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**al tempo delle Digital Humanities**

***Teaching and research***  
***in Digital Humanities' era***

edited by Stefano Allegrezza

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# Indice

<b>KEYNOTE LECTURES</b> .....	<b>7</b>
<b>L' "informatica umanistica" oggi, tra continuità e trasformazione</b> .....	<b>8</b>
Dino Buzzetti	
<b>Models as forms, models as concepts</b> .....	<b>9</b>
Øyvind Eide	
<b>Finding common ground between text, maps, and tables for quantitative and qualitative research</b> .....	<b>10</b>
Marieke Van Erp	
<b>Are the Digital Humanities 'language insensitive'? Connecting debates about Modern Languages, global cultural representation in DH and the international classroom</b> .....	<b>11</b>
Paul Spence	
<b>PANELS</b> .....	<b>12</b>
<b>Metodologie informatiche per le discipline umanistiche: stato dell'arte, criticità e proposte per una classe di laurea magistrale</b> .....	<b>13</b>
Francesca Tomasi, Alessandro Lenci <sup>2</sup> Anna Rovella, Franco Tommasi	
<b>Filosofia e Digitale?/Digital Philosophy?</b> .....	<b>17</b>
Luca Bandirali, Fabio Ciraci, Luigi Catalani, Francesca Di Donato, Riccardo Fedriga, Cristina Marras	
<b>L'uso degli applicativi HGIS-WebGIS nella ricerca geo-storica</b> .....	<b>23</b>
Tiago Luis Gil, Massimiliano Grava, Nicola Gabelliere, Vinicius Maluly	
<b>WORKSHOPS</b> .....	<b>27</b>
<b>Visualizing the Italian Literary Canon through Distant Reading</b> .....	<b>28</b>
Tiziana Mancinelli, Simone Rebora, Rachele Sprugnoli	
<b>LONG PAPERS</b> .....	<b>31</b>
<b>Per una filologia (digitale) degli scartafacci</b> .....	<b>32</b>
Elena Pierazzo, Alessia Marini	
<b>Can we do better than computers? Teaching Computational Thinking to Digital Humanists</b> .....	<b>34</b>
Marilena Daquino, Silvio Peroni, Francesca Tomasi	
<b>Developing digital research workflows among undergraduates</b> .....	<b>37</b>
Mike Cosgrave	
<b>L'ecosistema digitale per la cultura del piemonte. Strumenti e modelli per la condivisione della conoscenza dei beni culturali archivistici, librari e museali</b> .....	<b>42</b>
Dimitri Brunetti	
<b>SPARSAR recites Shakespeare's Sonnets – and Coping with Early Modern English variants</b> .....	<b>46</b>
Rodolfo Delmonte	
<b>"Digital Autoethnography" and "Connective Intelligence": Teaching and (Re)Thinking (About) Today's Techno-Society</b> .....	<b>49</b>
Stefano Calzati	
<b>Oltre la galassia delle Digital Humanities: per la costituzione di una disciplina di Informatica Umanistica</b> .....	<b>52</b>
Fabio Ciotti	

<b>Per un archivio digitale dell'Università Castrense di San Giorgio di Nogaro: saperi, pratiche, immagini durante la Grande guerra .....</b>	<b>57</b>
Dario De Santis	
<b>Funzione dell'edizione critica digitale nel contesto degli studi universitari. Questioni di scelte didattiche: studenti codificatori o studenti esecutori?.....</b>	<b>61</b>
Luciano Longo, Alba Castello, Natalia Librizzi, Ugo La Mantia	
<b>The Digital Repository Service of the National Documentation Centre in Greece: a model for Digital Humanities data management and representation .....</b>	<b>65</b>
Katerina Bartzi, Nikos Vasilogamvrakis, Elena Lagoudi, Despina Hardouveli, Evi Sachini	
<b>Didattica universitaria e ambienti digitali .....</b>	<b>72</b>
Chiara Panciroli, Anita Macaudo	
<b>The Use of Blockchain for Digital Archives: Challenges and Perspectives.....</b>	<b>78</b>
Clara Bacciu, Angelica Lo Duca, Andrea Marchetti	
<b>L'Oriente Foundation: un programma per l'introduzione delle nuove tecnologie nei curricula umanistici.....</b>	<b>82</b>
Johanna Monti, Valeria Caruso	
<b>Towards a Computational Stylistics of Book Reviews.....</b>	<b>86</b>
Massimo Salgaro, Simone Rebora	
<b>Lingue antiche e Digital Humanities: annotazione digitale dei testi tra ricerca e didattica.....</b>	<b>91</b>
G. Mugelli, G. Re, A. Taddei	
<b>Integrazione di dimensioni narrative e modalità immersive di esplorazione interattiva in visite educative museali .....</b>	<b>97</b>
Giovanni Luca Dierna, Alberto Machi	
<b>Narrazioni e frammenti, mosaici e algoritmi. La costruzione digitale del racconto tra spazialità e temporalità.....</b>	<b>104</b>
Federico Meschini	
<b>Il Trattato di Scienza Universal di Vivaldo Belcalzer: fra tradizione e segmentazione testuale. Prove di dialogo ecdotico .....</b>	<b>106</b>
Rosa Casapullo, Luciano Longo	
<b>Diogene alla ricerca dell'uomo contemporaneo: le Digital Humanities "lucerna" per riconoscere il Digital Cultural Heritage. La riflessione DiCultHer-AIUCD.....</b>	<b>110</b>
N. Barbuti, F. Ciotti, G. De Felice	
<b>Creating Digital Culture by digitizing Cultural Heritage: the Crowddreaming living lab method. ....</b>	<b>113</b>
N. Barbuti, Giuliano De Felice, Annalisa Di Zanni, P. Russo, A. Valentini	
<b>On the Use of Terminological Records in Specialised Translation.....</b>	<b>117</b>
Federica Vezzani, Giorgio Maria Di Nunzio	
<b>EpiCUM. Un museo epigrafico digitale per visitatori e specialisti .....</b>	<b>122</b>
Salvatore Cristofaro, Daria Spampinato	
<b>Digital Humanities and "Niche" Research Fields: The Case of Ancient Arabian Epigraphy.....</b>	<b>128</b>
Irene Rossi	
<b>Gli archivi personali nell'era digitale: stato dell'arte, criticità e prospettive .....</b>	<b>133</b>
Stefano Allegrezza	
<b>L'utilizzo dei database da parte degli storici:.....</b>	<b>138</b>
<b>storiografia e dibattito attuale.....</b>	<b>138</b>
Tiago Luis Gil	
<b>SHORT PAPERS .....</b>	<b>142</b>
<b>Analizzare, modellizzare e codificare i pareri di lettura editoriali .....</b>	<b>143</b>
Laura Antonietti	

<b>eLearning the URLCoFi - Digital Didactics for Humanists .....</b>	<b>146</b>
Armin Hoenen	
<b>14-18 Documenti e immagini della Grande Guerra .....</b>	<b>148</b>
Elisa Sciotti, Francesco Gandolfi	
<b>Il Laboratorio di Epigrafia Greca dell'Università Ca' Foscari. Una fucina didattica per l'epigrafia greca .....</b>	<b>150</b>
Eloisa Paganoni, Stefania De Vido, Claudia Antonetti	
<b>Complessità della codifica ed ergonomia strumentale nel contesto XML-TEI: dove siamo? (Bilancio a partire da un nuovo progetto di edizione digitale medievale) .....</b>	<b>152</b>
Marta Materni	
<b>“Osservate, leggete con me” Risorse LOD per la storia del melodramma: una prospettiva funzionale di rappresentazione .....</b>	<b>156</b>
Paolo Bonora, Angelo Pompilio	
<b>Le trascrizioni dei sogni dei sopravvissuti di Auschwitz: analisi linguistica e tematica secondo un modello Xml-Tei .....</b>	<b>161</b>
Carlo Chiaramonte, Francesco Figoli, Simone Mastrocesare, Daniele Silvi, Daniele Tosco, Marco Zanasi	
<b>Constructing Narratives Using NBVT: A Case Study .....</b>	<b>169</b>
Valentina Bartalesi, Daniele Metilli, Carlo Meghini	
<b>Progettare, realizzare e promuovere contenuti culturali digitali. Un esempio di didattica integrata: il progetto “Filosofia &amp; Migrazioni” .....</b>	<b>173</b>
Maria Eugenia Cadeddu, Francesca Gambetti, Cristina Marras, Ada Russo	
<b>Serious Games as immersive educational tools: a model for the Pathways of Romanticism (Porto, Portugal). .....</b>	<b>176</b>
João Victor Camara, Alice Lucas Semedo	
<b>A Corpus Linguistic Approach to Pronouns in a Work of Fiction: The Narrative Voices in Conrad's <i>The Shadow Line</i> .....</b>	<b>180</b>
Giuseppina Balossi	
<b>Corpora in classe – il caso della lingua serba per italofoeni.....</b>	<b>188</b>
Olja Perišić Arsić	
<b>Un'indagine sulle competenze digitali di studenti di facoltà umanistiche nativi digitali di ultima generazione .....</b>	<b>190</b>
Floriana C. Sciumbata	
<b>Crowdsourcing Peer Review in the Digital Humanities? .....</b>	<b>193</b>
Michael Soprano, Stefano Mizzaro	
<b>Le rappresentazioni digitali e le edizioni di documenti medievali online per la ricerca e la didattica della Diplomatica e della Storia della documentazione. Un caso concreto .....</b>	<b>196</b>
Antonella Ambrosio, Maria Rosaria Falcone, Vera Isabell Schwarz-Ricci, Georg Vogeler	
<b>La monografia digitale: una riflessione sulle implicazioni dell'innovazione testuale.....</b>	<b>200</b>
Alessandra Di Tella	
<b>Manzoni digitale: un laboratorio tra didattica e ricerca .....</b>	<b>203</b>
Beatrice Nava	
<b>Storia dell'informatica: metodi e strumenti per raccontarla da informatici .....</b>	<b>207</b>
Viola Bongini, Giovanni Antonio Cignoni, Emanuele Lenzi, Nicolò Fratelli	
<b>From collaborative transcription to interdisciplinary education: the postcards of the Great War case .....</b>	<b>211</b>
Enrica Salvatori, Federico Boschetti, Angelo Mario Del Grosso	
<b>Mapping the Persecution of Trentino People Deported to the 3rd Reich Camps .....</b>	<b>215</b>
Rachele Sprugnoli, Alessio Palmero Aprosio, Giovanni Moretti, Sara Tonelli	
<b>Text in metamorphosis: new aesthetics of digital humanities .....</b>	<b>220</b>
Herbert Natta	

<b>Un progetto per la consultazione on-line degli archivi del restauro (1850-1915).</b> .....	<b>223</b>
Gabriella Guarisco, Simonetta Ciranna, Chiara Devoti, Marco Felli, Elena Fioretto, Vittorio Foramitti, Rossana Gabaglio, Nora Lombardini, Alessandra Maniaci, Monica Naretto, Giuseppina Perusini, Elisa Piolatto, Martina Visentin	
<b>Strumenti di Laboratorio. Il Laboratorio Informatico per la Documentazione Storico Artistica del Dipartimento di Studi Umanistici e del Patrimonio Culturale dell'Università di Udine tra ricerca e didattica.</b> .....	<b>228</b>
Martina Visentin	
<b>Fondazione Memofonte: l'informatica «aiuta a razionalizzare la ricerca»</b> .....	<b>231</b>
Martina Nastasi, Donata Levi	
<b>The role of research infrastructures in the area of DH education, training and competence building.</b>	<b>233</b>
Tanja Wissik	
<b>Per un'edizione <i>online</i> dell'Epistolario di Alcide De Gasperi. Criteri di digitalizzazione, schedatura, regestazione ed edizione di lettere del Novecento</b> .....	<b>236</b>
Stefano Malfatti	
<b>POSTER PAPERS</b> .....	<b>241</b>
<b>Can the “digital” reinforce a museum’s mission - what information technologies to introduce into the planned exhibition?</b> .....	<b>242</b>
J. Valach, M. Eisler, P. Štefcová	
<b>Discovering Research Themes in Scientific Research: from Keyphrase Extraction to Co-occurrence Networks</b> .....	<b>244</b>
Rachele Sprugnoli, Giovanni Moretti	
<b>Hyper Spectral Imaging and the Herlufsholm Special Collection</b> .....	<b>248</b>
Jakob Povl Holck, Mogens Kragssig Jensen, Kamilla Jensen Husen, Anne Helle Jespersen	
<b>La <i>gamification</i> nella storia dell'arte e nella museologia: impatto sulla metodologia-</b> .....	<b>249</b>
Ana Knežević	
<b>LiLa: Linking Latin. Building a Knowledge Base of Linguistic Resources for Latin</b> .....	<b>252</b>
Marco Passarotti, Flavio M. Cecchini, Greta Franzini, Eleonora Litta, Francesco Mambrini, Paolo Ruffolo	
<b>Misurazione degli effetti organizzativi dei progetti digitali nelle reti documentali complesse</b> .....	<b>255</b>
Brizio Tommasi	
<b>Strolling around the dawn of Digital Humanities</b> .....	<b>261</b>
Gabriella Pardelli, Sara Goggi, Federico Boschetti	
<b>Time machines for Online Services: An Evaluation of a New Interface to Visualize Knowledge Over Time</b> .....	<b>265</b>
James Blustein, Nicola Raffaele Di Matteo	
<b>Uno sguardo nei depositi: l'esposizione multimediale dei reperti ceramici di Castelnovo del Friuli</b> ....	<b>267</b>
Irene Sarcinelli	
<b>Vita e i libri di guarnerio d'artegna: un percorso didattico nel digital storytelling laboratory</b> .....	<b>270</b>
Matteo Venier	
<b>A Catalog of Web App for Smart Teaching</b> .....	<b>273</b>
Marco Corbatto, Antonina Dattolo	



# Constructing Narratives Using NBVT: A Case Study

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## ABSTRACT

Narratives are a fundamental part of human life, starting from the epic poems of the ancient past to modern films. Since the 1970s, much research has been carried out to study the computational representation of narratives. Up to now, there is no standard definition of narrative. In our research, we intend narratives as networks of events defined by a narrator, endowed with participating entities (e.g. persons, location, time) and semantic relations. In this paper, we introduce the Narrative Building and Visualising Tool (NBVT), a semi-automatic software based on a formal ontology for narratives we developed. The tool allows users to construct and visualise narratives using Wikidata as reference knowledge base and Europeana for enriching the narrative with digital objects. As case study, we present the narrative of the life of the Austrian painter Gustav Klimt created using NBVT. Since Wikidata is not event-based, our efforts focus on the automatic extraction from Wikidata of the implicit events that compose the narrative. Furthermore, we developed a dedicated functionality in NBVT that finds the Europeana digital objects related to a particular event. This functionality matches the metadata of Europeana digital objects with the event and the participating entities using a similarity algorithm.

## KEYWORDS

Narrative, Semantic Web, Digital Libraries, Wikidata, Europeana

## INTRODUCTION

Narratives are a fundamental part of human life. Every human being encounters countless stories in their everyday life: from the ones told by people in casual conversation, to the epic poems of the ancient past. The reasons for this centrality of narrative are complex and still under study. A widely-held thesis in psychology is that humans make sense of reality by structuring events into narrative [3]. As aptly put by Taylor (1989), “[a] basic condition of making sense of ourselves [is] that we grasp our lives in a narrative” [13].

Despite the importance of narratives in human life, there is currently no way for a machine to understand narrative. Since the 1970s, much research has been carried out to study the computational representation of narratives [9]. However, to date there is still not a standard way to digitally represent narratives, visualise them, or share them on the Web. One issue is the difficulty in defining exactly what a narrative is. According to David Herman, a narrative is “a cognitive structure or way of making sense of experience, as a type of text, and as a resource for communicative interaction” [6]. Other scholars define narrative in a narrower way, e.g. a network of “temporally-indexed representations of events” [11].

In the last few years, we started investigating the introduction of narratives in Digital Libraries (DLs) using Semantic Web technologies. In particular, we developed a formal ontology for representing narratives [2] based on the CIDOC CRM standard vocabulary [4]. On the basis of the ontology, we built a semi-automated Narrative Building and Visualising Tool (NBVT)<sup>1</sup>, allowing users to construct and visualise narratives using Wikidata<sup>2</sup> as reference knowledge base (KB) [12]. In our study, we intend narratives as networks of events defined by a narrator, endowed with participating entities (e.g. persons, location, time) and semantic relations.

## STATE OF THE ART

Since the 2000s, in the context of DLs, several tools have been developed to organise and visualise digital collections using semantic models. For example, the CultureSampo project [7] developed an application to explore Finnish cultural heritage contents on the Web, based on Semantic Web technologies. The PATHS project [5] created a system that acts as an interactive personalised tour guide through existing digital library collections. The CULTURA project [1] developed a tool to enrich cultural heritage collections with guided paths in the form of short lessons. The CIPHER project [8] built a set of tools to facilitate the development of a narrative structure from existing or new contents.

In order to introduce narratives in DLs, we developed NBVT. In comparison with the existing tools which focus on specific domains of knowledge, NBVT adopts a domain-independent approach. Indeed, NBVT is based upon: (i) an ontology of narratives that aims to guarantee generality, interoperability and reuse; (ii) an open general-purpose knowledge base to populate the ontology model. This approach allows the construction of different

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<sup>1</sup> <https://dlnarratives.eu/tool.html>

<sup>2</sup> <https://wikidata.org>

types of narratives by different narrators, and it facilitates the fruition of the narratives from the widest possible audience.

## CONSTRUCTING THE NARRATIVE OF THE LIFE OF GUSTAV KLIMT USING NBVT

NBVT was designed for two kinds of narrators: (i) scholars who want to create a narrative starting from a text written by them, or (ii) general narrators (e.g. school teachers, students) who want to create a narrative based on a text written by someone else, or a narrative existing only in the narrator's mind.

In order to provide the narrator with events and entities to populate the narrative, NBVT uses Wikidata as reference KB. Wikidata is an open collaborative KB containing more than 50 million items organized on the basis of an ontology model [14]. Unfortunately, the number of events contained in Wikidata is relatively low, because Wikidata's ontology is not event-based. The knowledge about events is present in Wikidata, but it is generally represented in an implicit way. For instance, the birth of the Austrian painter Gustav Klimt is not represented as an event "Birth of Klimt", but instead the KB contains a statement of the form "Klimt *place of birth* Vienna". To solve this issue, we extracted the events implicitly contained in the KB, analysing all Wikidata properties and compiling a list of the ones that express implicit events. We collected these events in a graph that we call the Wikidata Event Graph (WEG). The graph is used to import events into NBVT.

We also made an experiment to enrich our narratives using the digital objects collected in Europeana<sup>3</sup>. Europeana is the largest European DL, containing descriptions of about 54 million cultural heritage objects in various formats from more than 3,500 European cultural institutions. In particular, as shown in Fig. 1, we developed a dedicated functionality in NBVT that finds the Europeana digital objects related to a particular event. This functionality matches the metadata of Europeana digital objects with the event and the participating entities using a similarity algorithm [10].

As case study, we used NBVT to create the narrative of the life of Gustav Klimt. This artist is well-represented in Europeana, where a search for the string "Gustav Klimt" currently returns 353 objects. Since we are not art historians, we decided to build the narrative based on the English Wikipedia page about the painter. For each event of the narrative, NBVT allows reporting entities from Wikidata, digital objects from Europeana, a textual description from Wikipedia and images from Wikimedia Commons.

The Klimt narrative is composed of 54 events. 31 of them are connected with Europeana digital objects, and 18 are linked to more than one digital object. The total number of digital objects in the narrative is 127, i.e. 36% of all Klimt-related objects in Europeana. It should be noted that several Europeana objects are not related to Klimt's biography, e.g. posters, modern objects inspired by Klimt. More than 70% of the entities used in the narrative were imported from Wikidata.

None of the 54 events that compose the narrative of the life of Gustav Klimt was explicitly present in Wikidata. After generating the WEG, the number of events that could be automatically detected in Wikidata is 34 (63% of the total). The

first version of the tool, presented in [10], allowed the creation of the narrative in about 3 person-days (7 hours per day). After adding the functionality to generate the WEG and to automatically extract and suggest to the user the relevant Europeana digital objects, the time was reduced to 10 hours.

The results of the case study show that NBVT constitutes a significant advancement for the task of digital narrative creation. Indeed, the narrator is able to easily import historical events and related entities from Wikidata and the WEG, thereby reducing the narrative creation workload in a significant way. Furthermore, the linking among different knowledge bases is facilitated since the narrator can easily enrich the narrative with any digital objects contained in the largest European digital library, and with text and images from Wikipedia and Wikimedia Commons.

Currently we are working to develop another significant feature for NBVT: the ability to import texts in natural language and extract events from them in an automated way.

## CONCLUSIONS

In the context of the Digital Humanities, and in particular of Digital Libraries, the narration of major cultural or historical events is a very central point. In this article we have presented NBVT, a semi-automatic tool that allows the creation of narratives that can be used in Digital Libraries.

Different kinds of users can benefit from our approach to create narratives. In particular, users could be: (i) scholars, such as historians, who can create and access narratives about the life and works of the authors they study; (ii) professors who want to use NBVT as a learning tool. A professor may create a narrative on a topic of study and show it to the students. At the same time, the tool could be used by the professor to verify the students' comprehension by asking them to create a narrative on a particular topic; (iii) exhibition or museum curators

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<sup>3</sup> <https://www.europeana.eu>

who can create a narrative that could be used during a monographic exhibition in order to associate the works of an artist to her/his biography and help the visitors to better understand the life and works of the artist. NBVT is based on a general ontology for narratives and on a general-purpose KB, i.e. Wikidata. Furthermore, it allows enriching the events of the narratives through Europeana digital objects. NBVT is domain-independent, thus it allows creating different types of narratives, from the history of the giant squid<sup>4</sup> to the evolution of climate change<sup>5</sup>.

As future work, we have planned to explore the automatic extraction of events from text. Adding this functionality to NBVT would make the narrative-building process faster and the user's work easier. However, automatic event extraction could also introduce inaccuracies in the narrative. We plan to analyse this problem in a further study.

The screenshot displays a digital narrative interface for Gustav Klimt. At the top, there are navigation buttons for 'BACK' and 'OTHER VISUALISATIONS'. The main title is 'GUSTAV KLIMT', with a subtitle 'Primary Source: Gustav Klimt's page on Wikipedia - https://en.wikipedia.org/wiki/Gustav\_Klimt'. The central focus is the 'Portrait of Sonja Knips' (1898), accompanied by a descriptive text: 'Klimt paints a lady from the Viennese elite, who was active with her husband in the circle of the Wiener Werkstätte. The face's plasticity contrasts with the soft inconsistency of the fluffy dress. In this diagonal composition, the evanescence of the chair, the book's red blur, the head surrounded by flowers, all anticipate the portraits of the golden period.' Below the text are sections for 'Secondary Sources' (Wikipedia, List of paintings by Gustav Klimt), 'Entities' (Gustav Klimt, Vienna, Portrait of Sonja Knips), and 'Digital Objects' (Study for the Portrait of Sonja Knips). At the bottom, a timeline from May 1895 to July 1903 shows various events as clickable cards, including 'Love', 'Music I', 'Beethoven Frieze', 'Klimt President of Ver Sacrum', 'Klimt President of the Wiener Sezession', 'Pallas Ath...', 'Portrait of ...', 'Garden wit...', 'Goldfish', 'Portrait of ...', 'Judith I', and 'Klimt in Ra Hope I'.

Figure 1. An event in the narrative of Gustav Klimt's life.

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<sup>5</sup> <https://dlnarratives.eu/timeline/climate.html>

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