THE BURNS ANTIPHONER: A PROJECT REPORT

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Abstract

In this paper authors report on a new project based around a 14th-century source, the Burns Antiphoner. In this project they focus on integrating and delivering images, metadata, and recorded audio and video to provide an in-depth look at the contents and experience of this particular source. Using high-resolution web-based image display technologies, they provide users with the ability to view small details on the page images, while integration with data collected in the CANTUS database provides a detailed view of the musical contents of each image, including liturgical function. A novel in-browser search system based on Lunr.js provides users with full-text and field-based search capabilities. Finally, authors explore the possibility of using Music Encoding Initiative (MEI) standards to encode and render the musical incipits, providing a valuable and open data source for publication and re-use.

Keywords: digital musicology, music encoding initiative, liturgical chant, digital scholarship
Ključne riječi: digitalna muzikologija, MEI (music encoding initiative - inicijativa za kodiranje glazbe), liturgijsko pjevanje, digitalno istraživanje

Introduction

Among Boston College's rare music holdings is a monophonic chant manuscript of unknown provenance copied in the mid-1300s in southern Germany, Austria or Switzerland.[1] Boston College Libraries purchased this manuscript in 1998 and it was identified by one of our music scholars, Dr Michael Noone, as a Franciscan antiphoner. The volume is a sanctorale that contains the offices for the feasts of Saints Francis and Clare, and a sequence for St Francis, which together indicate that it was most likely made *by* and *for* members of the Franciscan order. The *Burns Antiphoner* project (2015-2016) was a collaborative endeavor between the Digital Scholarship Group at the Boston College Libraries and musicologist Dr Michael Noone. Among our many partners were research assistants, external consultants, and database staff from the online CANTUS project.[2] The project presents over 1500 textual and musical incipits, as well as liturgical data from the manuscript in a searchable database. All of the incipits are encoded and presented in a dynamic interface using open-source tools and community standards. This open access, interactive project enables users to view high-resolution images side-by-side with incipits and data, as well as to conduct searches on the data and music notation. In addition to the searchable database and dynamic interface, a long-form narrative geared towards a non-specialist audience was written by Dr Noone and Dr Skinner to provide an historical introduction to the liturgical and musical practices associated with the antiphoner and the Franciscan order. In addition, they provide a description of such physical attributes of the manuscript as its binding, structure, and scribal hands. In order to illustrate how the music preserved in the antiphoner may have sounded, seven video performances recorded in the Spanish Primatial Cathedral in Toledo, Spain, by the specialist ensemble Schola Antiqua are featured.[3] Singing from a facsimile copy of the antiphoner, Schola Antiqua recorded these videos specifically for our project and their director, chant scholar Juan Carlos Asensio, provided a brief video introduction to the ensemble and the Burns manuscript.

About the manuscript

The manuscript is an early 14th-century Franciscan Antiphoner bound between leather-covered boards. It comprises 119 vellum folios that preserve text and music notation for the antiphons and responsories of the daily divine office of the liturgical

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[1] *Franciscan antiphoner (sanctorale) with sequences, circa 1300-1350*. MS.1996.097. John J. Burns Library, Boston College. http://hdl.handle.net/2345/2231.

[2] *The Burns Antiphoner*. Boston College Libraries. http://burnsantiphoner.bc.edu. Also see details about this and other projects on the Digital Scholarship Group website, https://ds.bc.edu/projects/.

[3] Performances can be viewed here: http://burnsantiphoner.bc.edu/performances/.
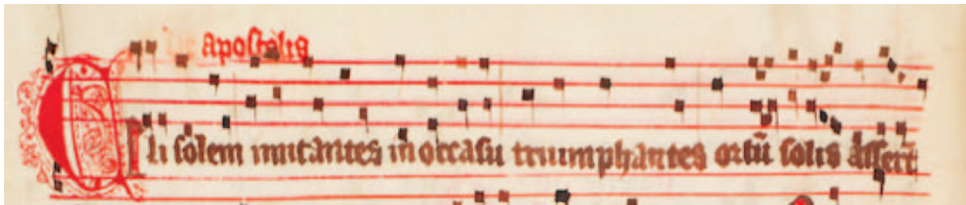
Figure 1: Folio 21r

Figure 2: Folio 89v

year's sanctorale cycle. Although our manuscript does not display the kind of superb calligraphy and illumination that is found in more precious presentation manuscripts, it is valuable precisely because it stands as a record of the actual daily practice of Gregorian chant in a late medieval Franciscan friary. Among its several interesting features are a number of palimpsests where the original copy (text and/or music) is erased and overwritten, either by the original copyist or a later scribe (Figure 1). In addition, there is the notable inclusion of a brief passage of written polyphony found in an otherwise entirely monophonic manuscript (Figure 2). This second feature is interesting, because it may help us further identify the provenance of the manu-

Figure 3: Folio 7r

script. Dr Noone believes that this antiphoner may have been copied by a German speaking scribe, possibly for use in a German speaking land. This reasoning is based on a single rubric indicating the beginning of the second nocturne at Matins of St. Agnes. It reads: *Der ander nocturnus* (Figure 3); every other rubric is written in Latin. Scholars and the public interested in learning more about how this manuscript was created and used, as well as about the Franciscan order, are provided with six narrative sections found on the website.[4]

Project background and process

We defined four goals for this project: 1) to develop an interactive, open access and responsive website with a searchable database and a dynamic presentation layer; 2) to use and develop open source technology, as this encourages and supports further development in the open source community; 3) to contribute our data to the international scholarly community through a collaboration with CANTUS, a database for Latin Ecclesiastical Chant; and 4) to develop software, workflows, and documentation that can inform future projects using similar technologies.[5]

Interactive manuscript

Prior to developing this project, the antiphoner was accessible online as a digitized object with a metadata record created by the digital library program at Boston College (Figure 4). While patrons could view high-resolution images, it was not possible to perform search queries on such parameters as a chant melody,

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[4] The six narrative sections about the manuscript, include a »Novice's Guide«, »Description«, »Structure«, »Contents«, »Performances«, and »Resources«.

[5] CANTUS can be accessed at http://cantus.uwaterloo.ca/.

Franciscan antiphoner (sanctorale) with sequences, circa 1300-1350

Abstract:	Gatherings 1-8: Proper of saints Andrew (30 Nov.), Lucy (13 Dec.), Thomas, Apostle (21 Dec.), Agnes (21 Jan.), Purification (2 Feb.), Agatha (5 Feb.), Annunciation (25 Mar.), De sanctis a festo Pasce usque ad Pentecostem, Philip and James (1 May), Inventio Crucis (May 3), John the Evangelist ante portam latinam (6 May), Birth of John the Baptist (24 June), Peter and Paul (29 June), Mary Magdalen (22 July), Laurence (10 Aug.), Assumption (15 Aug.), Beheading of John the Baptist (29 Aug.), Michael (29 Sept.), Francis (4 Oct), All Saints (1 Nov.), Martin (11 Nov.), Cecilia (22 Nov.), Clement (23 Nov.), Clare (12 Aug.); Celi solem imitantes (De Apostolia), Veni sancte spiritus et emitte celistus (De Sanctu Spiritu), Orbis totus gratulemur (De Beata Virgine) -- Gatherings 9-11: Common of saints, apostles, martyrs, confessors and bishops, virgins, dedication of a church; Hodierne lux diei (De Beata Virgine Maria), Celi cives in colono (De Beato Francisco) -- Appendix:Venite exultemus; Sancta Maria succurre miseris iuva pusillanimes; Celi regem attollamus et in voces erumpamus.
Persistent Recor...	http://hdl.handle.net/2345/2231
Creator:	Catholic Church
Date:	1300-1350
Format:	Musical notation
Genre:	book
Collection:	Franciscan antiphoner (sanctorale) with sequences, circa 1300-1350
Subject:	Antiphonaries
	Gregorian chants
	Music -- Manuscripts -- Early works to 1800
	Franciscans -- Liturgy
Note:	A second vocal part has been added to the first stanza of the sequence Celi solem imitantes, the only polyphonic source of this sequence.
	10 lines each of text (written in black ink in a gothic liturgical hand) and of music. Music in black square notation on a 4-line stave. Rubricated; initials in red, black and blue with penwork decoration.
	From South Germany (?), first half of 14th century.
	Bound with added fragment of a late 13th century manuscript as appendix containing nine variant settings of the psalm Venite exultemus.
	Late 16th or early 17th century blind-tooled calf over (original?) bevelled wooden boards.
Reproduction no...	Electronic reproduction. Chestnut Hill, Mass. : Boston College, University Libraries, 2011. Mode of access: Internet.
Physical Descript...	119 leaves of ms. music, bound : vellum ; 30 cm.
Language:	Latin
Identifier:	MS.1996.097
Use Restrictions:	These materials are in the public domain. No copyright permissions are needed. Acknowledgement of the Boston College University Libraries as a source for borrowed images is requested.

Click for more images

Figure 4: Metadata

text, or to isolate such specific data as liturgical occasion, genre, or mode. In our project, we seized the opportunity to produce an interactive manuscript with which scholars and the wider public could interact with granular data, explanatory text, and performances of a selection of chants – providing them with the kind of hands-on learning environment that static images simply cannot provide. A brief summary of our workflow, including tasks, standards, and technologies necessary for the development of this project will be discussed next.[6]

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[6] A poster outlining this workflow was presented during a poster session at DH2016. Anna KIJAS, *The Encoded Medieval Antiphoner: An Open Access Digital Source for Music and Liturgical Pedagogy and Scholarship*. DH2016. Krakow, Poland. http://dx.doi.org/10.17613/M68R3B (July 13, 2017).
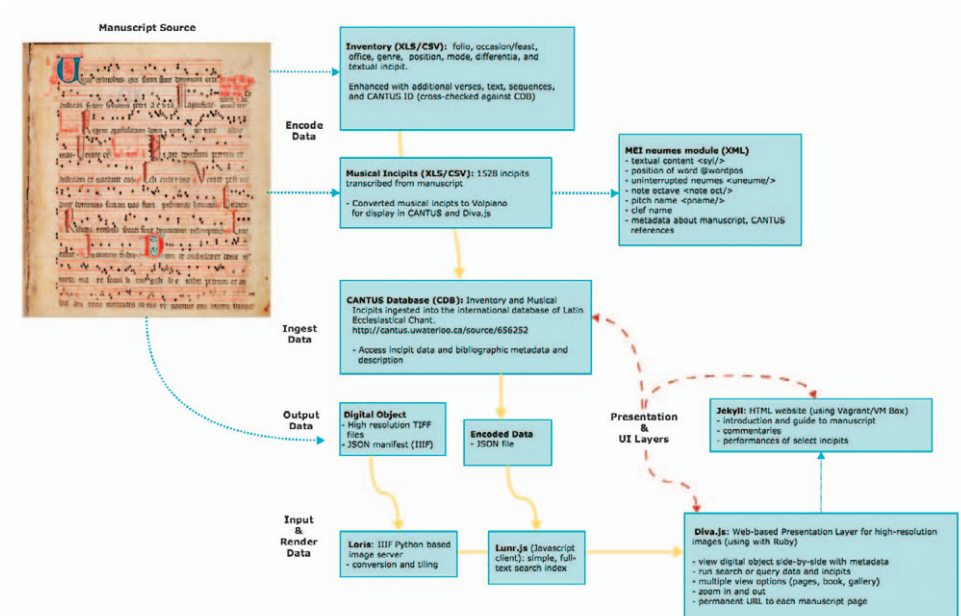
Technical workflow

Figure 5: Workflow

In order to create a searchable database, the textual and musical incipits had to be encoded so that they were machine readable for indexing and querying through a dynamic interface. We encoded the incipits according to the Music Encoding Initiative (MEI) schema, an open source standard for encoding musical documents that retains the original structure and semantics of notation types, such as neumes.[7] The MEI schema is expressed in XML and has associated customizations to validate MEI, as well as XSLT stylesheets, to convert MEI to other formats. Rather than immediately encode the incipits as XML, we created a CSV template with elements and attributes drawn from the MEI Neumes module so that our undergraduate researcher, Jonathan Mott, could easily transcribe 846 incipits (Figure 6). This process took about three months to complete and was later reviewed and enhanced by Dr Skinner and Dr Noone, expanding the incipits to a total of 1,528. Implementing this template made the process less overwhelming for our researchers who were not experienced MEI creators; it also enabled us to more easily review and make changes to the data, as well as later transform it from CSV to MEI.XML using a Ruby script. Each incipit in the manuscript is represented in its original structure, and each word is broken up by syllable <syl> in order to pre-

[7] Music Encoding Initiative, http://music-encoding.org/.

Incipit	<syl>	<rend color</>	<uneume name>	<note oct>	<pname> (1)	<pname> (2)	<pname> (3)	<pname> (4)
Unus ex duobus qui secuti sunt	U	blue	punctum	3	d			
Unus ex duobus qui secuti sunt	nus		clivis		d	c		
Unus ex duobus qui secuti sunt	ex		punctum		f			
Unus ex duobus qui secuti sunt	du		punctum		g			
Unus ex duobus qui secuti sunt	o		podatus		f	g		
Unus ex duobus qui secuti sunt	""		punctum		a			
Unus ex duobus qui secuti sunt	bus		clivis		a	g		
Unus ex duobus qui secuti sunt	qui		punctum		f			
Unus ex duobus qui secuti sunt	se		punctum		g			
Unus ex duobus qui secuti sunt	cu		punctum		a			
Unus ex duobus qui secuti sunt	ti		punctum		g			
Unus ex duobus qui secuti sunt	sunt		punctum		f			
Regem apostolorum dominum	Re	brown	podatus	3	g	a		
Regem apostolorum dominum	gem		punctum		g			
Regem apostolorum dominum	a		punctum		g			
Regem apostolorum dominum	pos		punctum		g			
Regem apostolorum dominum	to		punctum		g			

Figure 6: Template

Figure 7: Mei xml

serve the semantics of the neume notation. Each neume name, note octave, pitch name, and pitch name, and clef name is also identified. One task that remains for us is the addition of the position (@wordpos) of each marked-up syllable by identifying it as an i= initial, m=middle, or t=terminal syllable (Figure 7). It is important to note that the project viewer does not render the incipits directly from the MEI.XML file, because at this time Verovio[8] does not support the elements and attributes associated with the neume module[8] (Figure 8).

[8] Verovio is a music engraving library developed by the Swiss RISM Office that renders MEI files into SVG. http://www.verovio.org/index.xhtml.

Figure 8: Viewer

All of the data and code produced for this project is available to researchers in our GitHub repository.[9] We were invested in producing open data that is extensible and available to a wider community and one of our intentions was to contribute the data from the antiphoner to a prestigious international resource that is recognized and used by scholars, students, and librarians. For liturgical music scholars, the CANTUS database for Latin Ecclesiastical Chant, is such a resource. We collaborated with Debra Lacoste, Project manager, and Jan Koláček, Project Developer, to determine whether our data was structured well for batch ingest. Several enhancements and revisions were necessary, including representing feast names in Latin rather than in English and providing abbreviations for the Office, Genre, and Position Codes. In addition, several incipits originally omitted from the inventory were added for responsory verses and encoded according to MEI standards. Each incipit was cross-checked against the CANTUS database and assigned a CANTUS ID. Following the data review and revisions, our inventory and incipit data was formatted as CSV tables and ingested into CANTUS.[10] Each incipit text, for example: »Unus ex duobus qui secuti« is searchable in the index and appears with the corresponding elements (feast, office, etc.), as well as with a list of corresponding melodies (Figure 9). Some minor difficulties arose during the transformation of our notation incipits into Volpiano. For example, sequential duplicate chant sequences in the same folio would merge into one string in such cases as the

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[9] GitHub repository for Burns Antiphoner project, https://github.com/BCDigSchol/antiphoner-site.
[10] The Burns Antiphoner record and incipits can be viewed in CANTUS, http://cantus.uwaterloo.ca/source/656252.
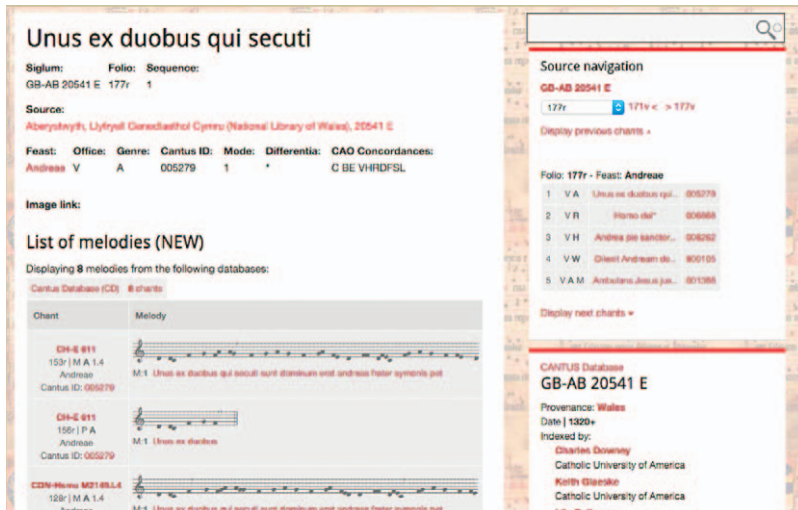
Figure 9: Cantus

Figure 10: Issues

following: folio 010v – »Obtulerunt pro eo domino« (Figure 10). Another round of review followed. Once the data was ingested into CANTUS, manual edits were made using the CANTUS editor dashboard.

Presentation and User Interface (UI) layers

The interactive Burns Antiphoner manuscript has a dynamic interface and uses Diva.js, an open source javascript image viewer and presentation layer developed by the Distributed Digital Music Archives & Libraries Lab (DDMAL) at McGill University.[11] We implemented Diva.js, because it provides a fast viewing experience utilizing minimum bandwidth for high-resolution document images. The viewer displays high-resolution TIFF files of the manuscript along with a IIIF JSON manifest that is served up using Loris, a IIIF-compatible image server (International Image Interoperability Framework).[12] The inventory and incipit data

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[11] Diva.js is a web-based, high-resolution document viewer, https://ddmal.github.io/diva.js/.

[12] The International Image Interoperability Framework (IIIF) supports interoperability between image repositories to provide greater access to image-based materials. Details and demos can be found here, http://iiif.io/. Our project's technical infrastructure and methodology is discussed here: http://burnsantiphoner.bc.edu/methodology/.

Figure 11: Performances

Figure 12: Search

encoded according to MEI standards was converted into a JSON file and indexed using Lunr.js, a simple, full-text search index. All of this content is then presented, searched, and accessed using the Diva.js viewer. The website where we host the project's text, multimedia, and Diva.js viewer was built in Jekyll with a customized HTML5UP theme.

In the viewer, each manuscript page is juxtaposed with corresponding incipits and data. When you select one of the incipits on the right, it displays corresponding data, including **Feast**, **Office**, **Genre**, and **Mode**. It also includes corresponding musical incipits displayed in a Volpiano font. Several performances from the manuscript are included in the manuscript viewer and are identified by a play button icon (Figure 11). Visitors to the site are able to search using keywords, pitch (volpiano font), genre, feast, office, and mode with each occurrence of the search query returned to you in the window on the right (Figure 12).

Conclusion

Our aim was to transform static images of a 14th century manuscript into a searchable database and dynamic interface, enabling access to data for manipulation, analysis, and future research or scholarship. The development of this project relied on collaboration with many talented people, was built on community standards, and the expertise of others across several areas or communities, including music encoding, digital libraries, music information retrieval, and digital scholarship.

Sažetak

BURNSOV ANTIFONAR: IZVJEŠĆE O PROJEKTU

Burnsov antifonar (burnsantiphoner.bc.edu) suradnički je projekt između *Digital Scholarship Group* i osoblja knjižnice *Boston College University Libraries*, muzikologa Michaela Noonea te nekoliko vanjskih suradnika, uključujući osoblje baze podataka CANTUS. U ljeto 2015. započeto je s kodiranjem franjevačkog antifonara iz četrnaestog stoljeća (http://hdl.handle.net/2345/2231), koristeći *Music Encoding Initiative* (MEI <http://music-encoding.org/>) standard te s razvojem internet stranice otvorenog sadržaja u svrhu prezentacije rukopisa kao interaktivnog objekta za istraživanje i znanstvenu uporabu. Izvorni Antifonar postoji u rukopisnom obliku ukoričen kožom prekrivenim daščicama i sastoji se od 119 pergamentnih folija s tekstualnim i notnim zapisima antifona i responzorijala za cjelokupni godišnji kalendar svetačkih svetkovina (sanktoral).

Ovo izvješće raspravlja o razvoju projekta i njegovim glavnim ciljevima, koji uključuju:

1. učiniti Antifonar interaktivnim izradom internetske stranice otvorenog i dostupnog sadržaja pomoću Diva.js, dinamičnog prezentacijskog sloja u kojem se može pretraživati i prikazivati sadržaj (podaci, notacija, XML/MEI) i multimedija;
2. korištenje i razvoj tehnologije otvorenoga koda u svrhu poticanja i podupiranja daljnjeg razvoja unutar *open source* zajednice, kao i dijeljenje dokumentacije i podataka;

3. dijeljenje projektnih podataka sa znanstvenom zajednicom preko suradnje s CAN-TUS-om <http://cantus.uwaterloo.ca/>, bazom podataka za crkveno pjevanje na latinskom jeziku; te

4. razvoj programa, tijek radova i dokumentacije u svrhu informiranja budućih projekata koji se koriste sličnom tehnologijom.

Proučava se tijek rada na transkripciji i kodiranju otprilike 1.500 incipita za ovaj projekt i bazu podataka CANTUS, uključujući neke poteškoće koje su se očitovale kroz rad na projektu. Osim toga, raspravlja se o ključnim rješenjima infrastrukture i aplikacija koje se primjenjuju u ovom projektu, uključujući implementaciju Diva.js kao prezentacijskoga sloja za dohvaćanje projektnih podataka preko JSON datoteke Lunr.js, kako bi se indeksiralo te podatke izravno u pregledniku, te korištenje IIIF, što omogućuje interoperabilnost slika iz projekta na različitim platformama.