

Understanding through Code Visualisation

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Outline

1. Background
2. Importance
3. Progress
4. Remaining time
5. What will be achieved
6. What to take away

Background

- Code comprehension
- Usefulness of visualisations
- Application of visualisations to live coding
- Creating meaningful visualisations

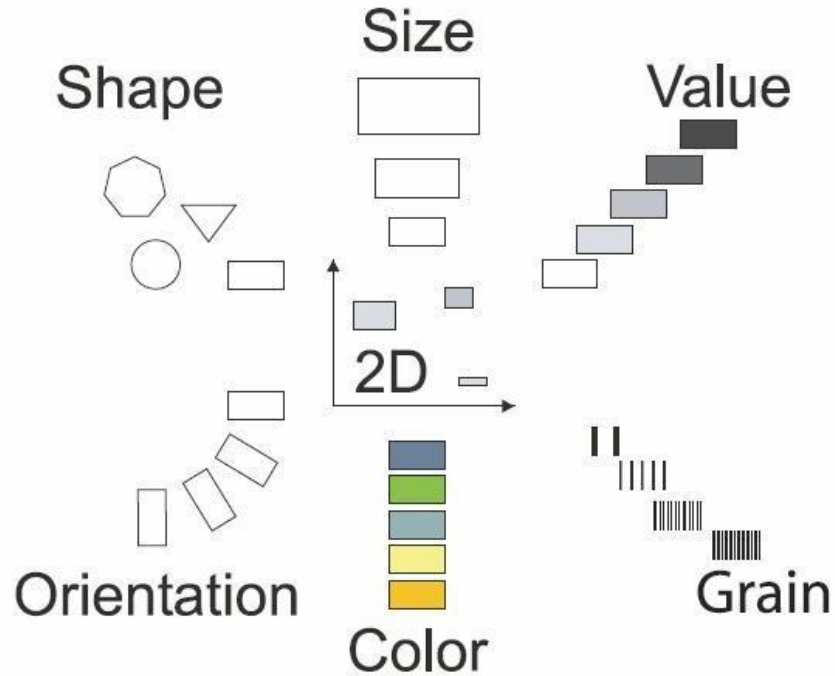
Importance

- Educational implications
- Software engineering implications
- Application within live coding
- Application beyond live coding

Progress

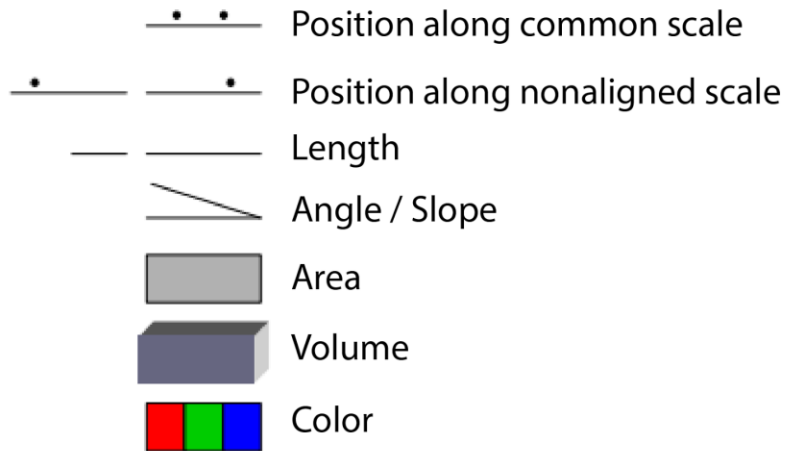
- Field study and lab study conducted
- Interviews conducted
- Requirements gathered
- Visualisations prototyped and tested
- Visualisation analysis model developed

Visual Variables



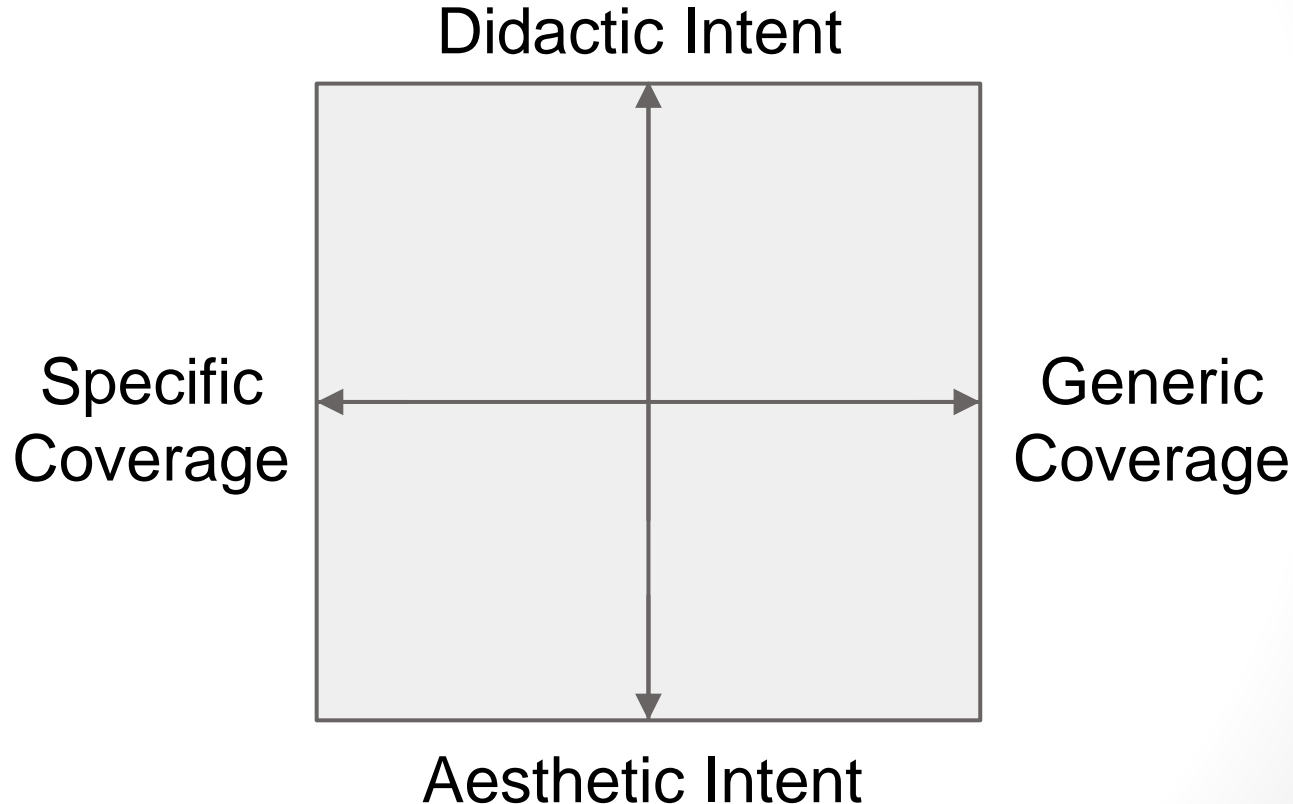
Hierarchy of Graphical Elements

More Specific

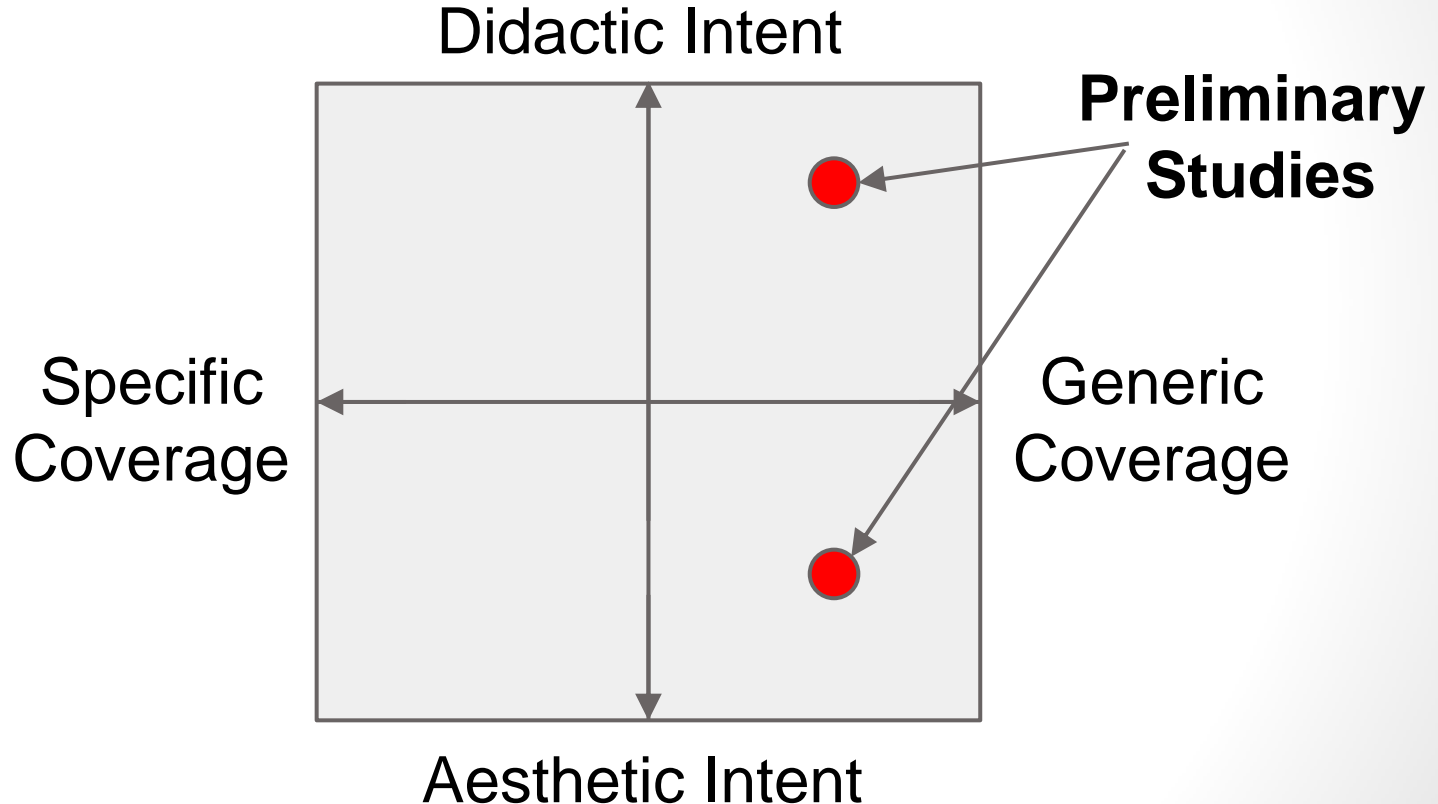


More Generic

Visualisation Analysis Model



Visualisation Analysis Model



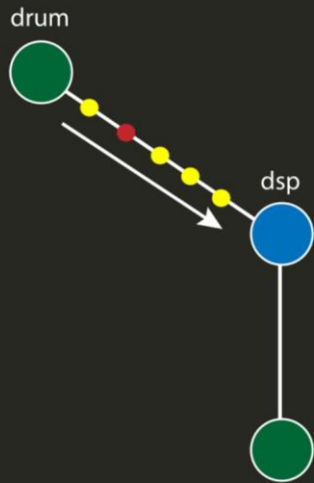
Study 1

- Field study with a survey
- 14 respondents
- Generated user requirements
- Conducted follow-up interviews
- Enjoyment vs understanding
- Link between code changes and music changes

Study 2 - Background

- Lab study with survey
- Testing two sets of visualisations:
 - Aesthetic Intent
 - Didactic Intent
- Goal to see if visualisations heading in the right direction

Prototypes



```

77 ;; slightly more complex example
78 (bind-func dsp
79   (let ((oscs :/9,[SAMPLE,SAMPLE,SAMPLE]* (zalloc))
80         (l 0))
81     (do!times (l 0)
82       (aset! oscs l (osc_c 0.0)))
83     (lambda (a:SAMPLE b:164 c:164 d:SAMPLE*)
84       (cond ((= c 0.0) ;; left channel
85         (* ((aref oscs 0) (+ 0.3 ((aref oscs 2) 0.2 1.0)) 60.0)
86           ((aref oscs 3) 0.2 220.0)
87           ((aref oscs 4) 0.2 (+ 400. ((aref oscs 5) 200. .1)))
88           ((aref oscs 6) 0.1 900.0)))
89         ((= c 1.0) ;; right channel
90           ((aref oscs 7) 0.3 (+ 220.0 ((aref oscs 8) 110.0 20.0)))
91           (else 0.0)))))) ;; any remaining channels
92
93 (bind-func dsp
94   (let ((osc1 (osc_c 0.0))
95         (osc2 (osc_c 0.0))
96         (freq1 220.0)
97         (freq2 220.0))
98     (lambda (in:SAMPLE time:164 channel:164 data:SAMPLE*)
99       (cond ((= channel 1.0) (osc1 0.3 freq1))
100         ((= channel 0.0) (osc2 0.3 freq2))
101         (else 0.0))))
102
103 (bind-func change_freq
104   (lambda (freq1 freq2)
105     (dsp.freq1:SAMPLE freq1)
106     (dsp.freq2:SAMPLE freq2)))
107
108 (define loop
109   (lambda (time freq dir)
110     (change_freq
111      (* 1.0 (random 100 500))
112      (* 1.0 freq))
113     (callback time 'loop (+ time (* 20.0 freq))
114              (dir freq 50.0)
115              (cond ((> freq 600.0) -.)
116                    ((< freq 300.0) +)
117                    (else dir))))))
118
119 (loop (now) 220.0 +)

```

change_freq

loop

```

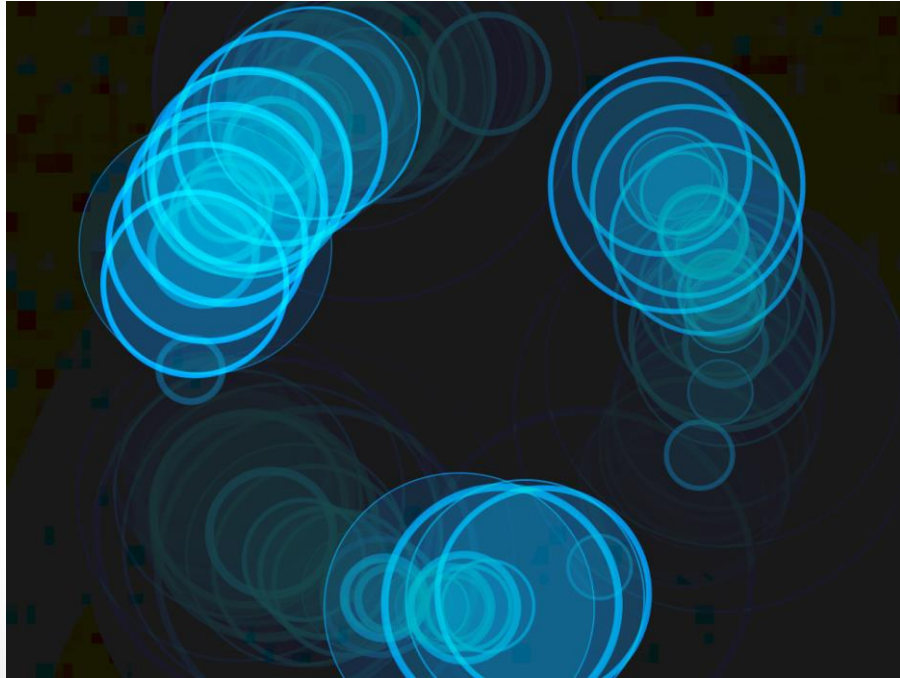
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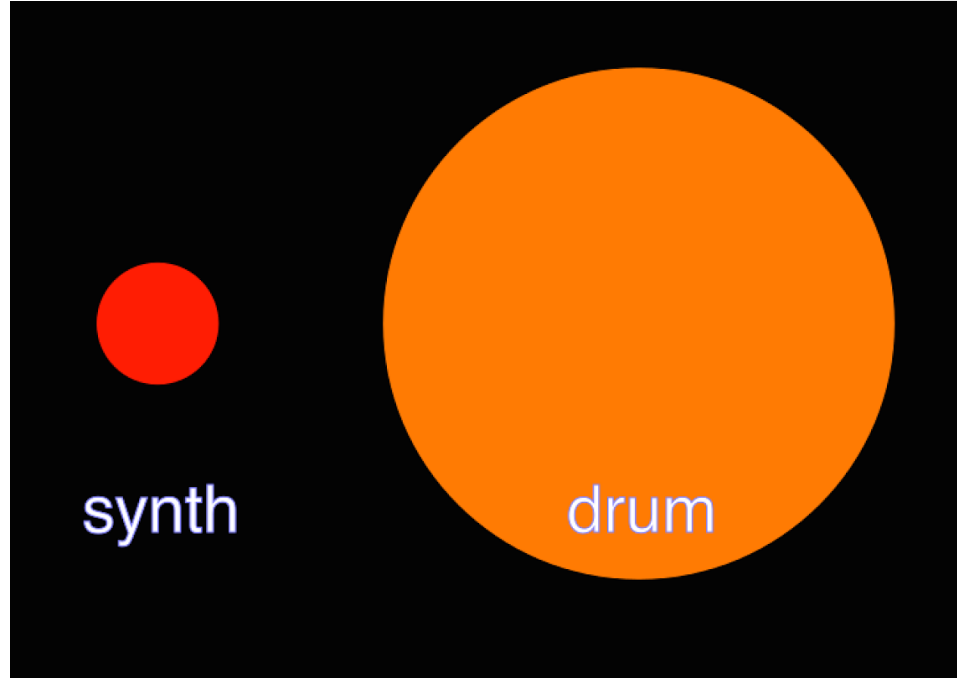
dsp
descriptive comment

loop
descriptive comment

Study 2 - Visualisations



Aesthetic Intent



Didactic Intent

Study 2 - Results

- Still in the process of analysing data
- 41 respondents
- Provided direction for improvement

Timeline

- Study 1 (field study) - March
- Develop basic visualisations - April
- Study 2 (lab study) - May
- Refine visualisations - June
- Study 3 (lab study) - July
- Further refinement and study 4 - time permitting
- Write-up - September and October

Remaining Time

- One more study planned, another study possible
- Further develop theoretical model
- Further prototyping:
 - Code manipulation visualisations
 - Code structure visualisations
- Further analysis of studies and literature to inform direction of project

What will be Achieved?

- Develop an effective code visualisation
- Indication of visual understanding of code
- Answer how we can better communicate the programmer's intention

What to Take Away

- Project on track
- Visualisations show potential for influencing understanding and enjoyment
- Focus on linking code to visuals in next study to achieve understanding through visualisation

Questions?