Overview of the course Knowledge and Media

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ABSTRACT

In this document, the proceedings of the course Knowledge and Media, as presented at Vrije Universiteit, Amsterdam, in the academic year 2013-2014 by assistant professor Paul Groth are described. Proceedings will consist of lecture summaries as well as summaries of (compulsory) reading material and assignments.

Keywords

Knowledge, Media, Ontology, Representation, Knowledge Management Systems, Information Management Systems

INTRODUCTION

The proceedings are the records of the course Knowledge and Media. During the course it will become clear what correlation exists between knowledge and media, and how one can benefit from the other. During this course three different parts will be discussed; Knowledge Information Systems, Ontology Construction and Application to Media. Each lecture and assignment will be summarized in a separate chapter of this paper. Some figures will have a larger image available in Appendix, this will be noted in a footnote. A reflection on the topics discussed each week will be present at the end of each chapter, as well as a final reflection on the course.

The schedule for the course is as follows:

- Week 1 (Why Knowledge & Media?)
  - Introduction
  - The Importance of Knowledge Organization Systems
- Week 2 (Description)
  - Describing Things
  - Knowledge Representation & Ontologies
- Week 3 (Building Ontologies)
  - Ontology I: Categorization
  - Ontology II: Relationships
- Week 4 (From knowledge to media)
  - Ontology III: Evaluation
  - Wordnet and NLP + Portfolio Discussion
- Week 5 (Web)
  - Organizing Web Content
  - KOS Web Search and Data
- Week 6 (Images + Video)
  - Images
  - Video
- Week 7 (Project Week)

WHY KNOWLEDGE AND MEDIA

To understand what will be discussed during this course, it is adamant to know what actually is knowledge and media. The following weeks this will become common knowledge to us, students. Readers of this paper will receive the same information in a much shorter time and format.

Introduction (lecture 1)

Class started with a short group assignment. This was a very good exercise for thinking off your head. The room was divided in several groups, which each received a few newspaper clippings. Each group was to order these in a way they would feel good about it. Our group started out by sorting the articles by topic, in the same order as a traditional newspaper. Then we discussed and decided on ordering them by whether they were national or international, quickly followed by sorting by language and later by color. Our final idea then stuck, and we have sorted the clippings by sort of media, text or picture.

Each groups had a different approach for this exercise, some similar, like sorting by topic, some surprising, like sorting based on geography of the base of the topic of the article.

After this exercise, we have learned about the logistics of the course and what is expected of us, the students. To pass the course students are required to write a portfolio of sorts, outlining the content of the course, i.e. lectures and compulsory reading. There will be assignments and papers to read, summarize and reflect on each week. Also, the lectures have to be summarized each week so someone not following the course could understand what was learned during that week without being present. This requires a perfect attendance. The portfolio also should have a reflection section, in which the student reflects on the topics learned. It is expected to actively participate in and contribute to discussion, both online and offline.

Now everyone attending knew what to expect of the course, the next part of the lecture was spent on explaining mind maps. We started creating a mind map about knowledge and media. This exercise led to the first assignment.

Assignment 1

The first assignment we have received is finishing the mind map we started in class, and creating one for the two articles that have been given as reading material for lecture 2. Both these mind maps are listed in this chapter. Furthermore, summaries of both articles were to be made, as well as a discussion topic placed on Blackboard.

Mind maps

To find out what we, the students, expect of the course, we were given the assignment to name terms for a mind map about Knowledge and Media. A mind map is actually a relationship list.

After naming the terms for the mind map about Knowledge and Media, we had to divide them based on their relation with each of the general terms, i.e. Knowledge and Media. This proved to be not so easy, because there were several terms which overlapped in relationships to another term.

With the foundation being laid, we had to finish this mind map individually (Figure 1). A lot of terms from the map have overlap with each other. Also there are some terms that could be applied to both *Knowledge* and *Media*, for example *legality*.

Figure 1. Mind map Knowledge and Media

The next part of the assignment was to create a mind map of the issues faced in organizing knowledge in the two assigned papers for lecture 2 (Figure 2. Knowledge Management Issues).

Reading material

As shown in Figure 3, the main topics of the reading material for this assignment was about knowledge systems in different settings. On own hand there are homebrew databases in organizations with volunteers (Voida, Harmon, & Al-Ani, 2011), on the other hand, there are knowledge systems in companies (Mukherjee & Mao, 2004). Each comes with its own possibilities and constraints. For example, while homebrew databases are relatively cheap, the fact that only the person who created the database really understands what it's about, makes it difficult for other people to use. With regular changes in the volunteers working for the organization, this creates the need to build a new "database" each time someone else starts organizing.

Mukherjee & Mao discuss the difference between internet search and intranet search, while also showing the possibilities and constraints of knowledge management systems in companies. One big difference is that while searching the intranet, one has a pretty good idea about what it is he or she is looking for. Most of the time it is a document they have seen and/or used before. While on the internet, people do not really know what it is they are looking for. Also, the information on the intranet is often structured in a way, which makes it hard to use the same search options as on the internet.

While there are many differences between knowledge management in companies or volunteer based organizations, the basis is the same. Therefor I had not made two branches, but listed *Organizations* as sort of *Company*, facing the same issues. However, after the feedback in lecture 2, I have altered my mind map as shown below.

Figure 2. Knowledge Management Issues

The importance of knowledge management systems (lecture 2)

While Voida et al. and Mukherjee et al. implicitly show the importance of knowledge management systems and their use, during the second lecture we learned more about this topic. More specifically we focused on what people organize. After some debate, and seeing the lecture slides, realization dawned. People organize things, information about things, information and information about information.

Organizing things and information is not a new idea. People have started organizing things early on. Look at ancient libraries for example. According to (Harris, 1999) *"Organized archives existed in both Egypt and Babylonia before 3000 B.C., and before 2000 B.C. there were institutions in both countries that were libraries in the true sense of the word."*. The main reason for organizing things is to enable

usage of the things or information. Again the library is a good example.

Libraries, or librarians, sort information in a way it is easy for a user to retrieve what they are looking for. Libraries use several systems for sorting and organizing their non-fiction books. For example, in the United States Dewey Decimal Classification (DDC) is used, while in the Netherlands there are two systems used. One is an old system, based on the same principles as Dewey's system, called SISO[1]. The other system, which has become more used throughout the years, is PIM[2]. While SISO uses a decimal system, PIM uses a visual system with pictograms to sort books. Main purpose of libraries is to make information accessible to anyone with an interest in this information. Without organizing information in some way, this is not possible. This leads to the conclusion that information retrieval and information organization are intertwined.

Designing Organization Systems

Knowledge Organization Systems in effect are systems for information organization, based on the idea of memory institutions, as public libraries have been in the past, but specialized libraries still are. A good example is the Koninklijke Bibliotheek (KB)[3], or the Instituut voor Beeld en Geluid[4].

Important questions to ask oneself while designing an organization system are the following.

- What is being organized?
- Why is it being organized?
- How much is being organized?
- When is it being organized?
- How or by whom is it being organized?

When you have an answer to these questions, you have a general idea of what is expected of the system.

There are different reasons why people organize things. One, as shown in the library example, is for preservation and archival goals, even though (public) libraries have little archival tasks nowadays. Organization of information can be used to achieve some task, as shown by Voida et al. and Mukherjee et al.

How much is being organized is dependent on how much is required to retrieve the right set of data. In class an example was given of a Facebook timeline versus investigative reporting. One can imagine that for investigative reporting

much more information is needed than for a Facebook timeline. Also, the more data you have, the more organization is needed.

Information organization is basically done by anyone. I do it, you do it, professionals do it for you. Also communities and computers organize things.

When looking at the question of when it is being organized it is important to also look at the question of where the investment lies. Does is lie on the way out or the way in.

Examples of Knowledge Organization Systems

Knowledge Organization Systems, or KOS, come in many different forms; term lists, classifications, relationship lists. During class we looked at Vimeo[5]. The classification on this website is multi-layered. There are parts that organized as relationship lists, but also as term lists. This shows there is not only one road that leads to Rome. To get the desired organization, multiple ways of organization have been used.

Reflection

This first week of classes, assignments and reading material have shown us why it is important to organize knowledge and how this can be done.

Mind mapping is a method used even in elementary schools nowadays. What in earlier years is called a "word spider", based on a certain topic, evolves into using Mind maps in later years. Children learn how to organize the information they already possess about a certain topic by creating these mind maps. By discussing these maps in class, they learn more, and have an easy way of summarizing their knowledge for later use. Mind maps are used for initial knowledge gathering about the topic at hand, but can be expanded as we learn more about the mapped topic.

An example of how this is done in elementary school you will find in Figure 3. This mind map was made by my ten year old daughter. It is about Prinsjesdag, which occurs every third Tuesday of September in the Netherlands.
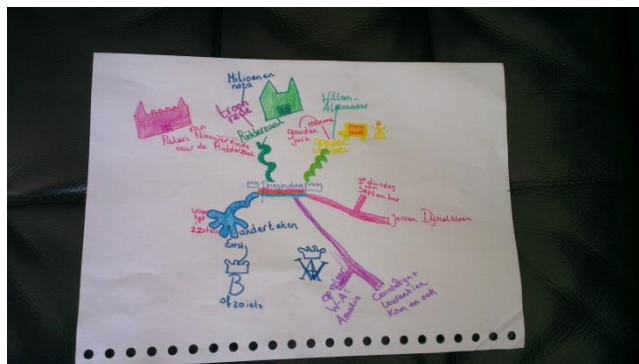

Figure 3. Mind map Prinsjesdag[6]

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[1] Schedule for Classification of Systematic catalog in Public Libraries (SISO)

[2] Presentation System Informative Media (PIM)

[3] Royal Library of the Netherlands, situated in The Hague, Holland

[4] Institute for picture and sound, situated in Hilversum, Holland

[5] Vimeo, a video sharing website (http://www.vimeo.com)

[6] See larger image of all mind maps from this chapter in Appendix A – Mind Maps

Important questions to consider when organizing information were shown. In personal life, most people have different organizing systems, which range from how the spices are sorted in a spice rack to the ordering of photo albums and books. In this organizing, they will probably unconsciously answer the mentioned questions (what, why, how, when and by whom).

DESCRIPTION

The following two lecture where about describing things. As learned in the previous part, organizing things is what we do, but how to describe these things in a functional way, we have yet to learn.

Describing Things (lecture 3)

When looking at the questions one needs answered before creating an knowledge organization system, as mentioned in the previous lecture (what, when, why, how and by whom), one automatically some to description or describing thing. By answering these questions, we can further look at the knowledge organization system that is needed for the specific information. Describing things is a very important part of this.

When describing things, there are some trade-offs. For example, there is the simplicity versus the complexity of the description, is the describing done at the time of organization or at the time of retrieval. Also, is it automated or human description. Which way is better really depends on what the goal of the knowledge organization system is, and what is described.

In description there are different types of properties:

- Name: e.g. coat, chair
- Physical properties: e.g. shape, material, colour, weight
- Cultural & contextual properties: e.g. when looking at the description of the Night Watch[7], *Amsterdam* (geographical location) is a contextual property, whereas *people wearing costumes* is a cultural property.
- Structural properties; i.e. the relation to other things in the space, for example Night Watch in relation to other paintings from the same painter.

Figure 4. Night Watch

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[7] Famous painting by the Dutch painter Rembrandt

As an example of description, a video was discussed (Figure 4). In the metadata of this video several properties were easily identified. For example Name. At the same time it was shown that Name is not always an easy thing to describe, since different things can be names. In this case, the URL of the specific video was a name, but also the title of the video.
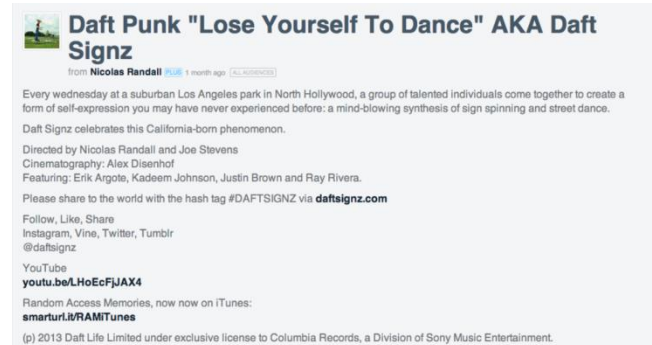
Figure 5. Video Metadata

Specific information about location of the video were considered contextual properties, while physical properties were about the duration of the video and what type of video it is. Structural properties in this case are named under Random Access Memory, which shows us what album the song is from.

An important question which arose here was, what we were we describing exactly; was is the video itself or the things seen in the video? And, what is important in describing this video? These questions can be answered if you have your audience in mind. Define what or who is your audience, and what is your goal in describing things. For example for machines there are different kinds of descriptions than for humans. The goal can be similar, but the audience is different.

Process of description

To describe things there are certain steps you have to take.

1. Identify and scope the thing to be described
2. Study it to identify its important properties or features
3. Compare it with other things like it and unlike it
4. Develop a vocabulary
5. Create the description

Within these steps you decide on your retrieval intent and decide which properties or features are most important for this intent. Another important part of describing things is developing a vocabulary. This can be done organically, or structured. In class we have done this organically by just naming things from the top of our heads to describe a still from the video described in Figure 4, and the painting in Figure 3.

What makes a good description

Several checklists exist for making a good description. Again, the retrieval intent and audience are important is-

sues here. (McPherson, 2010) shows us that a good description depends on the audience, the goal, the context and the size of the collection. McPherson refers to (Svenomius, 2000) for a checklist of sorts to check whether or not a description is 'good'.

Svenomius uses the following checklist (as explained by McPherson):

- User convenience: choose descriptions with the user in mind
- Common usage: choose words that the majority of users will understand
- Representation: base descriptions on the way an entity describes itself
- Accuracy: faithfully portray whatever it is that is being described
- Sufficiency and necessity: descriptions should have enough information to achieve their objectives and exclude information that is not necessary for meeting these objectives
- Significance: include only those elements that are bibliographically significant
- Standardization: standardize descriptions to the extent possible
- Integration: base descriptions for any type of material on a common set of rules

When describing you do not want too much description, therefore it is important to look at sufficiency and necessity. Also the significance of the described information is important.

The problem of naming
When shown an image of a cup, the following question was asked: "What size is the cup?" Answers were different. One student replied "tall", while another student said "small". Without prior determination it is difficult to get the same vocabulary. Size in case of the cup is determined by how much liquid it can contain. In this case, the cup was from Starbucks, which serves coffee in different sized cups. Their definition of small or medium depends on the amount of liquid that can be put in the cup. They have established a vocabulary for describing this cup by defining these cup sizes.

At the beginning of the lecture, all students were asked to write down the name they would give to a program that tells about interesting activities occurring in some metropolitan area. This exercise showed how most students came up with different names for the same thing, thus showing that naming something is not as easy as it may seem. A controlled vocabulary can help. However, if Starbucks for example changed the volume of their medium sized cups, this would mean the vocabulary for describing the cup has changed.

Metadata
Metadata are in essence another way of describing things; a surrogate record for something. Properties are different kinds of metadata. A syntax is in effect the semantics of metadata written down. Each syntax allows for different metadata structures. Examples of syntaxes are XML, HTML, or Owl.

In order to create a syntax, a schema is needed. Each schema describes the semantics in metadata, thus creating the syntax. An example of such a schema is Open Graph. Syntaxes will be discussed in more detail in following lectures.

Assignment 3
(Davis, Shrobe, & Szolovitz, 1993) describe in their paper how they believe a knowledge representation is best described. They go about explaining five distinct and, according to their research, crucial roles a knowledge representation plays.

The first described role is that of *surrogate*; they state that a knowledge representation is in essence *"a substitute for the thing itself, that is used to enable an entity to determine consequences by thinking rather than acting, that is, by reasoning about the world rather than taking action in it."* This role was mentioned in Lecture 3 as an important part of describing things in metadata. Davis et al. give an example of a bicycle assembly program to clarify this role. In a system, there would be mention of different parts of the assembly, but each mention is only a representation of the thing in the real world. It is not in fact a real saddle, or sprocket, or other part. However, by naming this part, the program, or person working with this, understands what is meant.

The second role described is that a knowledge representation is a set of *ontological commitments*, in effect answering the question in what terms one should think about the world. Choosing a vocabulary for things, is the first step in deciding these commitments. (Gruber, 1995) states making these ontological commitments is in fact making design decisions. He does stress the importance of making as little as possible ontological commitment, in order to give users the freedom to specialize as needed.

Furthermore Davis et al. describe the third role to be a fragmentary theory of intelligent reasoning. This is expressed in three components; *"(1) the representation's fundamental conception of intelligent reasoning, (2) the set of inferences that the representation sanctions, and (3) the set of inferences that it recommends."* The fourth role is that a knowledge representation is a computational environment in which thinking is accomplished, or a medium for pragmatically efficient computation.

The fifth and last role is that it is a medium of human expression, a language in which we say something about the world. This language can be images, words, sounds, etc. depending on the subject, used surrogates, made ontological commitments and semantics. This role checks whether

or not the system is an adequate medium of communication.

Knowledge Representation and Ontologies (lecture 4)

To continue our education on knowledge and media, this lecture is about knowledge representation (KR) and ontologies. A knowledge representation is in short a set of ontological commitments, a medium of communication, a medium for efficient computation, a medium for human expression, a surrogate. It is an information organization system that enables reasoning in intelligent systems. It is a type of organization system, a subclass of organization systems. It denotes not only relationships between things, but also what you can do with these relationships.

An ontology is, according to Gruber, *a specification of a conceptualization*. In fact, an ontology is an information organization written down. All the rules for entities, relationships and classes are written down in an ontology, making it easier for a user to classify things, and thus describing thing.

Within ontologies there is spectrum of organization systems. This spectrum ranges from catalogs on one side, to structured relationship and class lists with general logical constraints. Figure 6 shows this spectrum based on the spectrum presented at the AAAI-99[8] by the ontologies panel.
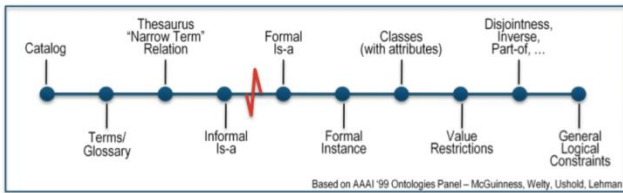
Figure 6. Ontology Spectrum

The ontology spectrum from left to right shows us:
- Catalog: controlled vocabulary
- Glossary: list with definitions
- Thesaurus: relationships along with the definitions
- Informal Is-a: hierarchy, mindmap, you can make assumptions about relations, but they are not written down, there are no rules
- Formal Is-a: hierarchy, but has rules. Shows reasoning rules for relationships.
- Formal instance: constraints about instances
- Classes: constraints about classes
- Value restrictions
- Disjointness, inverse, part-of,...: shows part-of relationships
- General Logical Constraints: full sized ontology with logical constraints

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[8] 1999 American Association for Artificial Intelligence National Conference (AAAI-99). Panelists were Michael Uschold, Michael Gruninger, Fritz Lehmann, and Deborah McGuinness

Reflection

Ontologies help us describe things in a structured way, in order to retrieve them more easily. As shown in the above part about describing things, it is very important to keep your goal and audience in mind. Sometimes the audience changes over time. For example the catalog from your local library; it contains all sorts of metadata about books. Earlier we have discussed the SISO and PIM categorization, where SISO is in my opinion created with the professionals in mind as the audience, in a time where the professionals were the only users of the system. PIM on the other hand, is created more with the non-professional users of the library as audience, reacting to the more independent user that visit the library nowadays. In both cases retrieval of books is the goal, therefore the goal is the same, but the audience is different. The rules have changed, even classes have changed, a whole new ontology was build.

BUILDING ONTOLOGIES

After looking at what ontologies are, we learn about how to build an ontology. This part is divided in two lectures about ontologies, one focussing on categorization and the second on relationships.

Ontology I – Categorization (lecture 5)

To understand ontologies better, one needs to understand the following:
- RDF : a format to represent relationships between things, where things are identified by URIs.
  For example <subject> predicate <object>
- OWL (OWL 2 Web Ontology Language, 2012) gives more of these predicates. Turtle syntax is easiest to read.

Creating a new class in Turtle is done in the following manner:
@prefix ex: <URI>
@prefix owl: <URI>
Ex: Monkey rdf type owl Class
Ex: Monkey owl.subclassof ex.Animal

Creating classes and entities and the relationship between those two is the basis of building an ontology. There are certain things to remember about classes. Creating classes in in essence creating a central grouping construct. Each instance of a class is called a member of this class. It is possible for a class to have multiple sub-classes and super-classes. A sub-class lies below the class in the hierarchy while a super-class lies above the class.

Example classes and properties
Person
Parent hasChild Child
Annemarie hasChild Joann
Annemarie hasDaughter Joann

Figure 7. Example of classes and properties

In the above mentioned example (Figure 7), when looking at the class child, it's sub-class is Daughter, and it's super-class is Parent. Parent can have a super-class of Human, and Daughter could have the sub-class Stepdaughter. The actual names of the daughter (Joann in the example) is the instance of the class Daughter, and the name of the parent (Annemarie) is the instance of the class Parent.

Above all classes lies one root class, which is called *Thing*. On the other hand lies the sub-class *Nothing*, which is the sub-class of all classes.

In Owl there are two types of properties:
- Object property, which shows the relation between two classes
- Datatype property, which links the actual data to the classes

Properties define the relationship between classes. In Owl and RDF properties have a direction, this is shown in the above example as Parent *hasChild* Child. A relationship between Parent and Child has been established here. It is implied that a reverse relation also exists, which would be noted as Child *hasParent* Parent.

The domain and range in an ontology is explained as follows.

Artist creates Artwork

In this example, Artist is the domain; the class of allowed values at the left side of the relationship: i.e. the origin. Artwork is the range; the class of allowed values at the right side of the relationship: i.e. the destination.

Besides sub-classes and super-classes, there is also the notion of equivalent classes. There are three types of equivalent classes:
1. As a union of other classes
2. As the intersection of other classes
3. As the negation of other classes

Starting from the example in Figure 7, this can be explained with adding a class Father, a class Woman and a class ChildlessPerson. In the first case, where the classes are a union of other classes, a member of the class Parent can be either a member of the class Father or Mother. In the second case, where the classes are an intersection of other classes, one can say members of the class Mother must be members of the class Woman and Parent. The third case, where the class is a negation of other classes, a member of the class ChildlessPerson is a member of the class Person but does not belong to the class Parent. These types of relations are called class expressions.

Assignment 5
The assignment belonging to this chapter was to build an ontology based on the Storyline ontology (A News Storyline Ontology, 2013). Each student selected one of the core-classes from Storyline ontology an extended this class with a particular set of properties. A self-chosen end user (application) and domain was to be explained as well as design decisions. Each extension should consist of 10 classes and 5 properties.

Introduction
Ontology based on the Class Topic from the Storyline Ontology, created for BBC (A News Storyline Ontology, 2013).

While the Storyline Ontology shows relations between the Classes Topic and Storyline, Topic has no further properties or classes named. For creating a system to order each topic, we felt it necessary to expand this Class. The system could be used to retrieve news items, based on their topic.

Ontology
Creating an ontology basically consists of seven steps:
1. Determine the scope and domain
2. Consider reusing existing ontologies
3. Enumerate important terms
4. Define classes and hierarchy
5. Define properties of classes
6. Define data type of properties
7. Create instances

(Noy & McGuinness)

For this ontology, the domain and scope of the ontology is that of editors of a magazine on health. They will use the ontology to create an addition to the information retrieval system as described in the Class StorylineSlot in the Storyline Ontology. This addition can be used to order news items by Topic. These topics are consistent with the used main topics in the magazine; mental health, physical health, alternative healthcare, regular healthcare, medicines, research. As said before, the Storyline Ontology is the basis for this ontology.

The most important terms in this ontology are the following: topic name, description, retrieval location, subject, section, subsection. Also the above mentioned topics will be seen in the ontology.

Classes and hierarchy

From top to bottom, the hierarchy for the classes is shown below. In this ontology we have taken some classes from Storyline to better show the relations.

By dividing all Topics in Sections, one can easily retrieve news items needed to fill the magazine, or search the archives. Queries can be run on how many and which Storylines belong to a certain topic. There are two subjects named, based on the topics published in the magazine. Each subject has two sections.

The class RetrievalLocation has the properties classificationNumber, description and numberOfStorylineSlots. Each Topic has a description, RetrievalLocation, title and numberOfStoryLineSlots.

This hierarchy shows classes and properties. Figure 8 shows the classes. Table 1 shows the class hierarchy, Table

2 the properties for the classes. The Turtle code for this ontology can be found in Appendix B.
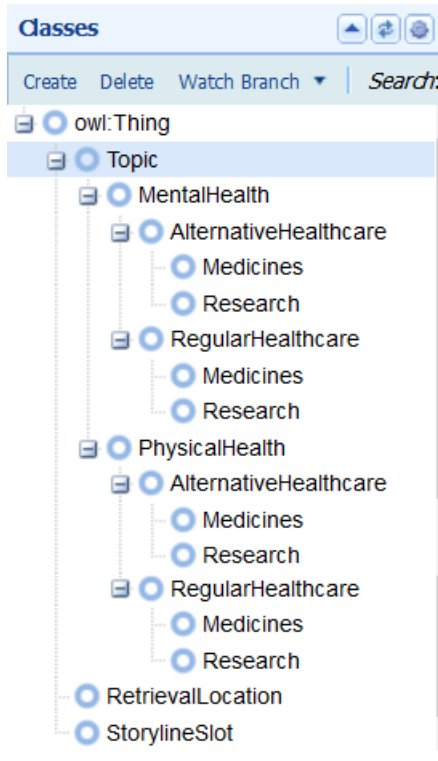

Figure 8. Classes

As shown in figure 8 and table 1, the classes AlternativeHealthcare, RegularHealthcare, Research and Medicines are linked more than once. Both the Topics MentalHealth and PhysicalHealth have a division between AlternativeHealthcare and RegularHealthcare (within that topic). Both AlternativeHealthcare and RegularHealthcare have a division between Research and Medicines (within that topic). Ultimately these classes are the same, and have the same URI to identify them.

Table 1. Class hierarchy

AlternativeHealthcare   A subtype of Topic.   • has super-classes: MentalHealth, PhysicalHealth   • has sub-classes: Medicines, Research
Medicines   A subtype of Topic.   • has super-classes: AlternativeHealthcare, RegularHealthcare
MentalHealth   A type of Topic.   • has super-classes: Topic
• has sub-classes: AlternativeHealthcare, RegularHealthcare
PhysicalHealth   A type of Topic.   • has super-classes: Topic   • has sub-classes: AlternativeHealthcare, RegularHealthcare
RegularHealthcare   A subtype of Topic.   • has super-classes: MentalHealth, PhysicalHealth   • has sub-classes: Medicines, Research
Research   A subtype of Topic.   • has super-classes: AlternativeHealthcare, RegularHealthcare
RetrievalLocation   Location where storylines can be found, either physical or digital.   • has super-classes: owl:Thing
StorylineSlot   A storyline slot, used as a container for storyline components.   • has super-classes: owl:Thing
Topic   The topic of a storyline. An interface to some concept in a knowledge domain.   • has super-classes: owl:Thing   • has sub-classes: MentalHealth, PhysicalHealth

Table 2. Properties

hasRetrievalLocation   Associates a Topic a StorylineSlot to a RetrievalLocation
hasDescription   Associates a description to each Topic and RetrievalLocation
hasNumberOfStorylineSlots   Associates a number of StorylineSlots to each Topic and RetrievalLocation
hasTitle   Associates a title to each Topic
hasSubject   Associates a Topic with a sub class of Topic
hasClassificationNumber   Associates a classificationNumber to each RetrievalLocation

Ontology II – Relationships (lecture 6)

During the lecture the focus was on the concept of part-whole relations, which is known as Mereology: "*the formal study of the logical properties of the relationship of part and whole*" (Mereology). This theory is common in many domains, for example human body (i.e. my hand is part of my body), cars (i.e. engine is part of a car), etc. The theory is different from the subclass-generalization relation as used in Owl for example. In fact, in Owl there is no built-in modelling construct to show this relationship. There are different types of part-whole relations (Odell, 1994).

Aggregation versus generalization

In relations one has to look for aggregation versus generalization. There are some similarities. Both have a tree-like structure and transitive properties: e.g. hand is part of the arm, finger is part of the hand, nail is part of the finger therefore nail is part of the arm.

There are also some differences, the main difference being that in aggregation there is a AND-tree, while in generalization there is an OR-tree. Another difference is that in aggregation there is more of an instance-tree, while in generalization there is a class-tree. This is best explained by looking at whether something is partOf or subClassOf of something else.

During the lecture we talked about these relations by looking at the examples as shown in Figure 9. By deciding if the relations was partOf or subClassOf, one gets a better understanding of these relations. One of the ways to check if something is part of, is to look for the inverse hasPart. From the example this would mean that a house is a subClassOf of a building, not a part of. A brick however, is a partOf a house. Both Sylvio and Veronica are partOf a married couple. A hand is a subClassOf body part, whereas finger is a part of a hand.

- House – Building
- Brick – House
- Antique book – Antique book collection
- Silvio – Married Couple
- Veronica – Married Couple
- Hand – Body part
- Finger - Hand

Figure 9. Relationship examples taken from slides Lecture 6

Types of part-whole relations

There are different types of part-whole relations based on three distinctions:

1. Configurability: Is there a functional or structural relation with the other parts or the whole?
2. Homeomerous: Are parts the same kind as the whole?
3. Invariance: Can parts be separated from the whole?

Below we will list different types of part-whole relations, with a short explanation:

- *Ownership* - Annemarie owns a bike, it is not a part of Annemarie
- *Attachments* - a wristwatch, it is attached to my arm, but not a part of my arm
- *Classification inclusion* - a type of book, for example Gone with the wind; it is not a part of a book
- *Temporal topological inclusion* - an space shuttle is in a space, but not part of it
- *Material-object relation* - when you take a part out of something, and it is not the same thing anymore; for example a human body without water is no longer a human body; an orange without vitamins is no longer an orange
- *Portion-object relation* - a slice of bread is part of a loaf of bread.
- *Place-area relation* – Amsterdam is a part of North-Holland
- *Member-Bunch* - student and class of '13; book and library
- *Member-partnership* - if you remove John Lennon from the Beatles, the Beatles no longer exist
- *Component-integral* - branch and tree; article and newspaper

Reflection

After each creating our own extension of the Storyline ontology, the most important issues with the assignments in general were discussed. The lecture started with feedback on the assignment. Important to remember was that properties and relations need to be explained as well as the classes. It was advised to not leave the explanation for this to Turtle code. Last, it is difficult to make the distinction between classes and instances. This is however a very important part of the ontology.

The ontology as shown in Assignment 5 had the advantage of being discussed in lecture 6, which gave extra feedback and led to the ontology described in the previous section. It was good to see that after looking over notes from the lecture, and re-reading the discussed literature from lecture 5, the idea for the ontology could be written down clearer and in more detail. Also the concept of classes and instances of these classes became more clear during the lectures.

Understanding relations is an important part of describing things and understanding ontologies. If you know whether or not something is a part of or a subClassOf, one can figure out more easily what kind of relationship is needed in the ontology.

FROM KNOWLEDGE TO MEDIA

During this week, both lectures were given by guest lecturers. The assignment for this week consisted of delivering this portfolio, up to lecture 6. Extensive feedback was given on the portfolios during lecture 9.

Ontology III: Evaluation (lecture 7)

This lecture was given by a guest lecturer; Jacco van Ossenburg, employed by the Centre for Mathematics and Informatics at VU University. The focus of this lecture was on evaluation Knowledge Organization Systems (KOS) and ontologies. The goal of this lecture is to learn how to analyse KOS properties, understand underlying decisions and motivate opinions about the validity in context.

The first step is to realize for which purpose a system is used, this will help explain a lot of design decisions. Understand and consider the context. Sometimes what seems a severe logical error is just a smart short cut which works just fine in the system at hand, but information tends to outlive or outgrow the systems it was designed for.

There are general design guidelines to consider when designing a KOS. First it is important to consider the principle of minimal ontological commitment, this allows extensions on the ontology. This is for example shows in BBC's Storyline Ontology. The ontology has minimal ontological commitment and allows for extensions, as done in Assignment 5.

Minimal ontological commitment does not mean no ontological commitment. A trade-off has to be made considering the price for under commitment and over commitment. The storyline ontology has a shared minimal ontological core, with freedom to extend and specialize. This is the dimension in which to evaluate SKOS and OWL. (Baker, Bechhofer, Isaac, Miles, Schreiber, & Summers, 2013) provide an extensive history of SKOS.

Baker et al. discuss the main components of SKOS and how they are expressed in OWL. They state that while using SKOS, concepts can be identified using URIs, labelled with lexical strings in one or more natural languages, assigned notations (lexical codes), documented with various types of note, linked to other concepts and organized into informal hierarchies and association networks, aggregated into concept schemes, grouped into labelled and/or ordered collections, and mapped to concepts in other schemes.

They also provide an account of design decision taken by the Semantic Web Deployment (SWD) Working Group of the World Wide Web Consortium (W3C). They discuss the history of SKOS, which goes back several decades and state future work on issues that have been postponed while developing the W3C Recommendation for SKOS.

Ontology evaluation

(Guarino & Welty, 2002) discuss the OntoClean methodology for evaluating ontologies. OntoClean looks metadata-properties for characterizing classes. They start with explaining essence and rigidity, where essence looks at whether or not a things property is essential or not and rigidity decides whether or not the specific property is essential for all the instances; every entity that can exhibit the property must exhibit it. As an example they discuss a hammer; a hammer is hard, and has to be hard, a sponge can also be hard, but it is not of essence for it to be hard. During the lecture the example in Figure 10 was given to explain rigidity.

```
Class Human
        hasBodyWeight (rigid)
        isFather (anti-rigid)
        isFemale (semi-rigid)
        hasGender (rigid)
```
Figure 10. Example of rigidity in Classes

Next they move on to identity and unity, the benefits of ontological analysis and subsumption. The authors conclude with saying OntoClean is a widely used methodology, and several large ontologies are evaluated with this. Among others, these ontologies include a restructuring of WordNet and the SOALAR project from IBM Research. WordNet is discussed in more detail in the following lecture.

Wordnet and NLP (lecture 8)

This lecture's guest lecturer was Marieke van Erp, postdoctoral researcher on the NewsReader project[9] at VU University. The focus of this lecture was on two different topics; Natural Language Processing (NLP) and WordNet.

Natural Language Processing (NLP)

NLP adds semantic understanding of named entities (people, companies, locations, etc.), pattern-based entities (email-addresses, phone numbers), concepts (abstractions of entities), facts and relationships, concrete and abstract attributes (e.g., 5 years, expensive), and subjectivity in the form of opinions, sentiments and emotions. NLP transforms unstructured text into structured information. This structured data can then be categorized, queried, mined for patterns, topics or themes, presented intelligently, visualised and explored. There are three kind of approaches for NLP; (1) rule-based, (2) statistical, (3) hybrid methods.

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[9] http://www.newsreader-project.eu/

The tasks of NLP are many and diverse. Figure 11 shown the different tasks of NLP. During the lecture these tasks have been discussed and explained in more detail. In this summary we will only highlight certain tasks.
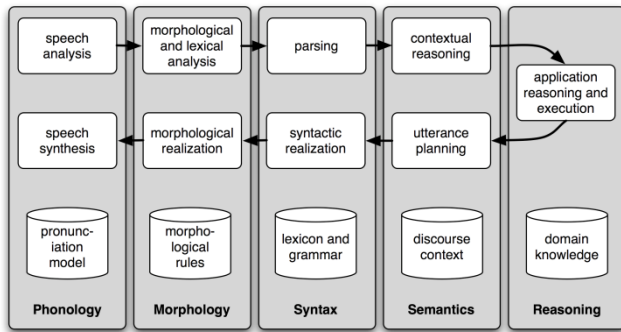

Figure 11. NLP Tasks[10]

By segmenting text by for example chunking, or Part of Speech (POS) tagging, syntactic analysis can be done. POS is in effect determining the part of the specific speech; i.e. begin, middle or end of the word. Chunking is dividing the text in subpart of the sentence, for example 'I am driving the red car', where 'the red car' is a chunk.

For semantic analysis the method Named Entity Recognition (NER) is used. NER systems identify different types of proper names, such as person and company names, and sometimes special types of entities, such as dates and times, that can be easily identified using surface-level textual patterns. Important to note here is that information extraction is not all about named entity extraction. (Hobbs & Riloff, 2010) state that a much more difficult and potentially much more significant capability is the recognition of events and their participants.

Challenges in NLP are negation, "messy" text (e.g. Twitter and SMS language), domain adaptation, cross- and multi-document text analysis and resource-scarce languages. Natural language is hard to grasp for machines, and NLP is only just started making sense of language.

WordNet
WordNet[11] is a network of semantically related words. It has a hyponymy – hierarchy, as well as meronomous relations. According to Van Erp, the developers are at version 3 of WordNet, which consists of 155,287 unique strings, 117,659 synsets and 206,941 total word-sense pairs.

Within WordNet 25 unique beginners for nouns are defined, with which one can describe most things in the world, below that come base level concepts. The system was developed by George Miller and his team at Princeton University, as the implementation of a mental model of the lexicon. Nowadays it is the most used database in language technology and has had an enormous impact in language

technology development. It being free and downloadable, is probably one of the reasons for that.

WordNet is in principle an English language database. Throughout the years several other initiatives have made sure the system was implemented in other languages. There is for example EuroWordNet. This WordNet used English concepts and linked the words from other languages to these concepts. Problems with this occur when a concept does not exist in the English language, or when a concept in a different language has many concepts. To follow this development, a GlobalWordNet was started. This consists now of over 70 different languages.

It is important to understand that WordNet is not an ontology. There are some differences, for example in usage. WordNet is used to predict substitution in text for information retrieval, text understanding, text generation and machine translation. Ontologies are used for making semantic inferences. The ontology of WordNet must be powerful enough to encode all concepts. WordNet has started to make explicit some of the peculiarities of and help computers deal with natural languages.

Reflection
This week's lectures have taken us back to looking at earlier examples of KOS. It is much clearer why the Storyline ontology is as general as it is. If more ontological commitment was made, it would be harder to expand and add to this ontology whereas now this is easily done. Looking at audience and goal when designing an ontology or KOS is just as important here as it is whit describing things. Of course ontologies and KOS are only a means of describing things.
Projects such as WordNet are very interesting to follow. Especially as natural language is a difficult thing to grasp for computers. If NLP is only now starting to make sense of language, one can deduce that complete understanding is a concept that is still far away. To me, studying more about these projects sound like a good idea; I missed the lecture due to another appointment.

WEB

This week's lectures focus on the web; organizing web content and Linked Open Data, or the web of data.

Organizing Web Content (lecture 9)

KOS and the web
Primary questions to ask when thinking about KOS and the web are:
- What are my KOS?
- How do they influence my design of (web)sites?

In site design, KOS are influencing and enabling web search. When designing one needs to think about:

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[10] Image source: http://nltk.org/images/dialogue.png

[11] http://wordnet.princeton.edu/

- Navigation; how will users navigate
- Indexing; how is it indexed
- Labeling; how is it labeled

These questions ultimately describe how people search and browse the website.

There are different ways to organize information on a website. This organizing can be done alphabetical, chronological (Twitter, Facebook timeline) and geographical (on maps). The information can also be categorized with a controlled vocabulary (Funda). Another way of organizing information on a website is using metaphor, this method is mostly used by educational systems. Besides these organization, there are websites that allow tagging, thus organizing their information by tags, which is a more social and informal way of organizing depending on by whom the tagging is done.

(Marlow, Naaman, Boyd, & Davis, 2006) discuss a taxonomy on tagging, while tags are not a taxonomy. This is called a folksonomy: a created taxonomy or term list, for example with tagging. If a tag has been used before, the tagger gets this tag as example when typing the first letters. With this, the system tries to coerce the user to user the tags already present, thus creating a controlled vocabulary.

One system is not per definition best, a combination of several systems can be better. For example, the website Amazon[12]. There a thesaurus is used, connecting categories. Search can be performed in different manners; in category, or store department. There are categories which are highlighted. Stars can be given to books (rating), there are lists of 'what other people bought' (possible interests).

Figure 12. Amazon

Again we are taken back to the five questions for designing KOS:

- What is being organized?
- Why is it being organized?
- How much is being organized?

- When is it being organized?
- How or by whom is it being organized?

Assignment 8

This assignment was to create a small web page of our domain of choice. Mark this page up using structured data such as from Schema.org[13], Twitter Cards[14], RDFa[15] or Open Graph Protocol[16]. Show that the structured data can be extracted using a validator/tool. For example, the Google Structured Data Testing tool[17]. Furthermore we were to identify the type of knowledge organization system being used and it's features. We have used the ontology from Assignment 5 as the basis for our website.

Healthcare magazine website

For a healthcare magazine *Your Health* a small website is created. The main goal of the website is for visitor to be able to retrieve articles that have appeared in the magazine. There is also an archive for editors of the magazine to be able to find new articles that have not been published in the magazine as of yet. The magazine has two main focusses, one is mental health, the other is physical health. Within these topics, narrower searches can be performed for alternative and regular healthcare, and within those for research and medicines. The webpage as shown in this assignment shows an article on research done on Multiple Scleroses, which fits inside the Research part of regular healthcare for physical health.
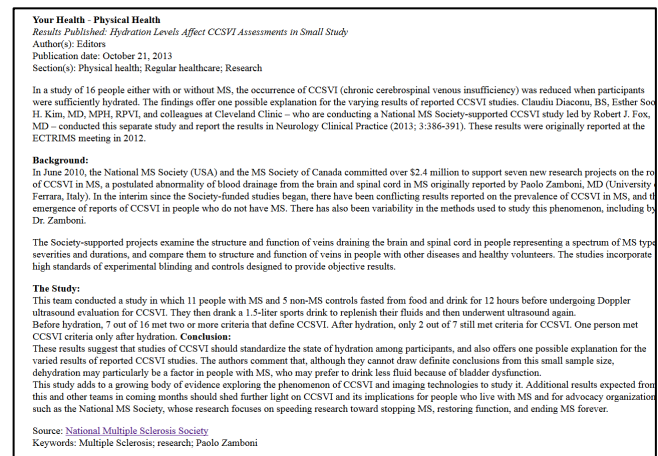

Figure 13. Webpage for health magazine

Schema.org

For this assignment we have chosen to use the controlled vocabulary from Schema.org to mark up the webpage. This

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controlled vocabulary was in our opinion well suited to mark up magazine articles. The main Class we used was the Class Article. The necessary fields were present in this ontology, which made marking up easier.

After marking up the webpage, we have tested our mark up using Google Structured Data Testing Tool. In Figure 14 you will find the results from this test. The HTML code and larger images of both the webpage and the test result for the marked-up page can be found in Appendix C.

Item	
type:	http://schema.org/article%3e
property:	
author:	Editors
datepublished:	October 21, 2013
articlesection:	Physical health
articlesection:	Regular healthcare
articlesection:	Research
articlebody:	In a study of 16 people either with or without MS, t cerebrospinal venous insufficiency) was reduced w The findings...
keywords:	CCSVI
keywords:	studies
keywords:	Paolo Zamboni
isbasedonurl:	National Multiple Sclerosis Society
keywords:	Multiple Sclerosis
keywords:	research
keywords:	Paolo Zamboni

Figure 14. Metadata

KOS Web Search and Data (lecture 10)

As an addition to the last lecture, more information about KOS and web search was given. First, the structured data tools from Assignment 8 were discussed in more detail.

schema.org is actually a lightweight ontology, or classification. One puts data in it and gets structured data back. The intended audience for *schema.org* are search engine developers. However, website developers can use this very well. Schema.org started with recipes and ingredients, and expanded from there.

Open Graph Protocol (OGP) enriches data. When using this one adds a vocabulary to their data, thus making it structured. It is in beginning a term list. Facebook[18] uses OGP to organize posts. The intended audience for OGP is OGP not only describes things, but also actions, such as run, walk, bike, treating actions like things.

Twitter cards This gives extra information to a tweeted URL, based on a vocabulary given by Twitter. To be able to use this vocabulary, one must structure the data on ones website in a specific way.

Linked Open Data
(Bizer, et al., 2009) discuss DBpedia, which is a part of Linked Open Data. DBpedia is a community effort to extract structured information from Wikipedia[19] and to make this information accessible on the Web. In 2009, DBpedia consisted of 2,6 million entity descriptions which result in a web of interlinked data sources with approximately 4.7 billion pieces of information.
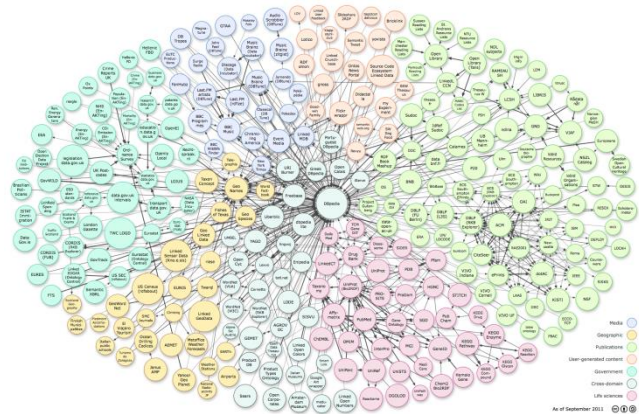

Figure 15. Linked Open Data cloud[20]

Linked Data principles are in essence to provide URIs as names for things; use HTTP URIs so people can look up these things; provide useful info when people look up these things, use RDF or another standard for this; and include links to other URIs so people can discover more things. DBpedia does this effectively. These principle make things machine readable. It allows the information provider to extend and populate their data.

Naming is a very important for this. When using schema.org, it is clear schema.org is used. They control how that naming space is used, and how users can use this. The same applies to OGP, which has 'ogp.me' in every URI.

Linking data, and using the vocabulary of other sites, such as DBpedia, will make a webmaster's life easier. For example, look up Netherlands in DBpedia and see what names are connected to Netherlands. There could be several that are useful for your work, which you can then reuse.

This is also one of the ramifications for KOS. With Linked Open Data there are more audiences. A KOS is not only for one user, it has external as well as internal audiences. This leads to being able to grow internal information from the outside.
KOS can be integral to site design. For information retrieval both bottom up and top down organization is essential. KOS can facilitate aggregation and search.

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[18] http://www.facebook.com

[19] http://www.wikipedia.com

[20] Linking Open Data cloud diagram, by Richard Cyganiak and Anja Jentzsch. http://lod-cloud.net/

Reflection

The first lecture of this week turned us back to the article from Mukherjee et al. which was discussed for Assignment 1 in which they described the differences between enterprise search and internet search. There are many roads that lead to Rome, one can never say "my system/method is the best", for it is often so that a combination of methods results in better user experience and retrieval results.

Twitter cards might be something which can be used in my workplace. A Social Media Policy is being written, in order for the local library to make better use of social media to reach her audience. Steps have to be taken to structure the data on the website more. Already the articles on the website are adapted to use search engine marketing (SEO) and the organization is using search engine advertising (SEA). I believe using structured metadata would be a good addition.

IMAGES AND VIDEO

Cultural heritage and knowledge (lecture 11, fieldtrip)

For this lecture there was a fieldtrip planned to the Instituut voor Beeld en Geluid (Sound and Vision). This institute has briefly been mentioned in the second lecture. Sound and Vision is a memory institute. It is a collective memory of all things broadcasted in the Netherlands. This varies from radio broadcasts to television broadcasts and include commercials.

The fieldtrip consisted of three presentations about knowledge management within Sound and Vision. The class was divided in three groups which each received the presentations in a different order. Below each presentation will be more or less summarized, depending on how much was worth noting.

Thesaurus of Institute of Vision and Sound
Presented by Alma Wolthuis.

Sound and Vision uses a system called GTAA to classify their information. GTAA is an abbreviation for Common Thesaurus Audiovisual Archives. GTAA has 8 concepts within which all things can be categorized. These concepts include Subjects, Subjects for shots and sounds, Classification of the subject schemes, Genres, Names of organization, Names of persons and Geographical names.

Open SKOS is a web application used by Sound and Vision since the beginning of this year. The old application had to be replaced, for it did not meet with the (changed) current needs. The assignment for creating Open SKOS was given by CATCHplus. The main purpose of CATCHPlus is to valorise scientific research results to usable tools and ser-

vices for the entire Dutch heritage sector (About CATCHplus).

iMMix is the database which contains the actual video images, which the documentalist uses. From this database they suggest new subjects for the GTAA.

The people who control the thesaurus, receive about 100-200 requests for new concepts or changes in the present concepts each week. The thesaurus feeds a database for the documentalists, but also one for professionals (for example editors of De Wereld draait door[21]), and an internet search engine.

Manual Archiving
Presented by Tim Manders.

Since 2006, there has been a change in how the data is submitted to the institute. This does not happen in the correct way, so everything has to checked and corrected manually. All Dutch productions are archived. This means approximately 8000 hours of television and 18000 hours of radio each year. And this is only a selection. Next year it will be approximately 54000 hours, because then everything will be archived.

The hierarchical metadata model in Figure 16 shows how a fragment is described. Tim also showed how this is done in iMMix.
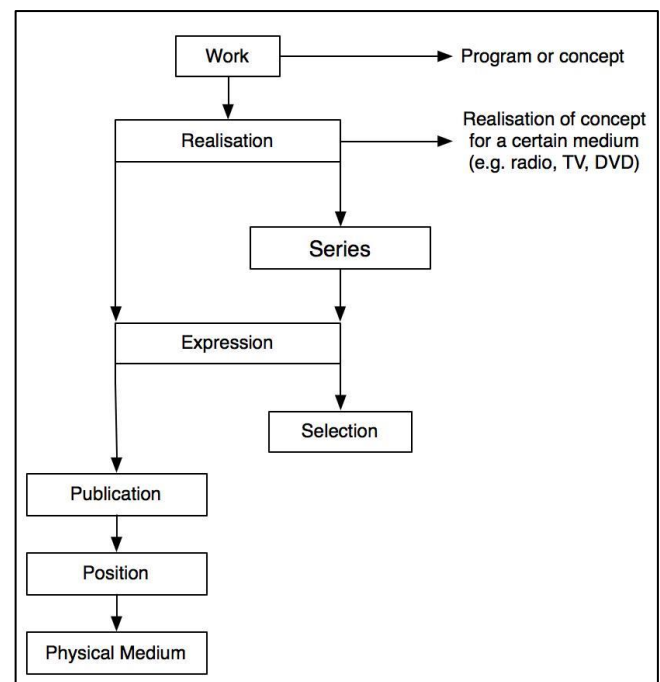

Figure 16. Hierarchical Metadata Model

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[21] http://www.dwdd.nl

Research and Development

Presented by Bauke Huurnink (annotation) and Maarten Brinkerink (crowdsourcing).

Sound and Vision is an audio-visual archive. It is required by the government to archive any material with cultural heritage. A big part of the audience for Sound and Vision are academics, mostly media academics. The biggest audience for Sound and Vision are broadcasters, general public, professionals.

The process of how fragments get into the archives of Sound and Vision is as depicted in Figure 17.

Professional annotation is very time consuming. For every hour of input, it costs a professional approximately 3 times as much to accurately annotate.

Sound and Vision's search engine is connected to Google. When someone searches Google, they can find fragments from Sound and Vision, but cannot access these. What is found are the descriptions, not the actual fragments. These fragments can be ordered online, against payment. Sound and Vision would like to make everything they annotate public, but are not allowed by copyright law.

There are also some parts of the archive which are annotated through machine analysis. There they basically take a large stack of videos, do multimedia content analysis and then low level features. This is very helpful for search results. Data for this is gathered from different sources: Twitter, Wikipedia, other programs, crowdsourcing and subtitles for the deaf and hard hearing. These subtitles are also supplied to Sound and Vision, and make it easier to look for a specific fragment in a television program for example.

Sound and Vision have developed among other things two crowdsourcing games; Waisda and Spotvogels. Waisda is discussed by (Oomen & Aroyo, 2011) who show the benefits as well as the challenges of crowdsourcing in the domain of cultural heritage. Spotvogels is a similar idea and uses the thesaurus GTAA, but also the thesaurus from Naturalis. With two different thesauri, there are also different controlled vocabularies.
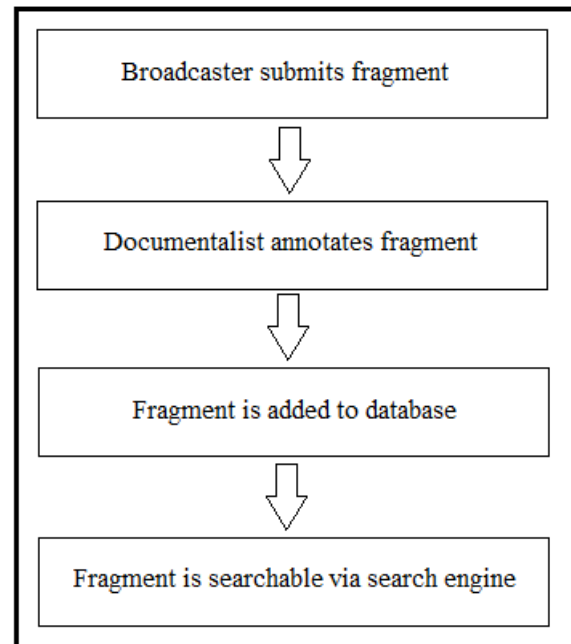

Figure 17. Fragment workflow

Assignment 9 – Tagging images

Assignment in which we tagged a self-chosen picture, using the Art and Architecture Thesaurus (AAT). Problems, or gaps, in the thesaurus are discussed, relating to the description of this picture.

Art and Architecture Thesaurus

As is the case with thesauri, Art and Architecture Thesaurus (AAT) is a structured vocabulary in aid of describing things, in this case specifically in the field of art and architecture (About the AAT, 2013). By using the concepts within these thesaurus, one can improve cataloging by using the classification and structure, and retrieval for they contain semantic networks and show links between different concepts. Also AAT can be used as research tool, because of the contextual knowledge which presides in the thesaurus.

Figure 18. Nesting swan in Amsterdam

Tagging Images

The chosen image (Figure 18) shows a swan, nesting in a pile of waste, below an overpass in the city of Amsterdam. We felt it remarkable that the swam couple used the discarded plastic and construction waste to create a safe haven for her offspring. This picture is taken in 2012, while many construction works were going on around Central Station in Amsterdam.

Concepts from AAT

The following terms are chosen from AAT to describe Figure 1. Nesting swan in Amsterdam.

- Swans
- Nests
- Waste
- Construction equipment
- Plastic

These terms (Figure 19. Searched terms) were searched based on what is shown in the picture. Not all terms seemed completely accurate, but sufficed for this initial search. The chosen terms were first deliberately broad, for choosing broader terms before becoming more specific is a good idea when one does not know exactly what terms are available. This generates a larger search result. By doing this, more specific terms were in some cases found. By combining the broader terms in search, we were directed to more specific (and sometimes even broader) terms and shown more relationships between terms.

When looking at the description of the concepts, it became clearer as to how concepts were related.

Figure 19. Searched terms

Issues with the found terms

Combining terms came up with very interesting results, even ones we would not have thought about immediately. For example, searching for *nests* AND *swans*, resulted in no found results, which we felt was odd, since swans build nests. According to the description of *nests (animal architecture)*, nests are "*Structures made or places chosen and adapted by a bird, insect, or other animal in which to lay and incubate its eggs and usually to rear its young*" (Full Record Display - nests (animal architecture), 2013). According to the full description *swans* are *Anatidae (family)*, (Full Record Display - Cygnus (genus), 2013) or family of

birds. So, swans are birds, birds build nests, but swans are not connected to nests.

On the other hand searching for *nests* OR *swans* led to the broader term *waterfowl*. A pretty logical term, but not one we thought of also not one that appeared when looking for *swans*.

What we missed was the more specific term *construction waste*. We were led to the terms *hazardous waste* and *refuse deposal*, but these did not satisfy the need completely. Also a connection between *waste* and *plastic* was not clear.

Of course, a thesaurus only shows which terms there are, and how they relate to broader terms. It was difficult to find very specific terms or a combination of terms.

Images and video (lecture 12)

During this lecture, which was given by the second assistant professor Michiel Hildebrand, we received a more detailed description of Waisda[22] and LinkedTV[23].

Waisda
Goals of Waisda:
- collect time based video annotations (what do you see in a particular part of the video)
- improve access to video fragments (research of search and order queries has shown that people only order a fragment, because of interest and cost)
- connect with the public (change their public appearance, relaying the message that this cultural heritage is for everyone)

Waisda is open source, and can be used for any other similar system. A similar game was created for a different program. This game is called Spotvogels[24].

Results of Waisda:
Annotation; there have been 70.000 tags added by semi-professionals from NCRV[25], the users from Waisda added 400.000 tags in the span of 4 months. Of these tags 8% compared to GTAA, 18% to Dutch dictionary, 11% to nonsense, and 63% to Google. Comparing with Google was done to check if the word was ever used in a search before. This does not mean it is an actual Dutch word. There are some issues here, for example person names are not in dictionary but are in GTAA.
Panofsky-Shatford's matrix shows most tags describe things in relation to 'what', next comes 'who', then comes 'where' and last is 'when'.

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[22] http://www.beeldengeluid.nl/onderzoek/projecten/waisda

[23] http://www.linkedtv.eu/

[24] http://spotvogel.vroegevogels.vara.nl/

[25] Public broadcast company in the Netherlands

Search; tags from Waisda result in higher precision of retrieval of fragments. This in comparison with title plus description, semi-professional tags from NCRV and transcripts (in that order).

LinkedTV
86% of television watchers use mobile devices at the same time. These devices are mostly used for unrelated tasks like texting, social networks, etc. The objective of LinkedTV is to add interesting information to enhance a user's television experience, with related information. This can be for example statistics of soccer players during a soccer match. What the project does is interweaving web and television.

Reflection
It was very interesting to see how a memory institute such as Sound and Vision organizes their data. I for one had no idea the annotation of a fragment takes so much time. I have learned a lot by looking at how the documentalist and the thesaurus lady worked. Some things seem a bit inconvenient, but as with most things, I am looking at it from the outside, have no clue as to how it really is to use it, so unless I have a great idea to enhance the program, just keep your mouth shut.

I think both Waisda and Spotvogels are a great way of gathering insights on what other people besides professionals see in describing things. This brings us back to the lectures from week 2, about describing things. Most people will do this without looking at the questions about what, why, how, by whom and when.

COURSE REFLECTION
To write a reflection on this course seemed very hard. As with all knowledge you gather, it kind of slips up on you. Once you have learned something, it is added to your memory as knowledge you already have, and from there you access it as such. What exactly was the source of the information is sometimes hard to recall. Some things discussed in this course I already knew or at least had heard of, some were entirely new.

I learned a lot of new things when ontologies were discussed. I've known the basics of information retrieval from my previous education and 12 years of experience as a librarian. To look at this subject not from the user's side but the developer's side was enlightening. It gave me notions and views on things I had not thought about before this course.

There are definitely things from this course that I can use right away, in my work. I will probably talk to my boss about for instance structured metadata. Although most of the library's website comes from the catalogue, and we cannot change anything in this catalogue, there are also parts that we can modify ourselves. Of course the first

question is if the Content Management System we use allows for these kind of changes. I assume the catalogue part already has structured data.

The explanations about how KOS are made are something I will not easily forget. The questions the questions about what, why, how, by whom and when are etched in my mind. I believe these are not only applicable for creating KOS, but for all interfaces and systems. If you do not have the answers to these questions in your mind in a clear way, there is no way you can deliver a system which meets the needs and requirements of the user in a satisfactory manner.

Ontologies are a very interesting subject. I understand how classes need to be generalized in order to be usable in different application. I have even done this myself in the assignments.

Learning how to write more formal is something I will have to take more notes on. I tend to write as I talk, which is good if you are explaining things to your regular Joe. However, while following a master's education, the level goes up, and so has my level of writing. I will work on this in the following courses.

As for a potential thesis topic, I found this a very hard question. I think that in relation to the discussed topics and my personal interests, I would like to learn how professionals can benefit from tagging by non-professionals. How useful are these tags in annotations? Does this lead to a greater openness or availability of information for the general public?

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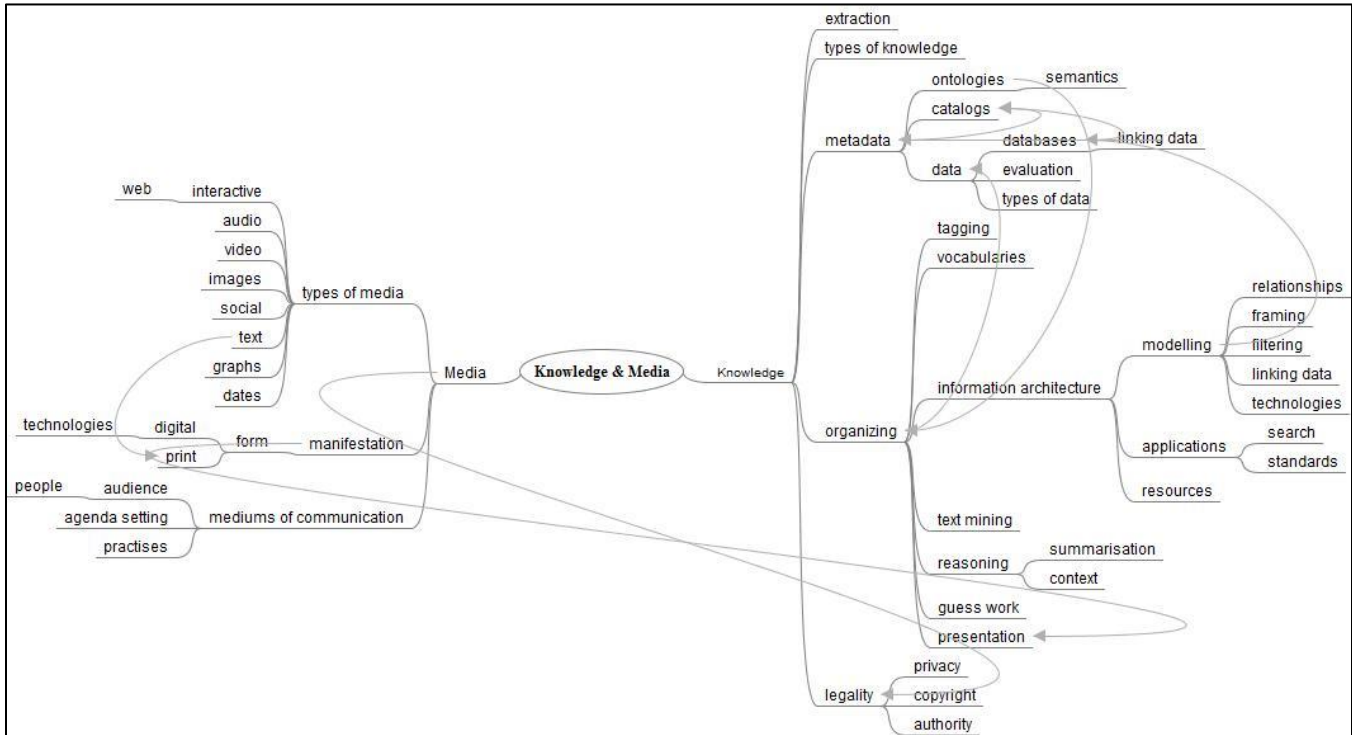
APPENDIX A – MIND MAPS

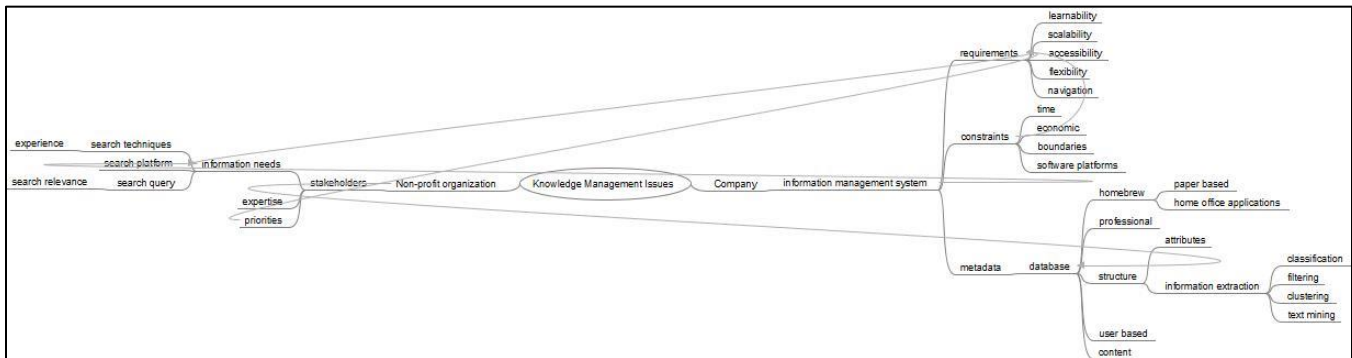**Figure 1. Mind map Knowledge and Media**

Figure 2. Mind map Knowledge Management Issues

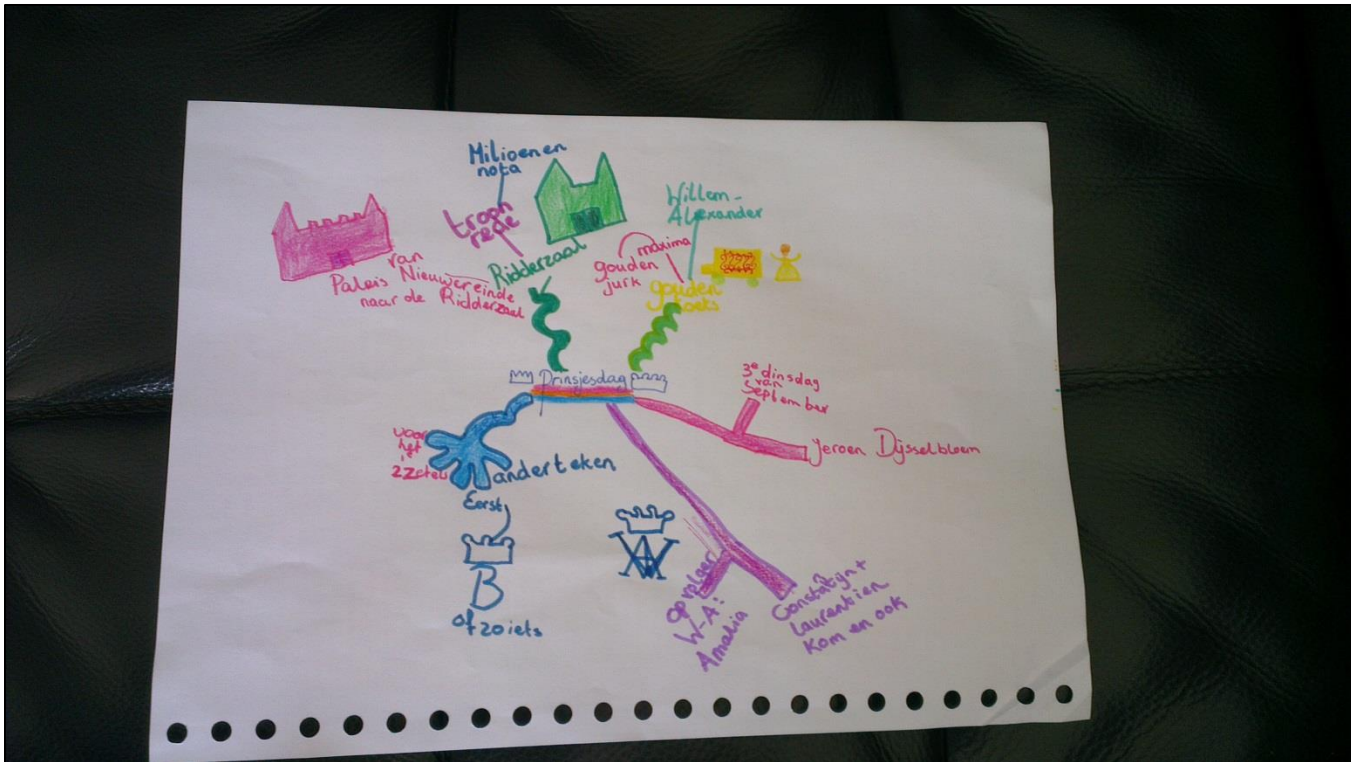**Figure 3. Mind map Prinsjesdag**

APPENDIX B – ONTOLOGY CODE (TURTLE)

@prefix : <http://webprotege.stanford.edu/project/BVRpxg6h0pA37Xn2I9H9jY#> .

@prefix owl: <http://www.w3.org/2002/07/owl#> .

@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .

@prefix xml: <http://www.w3.org/XML/1998/namespace> .

@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .

@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .

@base <http://webprotege.stanford.edu/project/BVRpxg6h0pA37Xn2I9H9jY> .

<http://webprotege.stanford.edu/project/BVRpxg6h0pA37Xn2I9H9jY> rdf:type owl:Ontology ;

<http://protege.stanford.edu/webprotege/revision> 58 ;

<http://purl.org/dc/elements/1.1/creator> "ACollijn"^^xsd:string ;

rdfs:comment "Assignment 5: Ontology based on the Class Topic from BBC's Storyline Ontology"^^xsd:string ;

<http://purl.org/dc/elements/1.1/date> "Oct 26, 2013 1:08:44 PM"^^xsd:dateTime ;

rdfs:comment "This ontology was generated from an ontology revision in WebProtégé http://webprotege.stanford.edu"^^xsd:string ;

<http://purl.org/dc/elements/1.1/creator> "system"^^xsd:string .

###
#
Object Properties
#
###

http://webprotege.stanford.edu/RDjc8owIeXc8mnf6fgMR3w5

<http://webprotege.stanford.edu/RDjc8owIeXc8mnf6fgMR3w5> rdf:type owl:ObjectProperty ;

rdfs:label "hasRetrievalLocation" .

http://webprotege.stanford.edu/RdqHsSsg6Hf04o5frXtkQl

<http://webprotege.stanford.edu/RdqHsSsg6Hf04o5frXtkQl> rdf:type owl:ObjectProperty ;

rdfs:label "hasSubject" .

###
#
Data properties
#

```
#####################################################################

### http://webprotege.stanford.edu/R6mYChtqwD0mU2fzpmFUHK

<http://webprotege.stanford.edu/R6mYChtqwD0mU2fzpmFUHK> rdf:type owl:DatatypeProperty ;

                            rdfs:label "hasTitle" .

### http://webprotege.stanford.edu/R7J4cIGQHVq2PXnXL2MRqbR

<http://webprotege.stanford.edu/R7J4cIGQHVq2PXnXL2MRqbR> rdf:type owl:DatatypeProperty ;

                            rdfs:label "hasLocation" .

### http://webprotege.stanford.edu/RBf9fHcya1yqU6LpeuP99y0

<http://webprotege.stanford.edu/RBf9fHcya1yqU6LpeuP99y0> rdf:type owl:DatatypeProperty ;

                            rdfs:label "hasDescription" .

### http://webprotege.stanford.edu/RBmbr6Y4vDMNsoeUj8bXvbZ

<http://webprotege.stanford.edu/RBmbr6Y4vDMNsoeUj8bXvbZ> rdf:type owl:DatatypeProperty ;

                            rdfs:label "hasClassificationNumber" .

### http://webprotege.stanford.edu/RVlyXZstEoyWMJ5W4pEYBw

<http://webprotege.stanford.edu/RVlyXZstEoyWMJ5W4pEYBw> rdf:type owl:DatatypeProperty ;

                            rdfs:label "hasNumberOfStorylineSlots" .

#####################################################################
#
#    Classes
#
#####################################################################

### http://webprotege.stanford.edu/R7WNsbYAFrj7RMVcxU14xL1

<http://webprotege.stanford.edu/R7WNsbYAFrj7RMVcxU14xL1> rdf:type owl:Class ;

                            rdfs:label "StorylineSlot" ;

                            rdfs:subClassOf owl:Thing ,
                                    [ rdf:type owl:Restriction ;
```

```
                                          owl:onProperty <http://webprotege.stanford.edu/RDjc8owIeXc8mnf6fgMR3w5> ;
                                          owl:someValuesFrom <http://webprotege.stanford.edu/RDdekx0jnB3DxfLEGZ9wNAm>
                                        ] .
```

http://webprotege.stanford.edu/R8LGHix41r6xb1jjwNZGWtS

```
<http://webprotege.stanford.edu/R8LGHix41r6xb1jjwNZGWtS> rdf:type owl:Class ;

                        rdfs:label "PhysicalHealth" ;

                        rdfs:subClassOf <http://webprotege.stanford.edu/RgCzg1XK4dZ543Cau5lPGj> ,
                                [ rdf:type owl:Restriction ;
                                  owl:onProperty <http://webprotege.stanford.edu/RdqHsSsg6Hf04o5frXtkQl> ;
                                  owl:someValuesFrom <http://webprotege.stanford.edu/RCLsv5x1RDUAiC97xKvZg90>
                                ] ,
                                [ rdf:type owl:Restriction ;
                                  owl:onProperty <http://webprotege.stanford.edu/RdqHsSsg6Hf04o5frXtkQl> ;
                                  owl:someValuesFrom <http://webprotege.stanford.edu/RsylFh324mPdin0c1BCwm3>
                                ] .
```

http://webprotege.stanford.edu/RB4L2eSmVn4U56Q4wVnKyJ1

```
<http://webprotege.stanford.edu/RB4L2eSmVn4U56Q4wVnKyJ1> rdf:type owl:Class ;

                        rdfs:label "Research" ;

                        rdfs:subClassOf <http://webprotege.stanford.edu/RCLsv5x1RDUAiC97xKvZg90> ,
                                <http://webprotege.stanford.edu/RsylFh324mPdin0c1BCwm3> .
```

http://webprotege.stanford.edu/RCLsv5x1RDUAiC97xKvZg90

```
<http://webprotege.stanford.edu/RCLsv5x1RDUAiC97xKvZg90> rdf:type owl:Class ;

                        rdfs:label "RegularHealthcare" ;

                        rdfs:subClassOf <http://webprotege.stanford.edu/R8LGHix41r6xb1jjwNZGWtS> ,
                                <http://webprotege.stanford.edu/RD1li1kzdv0yAJlAzIV2pyc> ,
                                [ rdf:type owl:Restriction ;
                                  owl:onProperty <http://webprotege.stanford.edu/RdqHsSsg6Hf04o5frXtkQl> ;
                                  owl:someValuesFrom <http://webprotege.stanford.edu/RB4L2eSmVn4U56Q4wVnKyJ1>
                                ] ,
                                [ rdf:type owl:Restriction ;
                                  owl:onProperty <http://webprotege.stanford.edu/RdqHsSsg6Hf04o5frXtkQl> ;
                                  owl:someValuesFrom <http://webprotege.stanford.edu/RaqEOLhRNZqJiEdu1z6aIJ>
                                ] .
```

http://webprotege.stanford.edu/RD1li1kzdv0yAJlAzIV2pyc

<http://webprotege.stanford.edu/RD1li1kzdv0yAJlAzIV2pyc> rdf:type owl:Class ;

        rdfs:label "MentalHealth" ;

        rdfs:subClassOf <http://webprotege.stanford.edu/RgCzg1XK4dZ543Cau5lPGj> ,

          [rdf:type owl:Restriction ;
           owl:onProperty <http://webprotege.stanford.edu/RdqHsSsg6Hf04o5frXtkQl> ;
           owl:someValuesFrom <http://webprotege.stanford.edu/RsylFh324mPdin0c1BCwm3>
          ] ,
          [rdf:type owl:Restriction ;
           owl:onProperty <http://webprotege.stanford.edu/RdqHsSsg6Hf04o5frXtkQl> ;
           owl:someValuesFrom <http://webprotege.stanford.edu/RCLsv5x1RDUAiC97xKvZg90>
          ] .

http://webprotege.stanford.edu/RDdekx0jnB3DxfLEGZ9wNAm

<http://webprotege.stanford.edu/RDdekx0jnB3DxfLEGZ9wNAm> rdf:type owl:Class ;

        rdfs:label "RetrievalLocation" ;

        rdfs:subClassOf owl:Thing ,

          [rdf:type owl:Restriction ;
           owl:onProperty <http://webprotege.stanford.edu/RBmbr6Y4vDMNsoeUj8bXvbZ> ;
           owl:someValuesFrom xsd:integer
          ] ,
          [rdf:type owl:Restriction ;
           owl:onProperty <http://webprotege.stanford.edu/RVlyXZstEoyWMJ5W4pEYBw> ;
           owl:someValuesFrom xsd:integer
          ] ,
          [rdf:type owl:Restriction ;
           owl:onProperty <http://webprotege.stanford.edu/RBf9fHcya1yqU6LpeuP99y0> ;
           owl:someValuesFrom xsd:string
          ] .

http://webprotege.stanford.edu/RaqEOLhRNZqJiEdu1z6aIJ

<http://webprotege.stanford.edu/RaqEOLhRNZqJiEdu1z6aIJ> rdf:type owl:Class ;

        rdfs:label "Medicines" ;

        rdfs:subClassOf <http://webprotege.stanford.edu/RCLsv5x1RDUAiC97xKvZg90> ,
          <http://webprotege.stanford.edu/RsylFh324mPdin0c1BCwm3> .

http://webprotege.stanford.edu/RgCzg1XK4dZ543Cau5lPGj

<http://webprotege.stanford.edu/RgCzg1XK4dZ543Cau5lPGj> rdf:type owl:Class ;

            rdfs:label "Topic" ;

            rdfs:subClassOf owl:Thing ,
               [rdf:type owl:Restriction ;
                owl:onProperty <http://webprotege.stanford.edu/RVlyXZstEoyWMJ5W4pEYBw> ;
                owl:someValuesFrom xsd:integer
               ] ,
               [rdf:type owl:Restriction ;
                owl:onProperty <http://webprotege.stanford.edu/R6mYChtqwD0mU2fzpmFUHK> ;
                owl:someValuesFrom xsd:string
               ] ,
               [rdf:type owl:Restriction ;
                owl:onProperty <http://webprotege.stanford.edu/RBf9fHcya1yqU6LpeuP99y0> ;
                owl:someValuesFrom xsd:string
               ] ,
               [rdf:type owl:Restriction ;
                owl:onProperty <http://webprotege.stanford.edu/RDjc8owIeXc8mnf6fgMR3w5> ;
                owl:someValuesFrom <http://webprotege.stanford.edu/RDdekx0jnB3DxfLEGZ9wNAm>
               ] .

http://webprotege.stanford.edu/RsylFh324mPdin0c1BCwm3

<http://webprotege.stanford.edu/RsylFh324mPdin0c1BCwm3> rdf:type owl:Class ;

            rdfs:label "AlternativeHealthcare"^^xsd:string ;

            rdfs:subClassOf <http://webprotege.stanford.edu/R8LGHix41r6xb1jjwNZGWtS> ,
               <http://webprotege.stanford.edu/RD1li1kzdv0yAJlAzIV2pyc> ,
               [rdf:type owl:Restriction ;
                owl:onProperty <http://webprotege.stanford.edu/RdqHsSsg6Hf04o5frXtkQl> ;
                owl:someValuesFrom <http://webprotege.stanford.edu/RaqEOLhRNZqJiEdu1z6aIJ>
               ] ,
               [rdf:type owl:Restriction ;
                owl:onProperty <http://webprotege.stanford.edu/RdqHsSsg6Hf04o5frXtkQl> ;
                owl:someValuesFrom <http://webprotege.stanford.edu/RB4L2eSmVn4U56Q4wVnKyJ1>
               ] .

Generated by the OWL API (version 3.4.3-SNAPSHOT) http://owlapi.sourceforge.net

APPENDIX C – ASSIGNMENT 8

Your Health - **Physical Health**
Results Published: Hydration Levels Affect CCSVI Assessments in Small Study
Author(s): Editors
Publication date: October 21, 2013
Section(s): Physical health; Regular healthcare; Research

In a study of 16 people either with or without MS, the occurrence of CCSVI (chronic cerebrospinal venous insufficiency) was reduced when participants were sufficiently hydrated. The findings offer one possible explanation for the varying results of reported CCSVI studies. Claudiu Diaconu, BS, Esther Soo H. Kim, MD, MPH, RPVI, and colleagues at Cleveland Clinic – who are conducting a National MS Society-supported CCSVI study led by Robert J. Fox, MD – conducted this separate study and report the results in Neurology Clinical Practice (2013; 3:386-391). These results were originally reported at the ECTRIMS meeting in 2012.

Background:
In June 2010, the National MS Society (USA) and the MS Society of Canada committed over $2.4 million to support seven new research projects on the role of CCSVI in MS, a postulated abnormality of blood drainage from the brain and spinal cord in MS originally reported by Paolo Zamboni, MD (University of Ferrara, Italy). In the interim since the Society-funded studies began, there have been conflicting results reported on the prevalence of CCSVI in MS, and the emergence of reports of CCSVI in people who do not have MS. There has also been variability in the methods used to study this phenomenon, including by Dr. Zamboni.

The Society-supported projects examine the structure and function of veins draining the brain and spinal cord in people representing a spectrum of MS types, severities and durations, and compare them to structure and function of veins in people with other diseases and healthy volunteers. The studies incorporate high standards of experimental blinding and controls designed to provide objective results.

The Study:
This team conducted a study in which 11 people with MS and 5 non-MS controls fasted from food and drink for 12 hours before undergoing Doppler ultrasound evaluation for CCSVI. They then drank a 1.5-liter sports drink to replenish their fluids and then underwent ultrasound again.
Before hydration, 7 out of 16 met two or more criteria that define CCSVI. After hydration, only 2 out of 7 still met criteria for CCSVI. One person met CCSVI criteria only after hydration. **Conclusion:**
These results suggest that studies of CCSVI should standardize the state of hydration among participants, and also offers one possible explanation for the varied results of reported CCSVI studies. The authors comment that, although they cannot draw definite conclusions from this small sample size, dehydration may particularly be a factor in people with MS, who may prefer to drink less fluid because of bladder dysfunction.
This study adds to a growing body of evidence exploring the phenomenon of CCSVI and imaging technologies to study it. Additional results expected from this and other teams in coming months should shed further light on CCSVI and its implications for people who live with MS and for advocacy organizations such as the National MS Society, whose research focuses on speeding research toward stopping MS, restoring function, and ending MS forever.

Source: National Multiple Sclerosis Society
Keywords: Multiple Sclerosis; research; Paolo Zamboni

Figure 13. Webpage for health magazine

Item	
type:	http://schema.org/article%3e
property:	
author:	Editors
datepublished:	October 21, 2013
articlesection:	Physical health
articlesection:	Regular healthcare
articlesection:	Research
articlebody:	In a study of 16 people either with or without MS, the cerebrospinal venous insufficiency) was reduced w The findings...
keywords:	CCSVI
keywords:	studies
keywords:	Paolo Zamboni
isbasedonurl:	National Multiple Sclerosis Society
keywords:	Multiple Sclerosis
keywords:	research
keywords:	Paolo Zamboni

Figure 14. Metadata

HTML Code for marked-up webpage

```html
<html>
        <head><b>Your Health - Physical Health</b>
        </head>
        <body>
                <title>Physical Health - Regular Healthcare - Research</title>
                <div itemscope itemtype="http://schema.org/Article>
                <span><h1>Article - Research</h1></span>
                <span>Title:
                        <span itemprop="headline"><i>Results Published: Hydration Levels Affect CCSVI Assessments in Small
                        Study</i></span></span><br>
                <span>Author(s):
                        <span itemprop="Author">Editors</span></span><br>
                <span>Publication date:
                        <span itemprop="datePublished">October 21, 2013</span></span><br>
                <span>Section(s):
                        <span itemprop="articleSection">Physical health</span>;
                        <span itemprop="articleSection">Regular healthcare</span>;
                        <span itemprop="articleSection">Research</span></span><p>
                <span><span itemprop="articleBody"> In a study of 16 people either with or without MS, the occurrence of <span itemprop="keywords">CCSVI</span> (chronic cerebrospinal venous insufficiency) was reduced when participants were sufficiently hydrated. The findings offer one possible explanation for the varying results of reported CCSVI <span itemprop="keywords">studies</span>. Claudiu Diaconu, BS, Esther Soo H. Kim, MD, MPH, RPVI, and colleagues at Cleveland Clinic – who are conducting a National MS Society-supported CCSVI study led by Robert J. Fox, MD – conducted this separate study and report the results in Neurology Clinical Practice (2013; 3:386-391). These results were originally reported at the ECTRIMS meeting in 2012.<p><b>
                Background:</b><br>In June 2010, the National MS Society (USA) and the MS Society of Canada committed over $2.4 million to support seven new research projects on the role of CCSVI in MS, a postulated abnormality of blood drainage from the brain and spinal cord in MS originally reported by <span itemprop="keywords">Paolo Zamboni</span>, MD (University of Ferrara, Italy). In the interim since the Society-funded studies began, there have been conflicting results reported on the prevalence of CCSVI in MS, and the emergence of reports of CCSVI in people who do not have MS. There has also been variability in the methods used to study this phenomenon, including by Dr. Zamboni.<p>The Society-supported projects examine the structure and function of veins draining the brain and spinal cord in people representing a spectrum of MS types, severities and durations, and compare them to structure and function of veins in people with other diseases and healthy volunteers. The studies incorporate high standards of experimental blinding and controls designed to provide objective results.<p> <b>
                The Study:</b><br>This team conducted a study in which 11 people with MS and 5 non-MS controls fasted from food and drink for 12 hours before undergoing Doppler ultrasound evaluation for CCSVI. They then drank a 1.5-liter sports drink to replenish their fluids and then underwent ultrasound again.<br>
                Before hydration, 7 out of 16 met two or more criteria that define CCSVI. After hydration, only 2 out of 7 still met criteria for CCSVI. One person met CCSVI criteria only after hydration.<b>
                Conclusion:</b><br>These results suggest that studies of CCSVI should standardize the state of hydration among participants, and also offers one possible explanation for the varied results of reported CCSVI studies. The authors comment that, although they cannot draw definite conclusions from this small sample size, dehydration may particularly be a factor in people with MS, who may prefer to drink less fluid because of bladder dysfunction.<br>This study adds to a growing body of evidence exploring the phenomenon of CCSVI and imaging technologies to study it. Additional results expected from this and other teams in coming months should shed further light on CCSVI and its implications for people who live with MS and for advocacy organizations such as the National MS Society, whose research focuses on speeding research toward stopping MS, restoring function, and ending MS forever.</span> </span> <p>
                <span>Source: <span itemprop="isBasedOnUrl"><a href="http://www.nationalmssociety.org/news/news-detail/index.aspx?nid=8345">National Multiple Sclerosis Society</a></span></span><br>
                <span>Keywords: <span itemprop="keywords">Multiple Sclerosis</span>; <span itemprop="keywords">research</span>; <span itemprop="keywords">Paolo Zamboni</span></span>

                </div>
        </body>
</html>
```