Towards an Approach for Analysing External Representations Created During Sensemaking Using Generative Grammar

Efeosasare Okoro

National Institute of
Construction Technology,
Edo State, Nigeria.

efeosasare@gmail.com

Simon Attfield
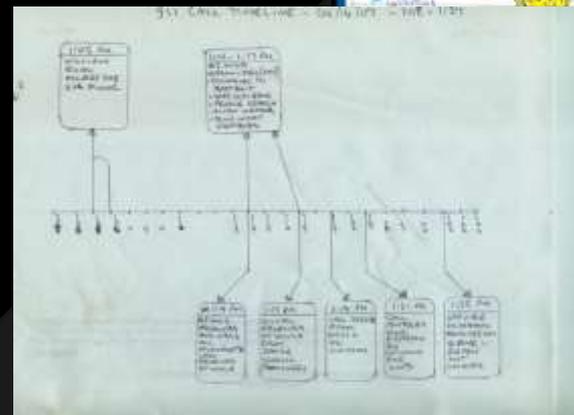
Middlesex University,
Hendon, London.

s.attfield@mdx.ac.uk

During sensemaking, users often create external structured representations.

Users create external representations.

- Adopt or construct some representational language.

- Forms can be diverse.

- To research them it would be helpful to have a way of describing form.

During Sensemaking, users often create external structured representations.

Software environments may be ideal for creating and such representations and communicating.

Decisions made about representational language.

- Primitives and relations (representational grammar) and interaction?

- Trade-offs between primitive complexity, flexibility and efficiency of interaction?
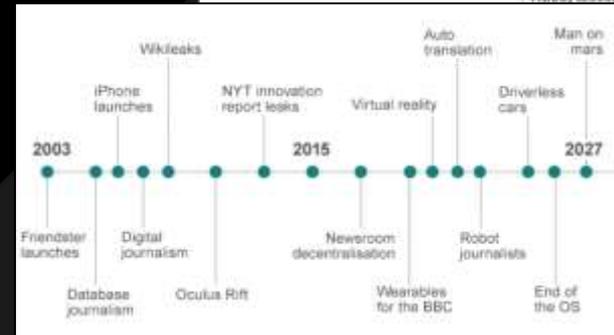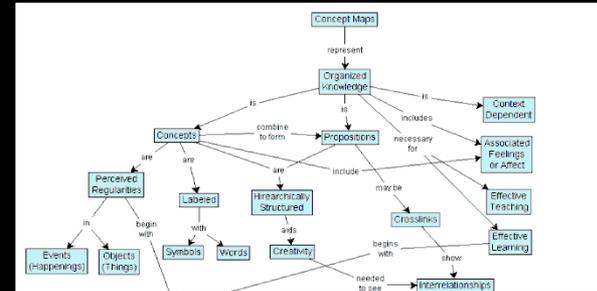
During Sensemaking, users often create external structured representations.

We developed an approach for analysing user-generated representations in terms of grammar.

- Involves creating generative grammars to account for structure.

- Explore applicability through a user-study in which participants created free-form representations in an evidential reasoning task.

Rhetorical Structure Theory (Mann and Thompson)

- Framework for analysis of text.

- Analyses author intent.

- Assumes a coherent text consists of hierarchically organisation of clauses linked by a set of (discourse) relations.

- Analysis involves identifying the relations to uncover structure of the text.
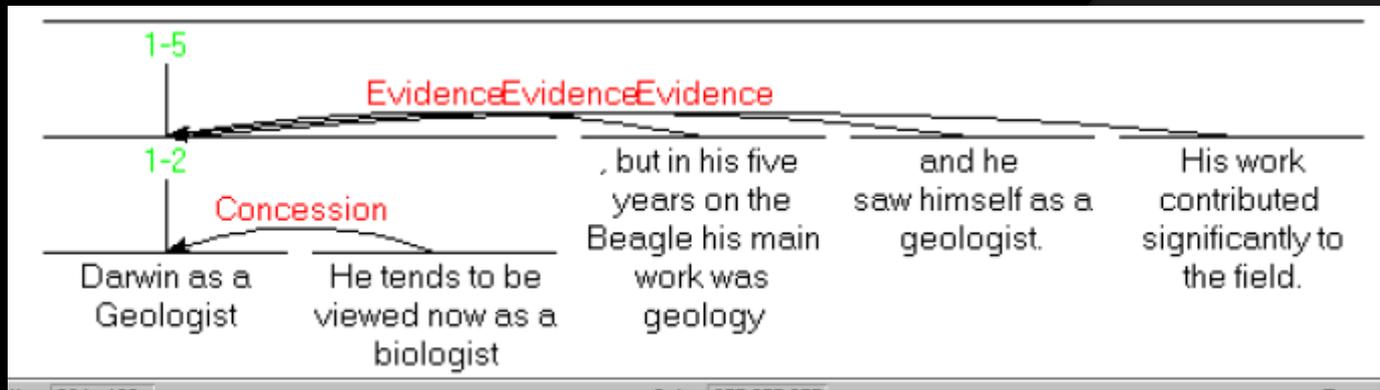
User Study

- 11 postgrad students.

- IEEE Visual Analytics Science and Technology (VAST) challenge 2011 MC 3.
    - News reports about fictional city called Vastopolis.
    - Used 30 articles including 13 relevant documents.

- "Analyse documents to identify and provide evidence for possible terrorist threat".

- PC running Microsoft OneNote.

- Unlimited time (11 to 59 minutes).

- Screen capture movies.

User Study

Towards an Approach for Analysing External Representations Created During Sensemaking Using Generative Grammar

Initial View of Findings

- Representation were:

— Heterogeneous (e.g. thematic grouping, argumentation, sequence)

— Hierarchical

— Used repeating surface-level substructures (looking for consistency)

… analysis of grammar will probably work!

Relation Definitions

Information object surrogate relation

A combination of elements acting as a proxy for a document or some other container of information. Has a mandatory element summary which reminds the sensemaker of the central idea communicated by the information object or an idea within it that is important for the current task. The summary can be a title, a gist or both. An information object surrogate can also include a date indicating when it was published or when an event that it reports occurred. It can also include a source which is some form of reference or pointer to the information object which allows the representation user to have a ready access to it. The source might be a clickable icon or a text string with an information object identification number or a combination of both.

Timeline relation

A combination of two or more information object surrogates sorted in order of publication date or date that reported events took place. The timeline relation allows the user to review multiple events in chronological order.

Themed grouping relation

A combination of information object surrogates which are about some common theme or topic. The themed grouping relation allows the user to review multiple events of the same theme.

Explanation relation

A combination of two information object surrogates linked through an explanatory relation. This relation has two mandatory elements: an explanans, which is the thing that does the explaining, and the explanandum, which is the thing that is explained. There may be multiple explanans. The explanation relation allows the user to express that an event explains why another event occurred.

Justification relation

An argumentation relation. It has mandatory elements of evidential support and claim and indicates that the claim follows from the evidential support. The evidential support element can be a representation of an information object. For example the document icon or a text string with the document identification number (e.g. 03040) or a combination of both. The justification relation allows the user to express a claim and provide support to increase the belief in the claim i.e. to show the argumentational support for the claim.

Relation Definitions

Information object surrogate relation

A combination of elements acting as a proxy for a document or some other container of information. *Has a mandatory element summary which reminds the sensemaker of the central idea communicated by the information object or an idea within it that is important for the current task. The summary can be a title, a gist or both. An information object surrogate can also include a date indicating when it was published or when an event that it reports occurred. It can also include a source which is some form of reference or pointer to the information object which allows the representation user to have a ready access to it. The source might be a clickable icon or a text string with an information object identification number or a combination of both.*

Timeline relation

A combination of two or more information object surrogates sorted in order of publication date or date that reported events took place. The timeline relation allows the user to review multiple events in chronological order.

Themed grouping relation

A combination of information object surrogates which are about some common theme or topic. The themed grouping relation allows the user to review multiple events of the same theme.

Explanation relation

A combination of two information object surrogates linked through an explanatory relation. This relation has two mandatory elements: an explanans, which is the thing that does the explaining, and the explanandum, which is the thing that is explained. There may be multiple explanans. The explanation relation allows the user to express that an event explains why another event occurred.

Justification relation

An argumentation relation. It has mandatory elements of evidential support and claim and indicates that the claim follows from the evidential support. The evidential support element can be a representation of an information object. For example the document icon or a text string with the document identification number (e.g. 03040) or a combination of both. The justification relation allows the user to express a claim and provide support to increase the belief in the claim i.e. to show the argumentational support for the claim.

Relation Definitions

Information object surrogate relation

A combination of elements acting as a proxy for a document or some other container of information. Has a mandatory element summary which reminds the sensemaker of the central idea communicated by the information object or an idea within it that is important for the current task. The summary can be a title, a gist or both. An information object surrogate can also include a date indicating when it was published or when an event that it reports occurred. It can also include a source which is some form of reference or pointer to the information object which allows the representation user to have a ready access to it. The source might be a clickable icon or a text string with an information object identification number or a combination of both.

Timeline relation

A combination of two or more information object surrogates sorted in order of publication date or date that reported events took place. The timeline relation allows the user to review multiple events in chronological order.

Themed grouping relation

A combination of information object surrogates which are about some common theme or topic. The themed grouping relation allows the user to review multiple events of the same theme.

Explanation relation

A combination of two information object surrogates linked through an explanatory relation. This relation has two mandatory elements: an explanans, which is the thing that does the explaining, and the explanandum, which is the thing that is explained. There may be multiple explanans. The explanation relation allows the user to express that an event explains why another event occurred.

Justification relation

An argumentation relation. It has mandatory elements of evidential support and claim and indicates that the claim follows from the evidential support. The evidential support element can be a representation of an information object. For example the document icon or a text string with the document identification number (e.g. 03040) or a combination of both. The justification relation allows the user to express a claim and provide support to increase the belief in the claim i.e. to show the argumentational support for the claim.

Relation Definitions

Information object surrogate relation

A combination of elements acting as a proxy for a document or some other container of information. Has a mandatory element summary which reminds the sensemaker of the central idea communicated by the information object or an idea within it that is important for the current task. The summary can be a title, a gist or both. An information object surrogate can also include a date indicating when it was published or when an event that it reports occurred. It can also include a source which is some form of reference or pointer to the information object which allows the representation user to have a ready access to it. The source might be a clickable icon or a text string with an information object identification number or a combination of both.

Timeline relation

A combination of two or more information object surrogates sorted in order of publication date or date that reported events took place. The timeline relation allows the user to review multiple events in chronological order.

Themed grouping relation

A combination of information object surrogates which are about some common theme or topic. The themed grouping relation allows the user to review multiple events of the same theme.

Explanation relation

A combination of two information object surrogates linked through an explanatory relation. This relation has two mandatory elements: an explanans, which is the thing that does the explaining, and the explanandum, which is the thing that is explained. There may be multiple explanans. The explanation relation allows the user to express that an event explains why another event occurred.

Justification relation

An argumentation relation. It has mandatory elements of evidential support and claim and indicates that the claim follows from the evidential support. The evidential support element can be a representation of an information object. For example the document icon or a text string with the document identification number (e.g. 03040) or a combination of both. The justification relation allows the user to express a claim and provide support to increase the belief in the claim i.e. to show the argumentational support for the claim.

Relation Definitions

Information object surrogate relation

A combination of elements acting as a proxy for a document or some other container of information. Has a mandatory element summary which reminds the sensemaker of the central idea communicated by the information object or an idea within it that is important for the current task. The summary can be a title, a gist or both. An information object surrogate can also include a date indicating when it was published or when an event that it reports occurred. It can also include a source which is some form of reference or pointer to the information object which allows the representation user to have a ready access to it. The source might be a clickable icon or a text string with an information object identification number or a combination of both.

Timeline relation

A combination of two or more information object surrogates sorted in order of publication date or date that reported events took place. The timeline relation allows the user to review multiple events in chronological order.

Themed grouping relation

A combination of information object surrogates which are about some common theme or topic. The themed grouping relation allows the user to review multiple events of the same theme.

Explanation relation

A combination of two information object surrogates linked through an explanatory relation. This relation has two mandatory elements: an explanans, which is the thing that does the explaining, and the explanandum, which is the thing that is explained. There may be multiple explanans. The explanation relation allows the user to express that an event explains why another event occurred.

Justification relation

An argumentation relation. It has mandatory elements of evidential support and claim and indicates that the claim follows from the evidential support. The evidential support element can be a representation of an information object. For example the document icon or a text string with the document identification number (e.g. 03040) or a combination of both. The justification relation allows the user to express a claim and provide support to increase the belief in the claim i.e. to show the argumentational support for the claim.

Example evolution of representational grammar

Step 1.

<Representation> → <source>
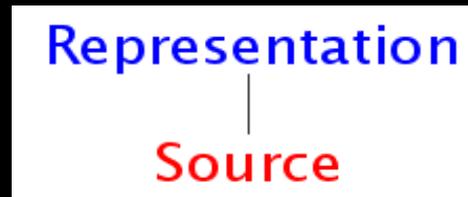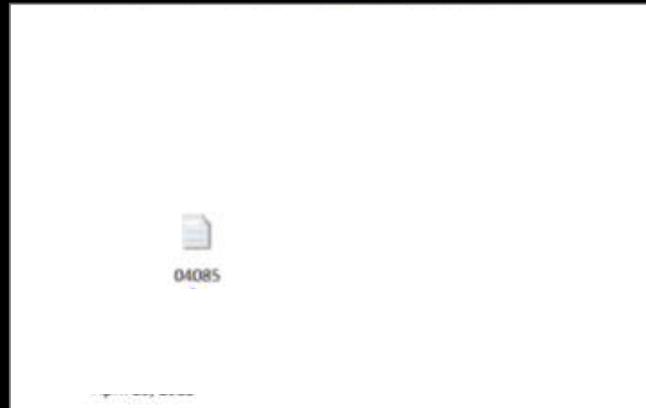
Example evolution of representational grammars

Step 2.
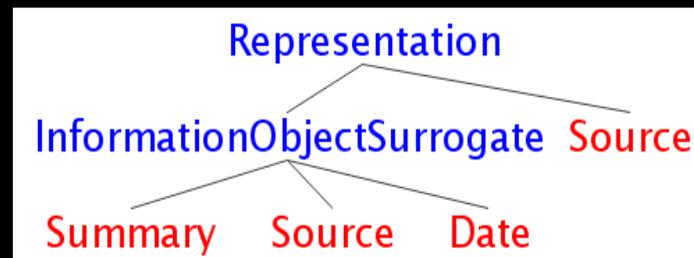

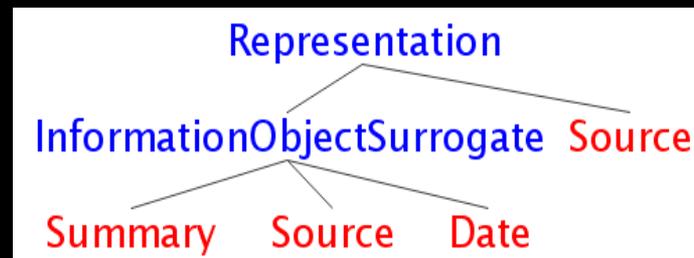
<Representation> → <Information object surrogate> <source>
<Information object surrogate> → <source>, <summary>, <date>

Example evolution of representational grammars

Step 2.

Information object surrogate ….reminds the sensemaker of the central idea communicated by the information object or an idea within it that is important for the current task.

<Representation> → <Information object surrogate> <source>
<Information object surrogate> → <source>, <summary>, <date>

Example evolution of representational grammars

Step 2.

Information object surrogate
….reminds the sensemaker of the central idea communicated by the information object or an idea within it that is important for the current task.

Cue variants
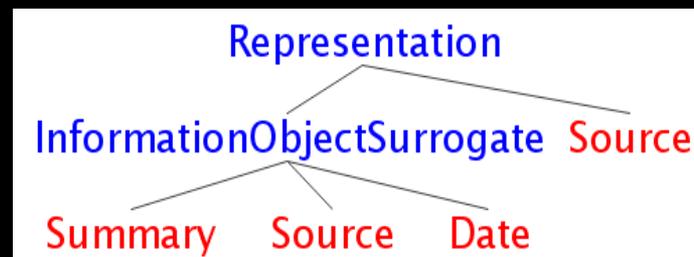- Arrow
- Proximity

Constituent variants accommodated by
- Adjusting definitions
- Mandatory and optional elements
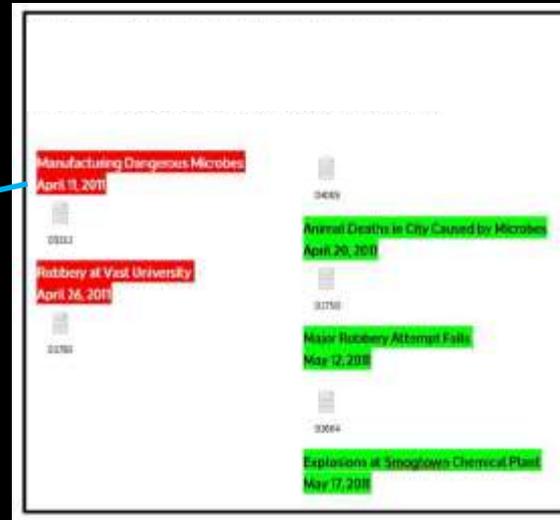
<Representation> → <Information object surrogate> <source>
<Information object surrogate> → <source>, <summary>, <date>

Example evolution of representational grammars

… later

Information object surrogate
- Now using proximity and object merge tool.
- Interpret this as space and time saving move.
- Required revision of previous instances.
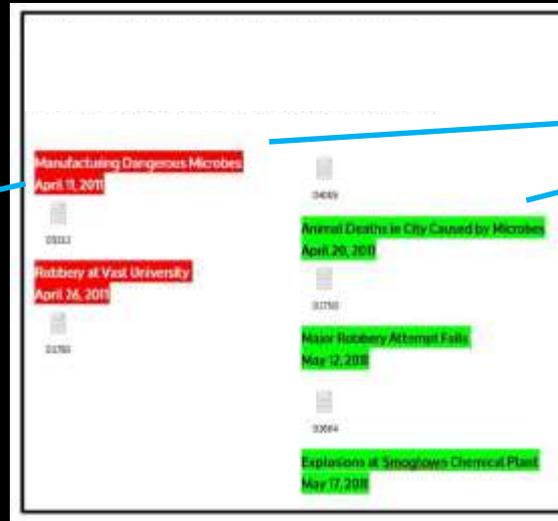- Conventions adhered to quite strictly.

Example evolution of representational grammars

… later

Two emerging themes
- Differentiated by proximity and colour.

Information object surrogate
- Now using proximity and object merge tool.
- Interpret this as space and time saving move.
- Required revision of previous instances.
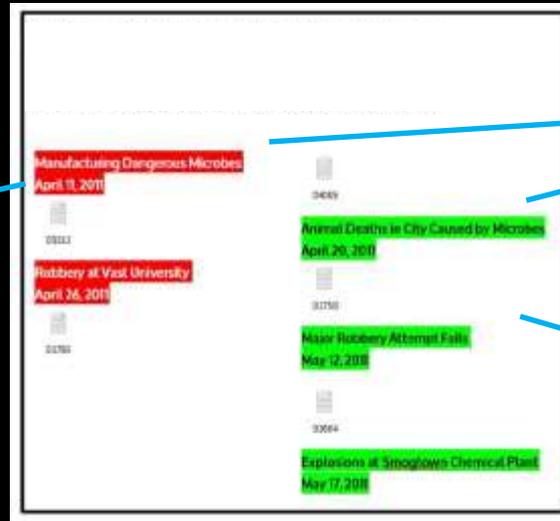- Conventions adhered to quite strictly.

Example evolution of representational grammars

… later

Two emerging themes
- Differentiated by proximity and colour.

Information object surrogate
- Now using proximity and object merge tool.
- Interpret this as space and time saving move.
- Required revision of previous instances.
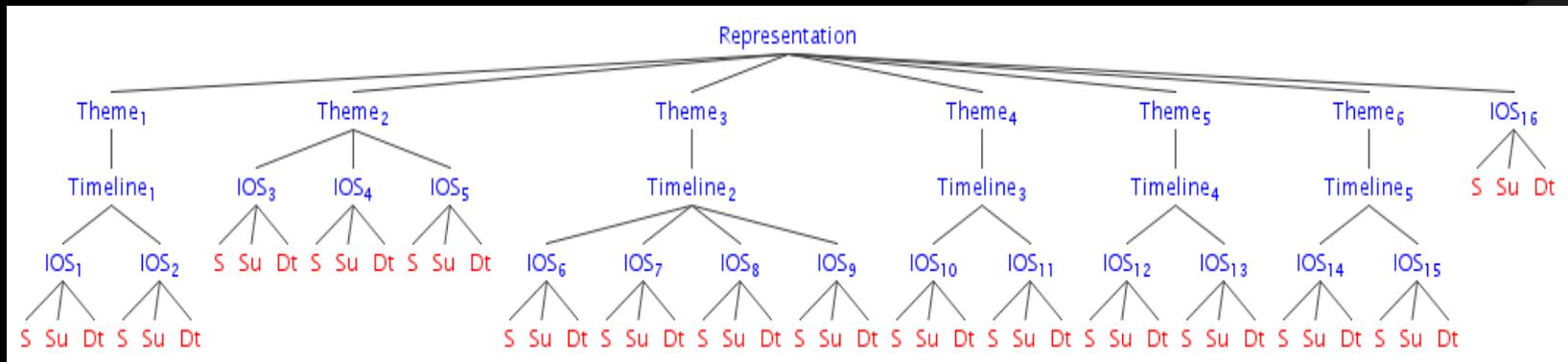- Conventions adhered to quite strictly.

Sorted by data… so they are timelines.

Example evolution of representational grammars

… finally

<Representation> → <Theme> <Information object surrogate>
<Theme> → <Timeline> | <Information object surrogate>
<Timeline> → <Information object surrogate>
<Information object surrogate> → <source> <summary> <date>

Discussion

- An approach to analysing user representations in sensemaking with linguistic analysis as a model.

- Production rule grammars can reveal things that would not have been easy to see otherwise.
  - Users create complex, heterogeneous representations.
  - Need a hierarchical theory to 'unpack' them.
  - Users introduce additional complexity to meet representational needs.
  - Users sometimes change surface-level cues to optimise space and effort.

- Better able to describe and differentiate what users do and describe and differentiate interfaces that might help them.

- Future work…
  - How does it apply to matrices and networks?
  - How does the approach apply variations of sensemaking task and support tools?
  - How does changing user-cost structures systematically change how users appropriate tools?