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Facilitating Reusable Third-Party Annotations in Digital Editions

Abstract: For third-party annotations in the digital edition to be interoperable, we argue they should not be anchored in web pages but in the edition's abstract information structure. We propose an ontology for the editorial domain based on $FRBR_{OO}$. The ontology distinguishes between the editable domain (works that can be edited) and the edited domain (the result of editing), as well as between the different FRBR levels. The edition's website, with the help of RDFa (RDF triples expressed by means of HTML attributes in the hierarchical HTML structure) can identify fragments of works and expressions and describe their relations. Annotation tools and other clients can use that information to identify the targets of annotation and perform other types of intelligent processing. We discuss what this facility might mean for annotation in the context of digital editions. We also note that the same functionality is desirable in the context of other types of cultural heritage material, such as newspapers and audio-visual archives.

Keywords: Collaboration, Modelling, Digital Edition, Markup, Media Types, Ontologies, Semantic Web, Tool, Digital Humanities

1 Motivation

Digital scholarly editions tend to follow the print model and are usually static. Siemens et al. (2012) argue that few digital editions make use of the developments in social media to increase the potential for textual engagement by their readers. Social software can make editions more 'social', allowing readers the possibility to share their thoughts and engage with those of others. One of the main categories of social uses they identify is collaborative annotation. Users of current digital editions include scholars who take notes during their use of the edition, which they incorporate in their publications, but editions rarely allow users to make annotations directly on the digital editions. The need for such support for third-party digital annotations in electronic editions has since long been argued for. Robinson (2004) described the need for digital editions that can be dynamically corrected,

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revised and augmented. Boot (2009) described annotations as mesotext between the annotated texts and the scholarly publications based on these annotations.

Annotating is a so-called scholarly primitive in the sense that it is a scholarly activity performed by scholars across all disciplines (Unsworth 2001; Palmer et al. 2009; Anderson et al. 2010). These annotations are made for different purposes, e.g. in the form of personal comments for scholars to structure and guide their thinking, in the form of tags or codes to analyse the edited sources and gather data, or in the form of links to other research materials to propose relevant relationships between the edited text and something else, be it another text, a photograph depicting an event described in the text or something else entirely (Boot et al. 2017; Ruvane 2005).

In current editions that do not support third-party annotations directly, the annotations are made on paper or on a scholar's personal computer, where they remain private and invisible to others. But these annotations can be rich sources of supplementary material, adding interpretations, explanations and perspectives on the edited text, that could be of great value to other scholars. In addition, allowing users to annotate a text also can encourage more attentive reading and engagement (Pearson et al. 2012). Annotations may be used as procedural signals for future attention, placemarkings and aids for memory, in situ working on problems, tracing progress or as interpretations (Marshall 1997). Open annotation of web content allows reviewing and discussion before, during and after publication, as well as fact checking and information extraction (Ruland Staines 2018).

In this chapter we argue for the value of facilitating third-party annotations on digital editions and describe an approach to digital annotation that takes into account the needs for scholarly annotations and their use in scholarly communication. We also present a prototype tool that implements this approach. By third-party annotations, we mean annotations that contribute to the explanatory material already present on the edition's website, for the purpose of either private study or of publishing them alongside a scholarly article in which they are used, made by researchers unaffiliated with the edition project. Given the different purposes of annotations and the different forms that they can take, we adopt an inclusive view of annotation as an activity that can be part of almost any research activity, as also argued by Haslhofer et al. (2009), Melgar (2016), Ruvane (2005) and Walkowksi (2017). This includes private as well as shared or public annotations. The annotations can be loosely or highly structured and have any data type (for example purely textual, a link to connect the annotated document to anything else or an image).

The goal of our tool is to offer a low threshold to participate in allowing third-party annotations, both for the edition projects that provide annotatable material for scholars who perform different types of annotation tasks. The tool is an open

source library that can be easily incorporated in edition websites. It uses the W3C Web Annotation Data Model,[1] an international open standard format for annotations derived from the Open Annotation initiative (Hunter et al. 2010). This ensures that scholars can extract, reuse and share their annotations.

There are a number of hurdles in making an annotation tool useful in the context of using digital editions for research. These have to do with the difference between how researchers think about the edition and how a web browser interprets the edition as a combination of text strings and structured layout information. There are also a number of consequences to consider in offering a tool for third-party annotation on digital editions. We will discuss these in turn.

2 Annotating digital editions on the web

When researchers make annotations on an online digital edition of a text, they probably think of the annotation as saying something about (a fragment of) the text and not about (a fragment of) a specific webpage that is part of the edition's website. But the web browser they use to view the edition only sees that webpage as a block of data containing a combination of text strings wrapped in HTML markup, with CSS information for styling the text and JavaScript code to make it interactive. This difference in perspective leads to two problems for annotation in research contexts. First, the user and the tool are 'thinking' differently about what the annotation refers to, i.e. the problem anchoring the annotation, and, second, about what kind of thing that referenced part of the edition is and how is related to other parts, i.e. the problem of semantics.

2.1 The problem of anchoring

There are already several well-established annotation tools for the web. Seatter (2019) compared a range of open annotation tools and environments on their flexibility to work with different text formats, the usability of their design and their sociality in allowing users to interact with each other through their annotations. Several of these tools are open source, allow collaborative annotation and sharing of annotations. There are integrated environments like Annotation Studio and Google Docs that can work with text documents and there are generic annotation

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1 See https://www.w3.org/TR/annotation-model/ (17.10.2019)

tools that can annotate web pages such as Hypothes.is (Perkel 2015),[2] Pundit (Grassi et al. 2012)[3] and dokie.li.[4] This immediately prompts the question: why do we need another annotation tool? We argue that existing tools have important drawbacks: the former cannot annotate web pages; the latter only 'see' the HTML structure: they have no 'knowledge' of the underlying resource that is displayed or of its structure. Nor do they allow annotation of images or multimedia objects.[5]

Annotation tools that run in web browsers typically allow users to select a text fragment or some other part of the web page, and add e.g. a comment or a tag. To keep track of what that comment or tag refers to, the tool stores it in combination with the location of the selected fragment, which is a combination of the URL of the webpage, and a so-called XPath expression that identifies the selected HTML element(s). This works well as long as the structure and layout of the page do not change and the page remains accessible via the same URL. But over the years, the HTML structure may change because of improved layout and presentation or because of updates in underlying technologies. It is also possible that the whole site structure is changed, or even that the site is moved to a different web domain (for instance if the organization changes its name). In all these cases, the annotation no longer has a valid referent. Moreover, there may be different editions of the same text for which the same annotation is relevant. In the mind of the researcher who made the annotation, the specific edition on which the annotation was made may be irrelevant, but the annotation tool can only refer to the current webpage and structure of a single edition.

As an example, Figure 1 on the facing page shows a letter of the Vincent van Gogh Letters edition (Jansen et al 2009).[6] It contains two main panels on the left and right hand side, and a notes panel in the middle. The left panel shows the text (in Dutch) of a letter sent by Vincent to his brother Theo, while the right panel shows notes. In each panel, the bar at the top allows users to switch between representations, from e.g. the Dutch text to an English translation, another version that maintains the line endings of the original letter, or the facsimile. Switching between representations changes the HTML structure and text content of the page, which illustrates the problem of anchoring an annotation to the HTML structure.

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2 See https://web.hypothes.is/ (17.10.2019)

3 See https://thepund.it/ (17.10.2019)

4 See https://dokie.li/ (17.10.2019)

5 An exception is Pundit, which can read underlying resource information from RDFa to use an object identifier as the annotation target instead of the web page URL, but does not interpret or exploit structural information about the object to do semantic reasoning.

6 For the letter, see http://vangoghletters.org/orig/let001 (17.10.2019). For the edition website see http://vangoghletters.org/vg/ (17.10.2019)

Fig. 1: A letter from the Vincent van Gogh Letters edition

An annotation made on a paragraph of the Dutch text in the left panel does not refer to the same paragraph when it is displayed in the right panel, and may refer to an incorrect paragraph in the left panel when e.g. the English translation is displayed.

2.2 The problem of semantics

The second problem has to do with the difference in semantics between the edited text, the digital edition that is based on it, and their representation as a web page. During the edition project, the editors typically create multiple, highly structured representations of a text. There may be different types of transcriptions and one or more translations. The representations also relate the text's physical structure (its distribution over pages) and its logical structure (in terms of sections, paragraphs, etc.). But to display the text on the web, this rich structure needs to be transformed to a markup structure that web browsers understand, i.e. HTML. In this transformation, a large part of the edition's structure and its semantic interpretation are lost.

To illustrate this, Listing 1 on the next page shows parts of the TEI/XML representation, made in the edition project, of the same letter shown in Figure 1. It uses

Listing 1: Fragment of TEI encoding for a the letter by Vincent van Gogh to his brother Theo. The Dutch translation and the notes are not shown.

```
1    ...
2    <div type="translation">
3    <pb f="1r" n="1" xml:id="pb-trans-1r-1" facs="#zone-pb-1r-1"/>
4      <ab>The Hague, 29 September 1872.</ab>
5      <vg:whiteline />
6      <ab>My dear Theo,</ab>
7      <ab>Thanks for your letter, I was glad to hear that you got
         back safely. I missed you the first few days, and it was
         strange for me not to find you when I came home in the
         afternoon.</ab>
8      <ab rend="indent">We spent some pleasant days together, and
         actually did go for some walks and see a thing or two whenever
         we had the chance.</ab>
9      <ab rend="indent">What terrible weather, you must feel <hi rend
         ="ital">anxious</hi> on your walks to <rs type="topo" key="1">
         Oisterwijk</rs>.<anchor n="1" xml:id="note-t-1" /> Yesterday
         there were trotting races on the occasion of the exhibition,
         <anchor n="2" xml:id="note-t-2" /> …() Ever,</ab>
10     <vg:whiteline />
11     <ab>Your loving</ab>
12     <ab>Vincent</ab></div>
```

both the general TEI namespace and a namespace specific to the Van Gogh edition to define the semantics of individual XML elements. To present the letter on the web, this is transformed by the web server to create an HTML version. A simplified version of the HTML representation is shown in Listing 2 on the next page. Here, most of the semantics of the TEI/XML is lost and this is the only information that both the browser and the annotation tool have access to.

3 Making editions annotatable

Boot et al. (2017) argued that for scholarly annotation, the annotation tool should have access to the underlying semantics of the annotated object, as the HTML representation has little meaningful connection to it. It should be able to show annotations made on one representation of a paragraph in the context of another

Listing 2: A simplified version of the HTML representation of the same letter

```
1   <html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en" lang="en
    ">
2     <head>
3       <title>To Theo van Gogh. The Hague, Sunday, 29 September 1872.
        </title>
4     </head>
5     <body class="letter-page">
6       ...
7       <div id="text">
8         <div class="letterbox" id="letterbox1">
9           <div class="p">The Hague, 29 September 1872.</div>
10          <div class="p">My dear Theo,</div>
11          <div class="p">Thanks for your letter, I was glad to hear
             that you got back safely. I missed you the first few
            days, and it was strange for me not to find you when I
            came home in the afternoon.</div>
12          <div class="p indent">We spent some pleasant days
            together, and actually did go for some walks and see a
            thing or two whenever we had the chance.</div>
13          <div class="p indent">What terrible weather, you must
            feel <i>anxious</i> on your walks to Oisterwijk.<span
            class="anchor">1</span> Yesterday there were trotting
            races on the occasion of the exhibition,<span class="
            anchor">2</span> (...) Ever,</div>
14          <div class="p">Your loving</div>
15          <div class="p">Vincent</div>
16        </div>
17      </div>
```

representation of it, regardless of any changes to web presentation of the letter or the URL at which it can be accessed.

3.1 Anchors and semantics via RDFa

Both problems of anchoring and of semantics can be addressed with technologies from the Semantic Web community. Web search engines like Google, Baidu, Bing

and Yandex crawl the web and index pages to provide access, but struggle with understanding the content of web pages. The HTML structure itself, as we discussed above, provides few hints of what a web page is about. Several technological solutions were proposed to alleviate these problems, including two that can be incorporated directly in the HTML: microdata and RDFa. Both use HTML attributes to add semantic information that can be read by applications but that do not affect the display. Compton et al. (2015) describe this as a form of 'invisible ink': the RDFa is embedded in the HTML, so that the semantic information is directly visible to tools that parse that HTML, but invisible in the surface layout that the user sees in their browser. The semantics are specified in an ontology that defines what the relevant concepts in a certain domain are, what they mean and how they are related to each other. For instance, a book shop can use the Store ontology from Schema.org[7] to make explicit that one HTML element contains the physical address of the shop, another set of elements specifies its opening hours and a third set describes the genres and prices of books available in their catalogues. When sites use a shared ontology, search engines can use that to give more intelligent access, for instance, showing to a user which of the shops listed in the results are currently open.

In the domain of digital scholarly editions, Compton and her colleagues show how RDFa can be used in editions to allow scholars to virtually collaborate with each other across texts, even if they are annotating different editions and do not know each other. Muri et al. (2016) created a social edition of the Grub Street Project, where the semantics of the displayed resources is embedded in HTML via Microdata. The edition offers no third-party annotation but uses the embedded semantics to bring together into a semantically interlinked whole a collection of maps, plans, prints and books and pamphlets printed and sold in eighteenth-century London. Beyond digital editions, Doush et al. (2012) proposed an ontology in the domain of e-learning to embed semantics in a mathematics learning platform via RDFa, so that students can semantically search for content using either mathematical expressions or names of equations.

With both Microdata and RDFa as available solutions, we chose to implement our approach using RDFa, for a number of reasons. First, microdata only works with HTML5 while RDFa can also be embedded in other version of HTML as well as in XML. Second, RDFa was adopted by the World Wide Web Consortium as an official recommendation, while the Microdata specification is still in draft at the

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7 See https://schema.org/Store (17.10.2019)

Listing 3: A HTML representation of the first part of the English translation of the van Gogh letter, semantically enriched through RDFa. The HTML elements have attributes that add identifiers and type information of parts of the letter based on a van Gogh-specific annotation ontology.

```
1   <html xmlns:vg="http://www.vangoghletters.org/ns/" xmlns:tei=
    "http://www.tei-c.org/ns/1.0">
2     <head>
3       <title>To Theo van Gogh. The Hague, Sunday, 29 September 1872.
        </title>
4     </head>
5     <body>
6       <div class="row">
7         <div about="urn:vangogh:letter=001" typeof="Letter" vocab="
          http://boot.huygens.knaw.nl/annotate/vangoghontology.ttl#">
8           <p resource="urn:vangogh:correspondence" typeof=
            "Correspondence" property="isPartOf">
9             <a href="http://vangoghletters.org/vg/">Van Gogh Letters
              </a>
10          </p>
11          <h2>To Theo van Gogh. The Hague, Sunday, 29 September
            1872.</h2>
12          <div>
13            <div>
14              <h2>Original text</h2>
15              <p property="hasPart" typeof="ParagraphInLetter"
                resource="urn:vangogh:letter=001:para=1"> Den Haag, 29
                 september 1872.</p>
16              <p property="hasPart" typeof="ParagraphInLetter"
                resource="urn:vangogh:letter=001:para=2">Waarde Theo,
                </p>
```

time of writing.[8] And third, RDFa makes it easier to use multiple vocabularies to describe the same content, which can be hard or impossible with Microdata.

A semantically-enriched version of the van Gogh letter HTML is shown in Listing 3. Annotation tools accessing this HTML can use the semantics of the edition to understand what they are annotating (Compton et al. 2014; Boot et al. 2017).

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8 For the RDFa recommendation, see https://www.w3.org/TR/rdfa-core/ (17.10.2019). For the Microdata specification, see: https://www.w3.org/TR/microdata/ (17.10.2019)

Listing 4: Triples from the ontology

```
1    vg:Letter rdf:type owl:Class.
2    vg:Letter rdfs:subClassOf hi:Work.
3    vg:ParagraphInLetter rdf:type owl:Class.
4    vg:ParagraphInLetter rdfs:subClassOf hi:PartOfWork.
```

The second <div> element in the <body> element has three RDFa attributes. The 'about' attribute contains an identifier for the letter, 'urn:vangogh:letter=001', and describes what the webpage is about. The 'typeof' attribute contains the value 'Letter' signalling that the main object described in this page is a letter. The third attribute, 'vocab', specifies the vocabulary or ontology that defines the concepts, classes and properties describes in these HTML attributes. In this case, the URL http://boot.huygens.knaw.nl/annotate/vangoghontology.ttl is a so-called Turtle file that contains the Van Gogh annotation ontology in the format of RDF triples.

These triples describe the set of concepts, classes, properties and relationships in the domain of the Van Gogh Letters. Each RDF triple consists of an object, a predicate and a subject. E.g. in Listing 4, the object 'vg:Letter' is related to the subject 'owl:Class' through the predicate 'rdf:type', which translates to 'vg:Letter' is a type of class.[9] The next triple states 'vg:Letter' is a subclass of the more general class 'hi:Work'. Similarly, the object 'vg:ParagraphInLetter' is defined as an 'owl:Class' and it is a subclass of 'hi:PartOfWork'.

Combining the ontology and the RDFa statements in the HTML, the identifier for the letter, 'urn:vangogh:letter=001', is identified as a resource of the class 'vg:Letter' which is a subclass of 'hi:Work'. The 'hi' prefix is defined in the Van Gogh ontology to represent the generic ontology http://boot.huygens.knaw.nl/annotate/genericontology.ttl. This generic ontology defines the general concepts of the annotation ontology, such as the classes 'hi:Work' and 'hi:PartOfWork' and the property 'hi:hasPart'. This 'hi:hasPart' property is used for the paragraphs in Listing 4 to declare that the letter 'urn:vangogh:letter=001' has a 'hi:hasPart' rela-

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9 The 'vg' is a prefix used as shorthand for the Van Gogh ontology URL http://boot.huygens.knaw.nl/annotate/vangoghontology.ttl#, while the 'hi' prefix is shorthand for the generic edition ontology URL http://boot.huygens.knaw.nl/annotate/genericontology.ttl#. The 'rdfs' prefix is shorthand to identify the semantic web concept http://www.w3.org/2000/01/rdf-schema#. For completeness' sake: 'owl' and 'rdf' here are prefixes used as shorthand to identify the semantic web concepts https://www.w3.org/2002/07/owl#Class and https://www.w3.org/1999/02/22-rdf-syntax-ns#type.

tionship with the two paragraphs identified by 'urn:vangogh:letter=001:para=1' and 'urn:vangogh:letter=001:para=2'.[10]

Several of the other HTML elements similarly have properties to semantically define parts of the letter, what their type is and how they are related to the letter. The 'typeof' property can contain one or more types. For instance, a <div> element containing the text of a paragraph could have both type 'Text' to indicate that it is a text, and type 'ParagraphInLetter', which is a concept defined in the Van Gogh ontology.

Once this semantic description is embedded in the page, an annotation tool could still use the HTML structure and XPath expression to determine the referent of an annotation, but it could also use the identifier of e.g. the second paragraph as an alternative, and more durable, referent. The main advantage of using the paragraph identifier is that, if the structure of the page changes or the page is moved to a different URL, the annotation maintains the same valid referent. If an alternative editions is available on another website using the same identifiers, the same annotation can be shown in that context.

Listing 5 on the next page is an example annotation in W3C Web Annotation format. It has a target property that identifies the fifth paragraph in the van Gogh letter ('urn:vangogh:letter=001:para=5') and states that it is both of type Text and of type ParagraphInLetter. Within the target is a more specific selector indicating that only the word Oisterwijk in that paragraph is selected. The body property contains a comment that states that the selected word is the place where Vincent van Gogh went to school as a child. Any webpage showing the same letter and using the same identifiers can show this annotation in context.

3.2 The Underlying Ontology

The embedded RDFa statements solve the problems of anchoring and semantics only partly. Recall that the van Gogh letter has both Dutch transcriptions and an English translation, each being a representation of the original letter. In bibliographic terms, they are different expressions of the same abstract work. In some contexts, it is important to distinguish between these different representations, for instance in the case of an incorrect English translation of a phrase in the letter. This is relevant to one of the representations, but not the others. In other contexts,

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10 Note that we use URNs for the identifiers that are similar to those used in the Canonical Text Services (Blackwell and Smith 2014). Such a service would allow us to go back from a collection of annotations to the text fragments that they annotate, which would be especially useful when working with annotations outside the context of the edition website.

Listing 5: Sample annotation in W3C Web Annotation format

```
1   {
2     "@context": "http://www.w3.org/ns/anno.jsonld",
3     "type": "Annotation",
4     "creator": "marijn",
5     "target": {
6       "@context": "http://boot.huygens.knaw.nl/vgdemo/
               vangoghannotationontology.ttl",
7       "source": "urn:vangogh:letter=001:para=5",
8       "type": ["ParagraphInLetter", "Text"],
9       "selector": {
10        "type": "TextQuoteSelector",
11        "exact": "Oisterwijk",
12        "prefix": "your walks to",
13        "suffix": ". Yesterday there"
14      },
15    },
16    "body": {
17      "value": "Van Gogh attended school here",
18      "purpose": "commenting",
19      "type": "comment",
20      "format": "text/plain"
21    },
22    "id": "urn:uuid:a9ef2014-09fc-4de8-9a6b-fa683ae398f1",
23    "created": "2018-02-24T13:27:13.115715+00:00",
24  }
```

it is important to consider that these representations all refer to the same work, e.g. to point out that the word 'Oisterwijk' in the letter refers to a town in the Netherlands. Such an annotation refers to the letters as an abstract work, and thereby also to its different representations, regardless of whether the annotation is made on the English translation or on one of the Dutch transcriptions.

The Functional Requirements of Bibliographic Records (FRBR) is a model from Library and Information Science that defines o.a. these concepts of Work and Expression and how they relate to each other. A bibliographic record of a physical book in a library should serve multiple purposes (Svenonius 2000). For instance, to identify who the author of the book is regardless of which edition of the book is held by the library, the record should describe the book at the Work level. To

identify which edition of the book is available in the library, it should describe it at the Expression level. To establish whether the copy in the library is a hardcover or paperback version, the record should describe it at the Manifestation level. To locate the physical copy of the book in the library it should describe it at the Item level.

This model can be used to distinguish between different representations (Expressions) of an edited text (the Work), and to define their relationships. An annotation ontology for digital editions should allow online editions to distinguish between the edited text (Work and Expression in the editable domain) from the outcome of the editing process, namely its various representations (as Expressions in the edition domain).

This FRBR model has a translation in the semantic web domain, to make it possible to describe resources on the web at these different levels. $FRBR_{OO}$ (Bekiari et al. 2016) is a formal ontology of FRBR that defines that for instance an abstract work is a class (formalised as F1_Work) and that can have a relation (R9_realised_in) with an expression of that work (F2_Expression). The $FRBR_{OO}$ model is directly connected to the CIDOC Conceptual Reference Model (CIDOC/CRM, LeBeouf 2012), a generic ontology for describing concepts and information in cultural heritage and museum documentation. $FRBR_{OO}$ allows texts, their representations and relations to be specified in RDF triples and given explicit semantics. We define our generic annotation ontology and the van Gogh ontology as extensions of $FRBR_{OO}$. In this way we can address the van Gogh letter as an abstract work as well as address its different representations, and we can describe the relationships between these.

A formal conceptualization of the editable and edition domains using $FRBR_{OO}$ is shown in Figure 2 on the following page, taken from Boot and Koolen (2018). The editable domain contains both the abstract Work as conceived and created by Vincent van Gogh and the physical Document as the Manifestation[11] of that Work. Each text fragment (Positioned Text Fragment) belongs to both the abstract Work and its Manifestation (it is for instance both part of a paragraph and positioned on a page). The process of editing produces a number of representations, e.g. a Page Image in the form of a digital facsimile representing the Document, a Transcript of the text representing the Positioned Text Fragments and a Reading Text that realises the abstract Work.

The connection between our edition annotation ontology and the $FRBR_{OO}$ ontology is demonstrated in the triples in Listing 6 on page 189, which show some

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11 Technically, the Manifestation Singleton.
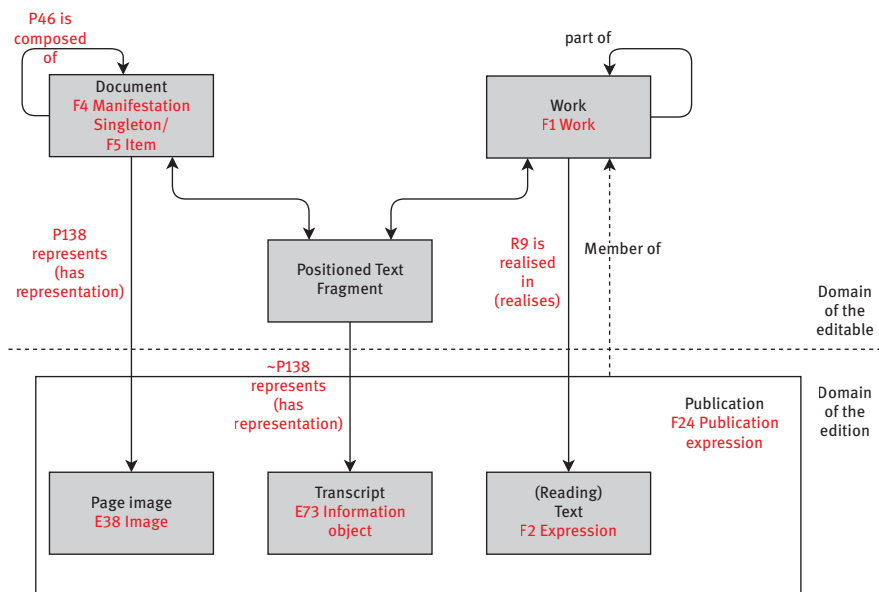
Fig. 2: A FRBR$_{OO}$-based ontology for the editable and edition domains. The concepts in red are the FRBR$_{OO}$ classes, the concepts and relations in black are subclasses defined in the edition annotation ontology.

of our classes as subclasses of the Erlangen implementation[12] of the FRBR$_{OO}$ and CIDOC ontologies.[13]

With this formalization, the letter and its representations can be semantically described, a fragment of which is shown in Figure 3 on the facing page. This analysis makes it possible to distinguish between an annotation on the abstract work (applies equally to all the representations of the work) and an annotation that only applies to a specific representation.

The prototype annotation tool we developed[14] allows users to specify whether their annotation refers to the representation that is visible in the web page, or to the underlying abstract work. When a specific representation is loaded in the

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12 http://erlangen-crm.org/ (17.10.2019)

13 From the edition annotation ontology:
http://boot.huygens.knaw.nl/vgdemo/editionannotationontology.ttl (17.10.2019)

14 The Scholarly Web Annotation tool consists of a client that can be loaded in edition webpages and a server that runs in the background to store and retrieve annotations, see https://clariah.github.io/scholarly-web-annotation/docs/development/ (17.10.2019)

Listing 6: Our ontology's classes as subclasses of FRBR$_{OO}$ and CIDOC/CRM

```
1   hi:AnnotatableThing rdf:type owl:Class ;
2     rdfs:label "AnnotatableThing" ;
3     rdfs:subClassOf ecrm:E71_Man-Made_Thing ;
4     rdfs:comment "E71 can be either E24_Physical_Man-Made_Thing
      (i.e. documents) or E28_Conceptual_Object (i.e. works)" .
5   hi:EditableThing rdf:type owl:Class ;
6     rdfs:label "EditableThing" ;
7     rdfs:subClassOf hi:AnnotatableThing ;
8     rdfs:comment "Realm of things that can be or have been edited" .
9   hi:EditionThing rdf:type owl:Class ;
10    rdfs:label "EditionThing" ;
11    rdfs:subClassOf hi:AnnotatableThing ;
12    rdfs:comment "Realm of things that result from editing" .
13  hi:Work rdf:type owl:Class ;
14    rdfs:label "Work" ;
15    rdfs:subClassOf efrbroo:F1_Work ;
16    rdfs:subClassOf hi:EditableThing ;
17    rdfs:comment "Works that are edited" .
18  hi:PartOfWork rdf:type owl:Class ;
19    rdfs:label "PartOfWork" ;
20    rdfs:subClassOf hi:EditableThing ;
21    rdfs:subClassOf ecrm:E89_Propositional_Object ;
22    rdfs:comment "Consists of parts of works that are edited" .
```
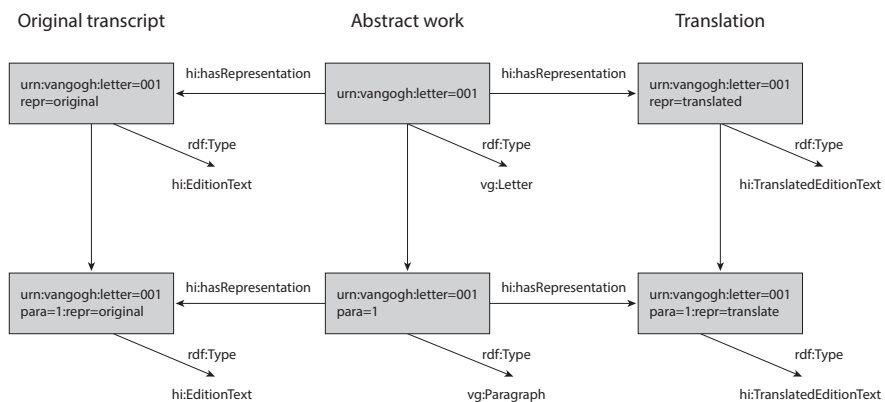

Fig. 3: A semantic description of the van Gogh letter as abstract work (middle) and the Dutch transcription (left) and English translation (right) using the Van Gogh Annotation ontology

webpage, the annotation tool scans the RDFa statements and ask the annotation server to retrieve all annotations on the resources described.

There are different ways in which the relationships between an abstract work and its representations can be made available to the annotation tool. The advantages and disadvantages of the various approaches we have tried are described in a separate article (Boot and Koolen forthcoming).

4 Facilitating third-party annotations

Although the technical approach described in the previous sections makes it possible to enable third-party annotation on digital editions, it bears considering what the potential consequences and impact are, for maintainers of the edition, for scholars annotating it and for other users. Should any user be able to annotate or should this be restricted? Should annotations be private and only visible to the creator of the annotation or to anyone using the edition? Where should the annotations be stored and who owns them? If only certain annotations are relevant to a wider set of users, how should a selection be made and who is responsible for this? What is the potential impact of showing third-party annotations alongside the edition for its users and for its maintainers?

4.1 The consequences

Given that social media technologies are present in almost every part of our online world, one may wonder why they are still almost completely absent from digital scholarly editions. It is possible that digital editors have not considered such technologies as relevant to their editions, or their implementation to be too expensive to include. Price (2016) discusses questions of quality control in the context of the Walt Whitman Archive: "How can the Archive best negotiate the roles of scholarly specialists and interested users, and in particular, how can quality control be established without discouraging user involvement?" In other words, editorial reticence may also be motivated by the fear of users adding inappropriate annotations, or having popular editions flooded with annotations that together make it difficult to see the forest for the trees. On top of that, third-party annotations may be undesirable for other reasons. Some may be highly idiosyncratic annotations that are only relevant to a very specific research topic. There may be annotations that are nonsensical or even a form of vandalism similar to some edits made on Wikipedia pages.

Many modern web platforms that allow users to create their own content offer options to keep content private, share it with specific others or make them publicly available. Such a permission model is relevant for third-party annotation as well. It is important that annotations can be kept private. Private annotations are often used by scholars for personal reflection (Bradley 2012) to structure their own thinking, keep track of their reading and guide the writing process. Annotations may become irrelevant or obsolete when shifting from exploring many potentially relevant materials to a narrower set of selected text that will be used in the subsequent analysis phase. As McCarty argues, the act of annotating is a form of 'knowing in doing' (McCarty 2020).

Yet some annotations may be more permanently relevant, and to more than just the creator and their immediate collaborators. If a researcher makes annotations on an edition and uses them in a research publication, they can decide or be urged to publish those annotations alongside the published article (Boot 2009). This will affect scholarship around digital editions, as it makes the thought processes of the authors more visible, leading to different interpretation or appreciation of their arguments, and even show what considerations ended up being left out of the publication. Moreover, this makes it possible for others to cite annotations.

Furthermore, annotations can provide broadly useful background information that the edition maintainers would like to incorporate as official enrichment or additional metadata for the edition. They may want to work with the creators of such annotations to incorporate them in the edition as curated data. Crowdsourcing annotations for digital editions can be a way to gather new knowledge and multiple perspectives on a text (Tonra and Barr 2014). It can also be a way to deal with budget constraints in cases where there is more material to annotate than there are means for in a project (Farley 2012).

This suggests that third-party annotations can transition from being 'for writing' (a form of 'knowing in doing' through the act of making the annotation) to being 'for reading' by others (by reading the annotation in context as a form of 'knowing in using') (McCarty 2020). In making third-party annotation possible for a certain digital edition, a permission model could be added that allows the creator of an annotation to update the permissions and share them with other users or make them entirely public.[15] In this transition, it may be necessary to revise annotations to make them comprehensible by others, or to create a separate set of public annotations while keeping the original annotations private.

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[15] Our implemented prototype already has options to make annotations private or public. We have drafted some further considerations and options for dealing with permissions. See https://clariah.github.io/scholarly-web-annotation-client/docs/discussion/handling-permissions.html (17.10.2019)

This is due to the changing nature of annotation while scholars move through the different phases of their research, from exploration to assembling materials, analysis and finally presentation (Melgar et al. 2017). In early phases scholars tend to use annotation more for bookmarking and commenting but gradually shift to more structured coding, analytical memos and linking between different (parts of) objects. An additional challenge in making annotations comprehensible and reusable for others, is to make clear what was the motivation and context of its creation: "An annotation created in a crowdsourcing context without the use of a formal ontology is suitable for other research questions than the same annotation created by a disciplinary expert who applies a related ontology" (Walkowski and Barker 2014).

Enabling third-party annotations can turn digital editions into living documents with ongoing communication that is visible in the context of the edition itself. Further thought and experimentation is needed to establish guidelines for how to deal with this. For very popular editions used by a wide audience, third-party annotations may result in creating an impenetrable mess that makes them hard to use. It might be necessary to give third-party annotators no option to make their annotation public, at least not directly. A more flexible solution would be to design ways to filter and organise annotations and being able to switch on or off different sets of annotations. One option is to let users specify their interest in different types of annotations or annotations on specific parts of an edition. In the domain of astronomy, the AstroShelf platforms addresses this by letting users create a personal profile in which they can register their interest in parts of the data, such as particular types of observations, regions of space or specific stars (Neophytou et al. 2012). The platform has a live annotation view module that notifies users of new annotations that target that data. Another way would be to have recommended subsets of annotations displayed as defaults, with others only visible upon request.

Edition maintainers may be interested in a feedback loop in which the ongoing communication around the edition can be incorporated as an official, curated part of the edition (Farley 2014). Edition maintainers could offer users specific annotation types for such purposes (for example for correcting transcriptions or for associating names in a correspondence with Wikipedia entries). Of course, this depends on the available resources for maintaining such a process and on the expectation of getting relevant annotations.

However, there is a middle ground between private annotations and public annotations. When project groups or classes can share annotations on an edition within their groups, this already has the effect of creating a living document and an alternative channel of scholarly communication; it is fundamentally different from sending annotations via email or keeping a shared but separate annotation

document or database (Holub et al. 2014). The focus widens from 'reader-content' interaction to include 'reader-reader' interaction (Siemens et al. 2017). Being able to see the annotations of collaborators in the context of annotated object creates a direct connection that leads to a different engagement with the text (Pearson et al. 2012).

The right level of sharing and displaying third-party annotations no doubt depends on the nature of the edition, the edition project and the expected audience. Therefore, the approach we propose here allows edition maintainers to choose in what way and to what extent annotations can be shared with others. The same goes for the ability to make fine-grained distinctions between different levels of representations and the underlying abstract works. Being able to make fine-grained distinctions between abstract work and representations and their relationships may be appropriate for scholarly users. For other users, the increase in complexity may confuse them and drive them away. On the spur of the moment, they may not want to think deeply about whether an annotation is relevant only to a specific representation or to others as well. Forcing them to choose can break their flow of active reading, while making it optional and using a default level can result in annotations inappropriately targeting irrelevant representations. This is again a question where we need much more experimentation.

4.2 Beyond digital editions

The presented annotation approach is relevant beyond digital scholarly (text) editions and can be used with images and multimedia objects as well (Melgar et al. 2016). For instance, it can relatively easily be implemented in digital archives of historical newspapers, television and radio broadcasts and other digitized or digital born materials relevant to research. Within the context of the Dutch research infrastructure project CLARIAH[16] we are currently experimenting with making this approach to annotation available for the historical newspaper archive at the Dutch National Library and are implementing the prototype in the Media Suite,[17] which gives access to the archive of Dutch public television and radio broadcasts of the Netherlands Institute for Sound and Vision,[18] where similar issues of representation and anchoring play a role. A television program can have multiple video representations at different resolutions, separate audio tracks and speech

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16 Common Lab Research Infrastructure for the Arts and Humanities, see https://clariah.nl/ (17.10.2019)

17 See https://mediasuite.clariah.nl/ (17.10.2019)

18 See https://beeldengeluid.nl/en (17.10.2019)

transcripts and temporally-coded textual summaries or scripts used for subtitles. Annotations may refer to the program as abstract work or to a specific representation. For instance, an annotation on a part of the audio track that transcribes what is said in the segment, may be relevant to align with the video track as well. An annotation that indicates that there is a glitch in the sound, is less relevant to connect to other representations.

Just as annotating is a scholarly primitive activity performed all across the Humanities, the problems of anchoring, semantics and representation are also relevant across different types of materials studied across Humanities disciplines, as is the need and desire for third-party annotation.

5 Conclusion

Online scholarly editions have the potential to engage and enhance scholarly discussion of its content and structure and become a living edition by allowing third-party annotation. We argue that third-party annotation functionality integrated in an online edition can engage users through more active reading and through more visible scholarly communication in the context of the edition. But to do this effectively, it is essential that annotations can refer to edition components and that the components of the edition are described semantically.

We deal with these issues using open semantic web standards and an ontology of the domain of scholarly editing. We have developed prototype annotation client and server technology that can easily be integrated in existing online editions.

A third-party annotation facility can shape scholarly communication around the edition. This requires decisions on roles and permissions of annotators, administrators and users as well as a careful consideration of the user interface. We have offered some suggestions to address these questions, but experimentation with actual editions and their users is obviously needed, in the domain of the scholarly edition as well as for other media published on the web.

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