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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**
- Built using dedicated software (CmapTools, VUE).
- Exported to PDF or HTML.
- Can be embedded in web pages.
- Static, non-interactive, not discoverable.

**Concept maps 2.0**
- Can be created using dedicated web-based tools (CmapCloud).
- Can be linked to external resources.
- Can be embedded in web pages.
- Utilize social web technology to facilitate sharing and collaboration.

**Concept maps 3.0**
- Utilize semantic web (web 2.0) technology to make concept maps discoverable.
- Can be created using dedicated online/web based tools (Cmap Cloud).
- Can be exported to web 1.0 standards (SVG, HTML, or XML).
- Can be embedded in webpages.

Defining Five Fundamental Requirements for Concept Maps 3.0

We have adopted the following Web Data Principles (Wilde, E., 2016, http://dret.github.io/webdata/), which outline five recommendations for exposing data on the Web of Data / Semantic Web.

These recommendations state that Web Data should be:

- Linkable
- Parseable
- Semantically Interchangeable
- Usable
- Discoverable

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

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

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)

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

4. **Concept maps should be able to fulfill the requirement of concept maps being "web 1.0" i.e. should be parseable or human readable.** This allows concept maps to be utilized and understood by major search engines. This allows concept maps to be interesting and valuable for processing. Furthermore, we propose that this concept map metadata can be added to the concept maps using formats such as JSON-LD (Java Script Object Notation for Linked Data) or RDFa (Resource Description Framework). (Johnsen, L. & Jensen, J., 2016)

5. **Concept maps should be linked to external resources as a means to enhance their discoverability.** (Johnsen, L. & Jensen, J., 2016)

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.