A Creative Improvisational Companion based on Idiomatic Harmonic Bricks

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Motivation

- Educating (jazz) improvisers
- Provide feedback (visual and aural) on solos over chord changes:
  - Through-composed solos
  - Contrafacts (new melodies over chord changes of existing tunes)
  - Improvised solos (through MIDI input)

Aside on the Origin of "jazz"

- Said to be derived from **Irish**: "teas", pronounced "jass" or "chass"
- Meaning:
  - Heat, passion
- Reference:
  www.counterpunch.org/2006/07/14/how-the-irish-invented-jazz/

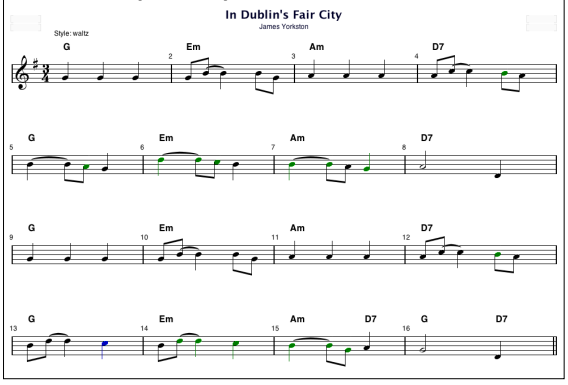
Impro-Visor (Improvisation Advisor)

- Free, open-source, software
- Developed at Harvey Mudd College since 2005
- Over 7000 users registered in community forum
- Classroom use for 5 years

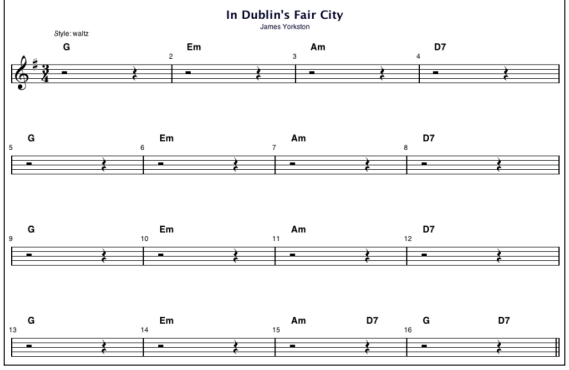
"Leadsheet"

- Commonly used by jazz and other musicians
- A leadsheet abstracts a tune:
  - Melody
  - Chord progression
  - Minimal or no arrangement

Sample Impro-Visor Leadsheet



Chords Only

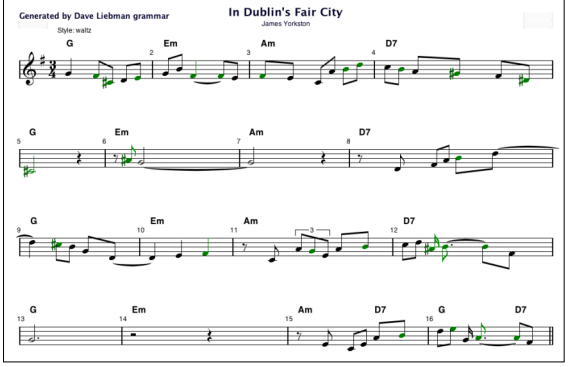


Human-Composed Solo

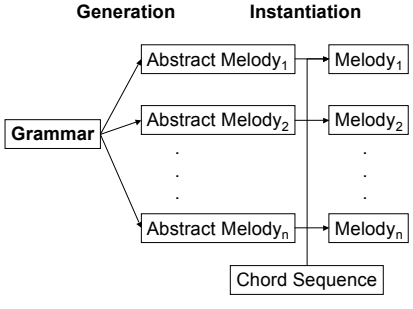
Impro-Visor Creativity

- Creates background (e.g. bass, piano, drums) from
  - Chord progression
  - Style specification
- Creates demonstrative improvised melodies
  - Based on probabilistic grammar & melody abstraction/induction
  - Tries to express various player styles

Induced Solo



Melody Induction



What can be improved?

- Coherence of generated melodic line
- "Bricks" provide an approach to enhancing coherence.

Bricks

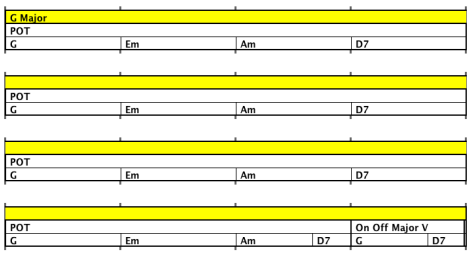
- After Conrad Cork (1988, …, 2008): "Jazz Harmony using LEGO Bricks"
- Reverse-engineering chord progression into **idiomatic sub-progressions** ("bricks").
- **Explain the tune** by providing an abstraction of a tune's harmony, coarser-grained than a sequence of chords.

Chord Sequence for "In Dublin's Fair City"

```
G | Em | Am | D7 |
G | Em | Am | D7 |
G | Em | Am | D7 |
G | Em | Am / D7 | G / D7 |
```

Brick Analysis = "Roadmap" of Tune

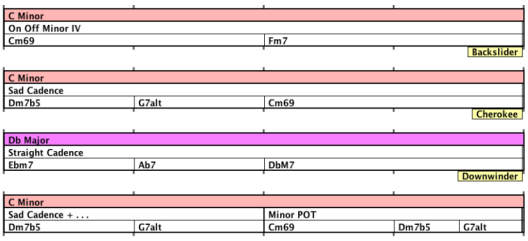
In Dublin's Fair City — 4 of same brick + 1



POT = "Plain Old Turnaround"

Roadmap of a Jazz Tune

Blue Bossa — 4 distinct brick types



Textual Input for the Jazz Tune

```
Cm69   | /      | Fm7   | /           |
Dm7b5  | G7alt  | Cm69  | /           |
Ebm7   | Ab7    | DbM7  | /           |
Dm7b5  | G7alt  | Cm69  | Dm7b5 G7alt |
```

Brick Analysis

- Impro-Visor automates analysis of chord progression into bricks.
- Based on "brick dictionary", an empirically-derived grammar.
- (Analysis algorithms are described in another paper, currently under review.)

Brick Dictionary

- About 100 brick types
- John Elliott: “Insights in Jazz” (2009)
- About 500 rules for brick expansion
- For more examples, google “The Roadmap Garden”:
  http://www.cs.hmc.edu/~keller/jazz/improvisor/RoadmapGarden508a.htm

Interaction

Interactive Companions for Jazz

- Al Biles: **GenJam** (1994)
- William Walker (1997)
- Belinda Thom: **BoB** (Band out of a Box, 2000)
- The above are either proprietary or not generally available.

Using Bricks for an **Interactive Companion**

- Play-along: point at brick to play / loop
- Auto-improvisation based on bricks
- Trading based on bricks

(work in progress)

Impro-Visor Grammars

- Currently productions expand to fill space, without discriminating on specific chord patterns.
- To add **coherence**, abstract window units (e.g. 1-bar in length) are sequenced by embedding Markov chains in grammar.

Brick-Based Grammars

- Intended to achieve greater coherence of generated melodic lines.
- Brick names used as non-terminals.
- Presence of brick in the roadmap determines possible melodic expansions.

Learning Aspects

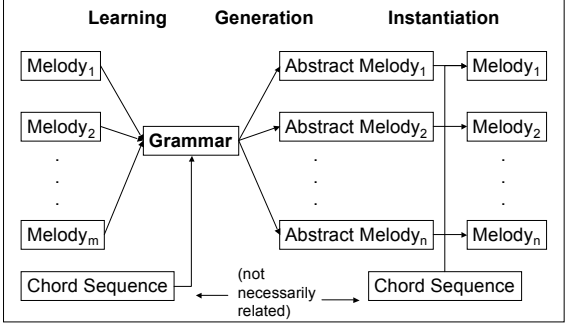
Learning Creativity: Degrees

- No learning
- Scripted learning — Impro-Visor
- Autonomous learning

Grammar Learning: Current

- Gillick, Tang, and Keller (CMJ, 2010)
  Grammar learning based on abstract *window* units that don't necessarily relate to harmonic phrasing.

Learning = Grammar Inference



Grammar Learning Direction

- Brick-based scheme
  - Use bricks as the grammatical unit.
  - Use the existing scheme to fill in any gaps in brick analysis.

Brick-Based Grammar Learning

- Transcribed solo melody is segmented according to bricks, rather than fixed-length windows.
- Segmented melodies are mapped to *abstract melodies*, as in current Impro-Visor.
- Productions are derived:
  - Left-hand sides: Brick names + duration argument
  - Right-hand sides: Abstract melodies

Remaining Work

- **Implementation** of brick-based grammars and learning.
  (Technology exists, integration required.)
- **Evaluation** of brick-based method.