Embedding Knowledge in HTML

Some content from a presentations by Ivan Herman of the W3c

HTML is Everywhere

- We usually think of HTML as the language of Web pages
- But it's also widely used on/for mobile devices and tablets
  - It readily adapts for different screen sizes/orientations
- And is the basis of many ebook formats
  - E.g. Kindle's formats, mobi, epub
- How can we add knowledge to HTML pages?

Adding RDF-like data to HTML

- We'd like to add semi-structured know-ledge to a conventional HTML document
  - Humans can see and understand the regular HTML content (text, images, videos, audio)
  - Machines can see and understand the data markup in XML, RDF or some other format
- Possibilities include
  - Add a link to a separate document with the knowledge
  - Embed the knowledge as comments, javascript, etc.
  - Distribute the knowledge markup throughout the HTML as attributes of existing HTML tags

One page, not two

- Content providers prefer not to generate multiple pages, one for humans (HTML) and another for machines (RDF)
  - RDF serializations are complex
  - Requires a separate storage, generation, etc. mechanism
  - Introduces redundancy, which can lead to errors if we change one page but not the other
- Simplifies the job of search engines as well

General approach

- Provide or reuse tag *attributes* to encode the metadata
  - Browsers and web apps ignore attributes they don't understand
- Three approaches have been developed
  - Microformats (~ 2005)
  - RDFa (~ 2007)
  - Microdata (aka schema.org) (~ 2012)
- Status 2014/5 (IMHO)
  - *Microformats* used but future is limited
  - *RDFa* becoming the encoding of choice
  - Schema.org vocabularies getting large uptake

Microformats approach

- Reuses HTML attributes like @class, @title
- Separate vocabularies (address, CV, …)
- Difficult to mix microformats (no concept of namespaces)
- Does not, inherently, define an RDF representation

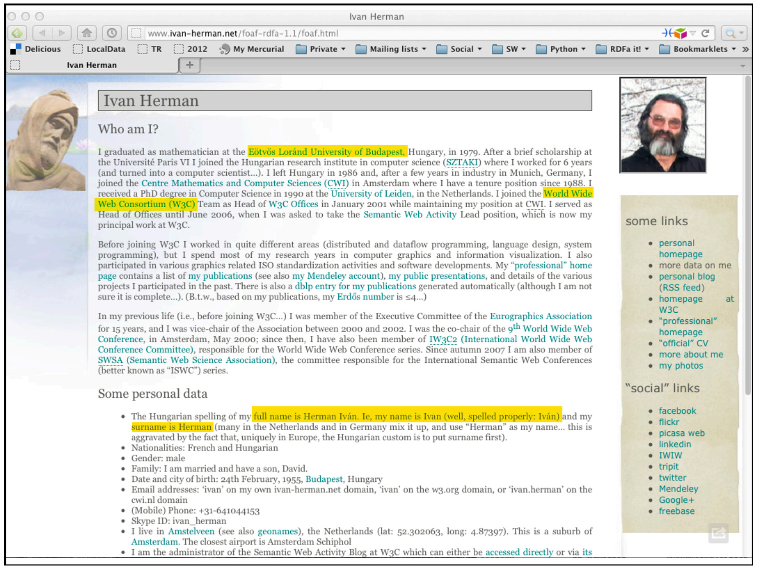
  possible to transform via, e.g., XSLT + GRDDL, but transformations are vocabulary dependent

Microdata approach

- Defined and supported by Google, Bing, Yahoo and Yandex
- Adds new attributes to HTML5 to express metadata
- Works well for simpler "single-vocabulary" cases, but not well suited for mixing vocabularies or for complex vocabularies
- No notion of datatypes or namespaces
- Defines a generic mapping to RDF

RDFa approach

- Adds new (X)HTML/XML attributes
- Has namespaces and URIs at its core
  - So mixing vocabulary is easy, as in RDF
- Complete flexibility for using literals or URI resources
- Is a complete serialization of RDF



Ivan Herman

Who am I?

I graduated as mathematician at the Eötvös Loránd University of Budapest, Hungary, in 1979. After a brief scholarship at the Université Paris VI I joined the Hungarian research institute in computer science (SZTAKI) where I worked for 6 years (and turned into a computer scientist…). I left Hungary in 1986 and, after a few years in industry in Munich, Germany, I joined the Centre Mathematics and Computer Sciences (CWI) in Amsterdam where I have a tenure position since 1988. I received a PhD degree in Computer Science in 1990 at the University of Leiden, in the Netherlands. I joined the World Wide Web Consortium (W3C) Team as Head of W3C Offices in January 2001 while maintaining my position at CWI. I served as Head of Offices until June 2006, when I was asked to take the Semantic Web Activity Lead position, which is now my principal work at W3C.

Before joining W3C I worked in quite different areas (distributed and dataflow programming, language design, system programming), but I spend most of my research years in computer graphics and information visualization. I also participated in various graphics related ISO standardization activities and software developments. My "professional" home page contains a list of my publications (see also my Mendeley account), my public presentations, and details of the various projects I participated in the past. There is also a dblp entry for my publications generated automatically (although I am not sure it is complete…). (B.t.w., based on my publications, my Erdős number is ≤4…)

In my previous life (i.e., before joining W3C…) I was member of the Executive Committee of the Eurographics Association for 15 years, and I was vice-chair of the Association between 2000 and 2002. I was the co-chair of the 9th World Wide Web Conference, in Amsterdam, May 2000; since then, I have also been member of IW3C2 (International World Wide Web Conference Committee), responsible for the World Wide Web Conference series. Since autumn 2007 I am also member of SWSA (Semantic Web Science Association), the committee responsible for the International Semantic Web Conferences (better known as "ISWC") series.

Some personal data

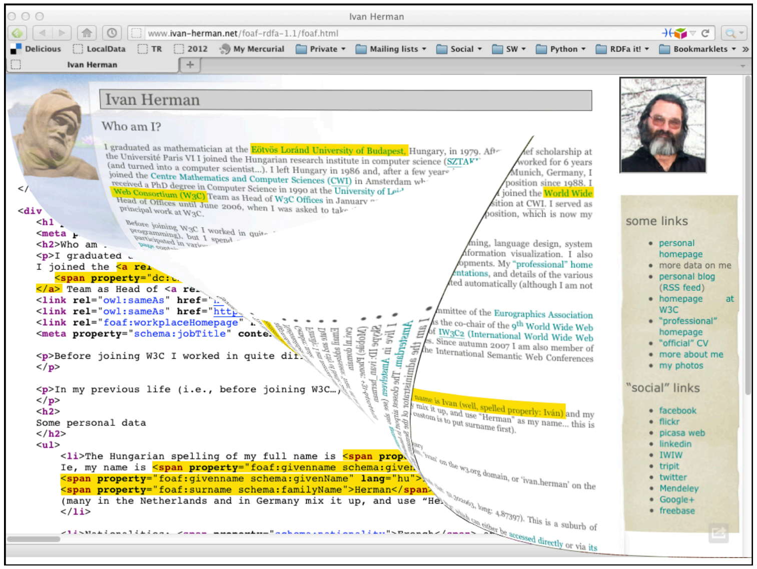
- The Hungarian spelling of my full name is Herman Iván. Ie, my name is Ivan (well, spelled properly: Iván) and my surname is Herman (many in the Netherlands and in Germany mix it up, and use "Herman" as my name… this is aggravated by the fact that, uniquely in Europe, the Hungarian custom is to put surname first).
- Nationalities: French and Hungarian
- Gender: male
- Family: I am married and have a son, David.
- Date and city of birth: 24th February, 1955, Budapest, Hungary
- Email addresses: 'ivan' on my own ivan-herman.net domain, 'ivan' on the w3.org domain, or 'ivan.herman' on the cwi.nl domain
- (Mobile) Phone: +31-641044153
- Skype ID: ivan_herman
- I live in Amstelveen (see also geonames), the Netherlands (lat: 52.302063, long: 4.87397). This is a suburb of Amsterdam. The closest airport is Amsterdam Schiphol
- I am the administrator of the Semantic Web Activity Blog at W3C which can either be accessed directly or via its

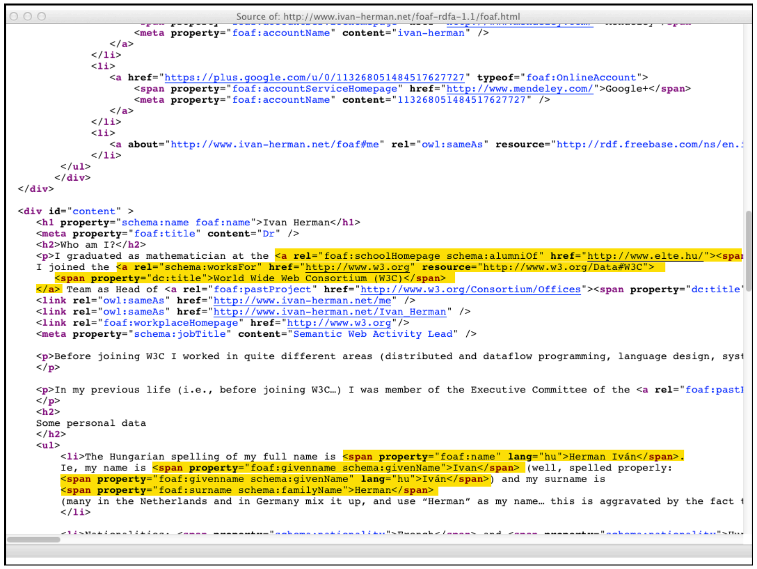
some links

- personal homepage
- more data on me
- personal blog (RSS feed)
- homepage at W3C
- "professional" homepage
- "official" CV
- more about me
- my photos

"social" links

- facebook
- flickr
- picasa web
- linkedin
- IWIW
- tripit
- twitter
- Mendeley
- Google+
- freebase



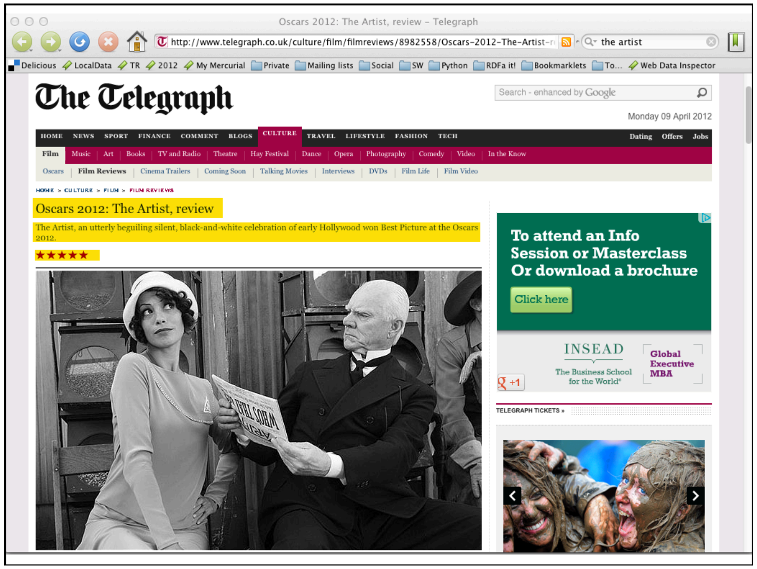


Source of: http://www.ivan-herman.net/foaf-rdfa-1.1/foaf.html

```
                <meta property="foaf:accountName" content="ivan-herman" />
            </a>
         </li>
         <li>
            <a href="https://plus.google.com/u/0/113268051484517627727" typeof="foaf:OnlineAccount">
                <span property="foaf:accountServiceHomepage" href="http://www.mendeley.com/">Google+</span>
                <meta property="foaf:accountName" content="113268051484517627727" />
            </a>
         </li>
         <li>
            <a about="http://www.ivan-herman.net/foaf#me" rel="owl:sameAs" resource="http://rdf.freebase.com/ns/en.
         </li>
      </ul>
     </div>
</div>

<div id="content" >
   <h1 property="schema:name foaf:name">Ivan Herman</h1>
   <meta property="foaf:title" content="Dr" />
   <h2>Who am I?</h2>
   <p>I graduated as mathematician at the <a rel="foaf:schoolHomepage schema:alumniOf" href="http://www.elte.hu/"><spa
   I joined the <a rel="schema:worksFor" href="http://www.w3.org" resource="http://www.w3.org/Data#W3C">
     <span property="dc:title">World Wide Web Consortium (W3C)</span>
   </a> Team as Head of <a rel="foaf:pastProject" href="http://www.w3.org/Consortium/Offices"><span property="dc:title"
   <link rel="owl:sameAs" href="http://www.ivan-herman.net/me" />
   <link rel="owl:sameAs" href="http://www.ivan-herman.net/Ivan_Herman" />
   <link rel="foaf:workplaceHomepage" href="http://www.w3.org"/>
   <meta property="schema:jobTitle" content="Semantic Web Activity Lead" />

   <p>Before joining W3C I worked in quite different areas (distributed and dataflow programming, language design, syst
   </p>

   <p>In my previous life (i.e., before joining W3C…) I was member of the Executive Committee of the <a rel="foaf:pastP
   </p>
   <h2>
   Some personal data
   </h2>
   <ul>
       <li>The Hungarian spelling of my full name is <span property="foaf:name" lang="hu">Herman Iván</span>.
       Ie, my name is <span property="foaf:givenname schema:givenName">Ivan</span> (well, spelled properly:
       <span property="foaf:givenname schema:givenName" lang="hu">Iván</span>) and my surname is
       <span property="foaf:surname schema:familyName">Herman</span>
       (many in the Netherlands and in Germany mix it up, and use "Herman" as my name… this is aggravated by the fact t
       </li>
```

Yielding this RDF

```
<http://www.ivan-herman.net/foaf#me>
    schema:alumniOf      <http://www.elte.hu> ;
    foaf:schoolHomePage <http://www.elte.hu> ;
    schema:worksFor      <http://www.w3.org/
W3C#data> ;
    …
<http://www.elte.hu>
    dc:title "Eötvös Loránd University of Budapest" .
…
<http://www.w3.org/W3C#data>
    dc:title "World Wide Web Consortium (W3C)"
…
```



Oscars 2012: The Artist, review - Telegraph

http://www.telegraph.co.uk/culture/film/filmreviews/8982558/Oscars-2012-The-Artist-r

the artist
Delicious LocalData TR 2012 My Mercurial Private Mailing lists Social SW Python RDFa it! Bookmarklets To... Web Data Inspector
The Telegraph
Search - enhanced by Google
Monday 09 April 2012
HOME NEWS SPORT FINANCE COMMENT BLOGS CULTURE TRAVEL LIFESTYLE FASHION TECH Dating Offers Jobs
Film Music Art Books TV and Radio Theatre Hay Festival Dance Opera Photography Comedy Video In the Know
Oscars Film Reviews Cinema Trailers Coming Soon Talking Movies Interviews DVDs Film Life Film Video
HOME » CULTURE » FILM » FILM REVIEWS

Oscars 2012: The Artist, review

The Artist, an utterly beguiling silent, black-and-white celebration of early Hollywood won Best Picture at the Oscars 2012.

★★★★★

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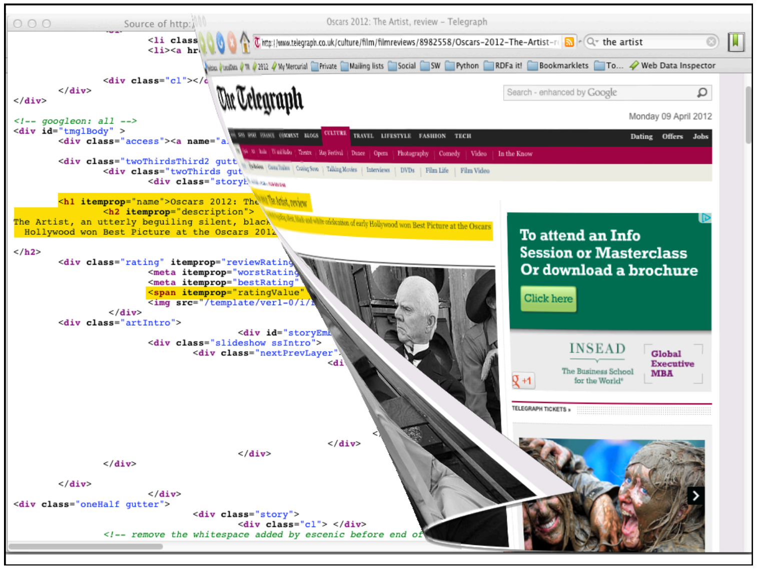
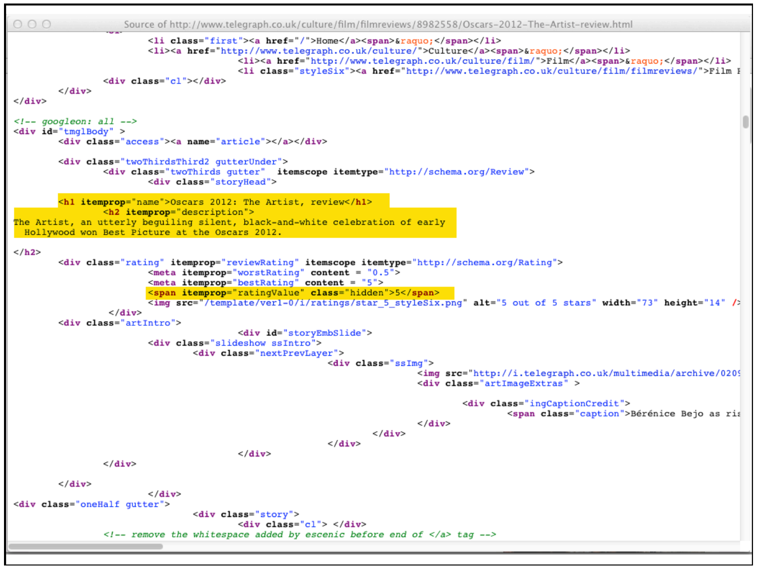




Source of http://www.telegraph.co.uk/culture/film/filmreviews/8982558/Oscars-2012-The-Artist-review.html

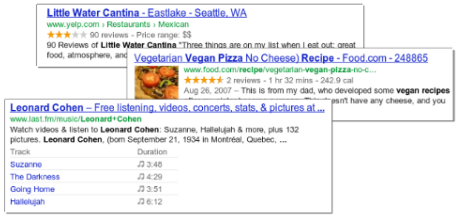
```
                              <li class="first"><a href="/">Home</a><span>&raquo;</span></li>
                              <li><a href="http://www.telegraph.co.uk/culture/">Culture</a><span>&raquo;</span></li>
                                          <li><a href="http://www.telegraph.co.uk/culture/film/">Film</a><span>&raquo;</span></li>
                                          <li class="styleSix"><a href="http://www.telegraph.co.uk/culture/film/filmreviews/">Film F
                  <div class="cl"></div>
            </div>
</div>

<!-- googleon: all -->
<div id="tmglBody" >
            <div class="access"><a name="article"></a></div>

            <div class="twoThirdsThird2 gutterUnder">
                  <div class="twoThirds gutter"  itemscope itemtype="http://schema.org/Review">
                              <div class="storyHead">

            <h1 itemprop="name">Oscars 2012: The Artist, review</h1>
                  <h2 itemprop="description">
The Artist, an utterly beguiling silent, black-and-white celebration of early
  Hollywood won Best Picture at the Oscars 2012.

</h2>
            <div class="rating" itemprop="reviewRating" itemscope itemtype="http://schema.org/Rating">
                              <meta itemprop="worstRating" content = "0.5">
                              <meta itemprop="bestRating" content = "5">
                              <span itemprop="ratingValue" class="hidden">5</span>
                              <img src="/template/ver1-0/i/ratings/star_5_styleSix.png" alt="5 out of 5 stars" width="73" height="14" />
                        </div>
            <div class="artIntro">
                                          <div id="storyEmbSlide">
                              <div class="slideshow ssIntro">
                                    <div class="nextPrevLayer">
                                                      <div class="ssImg">
                                                                  <img src="http://i.telegraph.co.uk/multimedia/archive/020
                                                                  <div class="artImageExtras" >

                                                                        <div class="ingCaptionCredit">
                                                                              <span class="caption">Bérénice Bejo as ris
                                                                  </div>
                                                            </div>
                                                      </div>
                                          </div>
                  </div>

            </div>
                              </div>
<div class="oneHalf gutter">
                                    <div class="story">
                                          <div class="cl"> </div>
                  <!-- remove the whitespace added by escenic before end of </a> tag -->
```

Yielding this RDF

```
[ rdf:type schema:Review ;
  schema:name "Oscars 2012: The Artist, review" ;
  schema:description "The Artist, an utterly
beguiling…" ;
  schema:ratingValue "5" ;
  …
]
```

Rich Snippets

- Search engines add text under results to preview what's on page and why it's relevant
- Text ften extracted from structured data embedded on the page
- See http://bit.ly/RichSN for more information

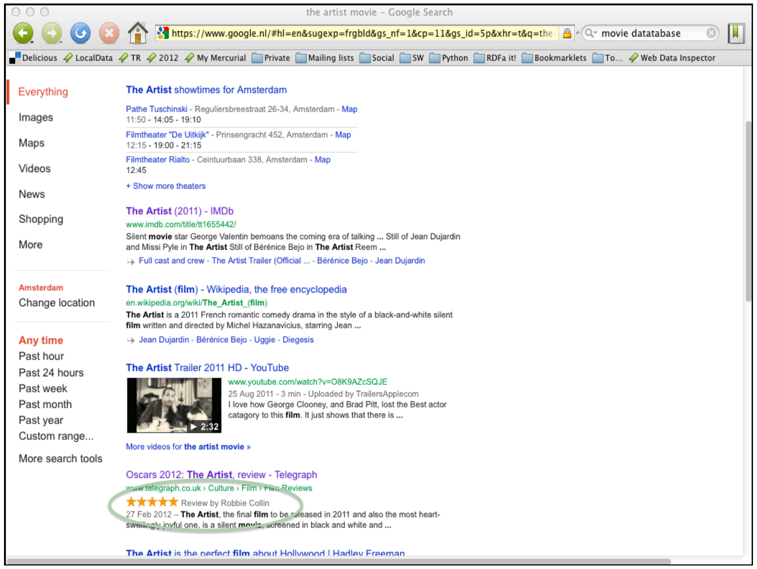


Little Water Cantina - Eastlake - Seattle, WA
www.yelp.com › Restaurants › Mexican
★★★☆☆ 90 reviews - Price range: $$
90 Reviews of **Little Water Cantina** "Three things are on my list when I eat out: great food, atmosphere, and

Vegetarian Vegan Pizza No Cheese) Recipe - Food.com - 248865
www.food.com/**recipe**/vegetarian-**vegan-pizza**-no-c...
★★★★½ 2 reviews - 1 hr 32 mins - 242.9 cal
Aug 26, 2007 – This is from my dad, who developed some **vegan recipes** ...esn't have any cheese, and you

Leonard Cohen – Free listening, videos, concerts, stats, & pictures at ...
www.last.fm/music/**Leonard+Cohen**
Watch videos & listen to **Leonard Cohen**: Suzanne, Hallelujah & more, plus 132 pictures. **Leonard Cohen**, (born September 21, 1934 in Montréal, Quebec, ...

Track	Duration
Suzanne	♫ 3:48
The Darkness	♫ 4:29
Going Home	♫ 3:51
Hallelujah	♫ 6:12



The Artist showtimes for Amsterdam
Pathe Tuschinski - Reguliersbreestraat 26-34, Amsterdam - Map
11:50 - 14:05 - 19:10
Filmtheater "De Uitkijk" - Prinsengracht 452, Amsterdam - Map
12:15 - 19:00 - 21:15
Filmtheater Rialto - Ceintuurbaan 338, Amsterdam - Map
12:45
+ Show more theaters

The Artist (2011) - IMDb
www.imdb.com/title/tt1655442/
Silent **movie** star George Valentin bemoans the coming era of talking ... Still of Jean Dujardin and Missi Pyle in **The Artist** Still of Bérénice Bejo in **The Artist** Reem ...
Full cast and crew - The Artist Trailer (Official ... - Bérénice Bejo - Jean Dujardin

The Artist (**film**) - Wikipedia, the free encyclopedia
en.wikipedia.org/wiki/**The_Artist**_(**film**)
The Artist is a 2011 French romantic comedy drama in the style of a black-and-white silent **film** written and directed by Michel Hazanavicius, starring Jean ...
Jean Dujardin - Bérénice Bejo - Uggie - Diegesis

The Artist Trailer 2011 HD - YouTube
www.youtube.com/watch?v=O8K9AZcSQJE
25 Aug 2011 - 3 min - Uploaded by TrailersApplecom
I love how George Clooney, and Brad Pitt, lost the Best actor catagory to this **film**. It just shows that there is ...
More videos for **the artist movie** »

Oscars 2012: **The Artist**, review - Telegraph
www.telegraph.co.uk › Culture › Film › Film Reviews
★★★★★ Review by Robbie Collin
27 Feb 2012 – **The Artist**, the final **film** to be released in 2011 and also the most heart-swellingly joyful one, is a silent **movie**, screened in black and white and ...

The Artist is the perfect **film** about Hollywood | Hadley Freeman

RDFa and Microdata: similarities

- RDFa and Microdata are modern options
  - Microformats is another
- Both have similar approaches
  - Structured data encoded in *HTML attributes only* – no new elements
  - Define some special *attributes*
    e.g., `itemscope` for microdata, `resource` for RDFa
  - Reuse *some* HTML core attributes (e.g., `href`)
  - Use textual content of HTML source, if needed
- RDF data can be extracted from both

RDFa and microdata: differences

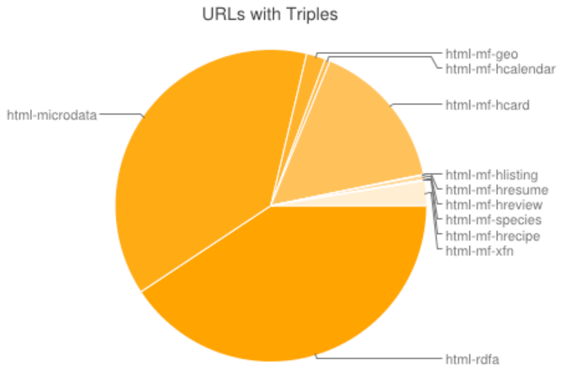
- Microdata *optimized* for simpler use cases:
  - One vocabulary at a time
  - Tree shaped data
  - No datatypes
- RDFa provides full serialization of RDF in XML or HTML
  - Price is extra complexity over Microdata
- RDFa 1.1 Lite is a simplified authoring profile of RDFa, very similar to microdata

Amount of structured data on Web?

- Web Data Commons project uses Common Crawl data to estimate how much structured data is on the Web
- Looked for Microdata, RDFa, and nine common Micro-data formats (e.g., hCalendar, hCard) in URLs parsable as HTML
- Nov. 2013 crawl:
  - 44TB (compressed) data from 2.2B URLs from 13M domains
  - 14% of domains, 26% of URLs had semantic data
- Processing 40TB (compressed) of the 2012 crawl took 5.6K machine hours on 100 machines and cost ~$400

What formats were found?

- Microdata use up (140K->463K sites form 2012->13)
- See here for details on 2013 crawl


URLs with Triples

Conclusions

- The amount of structured data on the web is growing steadily
- Microdata shows the strongest growth
- RDFa also common
- Microformat data is probably not growing as much