Design Considerations

Andrés Pérez

Digital Lutherie
Master en Música para Experiencias del Entretenimiento
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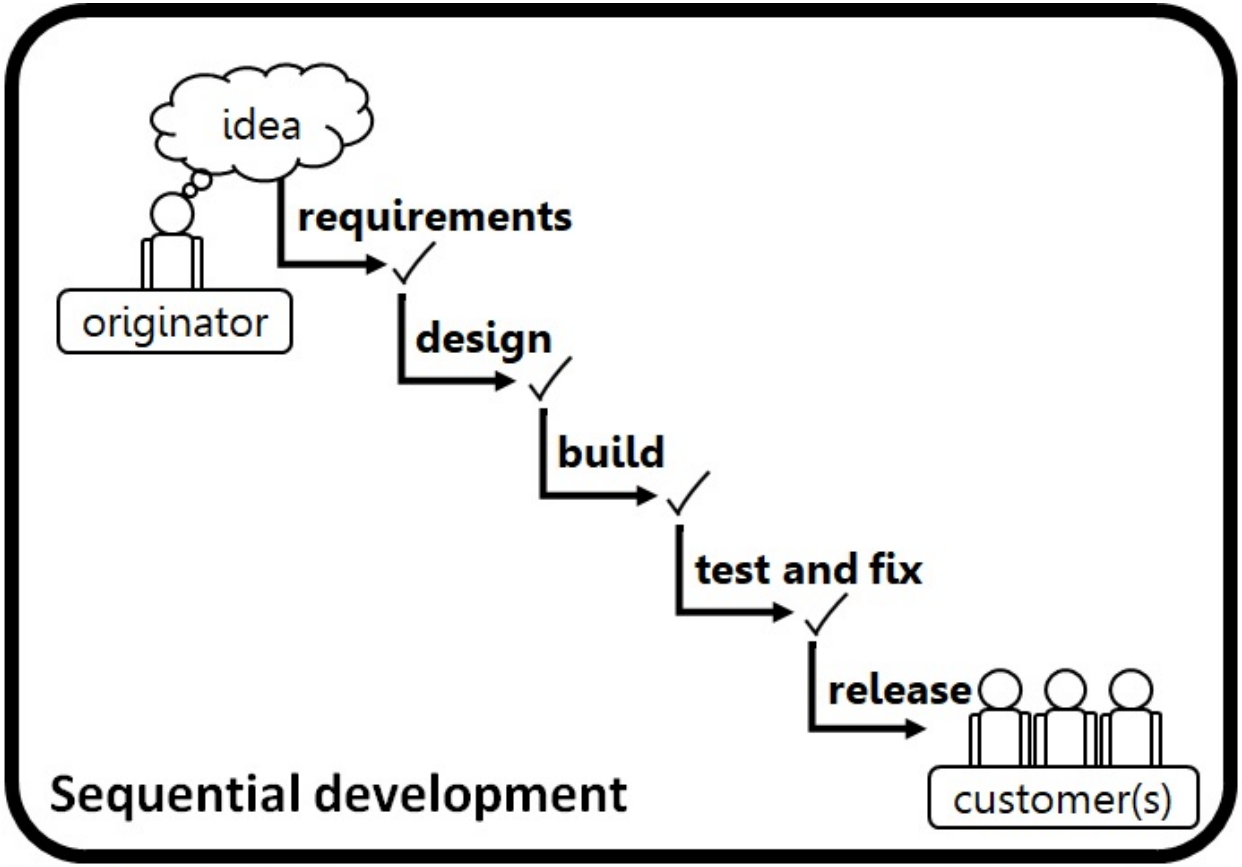
Outline

Outline

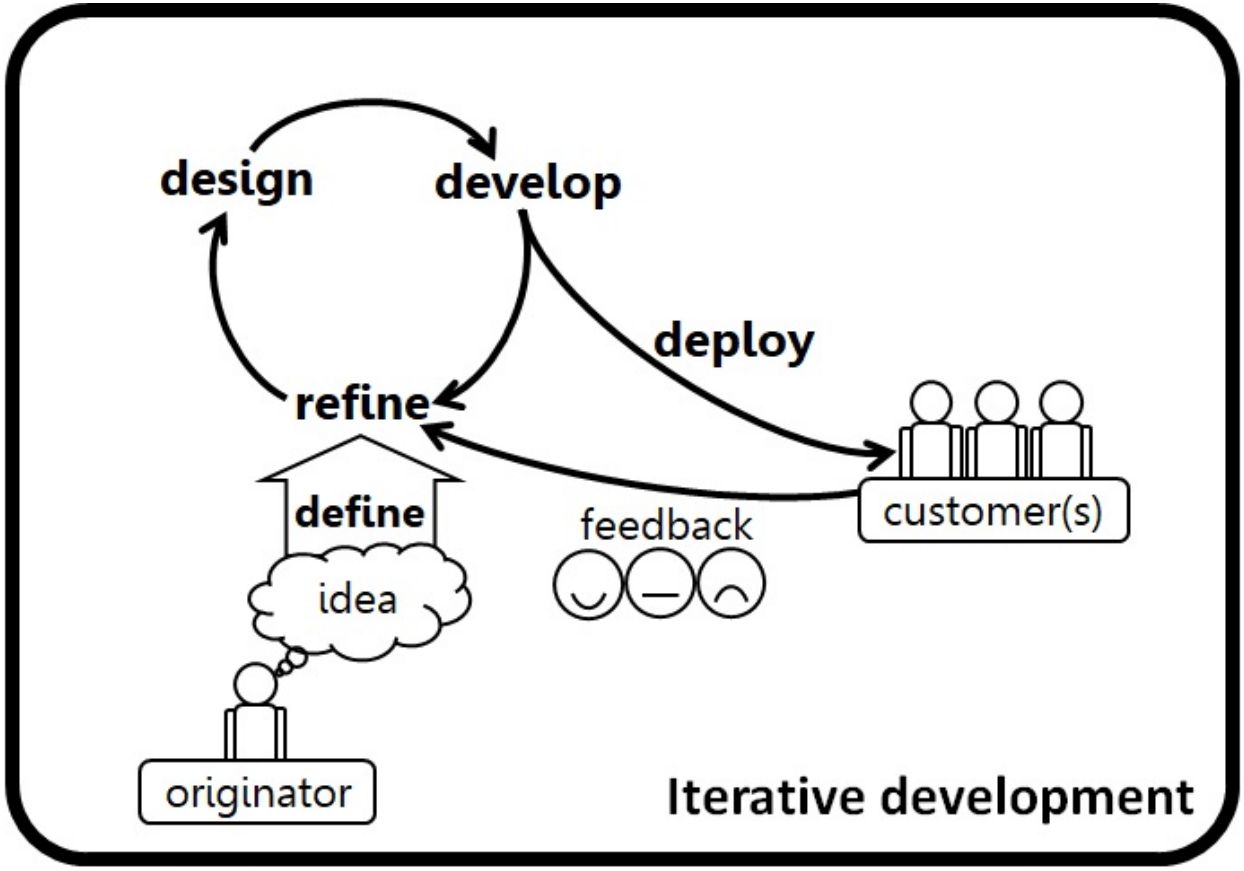
Design Cycle

Waterfall Model



Design Cycle

Iterative Model



Design Cycle

Questions about the Iterative Model:

- How to evaluate? (again)
- Who are the "customers"?

Design Cycle

Who are the "customers"?

"New standards may not be essential for the creation of new music; perhaps even **the concept of musical instruments just an old romantic burden** that would be better left aside [...]. New digital instruments conceived holistically and not as a conglomerate of several interchangeable components are scarce; even worse, **in most cases they are only performed by their creators**."[1]

[1] Jordà, S. (2007). Interactivity and live computer music. Computer Music Journal.

Design Cycle

Who are the "customers"?

- Which is/was the last "successful" DMI...?
- Which is/was the last "successful" non-digital instrument...?

Outline

Output Diversity

Jordà's classification (2007):[2]

- Macro-diversity
- Mid-diversity
- Micro-diversity

[2] Jordà, S. (2004). Digital Instruments and Players : Part II – Diversity, Freedom and Control, (January 2004).

Output Diversity

Jordà's classification (2007)

Macro-diversity (MacD)

- Context flexibility/versatility
- Generic vs specialized
- Correlation with player's expertise level

Output Diversity

Jordà's classification (2007)

Mid-diversity (MidD)

- Inter-performance diversity
- Low MidD:
  - *"Always playing the same piece"*
  - *"Good for fun but not to be taken too seriously"*

Output Diversity

Jordà's classification (2007)

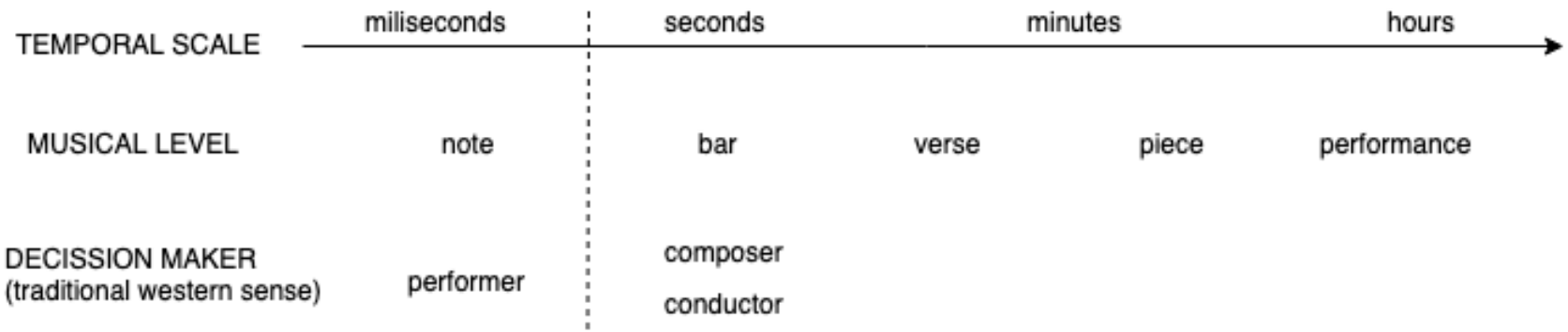
Micro-diversity (MicD)

- Intra-performance diversity
- Nuances: potential for virtuosi
- Expressivity

Outline

Multithread / Shared Control

Music temporal scale



Multithread / Shared Control

- Traditional instruments require continuous focus
- Traditional instruments affect up to note level (MicD)

But... DMIs do not need to follow these limitations!

Multithread / Shared Control

Multithread

- Focusing on several musical aspects at different times

Shared Control

- Leave some decision-making to the computer

Towards a conductor/composer perspective.

Outline

Apprenticeship

Interaction modes with music performance are broad...

Apprenticeship

Apprenticeship

Apprenticeship

Apprenticeship

Apprenticeship

Apprenticeship

... so, different people in different moments have different requirements from instruments!

Apprenticeship - Learning Curve

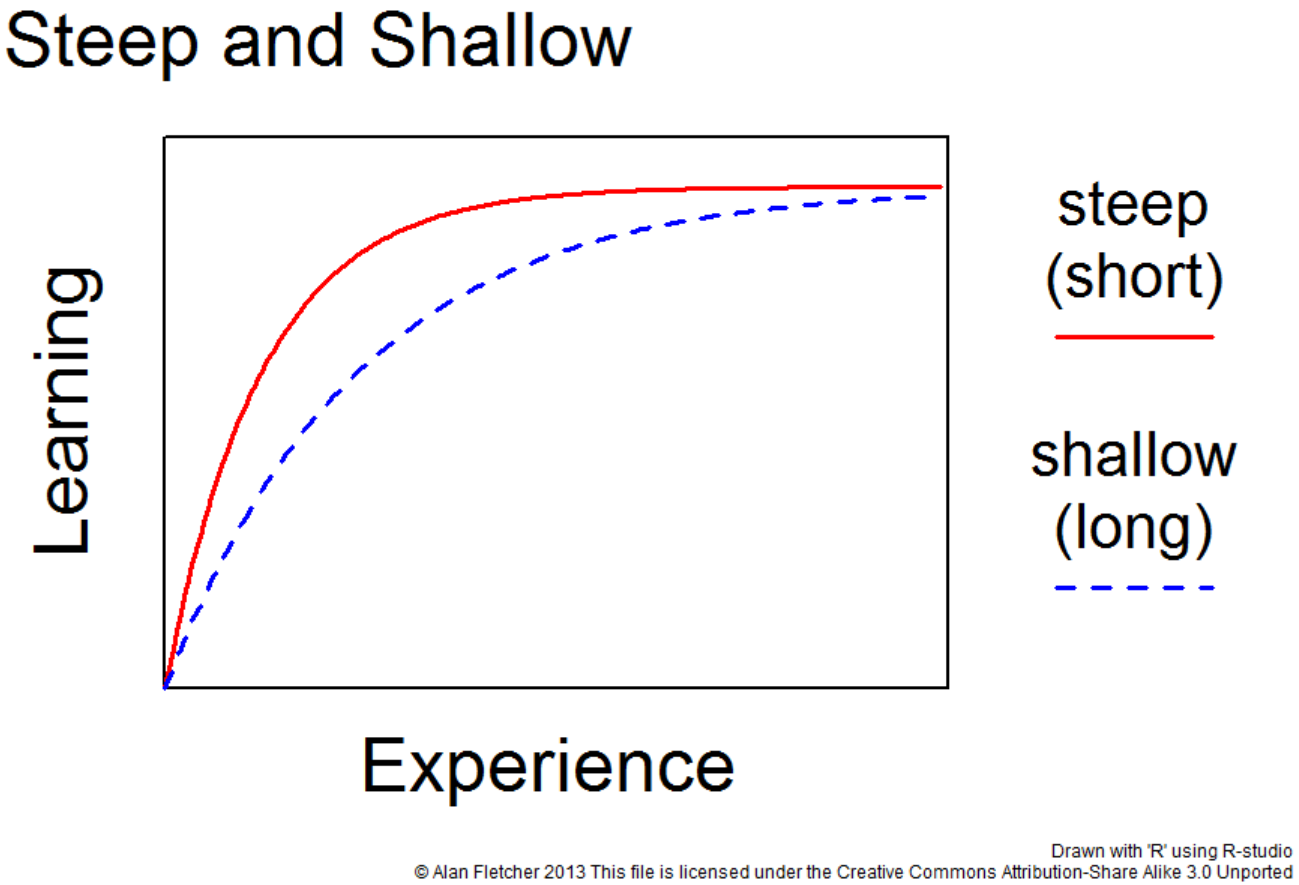
Apprenticeship - Learning Curve

Learning Curve (Ebbinghaus, 1885)

"A learning curve is a graphical representation of how an increase in learning (measured on the vertical axis) comes from greater experience (the horizontal axis)."[3]

[3]Wikipedia. Learning Curve. Accessed 19/02/2019

Apprenticeship - Learning Curve



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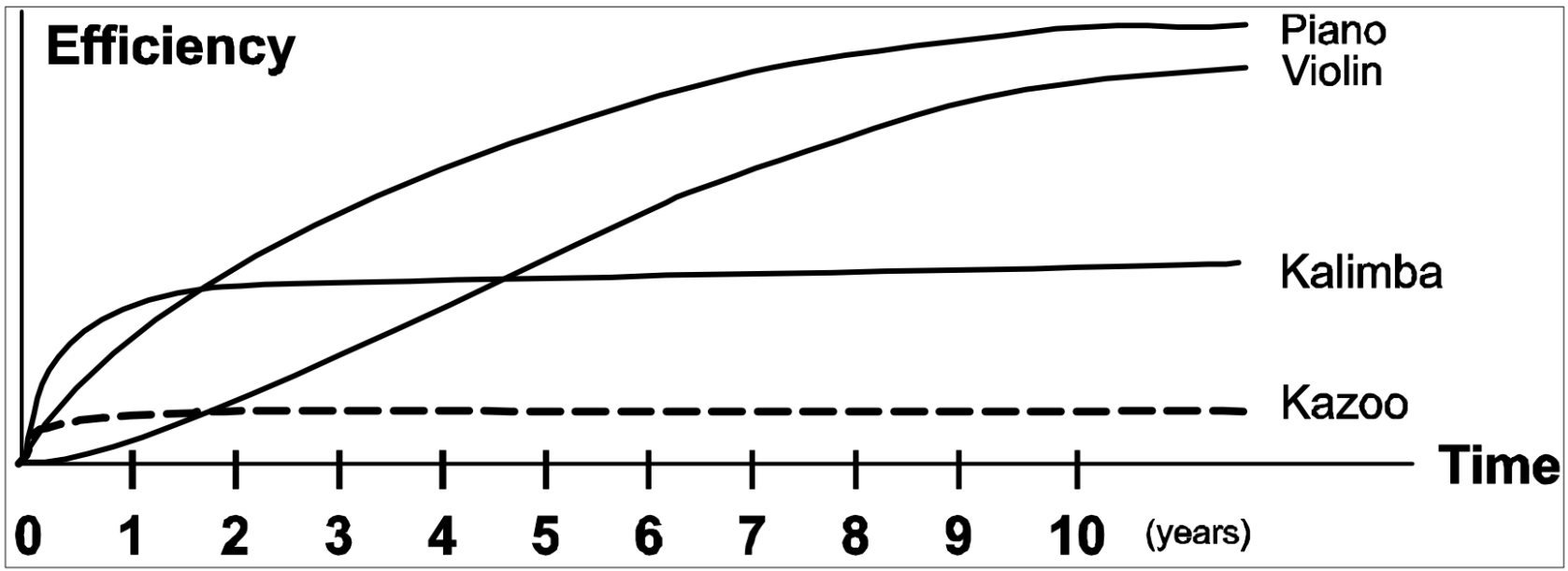
Apprenticeship - Learning Curve



Jordà, S. Digital Instruments and Players : Part I – Efficiency and Apprenticeship (2004).

Apprenticeship - Learning Curve

Some important timestamps:

- *Rewarding Point*[4]
  - Enough skills to enjoy playing an instrument.
- *Mastering Point*
  - Time to completely master an instrument.
  - Usually taken as 10 years for the first acoustic instrument.[5]

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[4] Levitin D.J. et al. Control parameters for musical instruments: a foundation for new mappings of gesture to sound. Organised Sound (2002)

[5] Lehmann, A.C. The Acquisition of Expertise in Music: Efficiency of Deliberate Practice as a Moderating Variable in Accounting for Sub-Expert Performance (1997) .

Apprenticeship - Efficiency

Efficiency (2b)[6]*:*

The ratio of the useful energy delivered by a dynamic system to the energy supplied to it.

$$\text{Efficiency} = \frac{\text{Output}}{\text{Input}}$$

[6] Merriam-Webster. Efficiency. https://www.merriam-webster.com/dictionary/efficiency. Accessed 19/02/2019

Apprenticeship - Efficiency

Musical Instrument Efficiency[7]:

$$\text{Efficiency} = \frac{\text{MusicalOutputComplexity}}{\text{ControlInputComplexity}}$$

Along time, the control input complexity might also increase..!

[7] Jordà, S. Digital Instruments and Players : Part I – Efficiency and Apprenticeship (2004).

Apprenticeship - Efficiency

Apprenticeship - Efficiency

Corrected Musical Instrument Efficiency[8]:

$$\text{Efficiency} = \frac{\text{MusicalOutputComplexity} \times \text{PerformerFreedom}}{\text{ControlInputComplexity}}$$

[8] Jordà, S. Digital Instruments and Players : Part I – Efficiency and Apprenticeship (2004).

Apprenticeship - Efficiency

Performer freedom

"A good instrument should not impose its music to its player. A good instrument should not be able to produce only good music! (What is good music anyway?) A good instrument should also be able to produce "terribly bad" music, either at the player's will or at the player's misuse."[9]:

[9] Jordà, S. Digital Instruments and Players : Part I – Efficiency and Apprenticeship (2004).

Apprenticeship - Efficiency

Playing music vs. Playing with music

Musical Instrument vs. Musical Toy

Apprenticeship - Efficiency