



Easy as abcDE: Piano Fingering Transcription Online

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1. Overview

AbcDE, the Didactyl Editor for abc music notation, is a JavaScript library to assist researchers investigating the piano fingering problem:

- Facilitates developing piano fingering corpora
- Accelerates data collection
- Reduces tedium
- Improves quality
- Standardizes data format ("abcD")

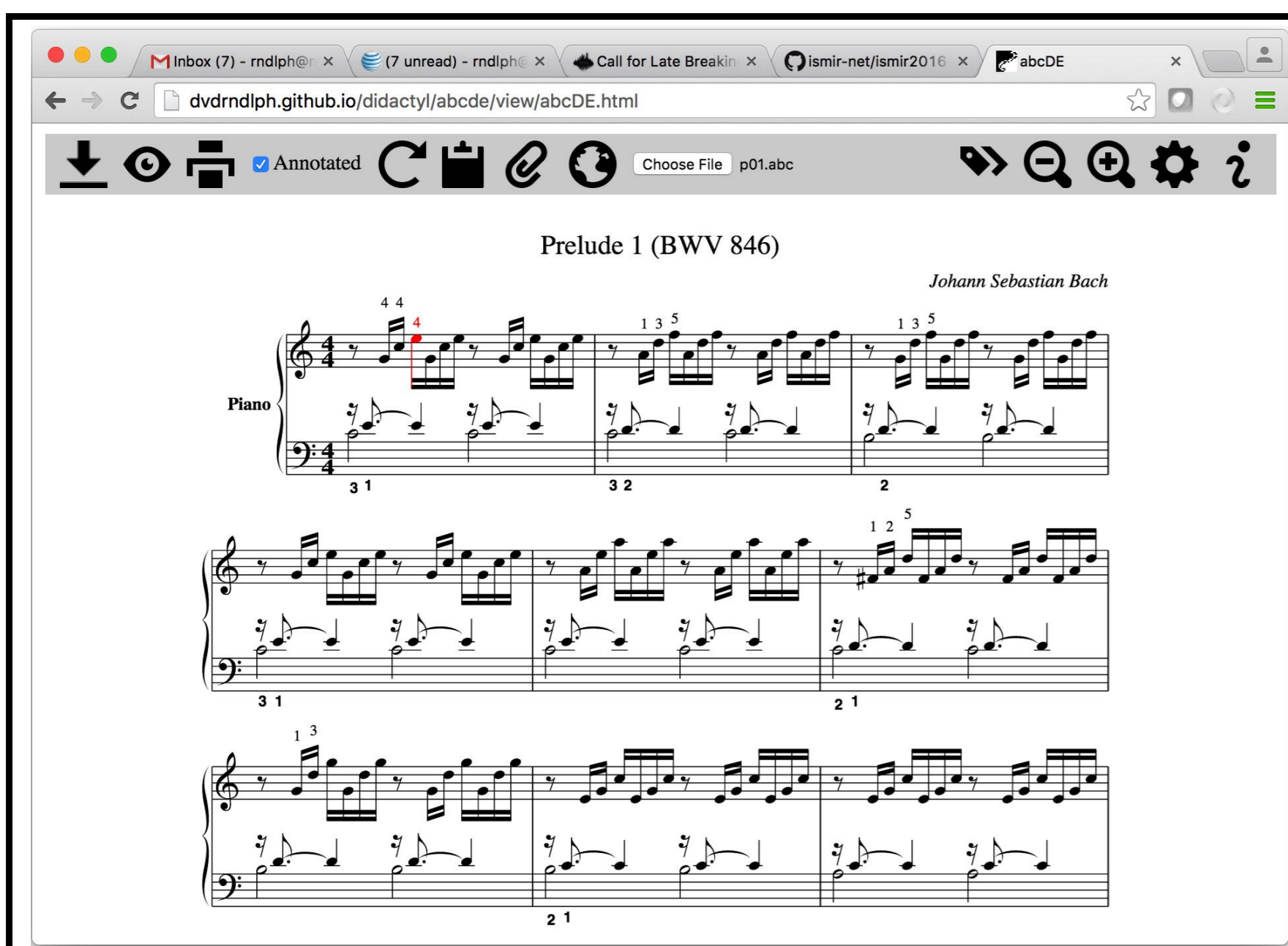


Figure 1: AbcDE in action in Chrome on Mac OS X.

Benefits

- Easily deployable as a web application
- Highly usable, with a what-you-see-is-what-you-get (WYSIWYG) paradigm to reduce data entry errors
- Scalable for data collection on the web (no more transcription of hand-written annotations)
- Configurable, with experimental design in mind
- Interoperable with Qualtrics survey tool (via its JavaScript API)
- Compatible with standardized, well-documented, and expressive new data file format (no need to roll your own)
- Flexible with respect to input definition (abc or the popular MusicXML format)
- Perfectly affordable (*gratis*)
- Mutable as open-source software (*libre*)

Used successfully with

- Chrome
- Safari
- Firefox
- Mobile (iOS and Android)
- Desktop (OSX and Windows)
- Qualtrics JavaScript API (mixed results)

2. Deployment

- Sample editor configurations
- Human readable source code
- Minimized library bundled with dependencies

All abcDE code is open source and released under the MIT license.

3. Implementation

AbcDE works with piano scores in

- abc (.abc)
- abcD (.abcd)
- MusicXML (.xml)
- Compressed Music XML (.mxl)

But transformation to abc is precursor to annotation because we leverage Moine's abc2svg library [6] for parsing and rendering.

User interface features:

- Navigate directly to notes by clicking
- Navigate using right and left arrow keys
- Unlimited undo and redo
- Copy/paste complete fingering sequences
- Platform independent zoom
- Automatic periodic save to browser's local storage
- Download as abcD
- Open content from URL or local file system
- Print standard notation or save as PDF
- Detailed online help

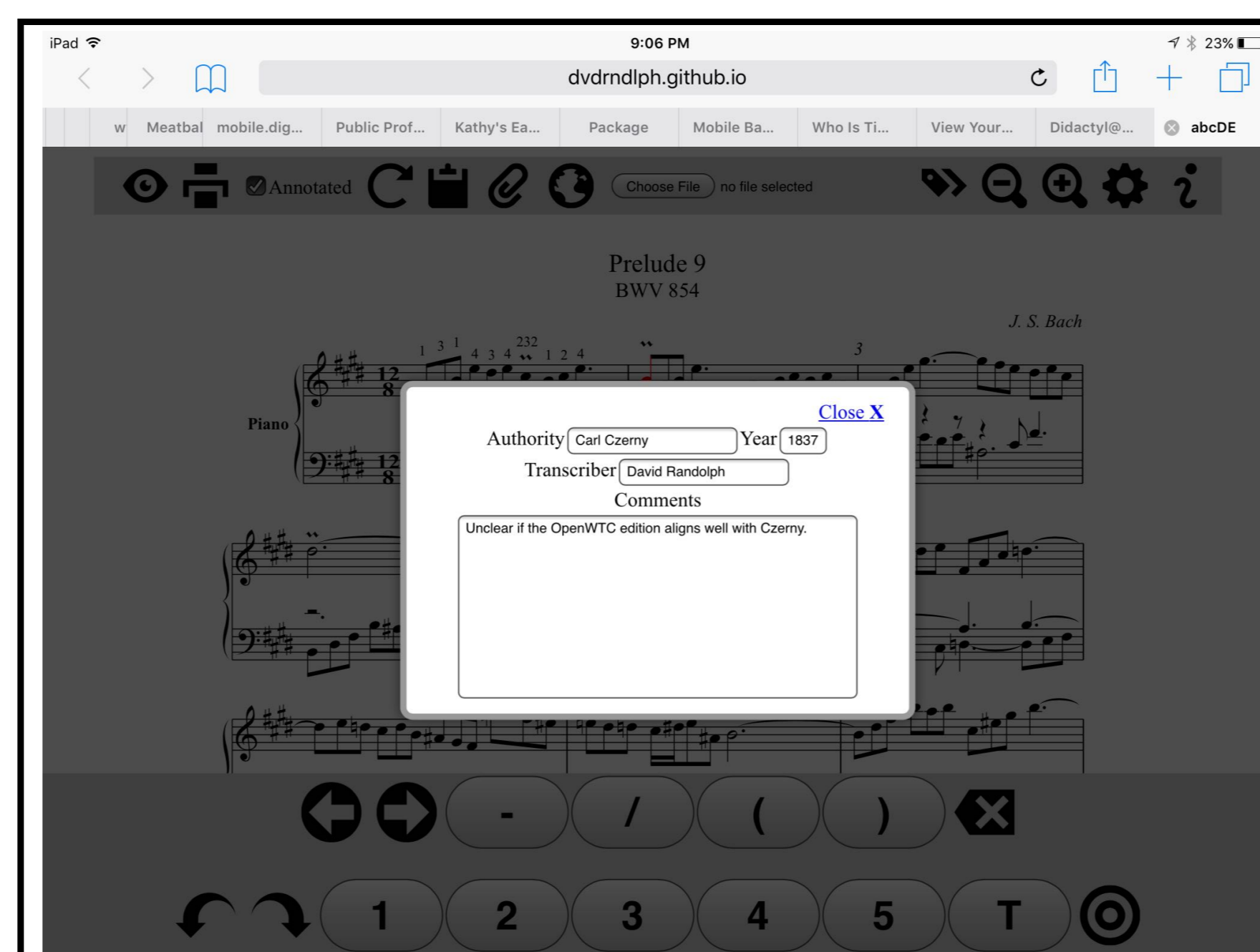


Figure 2: Metadata entry in Safari on iPad.

4. abcD File Format

AbcDE's native file format is called "abcD":

- Designed specifically for piano fingering
- Extends abc
- Adds fingering data
- Adds fingering provenance information

All valid abcD is also valid abc.

```
% abcDidactyl v5
% abcD fingering 1: 1/23231313123-14534@31 (3232) 31
% Authority: Joe Ivory (1847)
% Transcriber: David Bartleby
% Transcription date: 2016-06-29 12:49:02
% Joe Ivory is a mythical pianist.
% This is an example.
% abcDidactyl END
%%setfont-1 Bookman 11
%%setfont-2 Helvetica-Bold 11
X:1
T:abcD Demo
M:C
K:C
V:1 treble
!p!egfg egdg | cd'e2 abga:|
V:2 bass
[G,B,]4 z2 PG,2 |[G,B,]4z4:|
```

Listing 1: AbcD file example.



Figure 3: Rendered abcD file fragment.

5. abcDF Fingering Format

The extended Bachus-Naur form (EBNF) grammar displayed in Listing 2 is rendered into a PEG.js [4] transformer to allow parsing of abcD by abcDE.

```
sequence := staff ("@" staff)?
staff := line "&" staff | line | ""
line := (score_fingering)*

score_fingering := ornamental ("/" ornamental)?
| pedaled_fingering ("/" pedaled_fingering)?
```

```
| pedaling ("/" pedaling)?

ornamental := "(" (pedaled_fingering)+ ")"

pedaling := (soft)+ "x" (damper)+
pedaled_fingering := (soft)? fingering (damper)?

fingering := finger ("-" finger)?
finger := (hand)? digit

damper := "_" | "-"
soft := "p" | "f"
hand := "<" | ">"
digit := "1" | "2" | "3" | "4" | "5"
```

Listing 2: EBNF grammar defining the abcD format.

The format supports transcription of

- ornaments
- finger substitutions¹
- alternative fingerings²
- damper pedaling
- soft pedaling

The example in Listing 1 includes both a substitution and an alternative fingering. Unfortunately, abc does not currently support pedaling marks.

6. Corpus Development

Czerny Corpus

- Early abcDE version (leveraging abcjs [8])
- Requested complete annotation for seven short Czerny fragments [3] studied by Parncutt et al. [7]
- Deployed through Qualtrics
- 191 experienced pianists
- 1393 annotated fragments

WTC Corpus

- Latest version of abcDE
- Requested sufficient annotation for complete selections from *Open Well-Tempered Clavier* (WTC) [5]
- Deployed through Qualtrics and web server
- 29 experienced pianists
- Transcriptions of public-domain editorial scores by Czerny [1] and Tovey and Samuel [2]
- 72 annotated preludes and fugues

These corpora will be made public in the future.

7. Acknowledgments

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References

- [1] Johann Sebastian Bach. *The Well-Tempered Clavier: Forty-Eight Preludes and Fugues in Two Volumes*. G. Schirmer, New York, 1893.
- [2] Johann Sebastian Bach. *The Well-Tempered Clavier, Book 1*. Associated Board of the Royal Schools of Music, London, 1924.
- [3] Carl Czerny. *160 Kurze Übungen, Op. 821*. C. F. Peters, Leipzig, Germany, 1888.
- [4] David Majda. PEG.js: Parser Generator for JavaScript. <http://pegjs.org>, 2016. Accessed: 2016-06-27.
- [5] Olivier Miquel. Open Well-Tempered Clavier–MuseScore Edition. <https://musescore.com/open Goldberg/sets/openwtc>, 2015. Accessed: 2016-06-28.
- [6] Jean-François Moine. abc2svg. <http://moinejff.free.fr/js/index.html>, 2016. Accessed: 2016-06-27.
- [7] Richard Parncutt, John A. Sloboda, Eric F. Clarke, Matti Raekallio, and Peter Desain. An ergonomic model of keyboard fingering for melodic fragments. *Music Perception*, 14(4):341–382, 1997.
- [8] Paul Rosen. abcjs: JavaScript for Rendering abc Music Notation. <https://abcjs.net>, 2015. Accessed: 2016-06-28.

¹A finger substitution occurs when a different finger is used to release a key than the one that struck it.

²An alternative fingering applies to a note in a repeated section of music when a different fingering is used for the first iteration than for subsequent ones.