/or Shaping Structures](#)
- [Nightwear](#)
- **Accessories Worn**
 - [Head](#)
 - [Hairdressing](#)
 - [Face](#)
 - [Above waist](#)
 - [At waist or below](#)
 - [Arms and hands](#)
 - [Legs and feet](#)
- [Accessories Carried](#)
- **Accessories Added to Body or Clothing for Ornament**
[See Women's Garments](#)
- **Accessories Used in the Care of the Person**
[See Women's Garments](#)
- **Accessories Used in the Care of Clothing**
[See Women's Garments](#)
- **Accessories Used in the Making and Adjusting of Clothes**
[See Women's Garments](#)

- Women's Garments**
- *Main Garments*
 - *Outerwear*
 - *Protective Wear (against dirt or danger, not weather)*
 - *Underwear*
 - *Supporting and/or Shaping Structures*
 - *Night and Dressingwear*
 - **Accessories Worn**
 - *Head*
 - *Hairdressing*
 - *Face coverings and additions*
 - *Above waist*
 - *At waist and below*
 - *Arms and hands*
 - *Legs and feet*
 - *Accessories Carried*
 - *Accessories Added to Body or Clothing for Ornament*
 - *Accessories Used in the Care of the Person*
 - *Accessories Used in the Care of Clothing*
 - *Accessories Used in the Making and Adjusting of Clothes*

Figure 2. ICOM-Costume Vocabulary of Basic Terms for Cataloguing Costume, downloadable from:

<http://terminology.collectionstrust.org.uk/ICOM-costume/vbt00e.htm>

©ICOM International Committee for the Museums and Collections of Costume


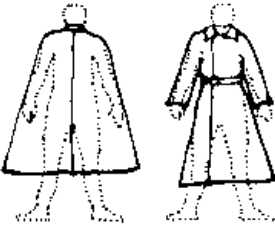
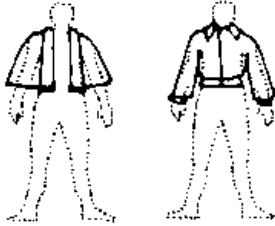

Men's Garments		
Outerwear		
2.1	<i>Unshaped textile, covering upper half of body or more</i> Shawl Shawl Plaid	
2.2	<i>Covering body above and below waist without shaping for arms</i> Cloak <i>with shaping for arms</i> Overcoat Overcoat Mackintosh	
2.3	<i>Covering body above waist without shaping for arms</i> Cape <i>with shaping for arms</i> Jacket	
2.4	<i>Covering body above and below waist or above only with partial shaping for arms</i> Mantle Inverness cape	

Figure 3. Men's Garments – Outerwear, ICOM-Costume Vocabulary of Basic Terms for Cataloguing Costume, downloadable from:

<http://terminology.collectionstrust.org.uk/ICOM-costume/vbtm02e.htm>

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Although classifying and searching on keywords remains a very powerful means for managing information, introducing concepts opens up new perspectives. Concepts are, or supposed to be, language-independent. Should they be structured in such a way so that their conceptual relationships are exploitable, improves relevance for search engines. The last version of the ISO standards on Thesauri (ISO 25964-1) illustrates this quite new approach. Another example is CIDOC Conceptual Reference Model (CRM), a reference ontology, a conceptual schema for the representation of cultural heritage information and an official ISO standard since 2005 (ISO 21127). CIDOC is currently the most elaborated ontology for the integration of cultural heritage information¹⁵.

Operationalizing concepts for IT applications directly leads to building Ontologies (in the sense of Knowledge Engineering). Computer-based (or applied) ontologies map out types of things and the relations between those types relevant for a given domain. Ontologies are populated by instances (or individuals) which represent the extensional definition of concepts. They are formal models, readable both by human and machine, which define and structure the concepts, thus making possible the conceptual modelling of the knowledge of the domain. To construct an ontology one has to model and represent a conceptual schema of a domain of knowledge, define the concepts, and formally represent the relations between them with a view to sharing this formal representation of the elements constituting it. Our approach combines ontology with terminology [Roche 2005] into an ontoterminology [Roche 2012] focussing on the concepts of the domain. Using a formal language allows to propose a standardized vocabulary of Greek garment terms expressing the stable domain knowledge from heterogeneous sources (textual and visual).

2.2.Ontoterminology

2.2.1. The ontoterminology model

Ontoterminology is a terminology whose conceptual system is a formal ontology. It makes explicit the two dimensions, linguistic and conceptual, which make up any terminology. Thus, ontoterminology makes it possible to distinguish the term and the name of the concept without confusing them since they fall under different semi-

¹⁵ CIDOC (Comité Internationale pour la Documentation) is ICOM's (International Council of Museums).

otic systems, i.e. the first one linguistic, the other one conceptual, where the name of the concept plays the role of identifier of the concept.

In order to reinforce this distinction, we note the term in quotation marks, i.e. “armchair”, and the name (identifier) of the concept between chevrons starting with a capital letter, i.e. < Seat one person with backrest feet and arms >. The term “armchair” denotes the concept whose name is < Seat one person with backrest feet and arms >. Let us recall that, while the term is provided by texts, the name of the concept is, or should be, constructed in such a way that by reading it one understands the place of the concept in the conceptual system: < Seat one person with backrest feet and arms >.

Similarly, Ontoterminology distinguishes the definition of a term written in natural language as a linguistic explanation of the concept¹⁶, from the definition of a concept, a formal and constructive definition written in a formal language [Roche 2015]. Taking the classical example of seats,¹⁷ for the linguistic system the term “armchair” is defined as: *Seat with backrest, usually with arms, for one person, in which one sits comfortably* (TLFi 02/06/2017) and denotes the concept < Seat for a person with backrest feet and arms >. For the conceptual system the concept of name <Seat one person with backrest feet and arms> is defined as < Seat >+/one person/+/with backrest/+/feet/+/with arms/¹⁸. The Tedi software environment reinforces this distinction by adding a color code for the 2 types of systems (blue for the linguistic dimension, green for the conceptual dimension).

We can notice that by separating the conceptual dimension from the linguistic dimension, ontoterminology allows a new approach for indexing and information retrieval. Terms are used to describe the contents which will be classified (indexed) under the corresponding concepts. Insofar concepts are extra-linguistic knowledge, i.e. language-independent, it becomes possible to manage multilingualism. The search in a given language returns all the contents that have been classified under the concepts corresponding to the request, whatever the language used for indexing these contents. Furthermore, taking into account the logical properties of the relationships between concepts enables to improve the recall and precision criteria.

¹⁶ In Terminology, the definition of term is mainly a *definition of thing*, i.e. a definition of the concept denoted by the term, without excluding any connotative information.

¹⁷ Pottier 1964.

¹⁸ Let us note that the definition of the term “armchair” in natural language is incomplete since we do not know whether the seat is with feet or without feet.

2.2.2. Tedi

Tedi, for ontoTerminology EDItor, is a software environment dedicated to building ontoterminologies. Tedi provides several specific editors for concepts, terms, objects and proper names.

Guided by epistemological principles relying on the logical properties of the ontological model, the Concept editor allows to define the essential characteristics (differences) organized into axes of analysis (including specification of dependencies between differences), descriptive characteristics (attributes), relations with their signature¹⁹, and concepts as sets of differences structured by a subsumption (isa) relationship. The Object editor allows to associate an URI and images to the objects.

Tedi is designed to efficiently manage multilingual terminologies. The Term editor allows to define different terminologies in different languages, as many as is needed. For each term, the user can provide a definition, assign a status²⁰, enrich with notes and contexts of occurrence, and, most importantly, link each term to its denoted concept(s) of the ontology. Terminological synonyms, as well as the equivalent terms in different languages, are automatically calculated by Tedi²¹.

Last, the ontoterminologies build with Tedi can be exported into different formats, e.g. RDF/OWL, HTML, CSV, JSON.

3. Greek garment ontoterminology

Building an ontoterminology can be seen as a five-step process, non-necessarily linear. Applied to the ancient Greek dress, these steps are as follows:

First, we selected the terms to be defined with the Term editor of Tedi from a previously built corpus²². The garment we selected to present here is designated by the following terms: “exomis” in English, “exomide” in French, “ἐξωμίς” in ancient Greek, “εξωμίδα” in modern Greek.

¹⁹ i.e. the type of objects that can be linked by the relation.

²⁰ The default statuses are “none”, “preferred”, “alternative”, “tolerated”, “non-recommended”, “obsolete”.

²¹ Two terms are terminological synonyms in a same language or terminological equivalents in different languages, if they denote the same concept.

²² Describing the process of building our corpus is outside the scope of the present article.

Ontoterminology of Ancient Greek Garments

Relying on the domain knowledge of the experts and on the knowledge designated by this set of terms, we then identified the *essential characteristics*²³ and structured them using a number of *axes of analysis*²⁴ with the Concept editor of Tedi software. To give an example regarding the axes of analysis: the axis of analysis ‘Body part’ is defined by the set of exclusive essential characteristics /around body/, /around head/, /around waist/²⁵.

The third step took us back to the linguistic dimension with the Tedi Term editor. For each previously defined term, we selected the set of essential characteristics designated by the term. If there is no concept corresponding to this set of essential characteristics, Tedi proposes to create a new concept whose name is built from the essential characteristics and whose formal definition is this set of characteristics. To illustrate, the term “exomis” denotes the following set of essential characteristics:

/around body/ + /male/ + /more than one part/ + /with sewing/ + /without sleeves/ + /attached/ + /one attachment/ + /knee-length/ + /under garment/ + /unpleated/.

This set of essential characteristics constitutes the formal definition of the concept denoted by the term “exomis”, whose name proposed by Tedi is: <Garment around body male more than one part with sewing without sleeves attached one attachment knee-length under garment unpleated>.

Based on the formal definition of the concept, we propose the following definition of the term “exomis” in the French language (“exomide”): *Vêtement de corps pour homme, court, non-plissé et sans manches. Composé de deux pièces cousues le long des côtés, attaché sur l'épaule gauche laissant l'épaule droite et une partie de la poitrine nues, il est généralement porté directement sur la peau.*

The definition of the term “exomis” in English is: Short and non-pleated garment for man, usually worn around the body directly on the skin, this sleeveless garment consists of two pieces of cloth sewn together along the sides, attached on the left shoulder leaving the right shoulder and part of the chest naked.

The definition of the same garment term in (modern) Greek is as follows: *Κοντό, χωρίς πτυχώσεις και χωρίς μανίκια ανδρικό ένδυμα, το οποίο συνήθως φοριόταν ως κυρίως ένδυμα. Αποτελούνταν από δύο κομμάτια υφάσματος ραμμένα στα πλάγια και στερεωμένα στον αριστερό ώμο που άφηναν τον δεξιό ώμο καθώς και μέρος του στήθους ακάλυπτα..*

²³ An essential characteristic is a characteristic such that if it is removed from the object, the object is no more what it is.

²⁴ The essential characteristics which compose an axis of analysis are exclusive each other.

²⁵ Essential characteristics (differences) are marked in between slashes, i.e. ‘/’.

Additional (encyclopaedic) information, e.g. pertaining to the wearers, function, type of fibre, colour of exomis, as well as to other garments the exomis could be worn with, do not form part of these definitions. As all this information is crucial to research focusing on ancient Greek garments and the culture that produced them, Tedi allows it to be recorded in the form of Contexts and Notes (see Fig. 4).

The last step consists in organizing the hierarchy of the concepts with Tedi Concept editor based on the inferred hierarchy automatically calculated by Tedi. For example, the concept denoted by the term “exomis” is a type of <Garment around body> concept.

The screenshot shows the Tedi Term Editor window. On the left is a 'Term List' with 254 terms, including 'epichrysa pasmata', 'epiporpama', 'epiporpoma', 'epitektos', 'epomydes', 'errammena', 'esthema', 'esthes', 'esthos', 'etruscan dress', 'exastis', 'exomis' (highlighted), 'fan', 'fancy dress', 'fibula', 'fringe', 'fur', 'gallic dress', 'garment', 'gloves', 'haliporphiros', 'halourgema', 'halourges', 'hamma parthenias', 'haplois', 'haplous', and 'headdress'. The main area is titled 'Terminology' and shows the term 'exomis' with its definition: 'Short and non-pleated garment for man, usually worn around the body directly on the skin, this sleeveless garment consists of two sewn pieces of cloth attached on the left shoulder, leaving naked the right shoulder and part of the chest.' It also shows 'Contexts' (Xenophon Memorabilia 2.7.5.5), 'Notes' (LSJ s.v. ἐξωμίς), 'Orthographic variations', 'Inflected forms', 'T. Equivalent terms' (fr: exomide, gr: ἐξωμίς), 'T. Hypernyms' (garment (preferred)), 'T. Hyponyms', 'T. Synonyms', 'T. Linked terms', 'Denoted Concept List' (Garment male around body more than one part with sewing without sleeves), and 'Inherited and own differences' (male, around body, more than one part, with sewing, without sleeves, attached, one attachment, knee-length).

Figure 4. Tedi Term Editor for “exomis”.

The Tedi Object editor allows to manage objects (e.g. images) and their associated information (see fig. 5).

Ontoterminology of Ancient Greek Garments

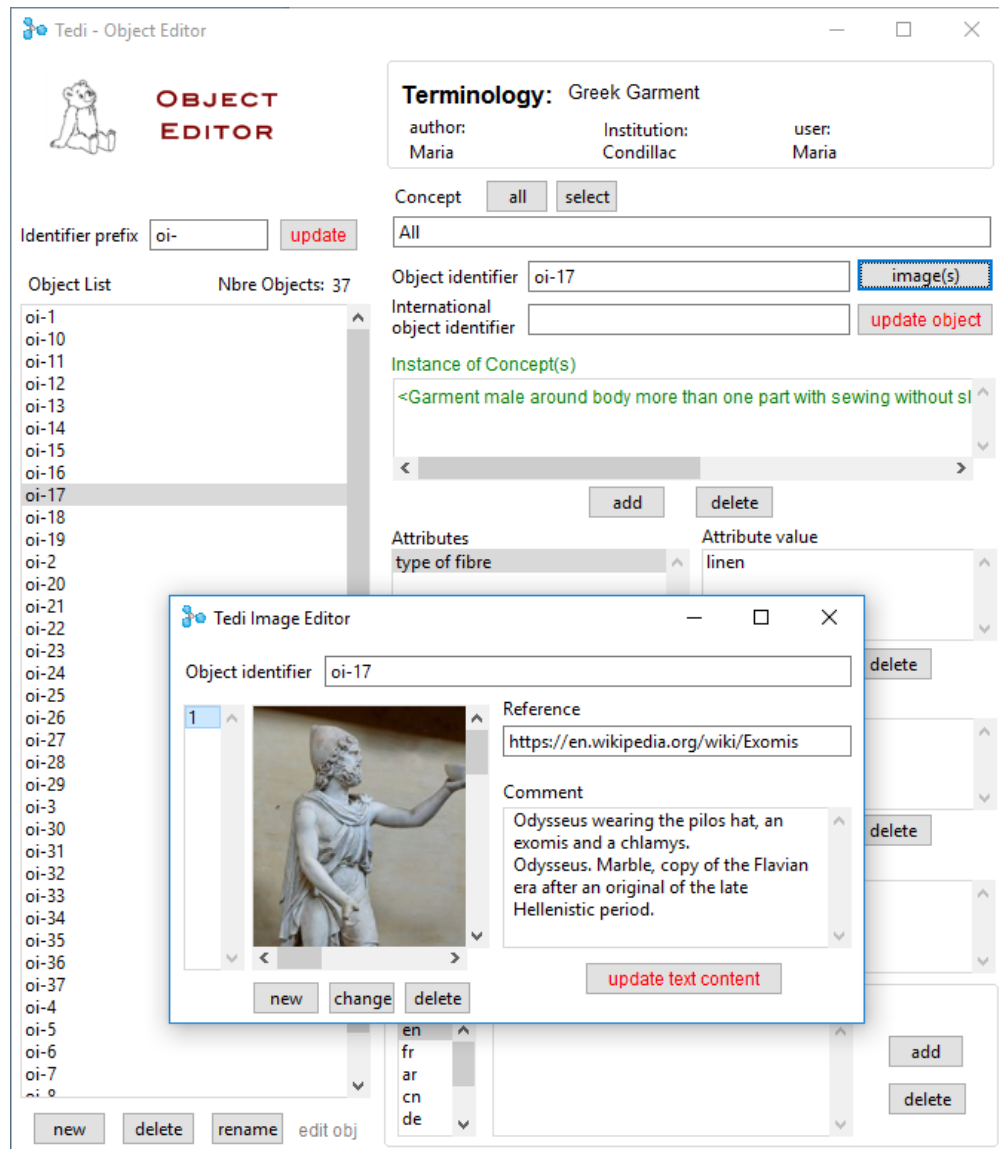


Figure 5. Tedi Image Editor featuring the Wikipedia image of an exomis.

Then the ontoterminology can be exported in different exchange formats, including OWL and HTML (fig. 6)

exomis

Definition: Short and non-pleated garment for man, usually worn around the body directly on the skin, this sleeveless garment consists of two sewn pieces of cloth attached on the left shoulder, leaving naked the right shoulder and part of the chest.

Status: preferred

Context(s):

1) Xenophon *Memorabilia* 2.7.5.5 Τί γάρ, ἔφη, ἰμάτιά τε ἀνδρεῖα καὶ γυναικεῖα καὶ χιτωνίσκοι καὶ χλαμύδες καὶ ἐξωμίδες; Σφόδρα γ', ἔφη, καὶ πάντα ταῦτα χρῆσιμα.
2) Pausanias 5.16.2-3 διὰ πέμπτου δὲ ὑφαινοῦσιν ἔτους τῇ Ἥρᾳ πέπλον αἱ ἐξ καὶ δέκα γυναῖκες· αἱ δὲ αὐταὶ πθέσαι καὶ ἀγῶνα Ἥρᾳ. ὁ δὲ ἀγὼν ἔστιν ἄμιλλα δρόμου παρθένους· οὗτοι ποὺ πᾶσαι ἡλικίας τῆς αὐτῆς, ἀλλὰ πρῶται μὲν αἱ νεώταται, μετὰ ταύτας δὲ αἱ τῇ ἡλικίᾳ δεύτεραι, τελευταῖαι δὲ θέουσαι ὅσαι πρεσβύτεραι τῶν παρθένων εἰσὶν. θέουσαι δὲ οὗτοι· καθεῖται σφισιν ἡ κόμη, χιτῶν ὀλίγον ὑπὲρ γόνατος καθήκει, τὸν ὦμον ἄκρι τοῦ στήθους φαίνεται τὸν δεξιόν. ἀποδεδειγμένον μὲν δὴ ἐς τὸν ἀγῶνα ἔστι καὶ ταῦταις τὸ Ὀλυμπικὸν στάδιον, ἀφαιροῦσι δὲ αὐταῖς ἐς τὸν δρόμον τοῦ σταδίου τὸ ἔκτον μάλιστα· ταῖς δὲ νικῶσαις ἐλαῖας τε δίδασσι στεφάνους καὶ βοῶς μῶραν τεθυμένης τῇ Ἥρᾳ, καὶ δὴ ἀναθεῖναι σφισιν ἔστι γραμμαμέναις εἰκόνας, εἰσὶ δὲ καὶ αἱ διακονοῦμεναι ταῖς ἑκατάδεκα κατὰ ταῦτα ταῖς ἀγωνοθετοῦσαις γυναῖκες. Pausanias. *Pausaniae Graeciae Descriptio*, 3 vols. Leipzig, Teubner, 1903. Available online: <http://www.perseus.tufts.edu/hopper/text?doc=Perseus%3Atext%3A1999.01.0159%3Abook%3D5%3Achapter%3D16%3Asection%3D2>

Note(s):

1) LSJ s.v. ἐξωμ-ίς, ἰδος, ἡ, (ῶμος) A. = χιτῶν ἐτερομίσχολος, tunic with one sleeve, leaving one shoulder bare, worn by slaves and the poor, *Id.* V.444 (cf. *Sch.* ad loc.), *Lys.* 662, *X.Mem.* 2.7.5, etc.; by Laconizers, *Ael.* VH9.34; by Cynics, *S.E.P.* 1.153; by the rich when not on ceremony, *Suid.* s.v.; by women, *Ar.* Fr. 8; at Rome, sleeveless tunic, *Plu.* Cat. Ma. 3, *Gell.* 6(7).12.3. Henry George Liddell, Robert Scott. *A Greek-English Lexicon*. Revised and augmented throughout by Sir Henry Stuart Jones. With the assistance of. Roderick McKenzie. Oxford: 1940. Available online: [http://www.perseus.tufts.edu/hopper/text?doc=Perseus%3Atext%3A1999.04.0057%3Aentry%3De\)cwm%2Fs](http://www.perseus.tufts.edu/hopper/text?doc=Perseus%3Atext%3A1999.04.0057%3Aentry%3De)cwm%2Fs)
2) LSJ, The Online Liddell-Scott-Jones Greek-English Lexicon. ἐξωμ-ίς, ἰδος, ἡ, (ῶμος) = χιτῶν ἐτερομίσχολος, tunic with one sleeve, leaving one shoulder bare, worn by slaves and the poor, *Id.* V.444 (cf. *Sch.* ad loc.), *Lys.* 662, *X.Mem.* 2.7.5, etc.; by Laconizers, *Ael.* VH9.34; by Cynics, *S.E.P.* 1.153; by the rich when not on ceremony, *Suid.* s.v.; by women, *Ar.* Fr. 8; at Rome, sleeveless tunic, *Plu.* Cat. Ma. 3, *Gell.* 6(7).12.3. Available online: [http://stephanus.tlg.uci.edu/ins/ndiv/lexica.jsp#q=111017&q=E\)CWM%2FS%2C+-J%2FDOS%2C+H\(&q=E1%BC%90%CE%BE%CF%89%CE%BC%CE%AF%CF%82%2C+%E2%80%91%CE%AF%CE%B4%CE%BF%CF%82%2C+%E1%BC%A1&sur_input=greek](http://stephanus.tlg.uci.edu/ins/ndiv/lexica.jsp#q=111017&q=E)CWM%2FS%2C+-J%2FDOS%2C+H(&q=E1%BC%90%CE%BE%CF%89%CE%BC%CE%AF%CF%82%2C+%E2%80%91%CE%AF%CE%B4%CE%BF%CF%82%2C+%E1%BC%A1&sur_input=greek)
3) Smith, William A Dictionary of Greek and Roman Antiquities (London: 1890). EXOMIS (ἐξωμίς), originally a tunic fastened over the left shoulder only (χιτῶν ἐτερομίσχολος, *Schol.* *Aristoph.* *Wasps* 444, *Phot.* and *Hesych.* sub voce ἐτερομ., *Heliod.* *Aethiop.* 3.1, *Paus.* 5.16.2, cf. *Plaut.* *Mil.* 4.4, 44), leaving the right shoulder and part of the breast free, and thus distinguished from the ἀμφιμάχαλος, which was fastened over both. It was especially characteristic of workmen and slaves (*Phot.* s.v. *Schol.* *Aristoph.* *Kn.* 879, *Laconizers* and *Cynics* (*Ael.* VH 9.3, 4; *Sext.* *Emp.* 1.153; *Suid.*); while the ἀμφιμάχαλος was used by the better classes. It was also the dress of old men in comic plays. (*Pollux*, 4.118), and as such worn by the chorus in the *Lysistrata* (662). Hephaistos as a god of labour (v. bronze in *Brit. Museum*, fig. p. 380, *Baumeister's Denkmäler*; *Müller*, *Archäol.* d. *Kunst*, § 366, 6) was commonly represented clothed in the exomis, as was also Odysseus. After Exomis. (Bronze in *British Museum*.) *Aristophanes'* time, short sleeves (ἄσπιδες) were introduced in the wide holes of the χιτῶν, like a blouse, and the terms ἀμφιμ. and ἐτερομ. (ἐξωμίς) were equally applied to the two forms so produced (of one sleeve, *Xen.* *Mem.* 2.7, 5; v. *Rich.* p. 659). On the other hand, the long-sleeved tunic, χιτῶν χειρὶδιωτός, was originally peculiar to barbarians, and accordingly appears in representations of Orpheus, the Indian Bacchus, Persians, Scythians, and the paedagogus. Later grammarians starting from the sleeved χ, wrongly interpreted ἐξωμίς "sleeveless" (*Aulus Gellius*, 7.12: "citra umerum desinentes"). The exomis, however, was not only a chiton [TUNICA], but also a ἰμάτιον or περιβλήμα [PALLIUM]. According to *Hesychius* (s. v. *Εξωμίς*) and *Aelius Dionysius* (ap. *Eustath.* ad *Il.* 18.595), it served at the same time both the purposes of a chiton (δὰ τὸ ζώνυσθαι) and a himation (ὅτι τὸ ἐτερον μέρος ἐβάλλετο), but *Pollux* (7.48) speaks of two different kinds of exomis, one of which was a περιβλήμα and the other a χιτῶν ἐτερομίσχολος. And his account is confirmed by existing works of art. In the *Museo Pio-Clementino* (vol. iv., pl. 11) is a Hephaistos wearing an exomis, which is a himation thrown round the body in the way in which this garment was always worn, and which clothes the body like an exomis when it is girded round the waist. (Cf. *Becker-Göll.* *Chankles*, iii. p. 112, &c.; *Guhl* and *Koner*, ed. 5, p. 206; *Hermann-Blümner*, *Privatalterth.* p. 176; and the figure in *Weiss*, *Kostümkunde*. Available online: <http://www.perseus.tufts.edu/hopper/text?doc=Perseus%3Atext%3A1999.04.0063%3Aalphabetical%3DE%3Aentry%3D4%3Aentry%3Dexomis-cn>
4) Le Dictionnaire des Antiquités Grecques et Romaines de Daremberg et Saglio (DAGR) EXOMIS sv TUNICA. Available online: <http://dagr.univ-tlse2.fr/consulter/1452/EXOMIS>
5) Wordnik, s.v. exomis In Greek antiquity, originally, a form of the short Dorian tunic or chiton, which was fastened over the left shoulder only, leaving the right arm entirely free. <https://www.wordnik.com/words/exomis>
6) Wikipedia, s.v. exomis The exomis (Ancient Greek: ἐξωμίς from exo "outside", and omos "shoulder") was a Greek tunic used by workers and light infantry. The tunic largely replaced the older chitoniskos (or short chiton) as the main tunic of the hoplites during the later 5th century BC. It was made of two rectangles of linen (other materials were also used), which were stitched together from the sides to form a cylinder, leaving enough space at the top for the arms. An opening at the top was also left for the head. The cylinder was gathered up at the waist with a cloth belt using a reef knot, which made the cloth fall down over the belt, hiding it from view. To allow freedom of movement to the right arm, the seam at the right shoulder was taken apart, and the right hand was passed through the head opening. The color of the tunic varied, but red (especially crimson) was increasingly the standard color preferred by hoplites during and after the Peloponnesian War. The exomis could be worn in conjunction with the chlamys (also known as ephaptis) cape. References: Greek costume (in French) *Sekunda*, Nicholas (2000). *Greek Hoplite 480–323 BC*. Oxford: Osprey Publishing. ISBN 1-85532-867-4. Available online: <https://en.wikipedia.org/wiki/Exomis>
7) Losfeld, G. 1991 *Essai sur le costume grec*, pp. 90-93. L'exomide est le vêtement masculin le plus simple, constitué par un rectangle d'étoffe assez exigü que l'on plie en deux dans le sens de la longueur.
8) For exomis as garment for women: see *Context* n. 2. Cf. Bronze statuette of female athlete, probably attached to a vessel or utensil, Date: 520-500 BC. Possibly made in Laconia, Greece and found in Prizren, Kosovo. *British Museum* (object number 1876.0510.1) Images available online: http://www.britishmuseum.org/research/collection_online/collection_object_details/collection_image_gallery.aspx?partid=1&assetid=256756001&objectid=462926

Equivalent(s):

- fr: exomide

- gr: ἐξωμ-ίς

Concept: <Garment male around body more than one part with sewing without sleeves attached one attachment knee-length unpleated under >

Essential characteristic(s): /male/, /around body/, /more than one part/, /with sewing/, /without sleeves/, /attached/, /one attachment/, /knee-length/, /unpleated/, /under/,

Figure 6. Export of the definition of the term “exomis” in HTML format.

Ontoterminology of Ancient Greek Garments

It should be noted that in the LSJ, the standard bilingual (Greek-English) dictionary used by scholars in Classics, the *exomis* is defined as “tunic with one sleeve”²⁶. The essential characteristics approach makes it possible to propose a more precise definition.

For the purposes of this paper we included a very limited number of contexts and notes. The Greek Dress OTB (OntoTerminology Database) entry for “*exomis*” includes a vast number of references to and quotes from the primary and secondary textual sources (in Tedi Term editor), as well as images (in Tedi Object editor).

As a final remark, it should be noted that Tedi allows different researchers to manage their own terminologies while sharing the same ontology. Tedi software environment thus allows different definitions of terms to be compared against the conceptual model.

Conclusion

We have elaborated a system to enhance the accuracy of ancient Greek dress terminology. The key idea was to structure dress-related content in such a way so as to allow it to be treated semantically supporting queries of high granularity. Apart from the enhanced granularity (i.e. higher level of detail in comparison to existing taxonomies, thesauruses, vocabularies) for this particular knowledge domain of Greek material culture the ontoterminology of the domain of ancient Greek dress allows to:

- access the terms by means of their concepts;
- differentiate between different concepts on the basis of essential characteristics;
- choose between different terms designating the same concept and propose the right status for each of them.

Responding to the need for better tools for entity-based searching, navigating, and visualizing the relations among concepts, terms, and artefacts is key. Tedi software environment closes the existing gap between ontology building and terminology management and offers the possibility to represent and manipulate domain knowledge both at the term and the concept level, while supporting W3C standards

²⁶ On what the Greeks understood by “sleeve” (*cheiris*) and the distinction between a chiton with sleeves (*cheiridotos*) and a chiton attached around both armpits (*chiton amphimaschalos*) or a single armpit (*chiton heteromaschalos*) see discussion in [Losfeld 1991, 98-100 and 112-118, where relevant bibliography].

for data sharing and reuse. Besides inventorying the clothing items of the ancient Greek world and providing a method for consistent identification of concepts and terms and for effective communication between experts in the domain of Greek garments, our model is extensible and transferrable to other domains of Greek (or other) material culture.

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LSJ = Henry George Liddell, Robert Scott, Henry Stuart Jones *A Greek-English Lexicon*. With the assistance of Roderick McKenzie. Oxford. Clarendon Press. 1940, 9th edition. Searchable online through the Perseus 4.0 Digital Library (Perseus Hopper): <http://www.perseus.tufts.edu/hopper/resolveform?redirect=true>

LSJ online = The Online Liddell-Scott-Jones Greek-English Lexicon. Searchable online through TLG (Thesaurus Linguae Graecae) <http://stephanus.tlg.uci.edu/ljsj/#eid=1&context=lsj>

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- TLFi = Trésor de la Langue Française informatisé. Searchable online : <http://www.atilf.fr/tlfi> , ATILF - CNRS & Université de Lorraine.
- Wikipedia. Searchable online https://en.wikipedia.org/wiki/Main_Page
- Wordnik. Searchable online <https://www.wordnik.com/>

Résumé

Cet article décrit la construction de la première ontoterminologie multilingue du domaine des vêtements de la Grèce antique, c'est-à-dire une terminologie dont le modèle conceptuel est une ontologie formelle. Notre recherche a pour objectif l'exploitation de sources textuelles, visuelles et matérielles afin de définir une ontoterminologie qui élargira et approfondira notre compréhension tant conceptuelle que terminologique du domaine des vêtements. Pour y répondre, nous avons suivi une démarche interdisciplinaire associant l'ingénierie ontologique à la linguistique pour les appliquer aux Classiques, à l'histoire de l'habillement, à l'histoire sociale et culturelle et aux études du patrimoine culturel.

La modélisation des connaissances du domaine s'est faite à l'aide de l'environnement Tedi (onTerminology editor), un nouvel environnement logiciel répondant spécifiquement aux besoins des terminologues et des spécialistes du patrimoine culturel. Cet article présente les étapes suivies pour la construction de l'ontologie du domaine et la définition des termes sur la base de caractéristiques essentielles structurées en axes d'analyse et posées comme extralinguistiques : la définition des termes en langue naturelle s'appuie sur la définition formelle des concepts qui en constitue également la justification. Le résultat est un ensemble multilingue de termes du domaine des vêtements de la Grèce antique définis de manière "cohérente" au sens où leur définition repose sur les propriétés de l'ontologie formelle. Associées à des connaissances finement structurées, cette démarche autorise deux types de requêtes, non seulement au moyen de mots, mais aussi au moyen d'idées (concepts). Ce travail met en évidence la richesse conceptuelle et la complexité de ce domaine, tout en démontrant l'importance d'avoir à la disposition de l'expert des environnements spécifiques pour la représentation de connaissances complexes et pour la définition de termes.