LilyPond

Il compositore tipografico per la musica

Saggio sull'incisione musicale automatizzata

Il team di sviluppo di LilyPond

Questo saggio tratta le funzioni di incisione musicale automatizzata nella versione di LilyPond 2.24.0.

Questo manuale è disponibile in altri formati ed è integrato col resto della documentazione. Maggiori informazioni in Sezione "Manuali" in *Informazioni generali*.

La documentazione completa si trova all'indirizzo `https://lilypond.org/`.

Per la versione di LilyPond 2.24.0

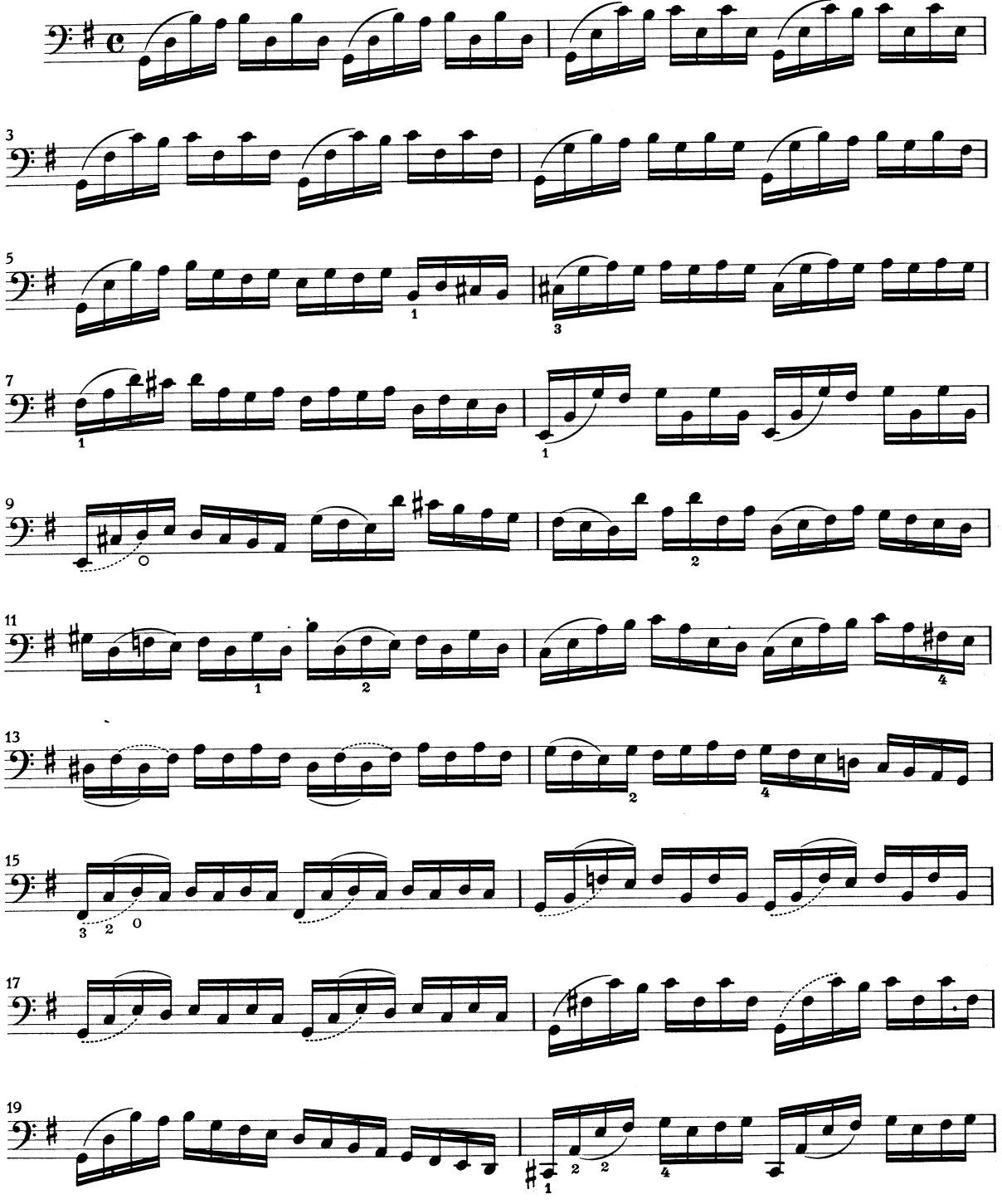
Sommario

Bärenreiter BA 320, ©1950:

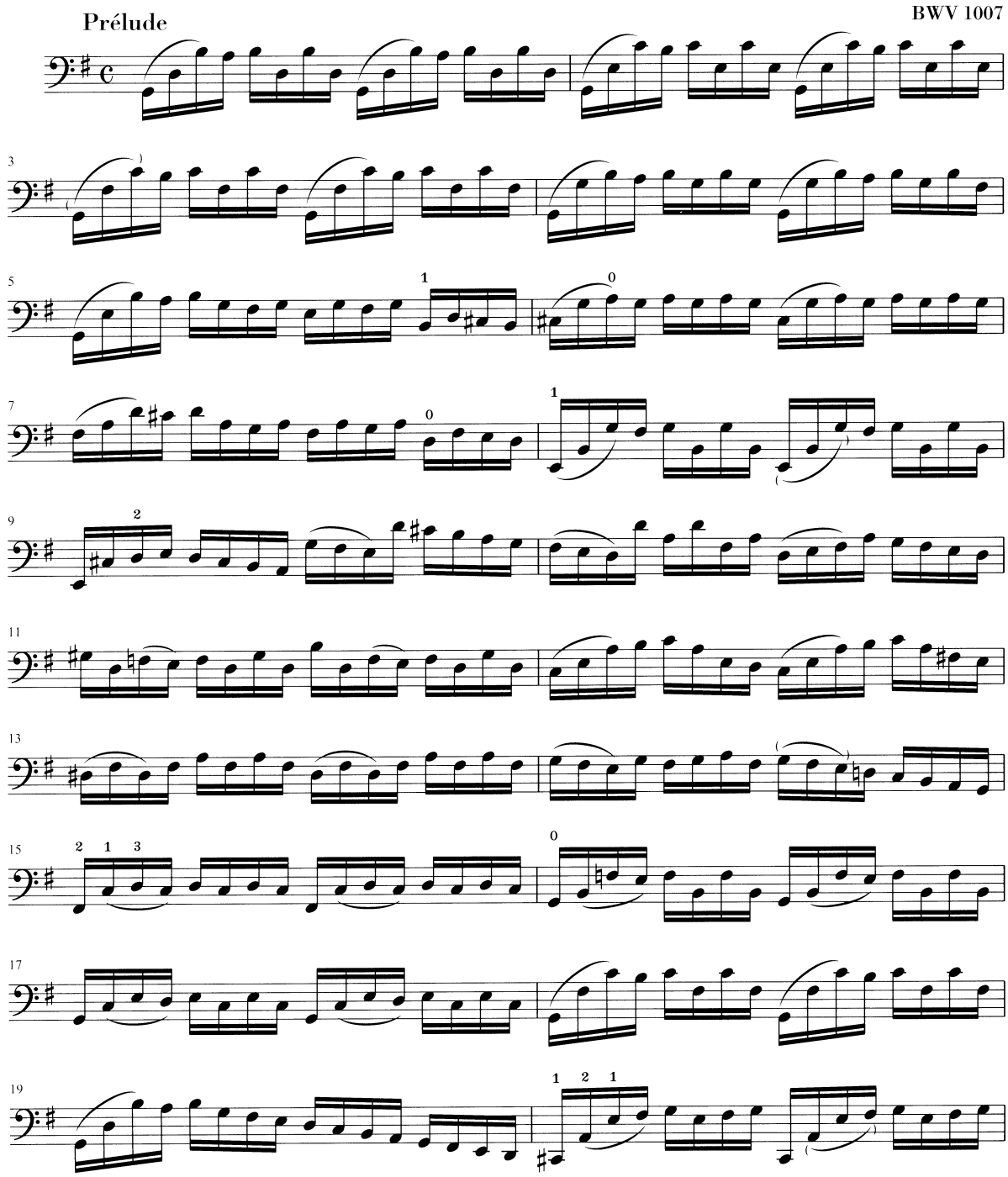
Suite I

BWV 1007

PRÉLUDE



Henle no. 666, ©2000:



1.2 Incisione in dettaglio

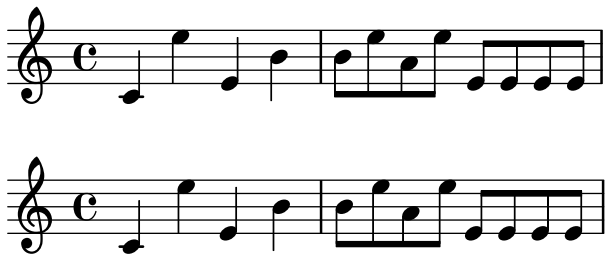
L'arte della tipografia musicale è chiamata *incisione (su lastra)*, un termine che deriva dalla pratica della stampa musicale a mano.[1] Solo pochi decenni fa, gli spartiti erano realizzati incidendo e punzonando la musica in modo speculare su una lastra di zinco o peltro. La lastra, poi, veniva inchiostrata e le depressioni prodotte da incisioni e punzonature trattenevano l'inchiostro. Imprimendo la carta sulla lastra, si produceva l'immagine della pagina. Punzonature e incisioni erano realizzate completamente a mano e correggere un errore era piuttosto laborioso, perciò l'incisione doveva essere praticamente perfetta al primo colpo. Saper incidere le lastre era una competenza che richiedeva un alto grado di specializzazione; un artigiano doveva sostenere quasi cinque anni di formazione prima di acquisire il titolo di maestro incisore, e per diventare veramente abile servivano altri cinque anni di esperienza.

LilyPond si ispira alle incisioni manuali tradizionali pubblicate per tutta la prima metà del XX secolo dalle principali case editrici musicali europee, tra cui Bärenreiter, Duhem, Durand, Hofmeister, Peters e Schott. Quei nomi e quel periodo storico sono talvolta considerati il culmine della pratica dell'incisione musicale artigianale. Avendo studiato queste edizioni, abbiamo imparato molto su come stanno le cose in uno spartito ben inciso e ne abbiamo individuato gli elementi da imitare con LilyPond.

Font musicali

Le immagini qui sotto mostrano alcune differenze tra un'incisione tradizionale e un tipico spartito prodotto dal computer. L'immagine a sinistra riproduce un bemolle preso da un'edizione Bärenreiter incisa a mano; quella a destra raffigura lo stesso segno ma preso da un'edizione della stessa musica pubblicata nel 2000. Nonostante che le due immagini siano stampate con la stessa tonalità d'inchiostro, la versione Bärenreiter sembra più scura: le linee del rigo sono più grosse e il bemolle appare audacemente arrotondato, quasi voluttuoso. Nell'immagine a destra, invece, le linee sono più sottili e il segno è piuttosto diritto e con spigoli vivi.

[1] I primi stampatori europei esplorarono diversi procedimenti, tra cui blocchi di legno intagliati a mano, caratteri mobili e sottili lastre metalliche incise. La tipocomposizione presentava il vantaggio di poter essere corretta più facilmente e di semplificare l'inserimento di testo e parole, ma solo l'incisione permetteva di impaginare la musica senza ostacoli e di inserire notazioni impreviste. Alla fine, gli spartiti incisi a mano divennero lo standard per tutta la musica stampata, con l'eccezione di alcuni inni e canzonieri per i quali la tipocomposizione era giustificata per il fatto di essere più semplice ed economica, anche nel XX secolo.

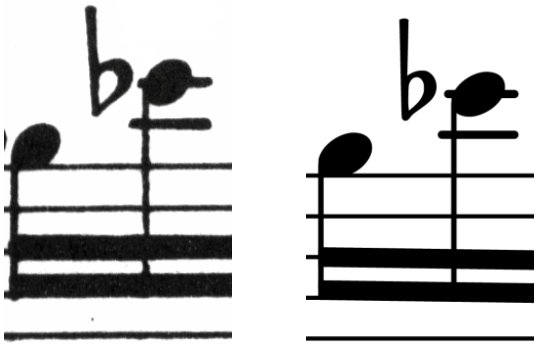


Ciascuna misura contiene unicamente note da suonare in un ritmo costante, e gli spazi interposti dovrebbero riflettere questa situazione. Purtroppo, però, l'occhio ci inganna un po': non solo esso rileva la distanza tra le teste delle note, ma tiene conto anche di quella tra gambi consecutivi. Di conseguenza, le note di una combinazione gambo in su/gambo in giù dovrebbero essere più distanti tra loro e quelle di una combinazione gambo in giù/gambo in su più vicine, il tutto a seconda di come si combinano le posizioni verticali delle note. Le due misure inferiori sono stampate con questa correzione; quelle superiori, tuttavia, contengono ammassi di note gambo in giù/gambo in su. Un maestro incisore avrebbe aggiustato la spaziatura come richiesto per compiacere l'occhio.

Gli algoritmi di spaziatura di LilyPond prendono in considerazione anche le stanghette. Perciò, l'ultimo gambo in su nell'esempio correttamente spaziato è stato allontanato ulteriormente dalla stanghetta finale per evitare troppe linee verticali vicine nella parte finale della misura. Un gambo in giù, invece, non avrebbe richiesto quest'accortezza.

Tagli addizionali

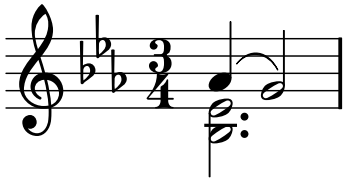
I tagli addizionali presentano una sfida tipografica: rendono più difficile inserire il corretto spazio tra simboli musicali vicini e debbono essere abbastanza nitidi da permettere di identificare l'altezza della nota a colpo d'occhio. Nell'esempio qui sotto, vediamo come i tagli addizionali dovrebbero essere più spessi di una normale linea del rigo e che un incisore esperto li accorcerà per permettere di avvicinare le alterazioni alla testa della nota. Nell'incisione con LilyPond abbiamo incluso anche questa funzionalità.



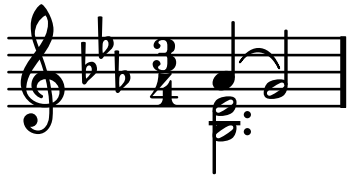
Dimensionamento ottico

Potrebbe essere necessario stampare la musica in una varietà di formati diversi. All'inizio, questo si poteva ottenere creando punzoni in ciascuno dei corpi richiesti, il che significa che ogni punzone era disegnato per dare il meglio di sé in quel particolare corpo. Con l'avvento dei font digitali, invece, una singola struttura può essere rimpicciolita o ingrandita in scala a piacimento, il che è molto comodo, ma nei corpi più piccoli i caratteri appariranno molto 'leggeri'.

In LilyPond, abbiamo creato font in una serie di pesi corrispondenti a una gamma di corpi per la musica. La prossima è un'incisione di LilyPond in corpo 26:

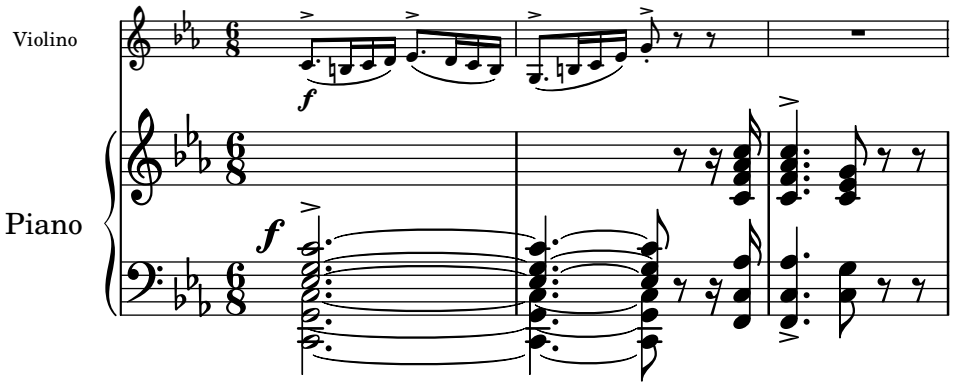


e questa è la stessa incisione in corpo 11, poi ingrandita del 236% per riportarla alle stesse dimensioni dell'esempio precedente:



Nei corpi piccoli, LilyPond usa linee proporzionalmente più grosse in modo che la musica sia ancora ben leggibile.

Ciò permette anche che righi in corpi diversi coesistano pacificamente se usati insieme sulla stessa pagina:



Perché lavorare così duramente?

Di solito, i musicisti sono presi più dall'eseguire la musica che dall'esaminarla così come appare sulla pagina, perciò i dettagli tipografici troppo cavillosi rischiano di passare per accademia. Ma non è così. Gli spartiti sono materiale da utilizzare praticamente: ogni cosa viene fatta per aiutare il musicista a migliorare il proprio rendimento, e tutto ciò che si rivela poco chiaro o poco piacevole da leggere diventa un ostacolo.

La musica incisa nel modo tradizionale impiega simboli neri su un rigo 'pesante' per creare un aspetto forte, ben bilanciato, chiaramente distinguibile quando è molto distante da chi deve leggerla: se messa su un leggio, per esempio. Un'attenta distribuzione degli spazi bianchi permette di disporre le note in modo molto serrato senza però affollare i simboli sul rigo. Il risultato riduce al minimo il numero delle voltate, con grande vantaggio per l'esecutore.

Questa è una caratteristica tipica della tipografia. L'aspetto della pagina dovrebbe essere bello, e non di per sé, ma soprattutto perché aiuta il lettore nel proprio compito. Per la musica stampata ciò è doppiamente importante, perché i musicisti reggono un carico di attenzione limitato: meno ne debbono impiegare per leggere la musica, più ne possono concentrare nell'eseguirla. In altre parole: migliore è la tipografia, migliori saranno le esecuzioni.

Questi esempi dimostrano che la tipografia musicale è un'arte raffinata e complessa, la cui messa in pratica richiede notevoli competenze di solito non possedute dai musicisti. LilyPond

costituisce il nostro sforzo per importare l'eccellenza grafica della musica incisa a mano nell'era informatica e renderla disponibile a qualunque musicista. Abbiamo sintonizzato i nostri algoritmi, i disegni dei font e le impostazioni del programma per produrre stampe corrispondenti alla qualità delle vecchie edizioni che amiamo osservare e suonare.

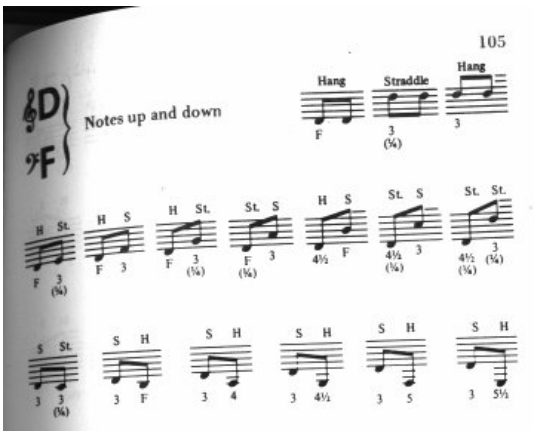
1.3 Incisione automatizzata

Qui descriviamo ciò che serve per creare un software in grado di simulare l'aspetto degli spartiti incisi: un metodo di descrizione della buona formattazione al computer e numerosi confronti dettagliati con incisioni effettivamente esistenti.

Concorsi di bellezza

In che modo noi decidiamo veramente sulla formattazione? In altre parole: quale delle tre configurazioni seguenti dovremmo scegliere per avere la legatura migliore?

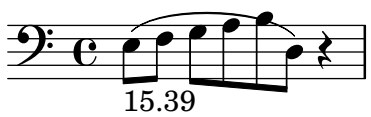
Esistono pochi libri sull'arte di incidere la musica, i quali, purtroppo, si limitano a fornire alcune semplici regole generali e qualche esempio. Da esse si può imparare qualcosa, ma sempre troppo poco per mettere a punto un algoritmo implementabile senza troppa fatica in un computer: seguendole, le eccezioni da codificare a mano sarebbero ancora troppe. Analizzare tutti questi casi è un lavoro enorme, e spesso nemmeno tutti vengono contemplati:



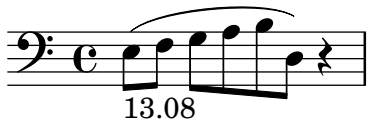
(Fonte: Ted Ross, *The Art of Music Engraving*)

Anziché cercare di scrivere regole di formattazione dettagliate per ogni situazione possibile, dobbiamo solo descrivere gli obiettivi in modo sufficientemente completo da permettere a LilyPond di giudicare da solo l'attrattiva delle diverse possibilità. Poi, per ogni configurazione calcoliamo un punteggio di bruttezza e scegliamo quella meno brutta.

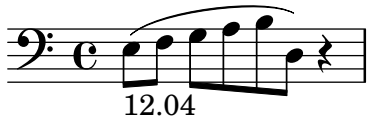
Per esempio, qui sotto mostriamo tre possibilità per una legatura, a ciascuna delle quali LilyPond ha assegnato un punteggio in 'punti di bruttezza'. Il primo esempio ottiene 15,39 punti perché la legatura attraversa una delle teste delle note:



Il secondo è più bello, ma la legatura non comincia o finisce sulle teste delle note. Ottiene 1,71 punti a sinistra e 9,37 punti a destra, più altri 2 punti a causa del fatto che la legatura ascende mentre la melodia discende, per un totale di 13,08 punti di bruttezza:



La legatura finale ottiene 10,04 punti per il vuoto a destra e 2 punti per la pendenza verso l'alto, ma è la più attraente delle tre configurazioni, e così LilyPond sceglie questa:

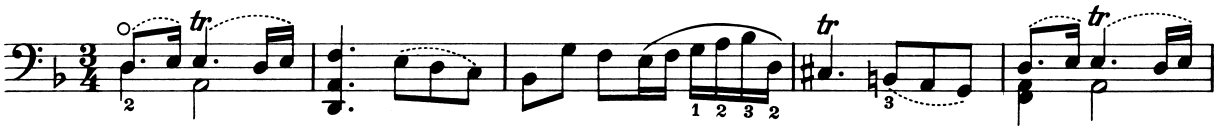


Questa tecnica è del tutto generale e viene adoperata per prendere decisioni ottimali in merito alla configurazione dei gambi delle note, delle legature di valore e dei punti negli accordi, nelle interruzioni di rigo e di pagina. Si può giudicare la bontà di queste decisioni confrontandole con incisioni effettivamente esistenti.

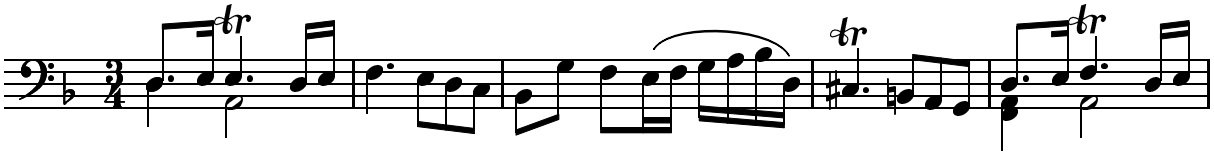
Miglioramento per analisi comparativa

Gli spartiti generati da LilyPond sono migliorati gradualmente nel tempo e continuano a migliorare grazie al confronto con quelli incisi a mano.

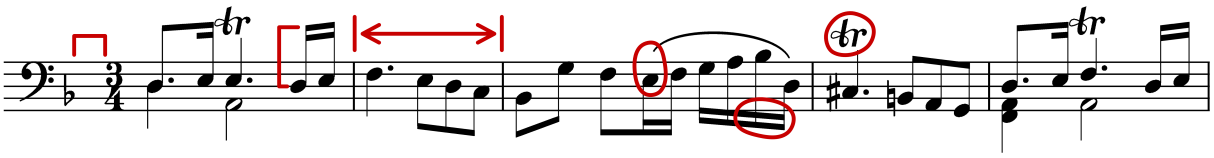
Per esempio, qui sotto si vede una riga di un brano di riferimento preso da un'edizione incisa (Bärenreiter BA320):



e qui la stessa citazione realizzata con una vecchissima versione di LilyPond (versione 1.4, maggio 2001):



La musica prodotta da LilyPond 1.4 è senza dubbio leggibile, ma un confronto serrato con lo spartito precedente ha mostrato numerosi errori nei dettagli di formattazione:

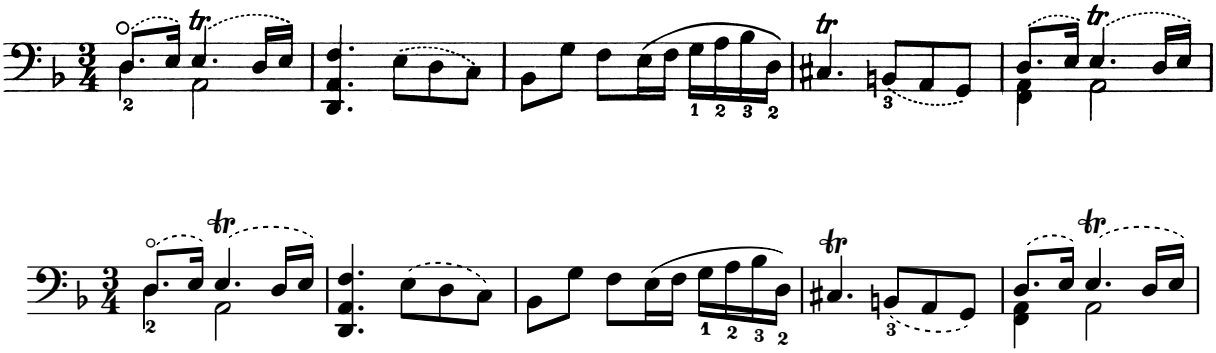


- c'è troppo spazio prima dell'indicazione di tempo
- i gambi delle note con travature sono troppo lunghi
- la seconda e la quarta misura sono troppo strette
- la legatura ha un aspetto imbarazzante

- le indicazioni di trillo sono troppo grandi
- i gambi sono troppo sottili

(Mancavano anche due teste di note, alcune indicazioni editoriali e c'era un'altezza errata!)

Aggiustando le regole di formattazione e il disegno del font, lo spartito è notevolmente migliorato. Confrontate lo stesso spartito di riferimento e quello prodotto con la versione corrente di LilyPond (2.24.0):

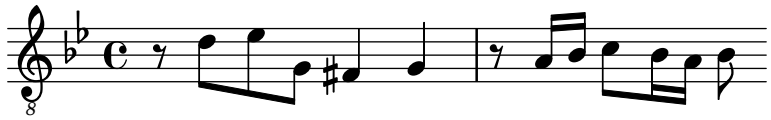


Non è certo un clone dell'edizione di riferimento, ma è comunque molto più vicino a una qualità editoriale rispetto alla versione precedente.

Mettere le cose a posto

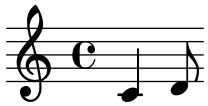
Siamo in grado di misurare l'abilità di LilyPond nel prendere decisioni sull'incisione della musica anche confrontando il suo prodotto con quello di un software commerciale. In questo caso abbiamo scelto Finale 2008, uno dei programmi di notazione musicale a pagamento più diffusi, in particolare nel Nord America. Sibelius è il suo più acerrimo rivale e sembra andare particolarmente bene nel mercato europeo.

Per il nostro confronto, abbiamo selezionato la Fuga in sol minore dal Libro I del *Clavicembalo ben temperato* BWV 861 di Bach, il cui soggetto d'apertura è



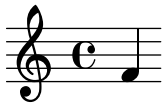
Abbiamo inciso le ultime sette misure del brano (n. 28–34) con Finale e con LilyPond. In questo punto della composizione, il soggetto ritorna in uno stretto a tre parti e conduce alla sezione finale. Abbiamo resistito alla tentazione di apportare qualunque modifica al prodotto predefinito di Finale, perché stiamo cercando di mostrare che cosa ciascun software riesce a fare da solo, senza interventi umani. Le uniche modifiche di rilievo introdotte sono state aggiustare le dimensioni della pagina per adattarla a quelle di questo saggio e forzare la musica in due soli sistemi per rendere più agevole il confronto. Per impostazione predefinita, invece, Finale avrebbe inciso due sistemi di tre misure ciascuno e un terzo sistema contenente la sola misura finale larga tutta la riga.

Molte delle differenze tra le due versioni si concentrano nelle misure 28–29, come mostriamo qui di seguito (Finale sta sopra):



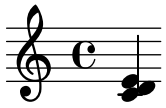
A scala microscopica, una sintassi simile si adopera facilmente. A una scala più larga, però, anche la sintassi ha bisogno di una struttura. In quale altro modo, altrimenti, sarebbe possibile scrivere brani complessi come sinfonie e opere liriche? La struttura è formata dal concetto di espressioni musicali: combinando minuscoli frammenti di musica in frammenti più consistenti, possiamo esprimere musica più complessa. Per esempio

```
f'4
```



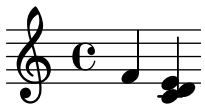
Possiamo costruire note simultanee racchiudendole tra << e >>:

```
<<c4 d4 e4>>
```



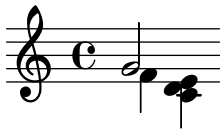
Possiamo mettere in sequenza queste due espressioni racchiudendole tra parentesi graffe { ... }:

```
{ f4 <<c4 d4 e4>> }
```



Anche quella qui sopra è un'espressione, perciò può essere ulteriormente combinata con un'altra espressione simultanea (una minima, in questo caso): <<, \\, e >>:

```
<< g2 \\ { f4 <<c4 d4 e4>> } >>
```



Strutture ricorsive come quelle appena esaminate possono essere specificate in modo pulito e formale in una grammatica indipendente dal contesto, la quale genera anche il codice di analisi. In altre parole, la sintassi di LilyPond è definita in modo chiaro e privo di ambiguità

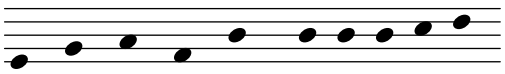
Interfacce utente e sintassi sono gli elementi immediatamente visibili agli utenti e quelli con cui essi hanno più a che fare. Un po' sono una questione di gusto, un po' l'argomento di molte discussioni: non troppo produttive, però, nonostante qualche pregio ce l'abbiano. Nel quadro più ampio di LilyPond, la sintassi di input non è molto importante: inventare una sintassi pulita è facile; molto più difficile, invece, è scrivere un codice di formattazione decente. Contiamo le righe di codice destinate ai due componenti e troveremo la conferma di quanto abbiamo appena affermato: analisi e rappresentazione occupano meno del 10% del codice sorgente.

Nel progettare le strutture usate in LilyPond, abbiamo preso decisioni diverse da quelle che appaiono in altri programmi. Considerate la natura gerarchica della notazione musicale:

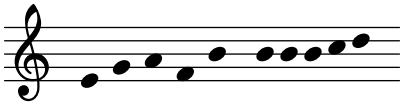
programmabili: ciascun tipo di simbolo è gestito da un modulo a sé, un cosiddetto plug-in, completamente modulare e indipendente, così da poter essere sviluppato e migliorato separatamente. Tali plug-in sono chiamati *incisori* per analogia con l'artigiano che traduce le idee musicali in simboli grafici.

Nell'esempio seguente, cominciamo con il plug-in per le teste delle note, il `Note_heads_engraver`.

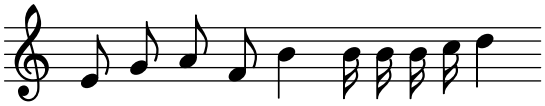
Poi il `Staff_symbol_engraver` aggiunge il rigo,



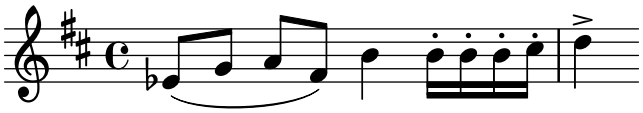
il `Clef_engraver` definisce un punto di riferimento per il rigo,



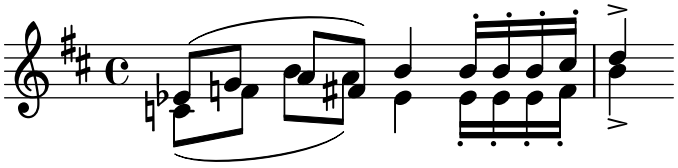
e lo `Stem_engraver` aggiunge i gambi.



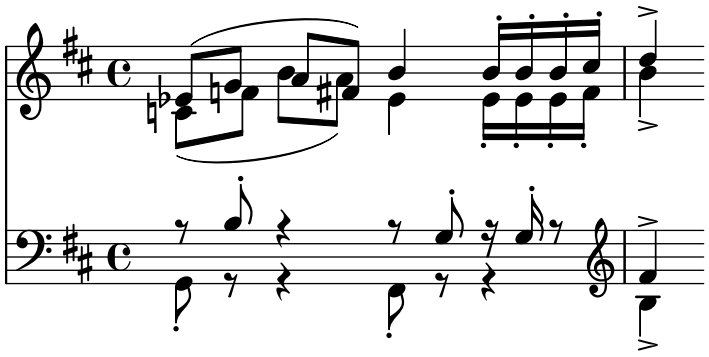
Ogni volta che il programma incontra una testa di nota (o più d'una, se si tratta di un accordo) leggendo il file sorgente, avvisa lo `Stem_engraver`, il quale crea un gambo e glielo unisce. Aggiungendo gli incisori per travature, legature, accenti, accidenti, stanghette di battuta, indicazioni di tempo e armature di chiave, otteniamo la notazione completa.



Questo sistema funziona bene per la musica monofonica, ma che succede con la polifonia? Nella notazione polifonica, voci diverse possono condividere lo stesso rigo:



Nell'esempio qui sopra, armatura di chiave e rigo sono condivisi, ma gambi, legature, travature, eccetera, appartengono in modo esclusivo a ciascuna voce, perciò gli incisori devono essere raggruppati. Quelli per teste delle note, gambi, legature, eccetera, vanno in un gruppo chiamato 'contesto Voice', mentre quelli per chiave, accidenti, misure, eccetera, in un gruppo chiamato 'contesto Staff'. Nel caso della polifonia, un singolo contesto Staff contiene più di un contesto Voice. Analogamente, contesti Staff multipli possono essere messi in un singolo contesto Score. Il contesto Score rappresenta il contesto notazionale di livello massimo.



Vedi anche

Internals Reference: Sezione “Contesti” in *Guida al Funzionamento Interno*.

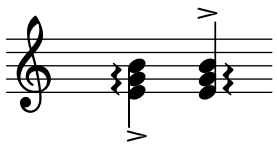
Architettura flessibile

Quando abbiamo cominciato, abbiamo scritto LilyPond interamente nel linguaggio di programmazione C++, scolpendo nella pietra le sue funzionalità. Per una serie di ragioni, però, la cosa si è rivelata insoddisfacente.

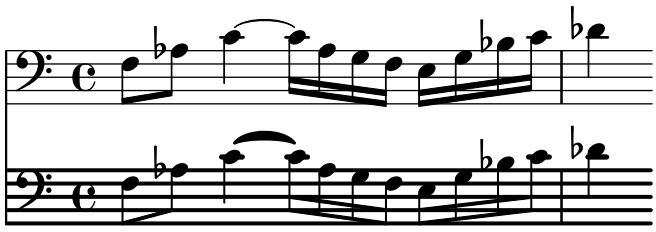
- Quando LilyPond commette degli errori, gli utenti devono sovrascrivere le decisioni di formattazione, il che significa, in altre parole, che devono poter accedere al motore di formattazione. Quindi, regole e impostazioni non possono essere stabilite da noi durante la composizione, ma devono essere accessibili agli utenti durante l’esecuzione del programma.
- La bontà di un’incisione viene giudicata dagli occhi, e in ultima analisi è questione di gusto. Per quanto esperti noi siamo, gli utenti possono essere in disaccordo con le nostre decisioni personali, perciò devono poter accedere anche alle definizioni dello stile tipografico.
- Infine, gli algoritmi di formattazione vengono rifiniti incessantemente da noi, il che ci richiede di dover contare su un approccio alle regole flessibile, e il modo con cui C++ impone di raggrupparle non può essere applicato facilmente alla formattazione della notazione musicale.

Abbiamo affrontato questi problemi integrando in LilyPond un interprete del linguaggio di programmazione Scheme e riscrivendoci parti del programma. Ora l’architettura di formattazione è costruita intorno alla nozione di oggetti grafici, descritti dalle variabili e dalle funzioni di Scheme, e comprende regole di formattazione, stile tipografico e decisioni di formattazione individuali. L’utente può accedere direttamente alla maggior parte di questi controlli.

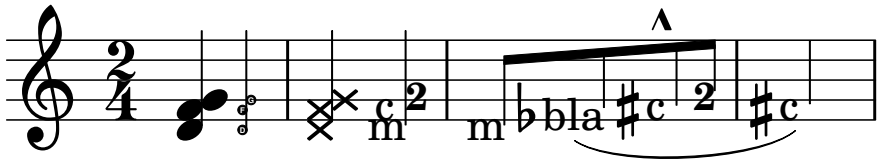
Le variabili di Scheme controllano le decisioni in merito all’aspetto della pagina. Per esempio, molti oggetti grafici possidono una variabile di direzione che codifica la scelta tra su e giù (o tra destra e sinistra). Qui sotto vedete due accordi con accenti e arpeggi. Nel primo, tutti gli oggetti grafici hanno direzione giù (o sinistra), nel secondo, hanno direzione su (destra).



Il processo di formattazione di uno spartito consiste nel leggere e scrivere le variabili degli oggetti grafici, alcune delle quali hanno un valore predefinito. Per esempio, lo spessore di molte linee – una caratteristica dello stile tipografico – è una di queste. Siete liberi di modificare questo valore, donando al vostro spartito un’impressione tipografica diversa.

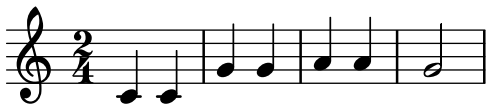


Anche le regole di formattazione sono variabili preimpostate: ogni oggetto possiede variabili contenenti procedure. Sono queste ultime a eseguire la formattazione vera e propria, e sostituendone di diverse, possiamo modificare l'aspetto degli oggetti. Nell'esempio seguente, la regola che governa quali oggetti sono adoperati per produrre il simbolo della testa di nota è cambiata nel corso del frammento.

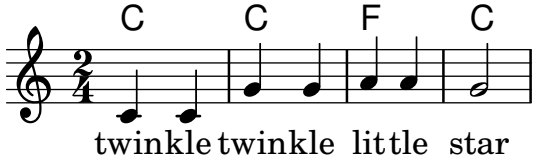


1.5 Mettere LilyPond al lavoro

Abbiamo scritto LilyPond per sperimentare come sia possibile condensare l'arte dell'incisione musicale in un programma per computer. Grazie a tutto questo duro lavoro, ora il programma può essere adoperato per eseguire compiti utili. La sua applicazione più semplice è la stampa delle note.



Aggiungendo i nomi degli accordi e le parole, otteniamo una notazione da canzoniere.

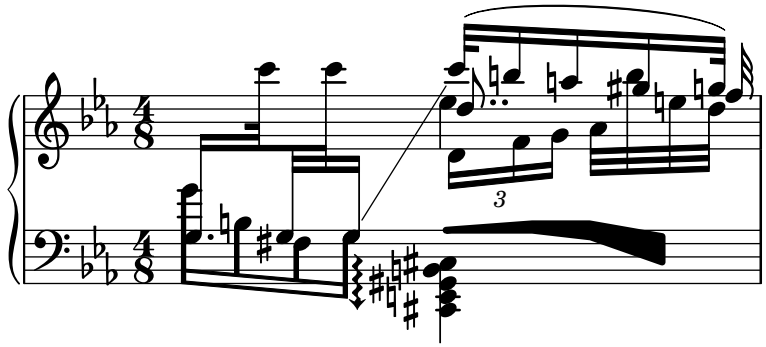


Possiamo stampare anche notazione polifonica e musica per pianoforte. L'esempio seguente combina alcune costruzioni più esotiche.

Screech and boink

Random complex notation

Han-Wen Nienhuys



Tutti i frammenti mostrati sopra sono stati scritti a mano, ma ciò non è indispensabile. Dato che il motore di formattazione è in gran parte automatico, può servire per generare output per altri programmi che gestiscono musica. Per esempio, può essere adoperato anche per convertire database di frammenti musicali in immagini da utilizzare in siti Web e presentazioni multimediali.

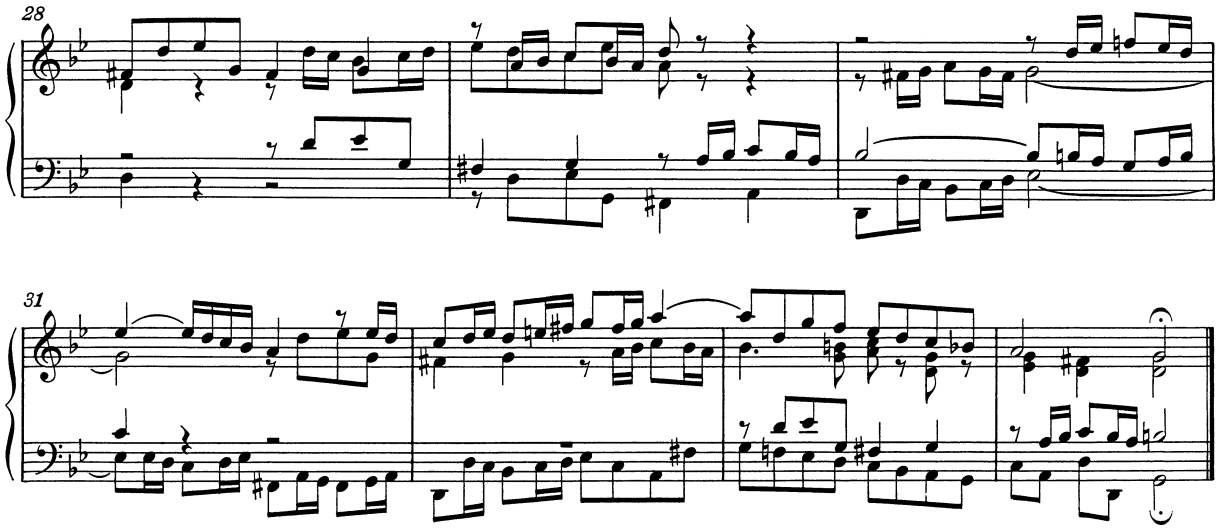
Anche questo documento ne mostra un'applicazione: il formato di input è testuale, perciò può essere facilmente integrato in altri formati basati sul testo come LaTeX, HTML o, nel caso di questo manuale, Texinfo. Mediante il programma `lilypond-book`, compreso in LilyPond, nei file di output PDF o HTML risultanti i frammenti di input possono essere sostituiti dalle corrispondenti immagini a contenuto musicale. Un altro esempio è l'estensione di terze parti OOoLilyPond per OpenOffice.org o LibreOffice, che rende estremamente semplice includere frammenti musicali nei documenti.

Per ulteriori esempi di LilyPond all'opera, per la documentazione completa e per il programma in sé, visitate il nostro sito Internet ufficiale: www.lilypond.org.

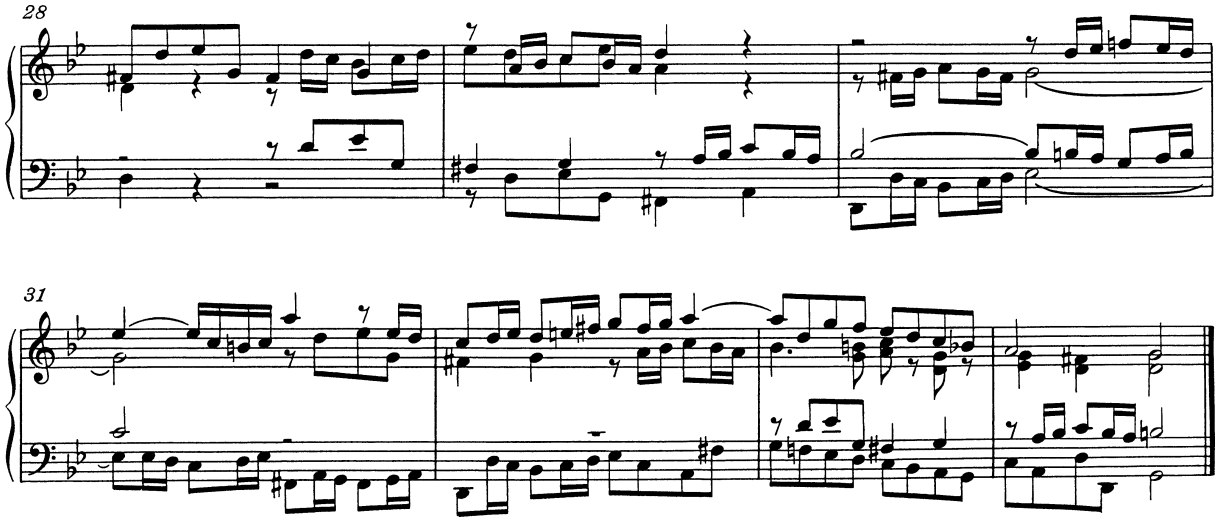
1.6 Esempi di incisione (BWV 861)

Questa sezione contiene quattro incisioni di riferimento e due versioni generate al computer delle ultime sette misure della Fuga in Sol minore dal *Clavicembalo ben temperato*, Libro I, BWV 861, di J.S. Bach.

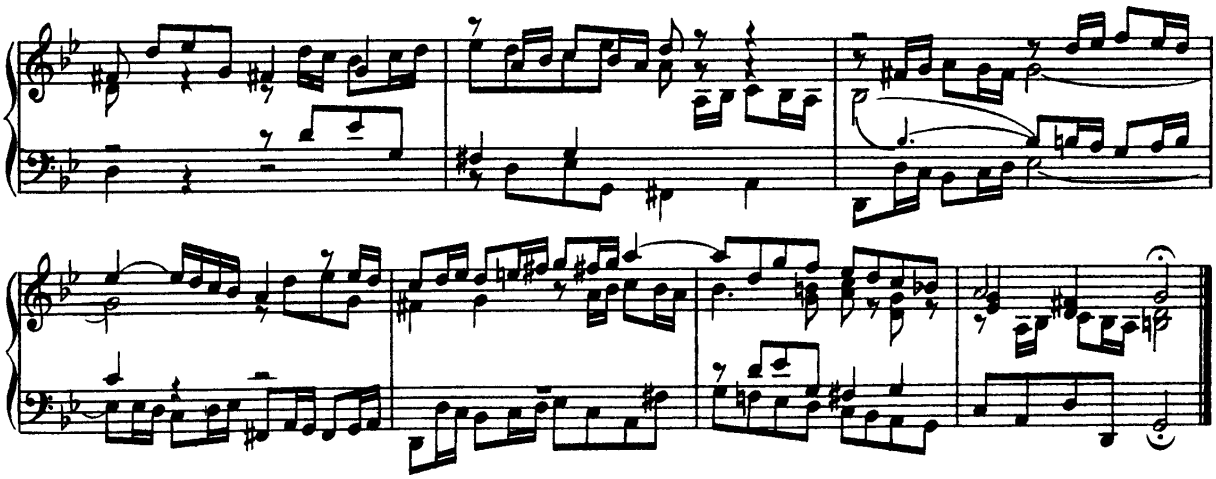
Bärenreiter BA5070 (Neue Ausgabe Sämtlicher Werke, Serie V, Band 6.1, 1989):



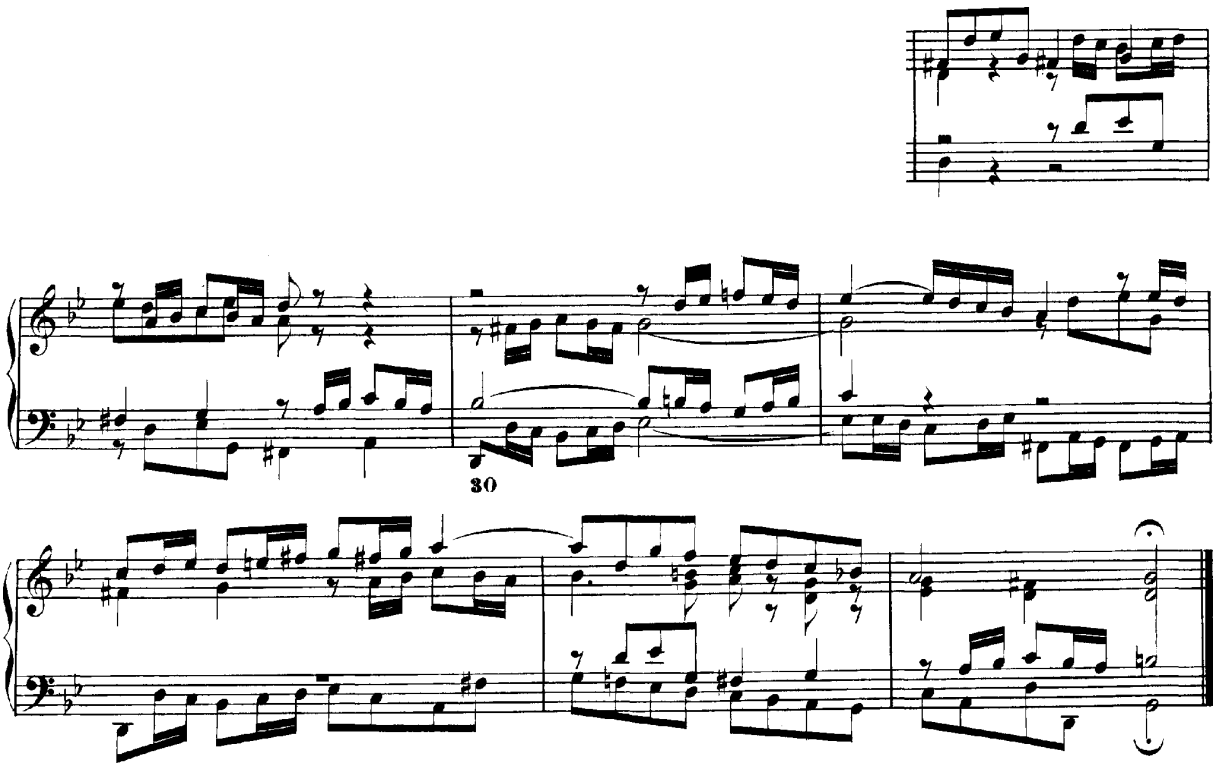
Bärenreiter BA5070 (Neue Ausgabe Sämtlicher Werke, Serie V, Band 6.1, 1989), fonte musicale alternativa. Differenze testuali a parte, questo esempio mostra leggere variazioni d'incisione anche nella stessa edizione della medesima casa editrice:



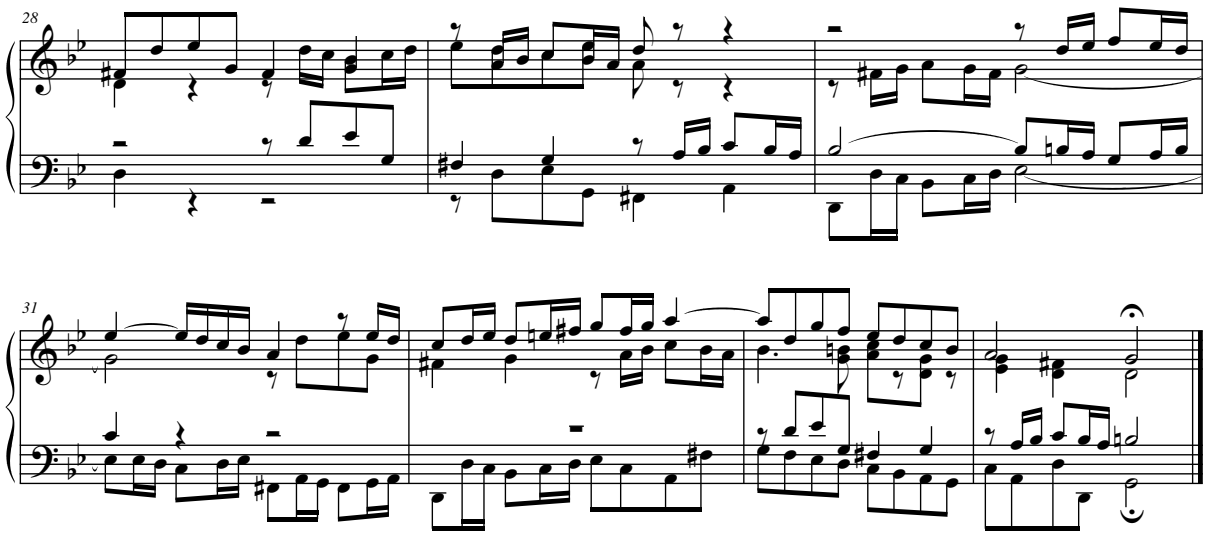
Breitkopf & Härtel, edited by Ferruccio Busoni (Wiesbaden, 1894), disponibile anche nella Petrucci Music Library (IMSLP #22081). Le indicazioni editoriali (diteggiature, articolazioni, eccetera) qui sono state rimosse per permettere un confronto più agevole con le altre edizioni:



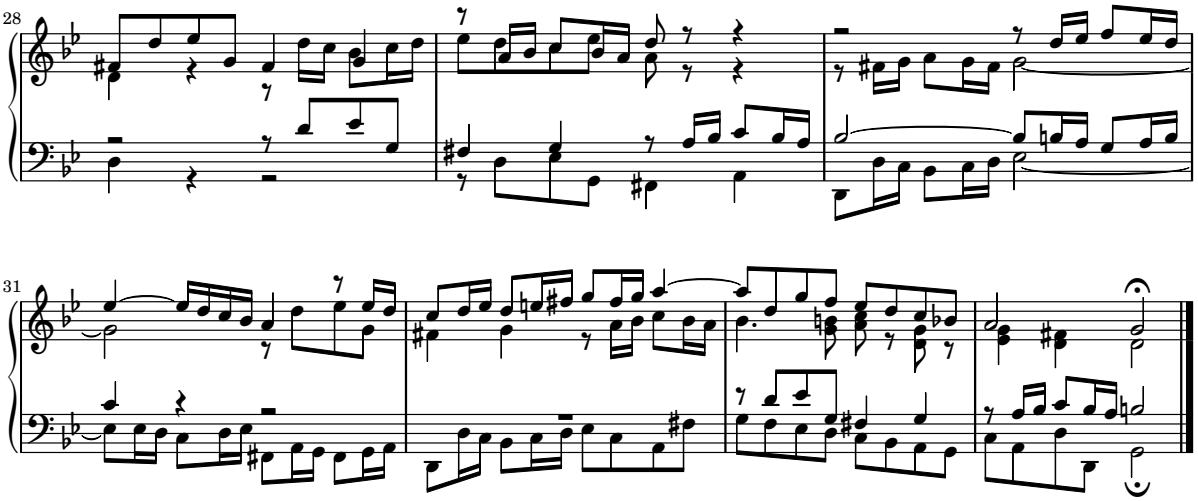
Bach-Gesellschaft edition (Leipzig, 1866), disponibile nella Petrucci Music Library (IMSPL #02221):



Finale 2008:



LilyPond, versione 2.24.0:



2 Bibliografia

Di seguito elenchiamo i riferimenti usati per LilyPond.

2.1 Bibliografia breve

Se avete bisogno di saperne di più sulla notazione musicale, qui ci sono alcuni titoli interessanti da leggere.

Ignatzek 1995

Klaus Ignatzek, Die Jazzmethode für Klavier. Schott's Söhne 1995. Mainz, Germany ISBN 3-7957-5140-3.

Guida introduttiva alla pratica del jazz sul pianoforte. Uno dei primi capitoli contiene una panoramica sugli accordi adoperati comunemente nel jazz.

Gerou 1996

Tom Gerou and Linda Lusk, Essential Dictionary of Music Notation. Alfred Publishing, Van Nuys CA ISBN 0-88284-768-6.

Un elenco conciso e in ordine alfabetico delle questioni riguardanti la tipografia e la notazione musicale, comprendente la maggior parte dei casi più comuni.

Gould 2011

Elaine Gould, Behind Bars: the Definitive Guide to Music Notation. Faber Music Ltd. ISBN 0-571-51456-1.

Hals über Kopf: Das Handbuch des Notensatzes. Edition Peters. ISBN 1843670488.

Una guida completa a regole e convenzioni della notazione musicale. Copre tutti gli argomenti dalle nozioni fontamentali alle tecniche più complesse e fornisce una preparazione completa sui princìpi della notazione.

Read 1968

Gardner Read, Music Notation: A Manual of Modern Practice. Taplinger Publishing, New York (2nd edition).

Un'opera fondamentale sulla notazione musicale.

Ross 1987 Ted Ross, Teach yourself the art of music engraving and processing. Hansen House, Miami, Florida 1987.

Questo libro parla di incisione musicale, cioè di tipocomposizione professionale. Contiene indicazioni sulla punzonatura, sull'uso degli strumenti di scrittura e sulle convenzioni notazionali. Interessanti anche le sezioni storiche e sulle tecniche di riproduzione.

Schirmer 2001

The G.Schirmer/AMP Manual of Style and Usage. G.Schirmer/AMP, NY, 2001. (Si può ordinare questo libro anche a noleggio.)

Questo manuale si concentra in particolare sulla preparazione della stampa per le edizioni Schirmer. Discute molti dettagli di solito non presenti negli altri libri sulla notazione musicale. Dà anche una buona idea di ciò che serve per conferire alle stampe una qualità editoriale.

Stone 1980

Kurt Stone, Music Notation in the Twentieth Century. Norton, New York 1980.

Questo libro descrive la notazione musicale per la musica seria contemporanea, ma comincia con una panoramica completa delle pratiche notazionali tradizionali esistenti.

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