Before Alpha-Go:

Interpretation though improvisation and LISP.

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Overview

Like Chess, Go is a non-chance combinatorial game - a strategy game with deceptively simple rules which go back over 3000 years. Only this year have human masters of the game been challenged and beaten by machine learning.

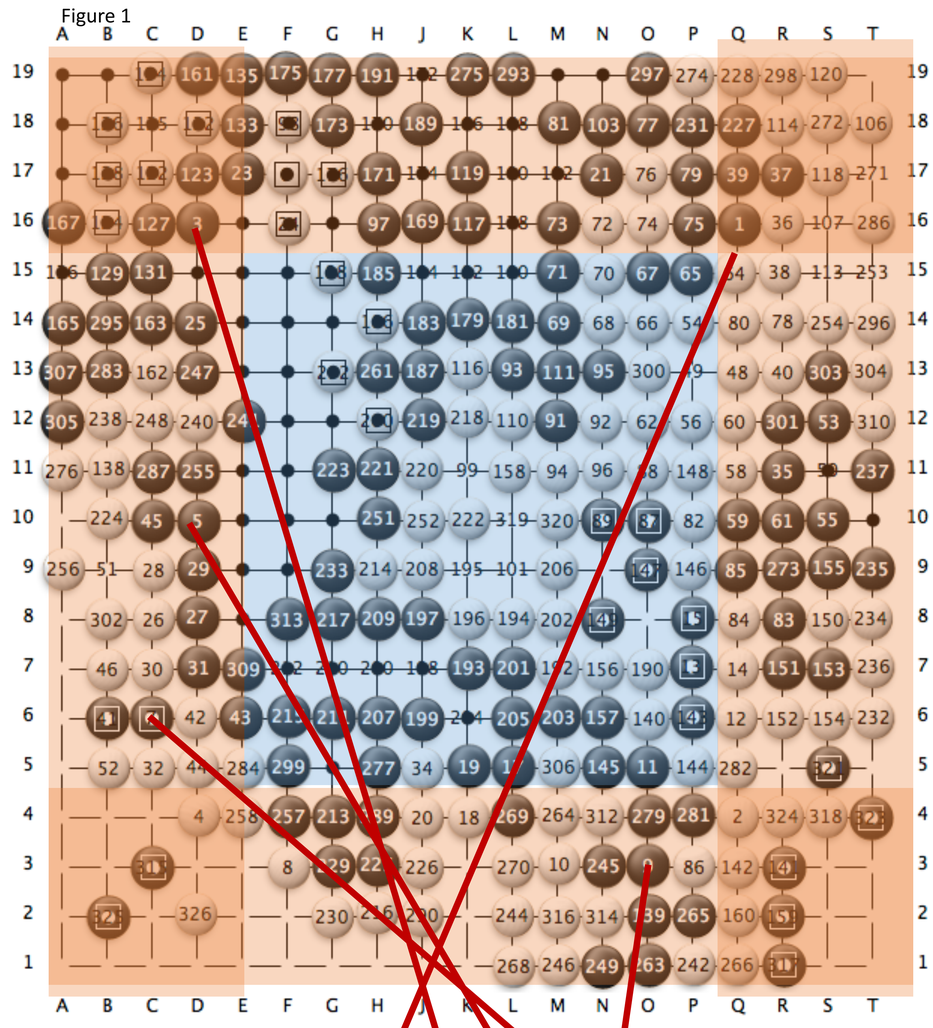
This poster outlines the process undertaken to write *Go/Koan*, a composition which uses a ½ point win Game between a mid-level Dan Go player and Zen19, a Go computer, which at the time (2013) was one of the strongest of its kind. Since then, Google's Alpha-GO has radically changed this landscape with wide reaching implications. It was performed in 2013, conducted by James Lowe.

There may be many ways to interpret a pattern which gets mapped into a musical form. For example, the positions on a Go board could represent individual notes, or rows scales. The problem with many of the possible mappings is that they do not represent the way in which players *think* about the game. That is, the position of stones which form groups have different impacts on the game depending on:

The number of liberties (adjoining spaces that support the life of a group) they have
How many stones touch those of the opponent
How close the the edge or centre of the board the group is
How far through the game the move is taking place

Importantly, the overall global strength of play at a given moment and direction of play are not considered. Along with the extremely high number of possible moves, these very high level aspects of the game were what made Go such a difficult AI problem, and it is what was addressed by Alpha Go with its value networks.

Figure 1



Mapping move position

The mapping of the move positions is taken by using the co-ordinates of a group in relation to the edge of the board. AA being any one of the four corners and LL being the centre. This system produces a diad , chord or cluster. These notes are positions of the harmonic series of a fundamental pitch which changes as the game progresses. For example, the move AA at the start of the game would produce the pitch C2.

Note: C C' G C E G Bb C …
Move: A B C D E F G H …

These mappings produced a long series of chords – this was used to form one part of the final composition and was a representation of the Zen19 computers play.

```
(setq zenmoves '((DD)(DD)(DJ)(CF)(FC) ;1-5
(FE)(EG)(EHG)(IE)(IJE) ;6-10
(CI)(CE)(DF)(DH)(DHIJ) ;11-15
(DGHIJ)(EI)(CI)(CC)(CD) ;16-20
(BCF)(EF)(CDGHIJ)(DF)(EG);21-25
(BI)(BH)(BJ)(FG)(DJ);26-30
(BCDIJ)(EFG)(EE)(EF)(FH);31-35
(EF)(DEFH)(CDEFCDE)(AF)(CDEF);36-40(71)
(BH)(BH)(HIJBCD)(FJ)(FG);41-45(81)
(HH)(GI)(GG)(DH)(IJ);46-50(91)
(II)(BFGH)(BB)(BD)(AC);51-55(101)
(DEFGHI)(BDE)(AC)(DJ)(CDJ);56-60(111)
(BI)(CDE)(BC)(CDE)(BD)));61-65(121)
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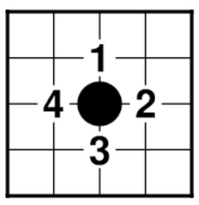
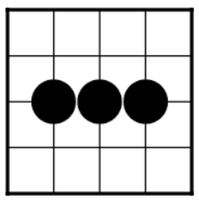
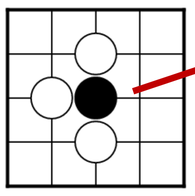


A single black stone with 4 liberties

n.b. the liberties produced rhythmic information not discussed elsewhere here.



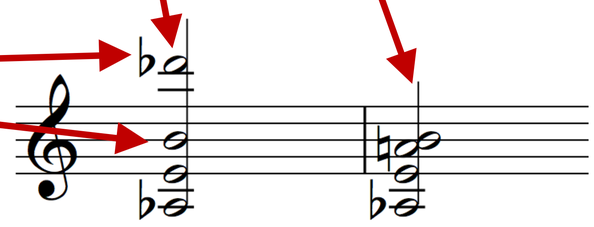
A group of three stones creates a chord. This group has 8 liberties



As the opponent's stones remove liberties and starts a fight. Depen

The number of stones touching the opponent (aggressiveness - add chromatics to tonality)

; disn - amount of distortion based on number of touching stones
(setq dis0 1.0)
(setq dis1 1.11)
(setq dis2 1.12)
(setq dis3 1.13)
(setq dis4 1.14)
(setq dis5 1.15)
(setq dis6 1.16)



;; Overall length of Game –
higher up the harmonic series.

```
(setq ot1 (activate-tonality (overtone-series 1 10 1 '(c 2)))) ;move 1-40
(setq ot2 (activate-tonality (overtone-series 2 12 1 '(c# 2)))) ;41-60
(setq ot3 (activate-tonality (overtone-series 3 15 1 '(d 2)))) ;61-80
(setq ot4 (activate-tonality (overtone-series 4 20 1 '(d# 2)))) ;81-100
```

From code to music

This code formed one half of the material used in the piece Go/Koan, other remaining material coming from an improvisation of the same game, representing the human competitor. The result is available to see and hear on the iPad.

Alpha Go

Since 2013, the AI landscape has dramatically shifted. Alpha Go was trained on the vast collection of games on the KGS server and then played against itself to improve. At the level that Alpha Go is now playing one has to fully consider the implications in terms of a general AI that is able to work so effectively within a limited domain. It is the ability to evaluate a situation and forecast possible outcomes without having to consider *all* possible outcomes that is so important.

In the same way that human experts have an intuition for which moves or possibilities to consider, so Alpha Go has shown us that it is able to 'imagine' a reasonable set of possible futures – and to steer the environment towards its 'desired' outcome. Is it a reasonable contention that this is proto-creativity as well as a proto-intelligence.

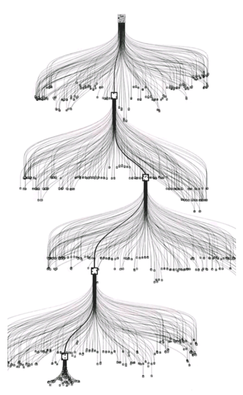


Figure 2

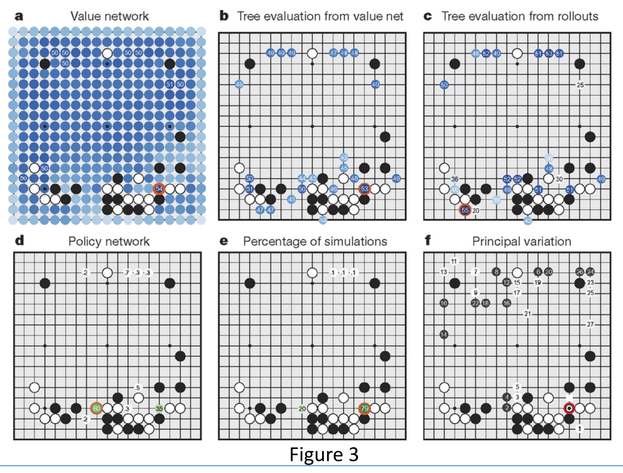


Figure 3

Figure 1: Game data is supplied by permission of the competitors and realized using Goban for Mac. http://www.gobanapp.com
Figure 2: Alpha Go Tree Diagram - http://thenewstack.io/google-ai-beats-human-champion-complex-game-ever-invented
Figure 3: Gibney, E. (2016). Google AI algorithm masters ancient game of Go. *Nature*, *529*(7587), 445-446. http://dx.doi.org/10.1038/529445a