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DEFINING THE NOTION OF CONCEPT MAPS 3.0

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Web based concept maps can be viewed as reflections of generations of web technology. Thus we define the following generations of concept maps:

Concept maps 1.0
• Contains static content, which must be manually updated either directly in the source code or through an interface.
• Are typically created using desktop tools (e.g., CmapTools, VUE).
• Can be exported to web 1.0 formats (GIF, HTML), or SVG, which are open standards.
• Can be embedded in web pages.

Concept maps 2.0
• Can be created using dedicated online / web based tools (CmapCloud).
• Utilize social web (web 2.0) technology to facilitate sharing and collaboration.
• Are represented in open standards such as SVG (Scalable Vector Graphics).

Concept maps 3.0
• Utilize semantic web / web of data (web 3.0) technology to make content dynamic.
• Can be embedded in webpages.
• Can be created using dedicated online / web based tools (Cmap Cloud).
• Can be exported to web 1.0 formats (GIF, HTML) or XML (e.g., concept maps in CXL).
• Can be linked to external sources, such as Wikidata, which can act as unique identifiers i.e. as pointers referencing web pages about concepts.

Based on the Web Data Principles above, we propose five requirements for concept maps 3.0 as data sets:

1. "Concept maps should be Linked, that is accessible via persistent or stable identifiers. This obviously applies to the concept map as a whole but preferably also to its constituent parts. In this way, external resources can point to specific entities or objects in the structure." (Johnsen, L. & Jensen, J., 2016)

We suggest representing concept maps in HTML (Extensible Markup Language) for two dimensional graphs that also makes it possible to attach unique identifiers to all the visual and textual elements that constitute a concept map.

2. "Concept map distributions should be represented in open formats that do not require proprietary software for processing and whose source code is open to inspection." (Johnsen, L. & Jensen, J., 2016)

We can also be used to fulfill this requirement of concept maps being accessible, as SVG is a W3C (World Wide Web Consortium) endorsed open format and standard, is supported by browsers, can be embedded in HTML (Hyper Text Markup Language), and can be rendered as part of larger web pages.

3. "Concept maps should be annotated with metadata using "well known" and/or "well documented" vocabularies." (Johnsen, L. & Jensen, J., 2016)

We propose to use schema.org [https://schema.org/] as the main vocabulary to mark up concept maps because it is both well known and/or well documented and can be translated and converted to processing. Furthermore, we propose that this schema.org metadata be added to SVG concept maps by using formats such as JSON-LD (JavaScript Object Notation for Linked Data) or RDFa (Resource Description Framework in Attributes).

4. "Concept maps should be linked to other resources to enhance their informational or learning value. Links should be interpreted as possible in order to further their communicational purpose and/or the nature of their target and so enable automated processing. Individual concepts should be linked to external resources to better determine their identity." (Johnsen, L. & Jensen, J., 2016)

This can be achieved by linking to Wikidata entries, which can act as unique identifiers to an a parent referencing web pages, which unambiguously indicate the entity or identity of some concept.

5. "Concept maps should be linked with a license to signify where, when, how and why they may be put to use and under what circumstances." (Johnsen, L. & Jensen, J., 2016)

This can be achieved by linking to a Creative Commons license, which allows the concept maps in question to be reused under the conditions defined by the license.

References:

A simple example of how a concept map 3.0 can be annotated and exposed as web data using the schema.org vocabulary and the format JSON-LD

This particular example includes a snippet of code specifying metadata for a history concept map about the American general George Armstrong Custer

```json
<script type="application/ld+json">

@context = "http://schema.org/"
@type = "LearningResource"
alternateName = "American general George Armstrong Custer"
additionalType = "Person"
headline = "George Armstrong Custer"
inLanguage = "en"
learningResourceType = "Role"
name = "George Armstrong Custer"
sameAs = "https://www.wikidata.org/wiki/Q188205"
url = "http://cmap.ihmc.us/xml/CXL.html#concept-1521622371RZ"

[...]
</script>
```

A link to a Creative Commons license specifying how the concept map may be used.

A link to the concept map and all properties used in the code specifying the schema.org vocabulary.

A simple example of how a concept map 3.0 can be annotated and exposed as web data using the schema.org vocabulary and the format JSON-LD.