The expressive power of digital formats

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... or...

criticizing the manicure of the wise man pointing at the moon

A summary of my argument

- The problem: representing text digitally
- The solutions: we have a multitude of formats
- The discussion: find the best format
- The bad: there is no best format
- The good: all formats are, in a way, equivalent
- The deduction: there is a way in which formats are ***not*** equivalent
- The odd: the non-equivalence is aesthetic rather than substantive
- ***The take-home message: aesthetics is important in representing text digitally***

Representing text digitally

Data

- Records
  - Structures describing entities by enumerating their properties
- Tables
  - Collections of data as lists of homogeneous records
- Trees
  - Hierarchies of data and collections
- Graphs
  - Networks of information structures more or less densely intertwined

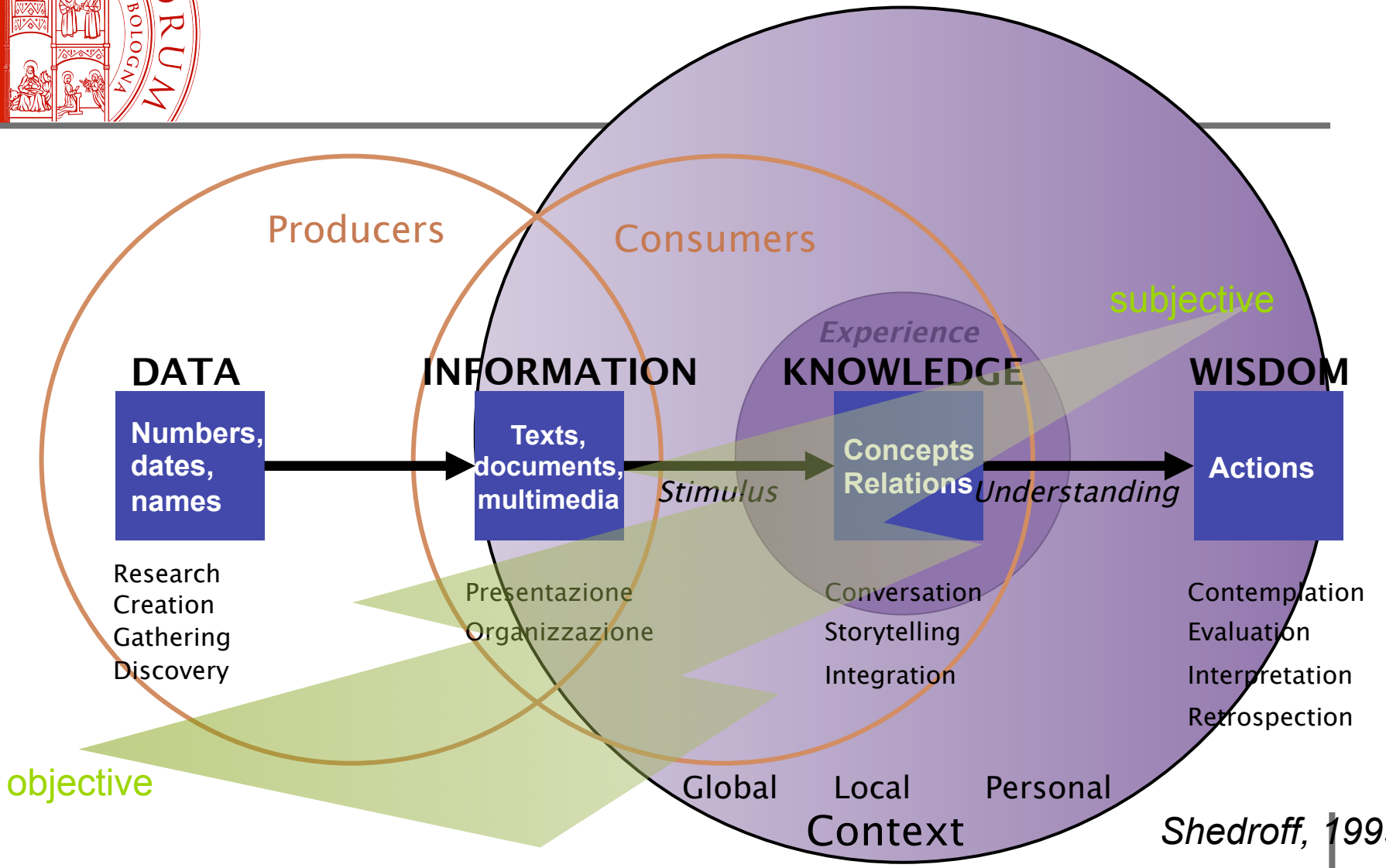
What about text?

- Text is hard
- Text contains relevant information, but its structure predates digitally representable information collections.
- It is not data. It is not a structure. It is not a collection.
- It is not organized in records, tables, trees, graphs.

Text

- Text has characters, including punctuation
  - We all (sort of) agree on this
- Texts is ordered
  - In "To be or not to be", it is important that "To be" comes before "not to be"
- Text has structure
- Text has presentation
- Text has grammar
- Texts has semantics
- Text has variants
- Text has a lot of things that can be said about it

Data vs. Information



Shedroff, 1999

A multitude of formats

A brief list of formats

- Data structures
  - CSV and tabular data
  - JSON
  - RDF
- Plain text formats
  - Plain text
  - TeX, LaTeX, etc.
  - Markdown, CommonMark and wiki syntaxes
- Markup formats
  - HTML, HTML5
  - XML
  - HTML5+ Embedded annotations (e.g., HTML5 + RDFa)
  - Markup spinoffs for overlapping (e.g. LMNL, TexMECS, etc.)

Data structures: CSV & tabular data

CSV (*Comma-Separated Values*)

- A long-time format for data exchange for tabular data.
- Each row is a record, each item is a value for a field.
- Data: pretty good, as long as it is regular and structured
- Hierarchical data: no support.
- Text: only plain, short text. There are issues with return characters and tabs in the text.
- References: not explicitly, but born for relational data
- Annotations: treated as regular data

```
Year,Make,Model,Description,Price
1997,Ford,E350,"ac, abs, moon",3000.00
1999,Chevy,"Venture ""Extended Edition""","",4900.00
1999,Chevy,"Venture ""Extended Edition, Very Large""",,5000.00
1996,Jeep,Grand Cherokee,"MUST SELL!
air, moon roof, loaded",4799.00
```

Data structures: JSON

```
{"menu": {
  "id": "file",
  "value": "File",
  "popup": {
    "menuitem": [
      {
        "value": "New",
        "onclick": "CreateDoc()"
      },{
        "value": "Open",
        "onclick": "OpenDoc()"
      },{
        "value": "Close",
        "onclick": "CloseDoc()"
      }
    ]
  }
}}
```

JSON (*JavaScript Object Notation*)

- Native to Javascript applications (used client-side on the Web),
- Available in all programming languages

- Data: pretty good
- Hierarchical data: pretty good
- Text: only plain text.
- References: no support
- Annotations: as regular data

Data structures: RDF

- RDF (*Resource Description Framework*)
  - Highly semantic, highly structured, everything expressed as a collection of simple and straightforward assertions (*subject predicate object*)
  - Not actually a format, rather a conceptual model that can be expressed in a number of actual formats (including Turtle, RDF/XML, RDFa, etc.)

  - Data: pretty good, but totally fragmented
  - Hierarchical data: no support.
  - Text: only plain, short text.
  - Validation: yes, through OWL ontologies
  - References: full support
  - Annotations: very good support. Designed for it

Data Structures
RDF (an example)

```
@base <http://example.org/> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@prefix rel: <http://www.perceive.net/schemas/relationship/> .

<#green-goblin>
    rel:enemyOf <#spiderman> ;
    a foaf:Person ;    # in the context of the Marvel universe
    foaf:name "Green Goblin" .
<#spiderman>
    rel:enemyOf <#green-goblin> ;
    a foaf:Person ;
    foaf:name "Spiderman", "Человек-паук"@ru .
```

Plain text formats: Markdown & wiki syntaxes

Text formats that use *ad hoc* plain text tricks to represent structures and typogaphy

- Data, hierarchical data: inappropriate
- Text: full support for long text
- Presentation of data: only the simplest typography
- References: well... hypertext links
- Annotations: inappropriate

```
An h1 header
============

Paragraphs are separated by a blank line.

2nd paragraph. *Italic*, **bold**, and `monospace`.
Itemized lists look like:

  * this one
  * that one
  * the other one
```

Markup formats: HTML & HTML 5

Current flagship representation format for text documents within the Web and the W3C

- Support is universal, tools are uncountable
- Mix of markup structures, Javascript APIs for advanced behavior, CSS for styling
- Data: represented as text (e.g. in a table)
- Hierarchical data: not naturally
- Text: full support for long text
- Presentation of data: fairly sophisticated typography
- Hierarchical text: now it is supported
- Validation: not possible without ad hoc code
- References: hypertext links
- Annotations: hidden in *data-* attributes

Markup formats: HTML5 + RDFa

This is a frequent combination of formats for text documents that contain semantically relevant data.

- Combines the success and genericity of HTML 5 plus the success and genericity of RDF
- HTML 5 text and RDFa information coexist, but do not really talk to each other.
- Data: represented as RDF hidden in attributes
- Hierarchical data: as RDF hidden in attributes
- Text: as HTML
- Presentation of data: as HTML (i.e., as CSS)
- Hierarchical text: as HTML
- Validation: only for the RDF part
- References: full support
- Annotations: as RDF hidden in attributes

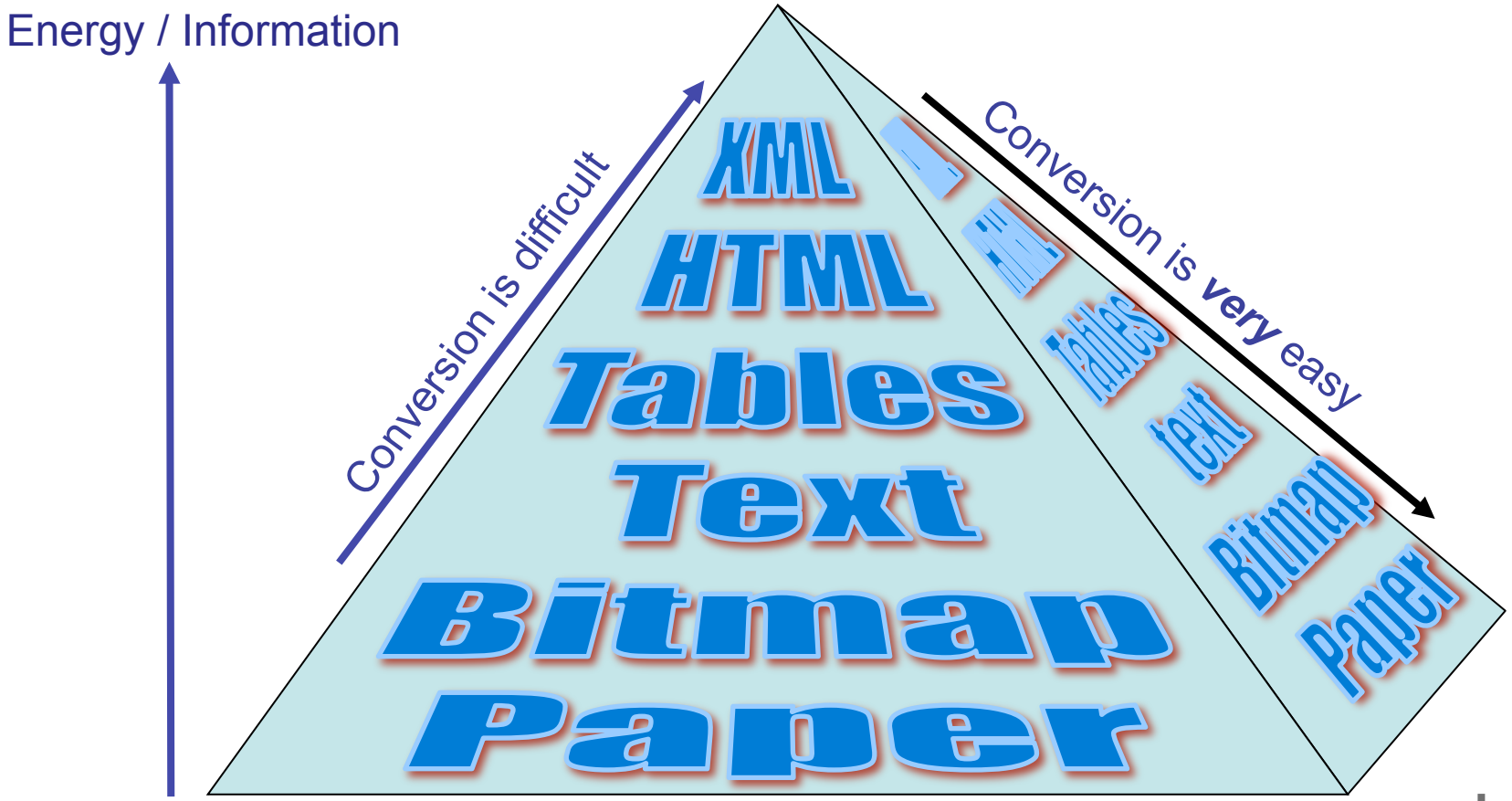
RDFa - example

```
<html prefix="foaf: http://xmlns.com/foaf/0.1/
        f: http://vitali.web.cs.unibo.it/a-rdf-ns#">
  <head>
    <title>Prof. Fabio Vitali</title>
  </head>
  <body about="f:fv">
   <p>
    <em property="foaf:name">Fabio Vitali</em> is the
    <span rel="f:teach" resource="f:tw">teacher
    </span> of <q about="f:tw" property="foaf:name"
    content="Web Technologies">the web tech course</q>
    at the University of Bologna.
   </p>
  </body>
</html>
```

Markup formats: XML

- XML allows to create markup languages that are readable, generic, structured, hierarchical.
  - Data: no problem
  - Hierarchical data: no problem
  - Text: no problem
  - Presentation of data: after transformation via XSLT
  - Hierarchical text: no problem
  - Validation: no problem
  - References: no problem
  - Annotations: as attributes or ad hoc sections of the document

The pyramid of sense-making



Overlapping!

Tibère, *la surprenant*

Poursuivez…

Agrippine

Quoi, Seigneur?

Tibère

Le propos détestable

Où je vous ai surprise.

Agrippine

Ah ! Ce propos damnable

D’une si grande horreur tous mes sens travailla.

Agrippine
Cyrano de Bergerac

Overlapping!

```
<TEI>
<l>
 <sp><speaker>Tibère</speaker>Poursuivez…</sp>
 <sp><speaker>Agrippine</speaker>Quoi, Seigneur?</sp>
 <sp><speaker>Tibère</speaker>Le propos détestable
</l>
<l>
 où je vous ai surprise. </sp>
 <sp><speaker>Agrippine</speaker>Ah! Ce propos damnable
</l>
<l>
 d'une si grande horreur tous mes sens travailla</sp>
</l>
</TEI>
```

Overlapping as a *disease of affluence*

- The ***real cause*** for overlapping is the wish to do too much with the same data.
  - Introduced by bored, revengeful scholars after their real problems had been solved by XML.
  - A clear case of *appetite comes with eating*
  - Unheard-of requirement outside of the XML community
- In most cases, we have overlaps when two separate hierarchies are forced to coexist over the same text
  - In Agrippine, the structure of poetry and the structure of the speeches.
  - Each structure is a well-behaving hierarchy in isolation, and becomes problematic when in mixed company
  - No, I'm not going to talk about self-overlap

Markup formats: formats for overlapping

- Syntaxes allowing for multiple hierarchies to coexist over the same data.
- Most look like XML on steroids. For instance: LMNL, XConcur, TexMECS

```
[excerpt [source}The Housekeeper{source] [auth}Robert Frost{auth]}
  [s}[l [n}144{n]}He manages to keep the upper hand{l]
  [l [n}145{n]}On his own farm.{s] [s}He's boss.{s] [s}But as to
hens:{l]
  [l [n}146{n]}We fence our flowers in and the hens range.{l]{s]
{excerpt]
```

Which is the best format?

	Data	Text	Hierarchies	Presentation	Validation	References	Annotations	Overlapping
CSV								
JSON								
RDF								
Markdown								
HTML								
HTML+RDFa								
XML								
Overlapping formats								

Handovers and workarounds

- Markdown has no sophisticated typography
  - But it can hand over it to HTML+CSS
- JSON does not support structured texts
  - But it can hand over them to HTML
- HTML does not support data and relations
  - But it can hand over them to RDF via RDFa
- XML does not support overlaps
  - But workarounds exist such as standoff, milestones and segmentation
- RDF does not support structured text nor overlapping
  - We designed a specific OWL ontology, called *Earmark*, as a workaround for that.

The same table with handovers and workarounds

with handovers & workarounds	Data	Text	Hierarchies	Presentation	Validation	References	Annotations	Overlapping
CSV						■		
JSON	■		■					
RDF	■				■	■	■	
Markdown		■						
HTML		■	■	■				
HTML+RDFa	■	■	■	■		■	■	
XML	■	■	■	■	■	■	■	
Overlapping fmts	■	■	■			■	■	■

... And some coding...

- Some simple CSS selectors in JQuery for adding some basic validation to HTML
- Some conversion to create HTML can allow for easy rendering of complex documents.
- Etc. ...

If you do not mind some coding...

with handovers & workarounds ***& some coding***	Data	Text	Hierarchies	Presentation	Validation	References	Annotations	Overlapping
CSV								
JSON								
RDF								
Markdown								
HTML								
HTML+RDFa								
XML								
Overlapping fomats								

Using HTML5

- Visualization of differences in Alessandro Manzoni's nove "I promessi sposi", in the 1827 and 1840 versions.

http://www.fabiovitali.it/filologia/

Quel ramo del lago di Como che volge a mezzogiorno tra due catene non interrotte di monti, tutto a seni e a golfi, a seconda dello sporgere e del rientrare di quelli, vien viene quasi a un tratto a ristringersi e a prender corso e figura di fiume, tra un promontorio a destra, e un'ampia costiera riviera dall'altra parte di rincontro; e il ponte, che ivi congiunge le due rive, par che renda ancor più sensibile all'occhio questa trasformazione, e segni il punto in cui il lago cessa, e l'Adda rincomincia ricomincia , per ripigliar poi nome di lago dove le rive, allontanandosi di nuovo, lascian lasciano l'acqua distendersi e rallentarsi allentarsi in nuovi golfi e in nuovi seni . La costiera riviera , formata dal deposito di tre grossi torrenti, scende appoggiata a due monti contigui, l'uno detto di san Martino, l'altro, con voce lombarda, il Resegone Resegone ,

Using HTML5

- Visualization of differences in Alessandro Manzoni's nove "I promessi sposi", in the 1827 and 1840 versions.

http://www.fabiovitali.it/filologia/

```
<p id="n0"> Quel ramo del lago di Como che volge a
mezzogiorno tra due catene non interrotte di monti, tutto
a seni e a golfi, a seconda dello sporgere e del
rientrare di quelli,
<span class="replace toscanizzazione visibile">
        <span class="newVersion">vien </span>
        <span class="oldVersion">viene </span>
</span>
 quasi a un tratto a ristringersi e a prender corso e
figura di fiume, tra un promontorio a destra, e un'ampia
...
</p>
```

So, all formats are equivalent

... in a way...

All formats are equivalent

- Equivalent in that all formats, if you allow some handovers, some workaround and some coding, can express pretty much the same things
  - But they become longer
  - But they are more difficult to read
  - But they are more difficult to maintain (and the code, too)
- These are not *substantial objections*, but *aesthetic objections*.

HTML + RDFa example

- HTML+RDFa can support most of the requirements listed above, but in a hardly readable way...

```
<p>In 1969, Led Zeppelin recorded their second album, <q>Led
Zeppelin II</q>, and King Crimson recorded their first, <q>In the
Court of the Crimson King</q>.</p>
```

HTML + RDFa example

- HTML+RDFa can support most of the requirements listed above, but in a hardly readable way...

```
<p>In 1969, <span about="lz" typeof="ex:MusicGroup"
property="foaf:name">Led Zeppelin</span> recorded their second
album, <span about="kc" property="ex:recorded" resource="lzii"><q
about="lzii" typeof="ex:Album" property="dcterms:title">Led
Zeppelin II</q></span>, and <span about="kc" typeof="ex:MusicGroup"
property="foaf:name">King Crimson</span> recorded their first,
<span about="lz" property="ex:recorded" resource="itckc"><q
about="itckc" typeof="ex:Album" property="dcterms:title">In the
Court of the Crimson King</q></span>.</p>
```

XML example

- Akoma Ntoso is an international standard for legal documents.
- It uses XML even for semantic relationships
- Requests for switching them over to RDF were made, and rejected.

```
<references>
  <TLCPerson href="/ontology/person#JohnSmith"
          id="Smith"  showAs="Senator John Smith" />
  <TLCRole   href="/ontology/role#MFA" id="MFA"
          showAs="Minister for Foreign Affairs" />
</references>
...
<debate>
  <question by="#Smith" to="#MFA">
    <from>Senator John Smith</from>
    <p>I would like to ask… </p>
    ...
```

XML example

- Akoma Ntoso is an international standard for legal documents.
- It uses XML even for semantic relationships
- Requests for switching them over to RDF were made, and rejected.

```
<div class="question">
  <p class="speaker"><span about="js-as-senator"
typeof="pro:RoleInTime" property="pro:withRole" resource="senator-
role"><span about="senator-role" typeof="pro:Role"
property="rdfs:label">Senator</span></span> <span about="js"
typeof="foaf:Person" property="foaf:name"><span
property="pro:holdsRoleInTime" resource="js-as-senator">John Smith</
span></span></p>
  <p class="speech" about="question" property="c4o:hasContent"><span
property="ex:askedBy" resource="js"><span property="ex:askedTo"
resource="minister-of-economy"><span about="minister-of-economy"
typeof="pro:Role">I would like to ask...</span></span></span></p>
</div>
```

RDF example

- You can, in principle, express anything in RDF, including texts and relations between fragments.
- You need to express all textual relations explicitly
  - Sequence of characters
  - Containment of structures
  - Fragments with special semantic content: legal references, definitions, facts, concepts, people, roles, events, etc.
- A specific ontology for expressing these relations exist. It is called Earmark, we created it in 2008.
- It works. It is painfully precise. It is much more expressive than XML. It is also 400% longer than the corresponding XML.

http://www.essepuntato.it/2008/12/earmark

A fragment of Earmark

```
e:lyrics
  a :URIDocuverse ;
  :has-uri "http://www.essepuntato.it/2009/01/andiloveher.txt"^^xsd:anyURI
e:funfacts
  a :URIDocuverse ; :has-uri "http://www.songfacts.com/detail.php?id=43"^^
e:attribute_values
  a :StringDocuverse ; :has-text "stanza - refrain - 4"^^xsd:string .
e:time_values
  a :StringDocuverse ; :has-text "68 - 72 - 76 - 80 - 84"^^xsd:string
e:r_refrain_1
  a :Range ; :begins e:location0-lyrics ; :ends e:location6-lyrics .
e:r_refrain_2
  a :Range ; :begins e:location6-lyrics ; :ends e:location14-lyrics .
e:location0-lyrics
  a :XPointerLocation ; :refers-to lyrics ; :at "xpointer(point(.0))"^^xsd
e:refrain_p
  a :Element ,
  [ a rdf:Seq ; rdf:_1 e:r_refrain_1 ; rdf:_2 e:r_refrain_2 ] ;
  :has-general-identifier "p"^^xsd:string.
```

The ecosystem of text

- Editing
- Validating
- Printing & displaying
- Transforming and converting
- Annotating
  - Annotating annotations
- Searching
- ...

Aesthetics is important

- A data format is not only what you use to represent the data (or text) that you have to deal with.
- An ugly format is, basically, a format for which you have to work a lot to obtain the things you need.
  - Like putting make up on a pig to make it pretty
- It very much depends on what is the use you plan for your data (or text).

A summary of my argument *(again)*

- The problem: representing text digitally
- The solutions: we have a multitude of formats
- The discussion: find the best format
- The bad: there is no best format
- The good: all formats are, in a way, equivalent
- The deduction: there is a way in which formats are ***not*** equivalent
- The odd: the non-equivalence is aesthetic rather than substantive
- ***The take-home message: aesthetics is important in representing text digitally***

The manicure of the wise man pointing at the moon is actually

the important part

... thank you!