
**Biomimetics — Ontology-Enhanced
Thesaurus (OET) for biomimetics**

This document is a preview generated by ERS



COPYRIGHT PROTECTED DOCUMENT

© ISO 2020

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

| | |
|---|-----------|
| Foreword | iv |
| Introduction | v |
| 1 Scope | 1 |
| 2 Normative references | 1 |
| 3 Terms and definitions | 1 |
| 4 Role of the knowledge infrastructure for biomimetics | 2 |
| 4.1 General | 2 |
| 4.2 Related work in the framework of the design processes of BID | 3 |
| 4.3 Positioning of OET in the context of the BID design process | 4 |
| 5 How Keyword Explorer works | 4 |
| 5.1 General | 4 |
| 5.2 A motivating example | 6 |
| 6 Ontology-Enhanced Thesaurus | 7 |
| 6.1 General | 7 |
| 6.2 Characteristics of biomimetics databases | 7 |
| 6.3 Basic design of a biomimetics database retrieval scheme | 7 |
| 6.4 Keyword translation and exploration | 9 |
| 6.4.1 General | 9 |
| 6.4.2 Keyword exploration: divergent thinking | 9 |
| 6.4.3 Keyword exploration: convergent thinking | 9 |
| 7 Ontologies in OET | 9 |
| 7.1 General | 9 |
| 7.2 Basic design of ontologies in OET | 9 |
| 7.3 Ontology of function | 10 |
| 7.4 Concepts other than function | 10 |
| 7.4.1 Taxonomy of organisms | 10 |
| 7.4.2 Properties | 10 |
| 7.4.3 Living environments | 10 |
| 8 Implementation and evaluation of a prototype of Keyword Explorer | 11 |
| 8.1 General | 11 |
| 8.2 OET Versions | 11 |
| 8.2.1 The demo version | 11 |
| 8.2.2 The prototype version | 11 |
| 8.3 Preliminary evaluation experiment | 12 |
| Annex A (informative) Ontology of function | 15 |
| Annex B (informative) How Keyword explorer works | 18 |
| Bibliography | 19 |

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 266, *Biomimetics*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

A thesaurus is often used to map terms between different knowledge domains. The Knowledge Infrastructure for Biomimetics project was established to fill the gap between biology and technology. The project originally planned to develop a biomimetic thesaurus and an ontology that would complement such a thesaurus in situations where the thesaurus cannot deliver useful search terms because concepts in the two domains are associated with keywords that lack explicit links. Although work on the biomimetic thesaurus has been postponed, Ontology-Enhanced Thesaurus (OET) does not require a thesaurus and can be used as a standalone tool. For more details see [5.2](#).

OET addresses a portion of this knowledge infrastructure. It is composed of an ontology of biomimetics and an application named Keyword Explorer that provides an interface to the ontology. OET and Keyword Explorer help designers, engineers, and other bio-inspired design (BID) practitioners by mapping technical terms to biological terms that can then be used to search biological texts to identify biological models (see [Figure 3](#)). For example, a traditional thesaurus may relate “stain-resistant” to “self-cleaning” or “soil release”. A biomimetic thesaurus or internet keyword search may additionally return “antifouling”. OET can identify organisms that share functions related to “antifouling” but not directly associated with the term.

In [Clause 4](#), after a brief overview of the current state of the art of tools and systems in biomimetics, OET and Keyword Explorer are positioned in the related work. [Clause 5](#) describes OET together with its design rationale. In-depth description on the implemented ontology in OET is [Clause 6](#) and [Clause 7](#). [Clause 8](#) describes accessing and running the Keyword Explorer prototype in order to get feedback from readers.

NOTE A publicly available version of Keyword Explorer and OET is available at <http://biomimetics.hozo.jp/OET/demo.html> as a web application — it only includes one function (antifouling) but demonstrates the capabilities of the prototype version. The corresponding ontology can be inspected via “Browsing the Biomimetics Ontology” in <http://biomimetics.hozo.jp/OET/>, but it is not possible to download it. Paid users of this document can download the prototype version.

Biomimetics — Ontology-Enhanced Thesaurus (OET) for biomimetics

1 Scope

This document describes prototypes of the Ontology-Enhanced Thesaurus (OET) and the Keyword Explorer interface to OET. Although their design philosophy is described, this document focuses on their value and how they work.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1 data

minimum piece of information that is meaningful for its potential readers or users

Note 1 to entry: In many cases, data is a component of larger entity, a data set or a data base. Data can be text as in research papers, simulation models, algorithms, numbers, pictures, figures, voice and video recordings.

3.2 database

set of almost any digital objects, which can be text, picture, sound, video, etc.

3.3 information retrieval service

set of software that allows users to retrieve information from *databases* (3.2)

Note 1 to entry: Quite often, ontologies or thesauri are incorporated in the information retrieval service.

3.4 index

set of key terms (usually arranged in alphabetical order) with pointers to the original source of each term (includes books, research papers, or other forms of writing)

3.5 metadata

data (3.1) that provides information about other data

Note 1 to entry: The keywords in an index are metadata of the body of the text from which the keywords are extracted.