



A Puzzling Letter Form, or How Ways-of-Looking and Ways-of-Seeing Differ


e-Science and Ancient Documents project





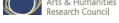
Sékolène M. Tarte
(OeRC & Classics Faculty, University of Oxford)

Object, Artefact and Script workshop
Edinburgh, 08.10.2009












E-Science and Ancient Documents project


- Targeted documents:
 - Stone
 - Lead
 - Wood
- Aim: develop a web-based Interpretation Support System (ISS) for ancient and damaged documents:
 - Image capture and processing (digitization, feature detection, web-services)
 - Chain of reasoning recording tool to help make explicit the implicit interpretations and knowledge (argumentation theory and epistemology)
 - Access external knowledge bases, e.g. linguistics, palaeographical, archaeological (contextual encoding, web-services)



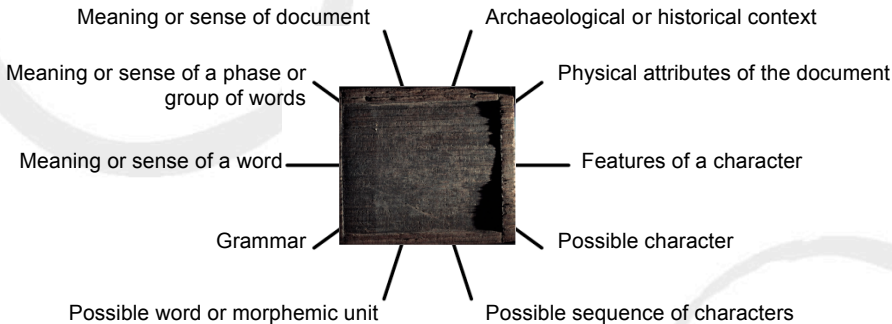
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A Puzzling Letter Form
Introduction





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The Transcription and interpretation process: levels of reading.




[Terras 2006, Rumelhart and McClelland 1986]

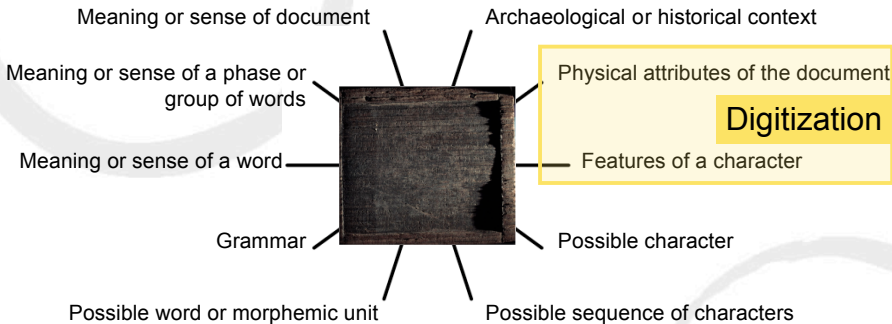
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Tools to assist at the various levels of reading.



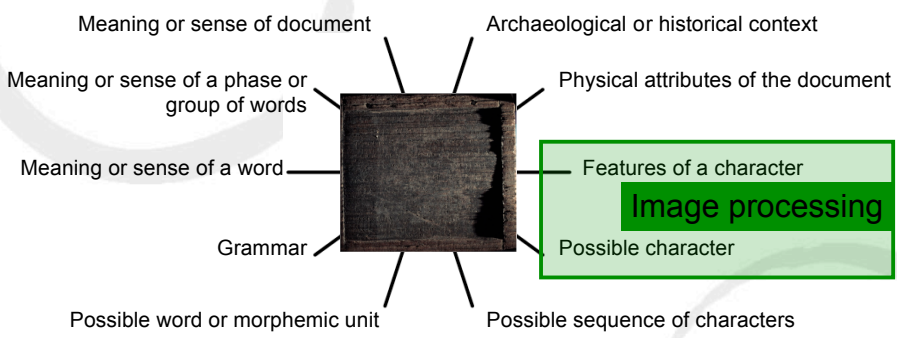
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Tools to assist at the various levels of reading.



Meaning or sense of document

Archaeological or historical context

Meaning or sense of a phase or group of words

Physical attributes of the document

Meaning or sense of a word

Features of a character

Image processing

Possible character




Grammar

Possible word or morphemic unit





Possible sequence of characters

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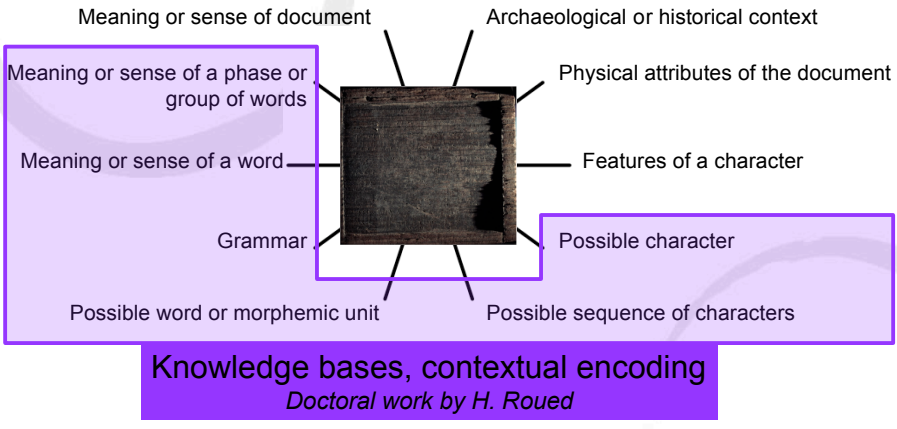
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Tools to assist at the various levels of reading.



Meaning or sense of document

Archaeological or historical context

Physical attributes of the document

Features of a character

Possible character

Possible sequence of characters

Possible word or morphemic unit

Grammar




Meaning or sense of a word

Meaning or sense of a phase or group of words

Knowledge bases, contextual encoding
Doctoral work by H. Roued

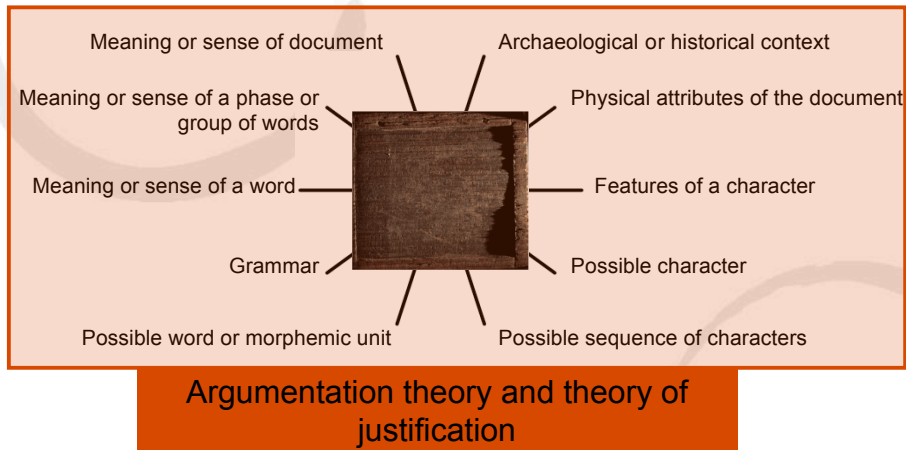
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Tools to assist at the various levels of reading.



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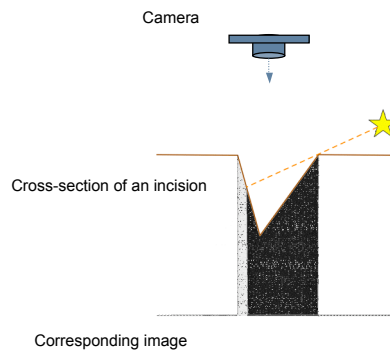
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Capturing volumetric information with digital photographs




- Shadow-stereo principle:
 - The highlight and shadow areas move according to the position of the light
 - Stains stay in place
- Yields volumetric information

→ Mimics experts' tablet rocking in raking light!




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1. Digitization



Frisian tablet.
Original transcription by C.W. Vollgraff, 1917 -- *"De tabella emptionis aetatis Traiani nuper in Frisia reperta"*






New transcription by A.K. Bowman, R.S.O. Tomlin, and K.A. Worp, 2009 forthcoming -- *"Emptio bovis Frisica: the 'Frisian ox sale' reconsidered"*

→ Digital pictures by Dr. C. Crowther

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A Puzzling Letter Form
1. Digitization




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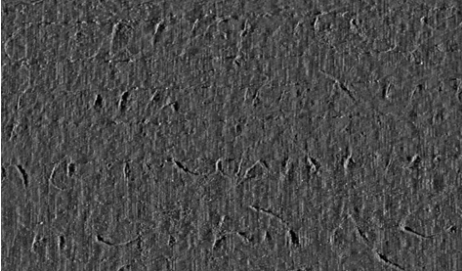
Woodgrain removal

- Multiplicative removal

Original image





After woodgrain removal



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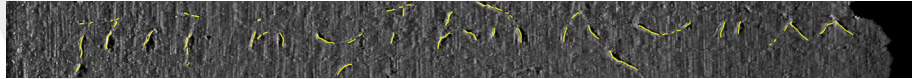
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2. Image processing



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Feature detection



- Aim: detect character features (work in progress)

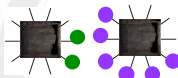


- Challenges:
 - Images noisier than medical images. Problem: how to remove noise without interfering with the contained information?
 - Normally, the answer would be: "Know what you're looking for!"
 - However, here, it's actually to better differentiate what we're looking for from noise that we wanted to identify the noise in the first place!!!
 - Elements of an answer: the noise should not change in nature, from one image to the next, whereas the visual aspect of the incisions does
- Combine images sensibly.
 - What does the visual system do and how to transpose that mathematically?

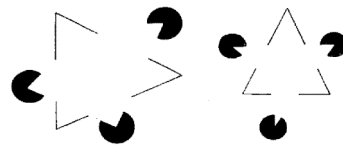
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2. Image processing

Filling in the gaps, identifying characters




- Given character features, how to link them up to identify possible characters?
 - Subjective/illusory contours, Kanizsa triangles
 - (Use luminance and contrast)
 - Use geometric constraints [Ullman 1976, Rutkowski 1979]
 - Character shape ontology
 - Qualitative descriptors [Teras 2006]
 - Length; orientation; relative position; angle.
 - Repertoire of letter shapes




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2. Image processing



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→ Digital
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Crowther

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3. Argumentation, justification

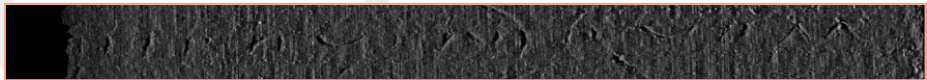


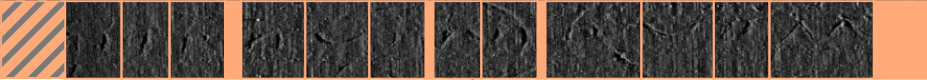
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"The case of the disappearing ox"







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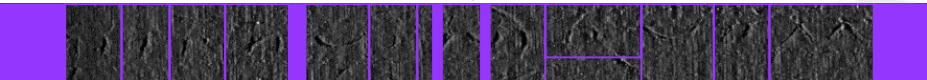
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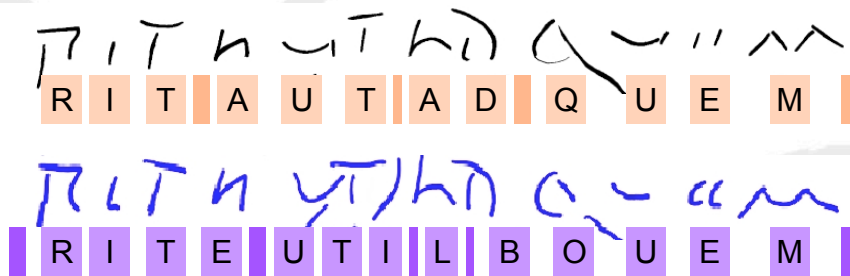
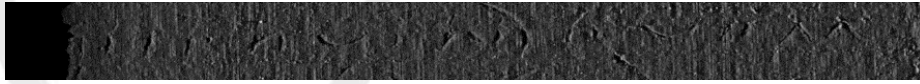
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3. Argumentation, justification



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“The case of the disappearing ox”



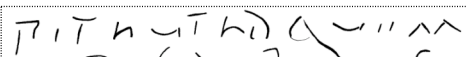
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3. Argumentation, justification



Expert interpretation strategies

- Kinaesthetic / palaeographical
 - Drawing
 - Embodiment of the script
 - Visual feedback loop between mental image of the text and the actual text
- Cruciverbalistic / philological
 - Puzzle solving
 - Script as collection of symbols
 - Intuitive knowledge of language and statistical occurrences of characters



RIT . UT . D Q U E M

- Predominant strategy closely related to personal skills
- Strategies not mutually exclusive!

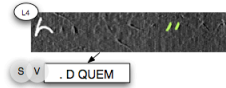
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3. Argumentation, justification

An evolving network of percepts



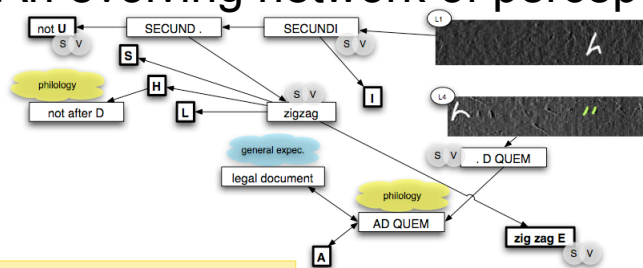
- Skilled vision
 - Perception & cognition
 - Specialised visual skill, expertise [Gibson 1953]
 - Connoisseurship [Neer 2005]
 - Memory association, mental organisational map



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3. Argumentation, justification

An evolving network of percepts



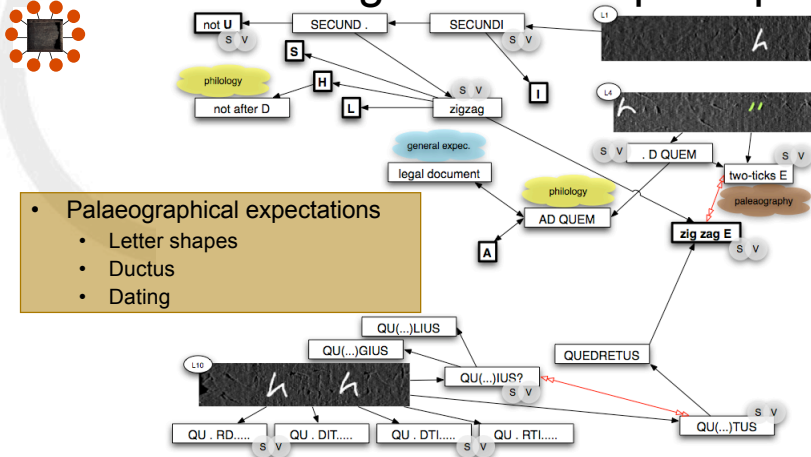
- Philological expectations
 - Occurrences of letters
 - Typical formulae
 - Linguistics

- General scholarly expectations
 - Layout and language of a legal document
 - Physical aspect of the object (holes, notch)

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3. Argumentation, justification

An evolving network of percepts



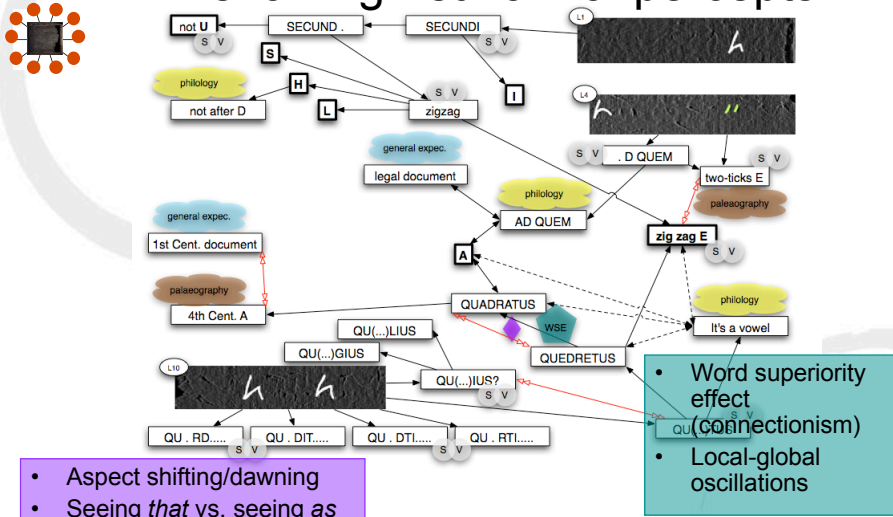
- Palaeographical expectations
 - Letter shapes
 - Ductus
 - Dating

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3. *Argumentation, justification*

An evolving network of percepts




- Aspect shifting/dawning
- Seeing *that* vs. seeing *as*

- Word superiority effect (connectionism)
- Local-global oscillations




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3. *Argumentation, justification*




Clash of expectations








ORC 'A'
1st cent. AD



Frisian tablet 'A'
29 or 116 AD






NRC 'A'
3rd/4th cent. AD

“ It’s only a late looking ‘A’ because we *think* it’s late looking ‘A’ ” “


Intentionality vs. serendipity
Expectations & habitus vs. perception & cognition

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3. Argumentation, justification

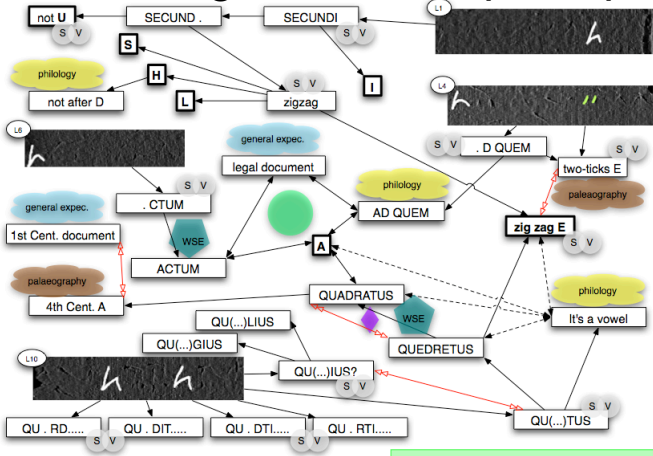




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An evolving network of percepts



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3. Argumentation, justification

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Current work

- Refine the “story of the A’ graph by injecting the levels of reading in the network of percepts:
 - Formalise the behaviours within a layer
 - Formalise the jumps between the layers
 - Skilled vision
 - Scholarly expectations
 - Aspect shifting
 - Oscillations (word superiority effect)
- How to evaluate the “goodness” of a percept, of an evidence?
 - Easing the tensions!

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3. Argumentation, justification

Ways of looking and ways of seeing: what do the experts do?

- Image capture and processing
 - Mimic real-world phenomenon, to ensure capture of evidence
 - How does the visual system discriminate features?
- Making explicit a network of (often implicit) percepts and their (always hidden!) triggers
- Facilitate both kineasthetic and cruciverbalistic approaches

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Conclusion






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Final remarks

- In the editions, compare the narratives about the interpretation process vs. the actual (convoluted?) course of development of the interpretation...
 - Shows the need for a recording tool that would assist in producing the edition?
 - Shows the *mutability* of the security of the evidence/percept?
- Experts are good, really good.
 - To some extent, we will be able to help them record their rationale with an ISS, i.e., keep track of the way they *see*, but can we help them *look* better/differently?




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Conclusion




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<http://esad.classics.ox.ac.uk>

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