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To cite this version:
Benjamin Ooghe-Tabanou, Mathieu Jacomy, Paul Girard, Guillaume Plique. Hyperlink is not dead!. WS.2 2018 International conference on Web Studies, Paris, France - October 03 - 05, 2018, Oct 2018, Paris, France. hal-03903954

HAL Id: hal-03903954
https://sciencespo.hal.science/hal-03903954
Submitted on 16 Dec 2022

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Hyperlink is not dead!

Digital Tools & Uses Congress
MSH Paris Nord - October 4th, 2018

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Hyperlink is not dead!

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ABSTRACT
The emergence and success of web platforms nurtured a trend within social studies: "Hyperlink is dead!". Capturing their users into mobile applications and specialized web interfaces to propose them a specific user experience (and business model) the platforms indeed created new information silos in the open World Wide Web space. The simplified availability of user behavioral data through these platforms APIs reinforced this idea in academic communities by providing scholars with an easy way to collect rich user-centric data for their research. After discussing the methodological aspects of the web divide between platforms and classical websites, we will argue that although it becomes more and more visible, the hyperlink, modern incarnation of intertextual links between documents, is still a central and structural element of the web. Hyperlinks remain an invaluable resource to turn the web into a research field in spite of the complexity to collect, manipulate and curate them. We will illustrate those methodological challenges by describing the choices we made in designing Hyphe, a tool dedicated to the creation of web corpora tailored for mining hyperlinks.

CSS CONCEPTS

- Information systems → Web mining. Web applications. Internet communications tools.

KEYWORDS
Hyperlink, hypertext, web mining, crawler, corpus, curation, network analysis.

ACM Reference Format:

1 ARE HYPERTEXT STUDIES OUTDATED?
The World Wide Web’s original design as a vast open documentary space built around the concept of hypertext made it a fantastic research field to study networks of actors. As a literary technology, hypertexts concepts are anything but new: “links are intrinsic to documents, and have been for millennia” [27]. According to Bardini [5], two main concepts are embedded in hypertext: association and connection. Hypertexts allow to create conceptual associations between documents - a powerful function when used in a free and creative context - but they can also be very efficient in connecting documents to communicate ideas (i.e. conceptual links) within a community.

When Tim Berners-Lee proposed his World Wide Web (WWW) project, hypertexts were presented more as a way to connect documents to enhance communication through navigation than as form of conceptual associations. “The texts are linked together in a way that one can go from one concept to another to find the information one wants” […] “The process of proceeding from node to node is called navigation” [6]. But following Bardini [5], if associative hypertexts are created freely by authors for their own use, connective ones which have a value within a community are more likely to be moderated. Although the goal of the WWW is to enhance information flows across communities, connections between documents are not controlled, as each individual website’s author is responsible only for the connections from his website to the rest of the WWW.

1.1 Hyperlinks directionality: a bottom-up hierarchy
This directionality of the links reveals asymmetrical associations between the linked documents: the referent knows the referee but not necessarily the other way around. Considering hyperlinks as references provides powerful insights on the distribution of influence on the web. As the study of complex networks has demonstrated, online connections are not randomly distributed across the web. According to the principle known as the "Matthew effect" or "preferential attachment" [4], new web documents tend to cite the already most cited documents, reinforcing the concentration of links to a small fraction of pages. A hierarchy naturally emerges from this pattern across all scales of the web: it can be observed locally (e.g. inside Wikipedia) as well as in its general structure. This hierarchy is bottom-up because it emerges spontaneously rather than by design, but also because hyperlinks tend to flow from a metaphorical bottom to a metaphorical top. Actors with high visibility drawing most of citations are a handful compared to the mass of low visibility actors who cite them. The structure emerging from the direction of hyperlinks was famously leveraged by Google’s
1. From the web to platforms: a (not so) brief history of hyperlinks
2. médialab: enabling digital field work through design & engineering
3. Hyphe: curate hypertexts into web corpora
4. Many angles of hypertext studies
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The Web: a vast open documentary space

« Links are intrinsic to documents, and have been for millennia. »

Hyperlinks: the backbone of the world wide web

« The texts are linked together in a way that one can go from one concept to another to find the information one wants. The network of links is called a web. [...] The texts are known as nodes. The process of proceeding from node to node is called navigation. »

Hyperlinks: a familiar & transparent feature

« But from the very beginning [...] the web has had one defining feature that we tend to overlook today, because it has become so intuitive and natural that it goes unnoticed. »

Brügger, 2017, Connecting textual segments: A brief history of the web hyperlink
Hyperlinks reflect assymetrical associations

« A hyperlink is a manifestation of intention. By linking one page to another, one piece of text to another, people intend to do particular things. »

Ryfe, Mensing, & Kelley, 2016, What is the meaning of a news link?
The Web: a place of dialogue and debates
A bottom-up hierarchy emerged from hyperlinks

« Matthew effect » : preferential attachment
→ new web pages tend to cite the already most cited ones
The 2010's divide: the Web Vs. gated platforms

• 1999: Google’s « PageRank » algorithm
  L. Page, S. Brin & al. 1999. ThePageRank Citation Ranking: Bringing Order to the Web.
  → development of Search Engines Optimization
  → hyperlinks at the core of online visibility

• 2004: Facebook

• 2006: Twitter

• 2010’s: « platformization » of the web, smartphones
  → capturing users with sharing buttons behind closed gates
  → increasing importance of likes & retweets

• 2018: legal definition of platforms in EU copyright reform

« The definition of an online content sharing service provider under this Directive shall cover information society service providers one of the main purposes of which is to store and give access to the public or to stream significant amounts of copyright protected content uploaded / made available by its users, and that optimise content, and promote for profit making purposes, including amongst others displaying, tagging, curating, sequencing, the uploaded works or other subject-matter, irrespective of the means used therefor, and therefore act in an active way. »
Are hyperlinks studies outdated?

- A new trend in Social Sciences: will LIKES replace LINKS?

- The rise of APIs in SHS:
  → simple access to massive and structured user centric data (Twitter, Facebook...)
  → development of Single platform studies
  → risks of commercial & ethical close-back (LinkedIn, Cambridge Analytica...)

- Working with the web otherwise can be hard: heterogeneous formats, unstructured messy data...
Bruno Latour, médialab founder

« Google is nice, but we need something better »

The Indian Express, 2011
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médialab @ Sciences Po

- Pluridisciplinary Research Lab created by Bruno Latour in May 2009, led by Dominique Cardon since 2017

- Social Sciences, Engineering & Design

- Articulate qualitative & quantitative methods through a digital approach

- Work with digital traces


- METAT: a monthly Open Support Workshop https://www.sciencespo.fr/recherche/fr/content/metat-latelier-de-methodes
The Web as a research field

**DIME Web**: one of three instruments of EQUIPEX DIME SHS

Methodological research and support

Network analysis, Controversies studies

Collect, enrich, clean, visualize & analyze digital traces:

→ **Generic** collection & exploration tools

→ **Specific** extraction scripts
A Quali/Quanti approach: exploratory iterations

Digital ≠ Magic

→ always avoid full automation
Research Driven Development

• Aim at large **Adoption:**
  → **build** tools fit for Social Scientists
  → **design** user centric interfaces
  → **publish** tools directly usable online

• Ensure maximum **Reusability:**
  → seize **opportunities** to implement new functionalities
  → Free Libre **Open Source** Software
    (downloadable, installable, editable, reviewable, improvable)
Playground: working with platforms’ APIs

- « Application Programming Interfaces »
- Structured data
- Massive and/or complete
- User behavioral data
- Problems:
  - volume
  - rate limits
  - black boxes
  - platforms’ perspectives

API reference index

Accounts and users

Follow, search, and get users

- GET followers/ids
- GET follow/ids
- GET friends/ids
- GET friends/list
- GET friendships/incoming
- GET friendships/lookup
- GET friendships/no retweets/ids
- GET friendships/outgoing
- GET friendships/show
- GET users/lookup
- GET users/search
- GET users/show
- GET users/suggestions
- GET users/suggestions/slug
- GET users/suggestions/slug/members
- POST friendships/create
- POST friendships/destroy
- POST friendships/update
Gazouilloire: systematic collection of tweets data

https://github.com/medialab/gazouilloire

Live and continuous collection via Search & Stream:
- tweets by keywords, urls, users, places, langages (up to 10 days back)
- threads and attached medias
- user profiles
CatWalk: qualitatively pick tweets from a corpus

https://medialab.github.io/catwalk/

« Tinder-like » review of all tweets listed in a CSV to decide to take them IN or OUT
SeeAlsology: semantic exploration from Wikipedia

http://tools.medialab.sciences-po.fr/seealsology/

Build & explore a semantic network of fields linked within « See Also » sections of Wikipedia pages
APIs are rare: data Scraping to the rescue

- **Extract information from a specific single source**
- **Build structured data from all kinds of web contents**
  - url, date, author, image, description, place, values...
  → Enable statistics & quantitative analysis
- **Whatever is public & formatted can be scraped**
- **Problem: The web constantly changes**
  → Maintenance issues
Artoo.js: the browser scraping companion

https://medialab.github.io/artoo/

- Common scraping traps:
  - user authentification
  - cookies
  - dynamic pages with JS...
- Avoid simulating browsers: hack them!
- Embed jQuery helpers to scrap directly from within the browser’s console (F12)

```javascript
> var data = artoo.scrapeTable( ".wikitable", {headers: 'th'} );
undefined
> data.length;
49
> data[0];
Object {Country: "World", CO2 emissions (kt) in 2014[2]: "35,669,000", "% CO2 Emissions by Country": "100%", Emission per capita (t) in 2014[3]: "5.0"}
> artoo.saveCsv(data, "CO2-world-emissions.csv");
undefined
```
Google bookmarklets: search results as CSV

https://medialab.github.io/google-bookmarklets/

Install Google Bookmarklets

Drag & drop images below into your bookmark bar:

Google bookmarklets

Simple buttons installable into the browser’s bookmarks to let one easily scrap search results as tabular data
Crawling: harvest data from a variety of sources

- Extract coherent data from heterogeneous sources

- Build loosely structured data from common grounds found within web documents (pages)
  - text content → natural language processing
  - hyperlinks → network analysis

- Problem: the web is a « dirty mess »
  redirections, erroneous links, dead links, disappeared websites, bad encoding...
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The interlinked mycellium: a network of hyphæ

[Image: CC-BY-SA - Rob Hille on Wikimedia Commons]
Hyphe: a research directed crawler

http://hyphe.medialab.sciences-po.fr/demo/

Build your own web documents corpus to study social phenomena online

→ gather « web actors »
→ explore hyperlinks between them

COP 21
Vie privée
Extrême droite
Tissu associatif
Produits laitiers
Cellules souches
Administrations culturelles
...

http://medialab.github.io/double-dating-data/

http://utopies-concretes.org/
There is no such thing as a « website »!

→ « WebEntities »: bundles of webpages aggregating coherent actors to answer a specific research question

= set of URL prefixes
Finely delimit the web territories of actors

Manually setup prefix patterns to adjust the cursor of « WebEntities »
Which data structure to manage hypertexts?

- **Tree** of urls
- **Graph** of hyperlinks
- Dynamic branches aggregates

https://medialab.github.io/hyphe-traph/fosdem2018/#/

Carla studies how immigration is discussed in the public debate...
Hyphe's crawling strategy: leverage hyperlinks

- Classical crawlers (DMI's IssueCrawler): Snowball → Top Layer attraction (Google, YouTube, Wikipedia...) → Topic drifts

- Hyphe:
  - crawl exclusively pages within the chosen WebEntities
  - sort discovered entities by degree of citation
  - humanly select new entities to include and crawl
Web prospection loop: curating a corpus iteratively

- Step by step iterative expansion & curation of entities

- Human/Time cost
- How to know when to stop?
  → hyperlink citations threshold
Qualify the corpus entities (tagging)

- Free notes
- Categories
HyBro: a web browser designed for corpus curation

https://github.com/medialab/hyphe-browser/releases/

« NaviCrawler » heritage: build a Hyphe web corpus while browsing
→ « in-situ » prospection & tagging (digital field work)
→ teach the web to students (IDEFI FORCCAST)
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Many ways to use Hyphe

- Complete methodology includes:
  - sourcing, automatized collection, iterative corpus building
  - qualitative categorization, exploratory analysis,
  - network visualization, quantitative statistical analysis

- Diverse audiences:
  - Research: help social scientists work on digital fields
  - Pedagogy: teach students what the web is beyond Google & Facebook

- Possible small & large scale analyses:
  - a website’s internal structure
  - a theme’s ensemble of actors and their ties
  - a controversy’s alliances & oppositions
  - etc.
From above: clusters, opposition & affinity

Social Representations of Stem Cells, Virginie Tournay, CEVIPOF, 2016
From within: explore webpages contents

http://tools.medialab.sciences-po.fr/privacy/

<table>
<thead>
<tr>
<th>Topics</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surveillance FR</td>
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<tr>
<td>Business &amp; Media</td>
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<tr>
<td>Surveillance US</td>
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<td>Cybersecurity</td>
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<td>Big data &amp; Analytics</td>
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<td>Data Regulation FR</td>
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<td>Cookies &amp; Tracking</td>
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<td>Telec Operators FR</td>
<td></td>
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<tr>
<td>Card and ID fraud</td>
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</table>

- **nakedsecurity.Sophos**
  - [https://nakedsecurity.sophos.com/category/technologies/operating-s..](https://nakedsecurity.sophos.com/category/technologies/operating-s..)
  - developers would rather quit than give FBI a backdoor A lead developer for the Tor Project said

- **Helpnetsecurity**
  - [http://www.helpnetsecurity.com/tag/backdoor/encryption backdoors a bad idea March 4, 2016 backdoor cybercriminals encryption Apple and the FBI](http://www.helpnetsecurity.com/tag/backdoor/encryption backdoors a bad idea March 4, 2016 backdoor cybercriminals encryption Apple and the FBI)

- **nakedsecurity.Sophos**
  - developers would rather quit than give FBI a backdoor 23 Mar 2016 1 Apple, iOS, Law & order, Privacy

- **nakedsecurity.Sophos**
  - developers would rather quit than give FBI a backdoor 23 Mar 2016 1 Apple, iOS, Law & order, Privacy

- **Sidstammm**
  - [http://blog.sidstamm.com/2016_02_01_archive.html](http://blog.sidstamm.com/2016_02_01_archive.html)
  - their phones vulnerable is not the right approach. The current public discourse on the Apple vs. FBI "open"

- **Laquadrature**

- **Laquadrature**

- **Laquadrature**
  - [https://mediakit.laquadrature.net/view.php?full=1&id=2374](https://mediakit.laquadrature.net/view.php?full=1&id=2374)
  - 20160219[AC] LCP Chiffrement Apple FBI Download : MP4 , WebM , How to embed ?
From the sides: a hierarchy of directed hyperlinks

- Conspiracy theorists
  - Not reliable
  - Not cited
  - Cite many reliable sources

- Right and extreme right
  - Not reliable
  - Cited only by conspirationists
  - Cite many reliable sources

- French national media
  - Reliable (*in this qualification)
  - Cited by everyone
  - Cite only platforms and regional media
Hyperlinks directionality: a bottom-up hierarchy

Each bloc’s surface is proportional to the count of websites. The color code is the same as the “Décodex”.

Reliable 46% 305 sites
Satirical 11% 76 sites
Imprecise 13% 89 sites
Unreliable 30% 197 sites

Right + extreme-right 9% 59 sites
Conspiracy theorist 11% 73 sites
Other 10% 65 sites

The thickness is proportional to the normalized link density*

*Accounts for the different group sizes.

Densities below 2% have been omitted.

Explore polarization dynamics
Roadmap: what next?

- Import / export corpora or lists of webentities & crawls:
  - duplication, reproduction
  - longitudinal time exploration
- Integrated text processing (NLP) for content analysis
- Use modern web technologies to handle JavaScript powered contents (Facebook, React applications, etc.)
- Quality control tools for crawls
- Archival & exploration tools to publish finalized web corpora
- Propose automatic setups of Hyphe as Software As A Service
Hyperlink is not dead: long live hyperlink studies!

- 10-year financial support of EQUIPEX
  → building cutting-edge research instruments demands long-term support
- Hyphe is Free & Open Source, try it online with the demo!
  
  https://hyphe.medialab.sciences-po.fr/demo/
  https://github.com/medialab/hyphe

Questions?

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