Algorithmic composition: An overview of the field, inspired by a criticism of its methods

Presentation in the seminar
Topics in Computer Music
at RWTH Aachen University

Sven Deserno

24 June 2015

WHAT TO EXPECT?

Basis

Pearce, Meredith, Wiggins (2002):
“Motivations and methodologies for automation of the computational process”

In addition

Overview of the field of algorithmic composition
Appreciation for good science and appropriate methods

OUTLINE

1. Introduction

1.1 What is algorithmic composition?

WHAT IS ALGORITHMIC COMPOSITION?

"...the partial or total automation of the process of music composition by using computers."

– Fernández/Vico, 2013

"...the technique of using algorithms to create music."

– Wikipedia: Algorithmic composition, 21 June 2015

1. Introduction

1.2 The Problem: Pearce/Meredith/Wiggins' criticism

THE PROBLEM

Widespread failure to…

"…specify the precise practical and theoretical aims of research"

"…adopt an appropriate methodology for achieving the stated aims"

"…adopt a means of evaluation appropriate for judging the degree to which the aims have been satisfied"

– Pearce/Meredith/Higgins, 2002

THE PROBLEM

"an implicit assumption that simply describing a computer program that composes music counts as a useful contribution to research"

– Pearce/Meredith/Higgins, 2002

A CASE STUDY

David Cope's EMI

Experiments in **M**usical **I**ntelligence
Imitates the style of a given corpus

Exemplary results: www.youtube.com/user/davidhcope/

Wiggins' review

Published work on EMI is vague & unscientific
Review begins with a discussion of pseudoscience

WHY IS THIS BAD?

Requirements for progress

- Well-defined problems
- Possible solutions to these problems
- The ability to meaningfully compare solutions
- Solid methodology

2. How did we get there?

2.1 A history of algorithmic composition

HISTORY: FIRSTS

First conceptualisation

Ada Lovelace, on the Analytical Engine:

"Supposing, for instance, that the fundamental relations of pitched sounds in the science of harmony and of musical composition were susceptible of such expressions and adaptations, the engine might compose elaborate and scientific pieces of music of any degree of complexity or extent."

– Ada Lovelace, 1843

Image: commons.wikimedia.org

HISTORY: FIRSTS

Proof of concept

1954: “Illiac Suite” by Lejaren Hiller, Leonard Isaacson

4 movements for string quartet

First composition by a computer program

Implementing and testing several principles
    e.g. different sets of rules, probabilities/randomness

HISTORY: FIRSTS

Iannis Xenakis

Composer (1922 – 2001)

Pioneer in computer music

Used the output of algorithms & mathematical models in his compositions

Image: www.iannis-xenakis.org

HISTORY: PRE-COMPUTER

Guido d'Arezzo

11th century

Deterministic mapping of vowel sounds to pitches

W. A. Mozart (attributed)

18th century

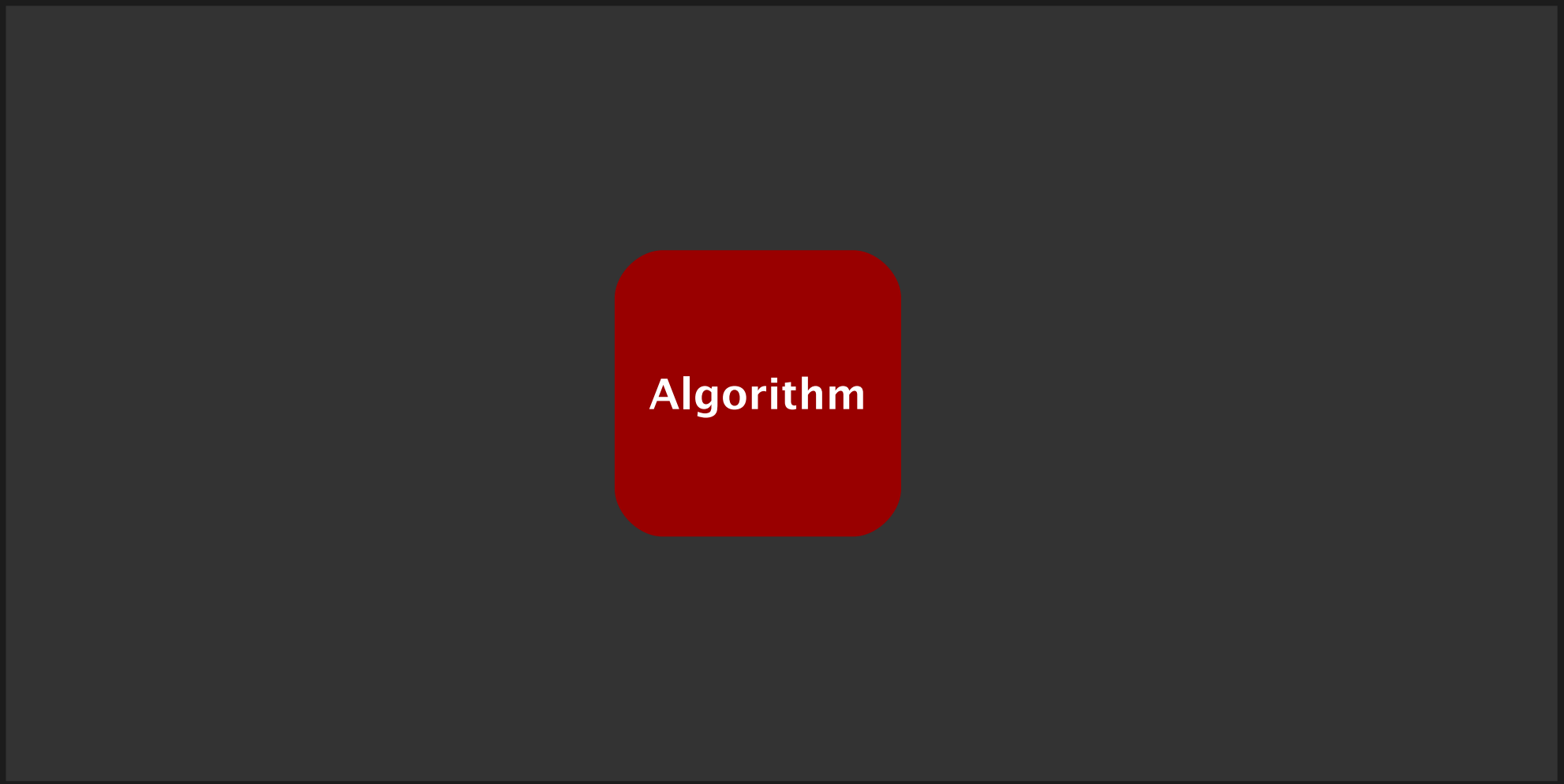
“Musikalisches Würfelspiel” / “Dice Music”

Randomised combination of pre-composed parts

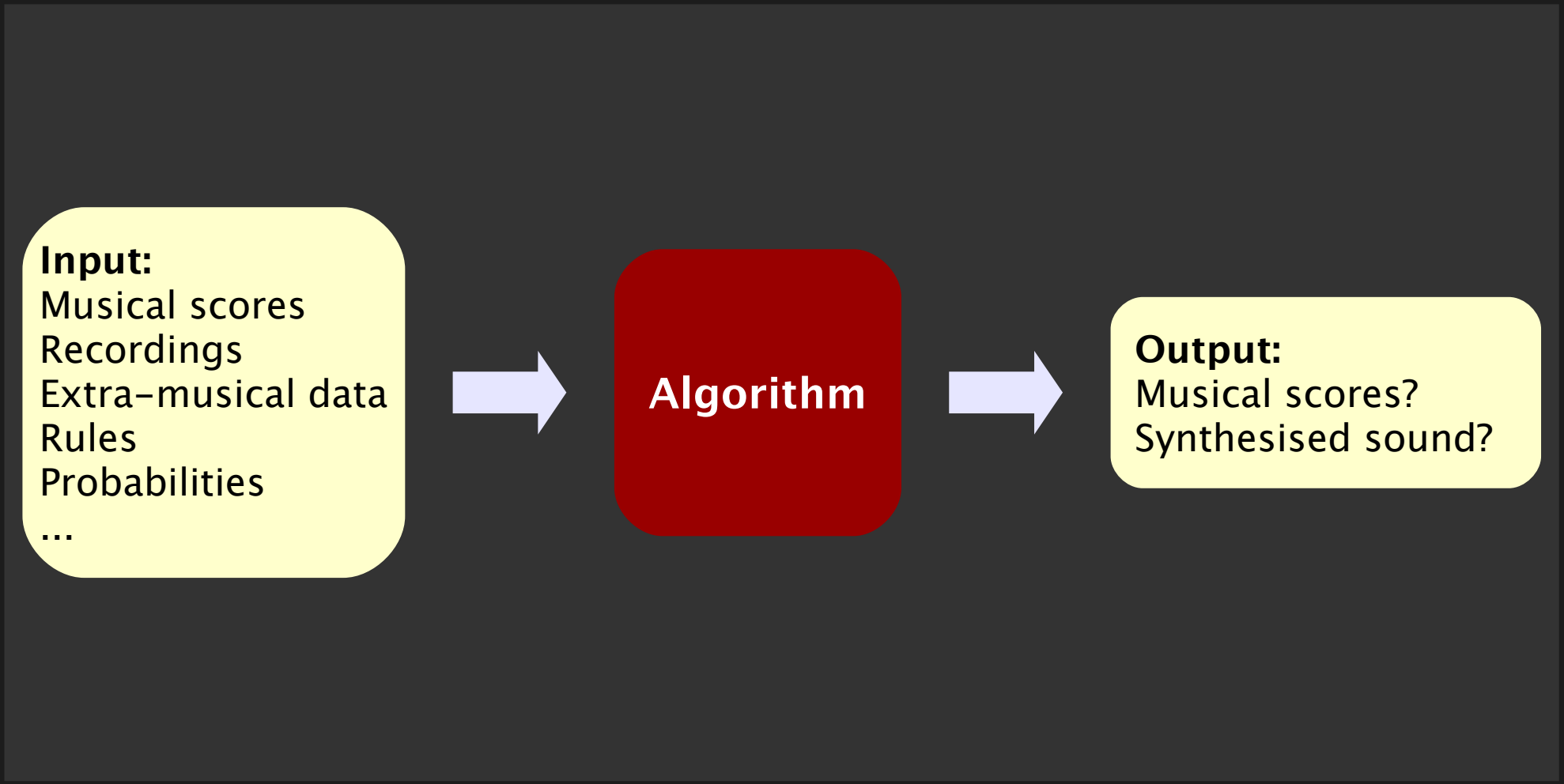
2. How did we get there?

2.2 Different problems and approaches

SOURCES OF VARIETY

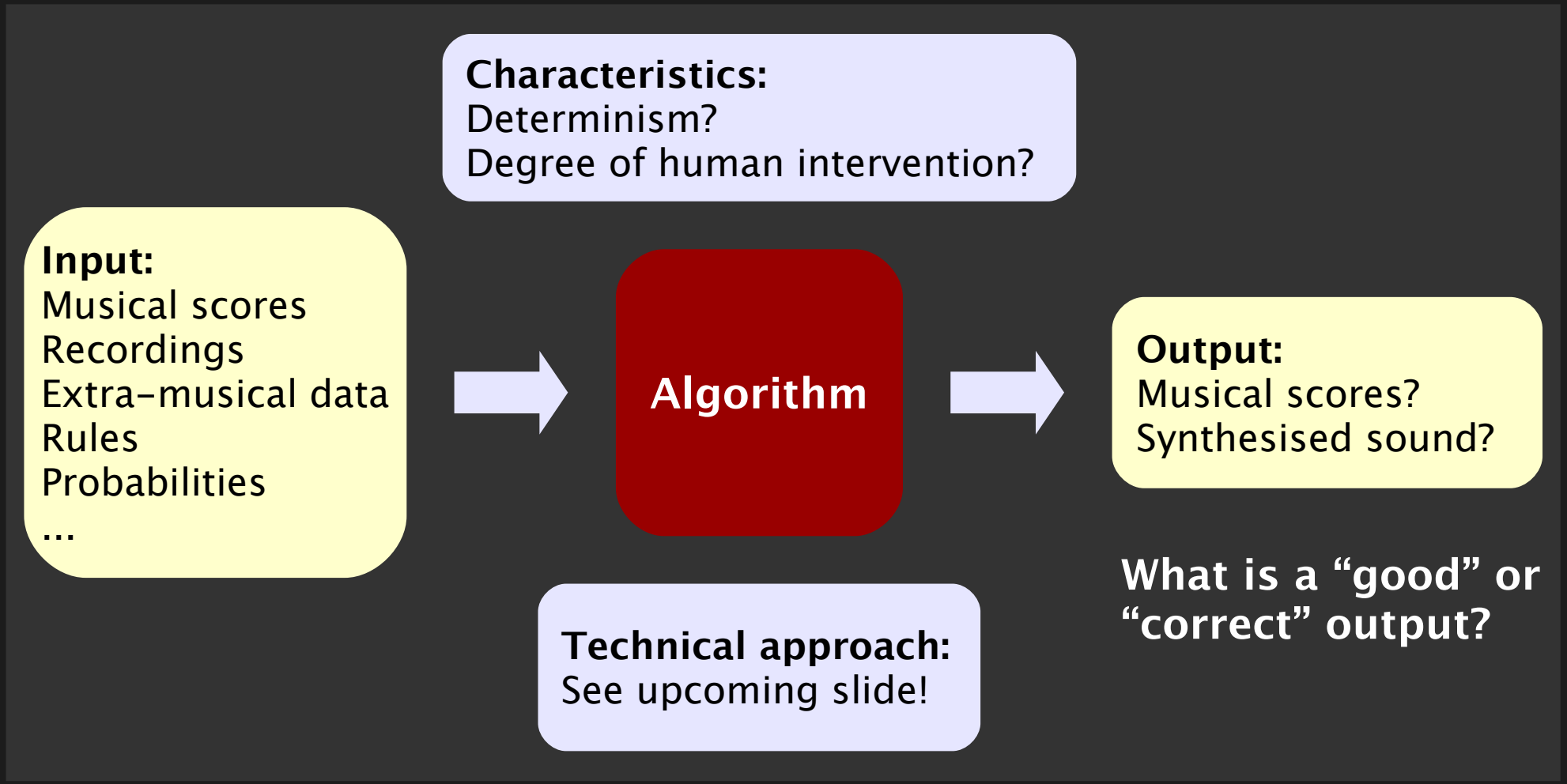


SOURCES OF VARIETY



SOURCES OF VARIETY

Each choice defines a different problem!



TECHNICAL APPROACHES

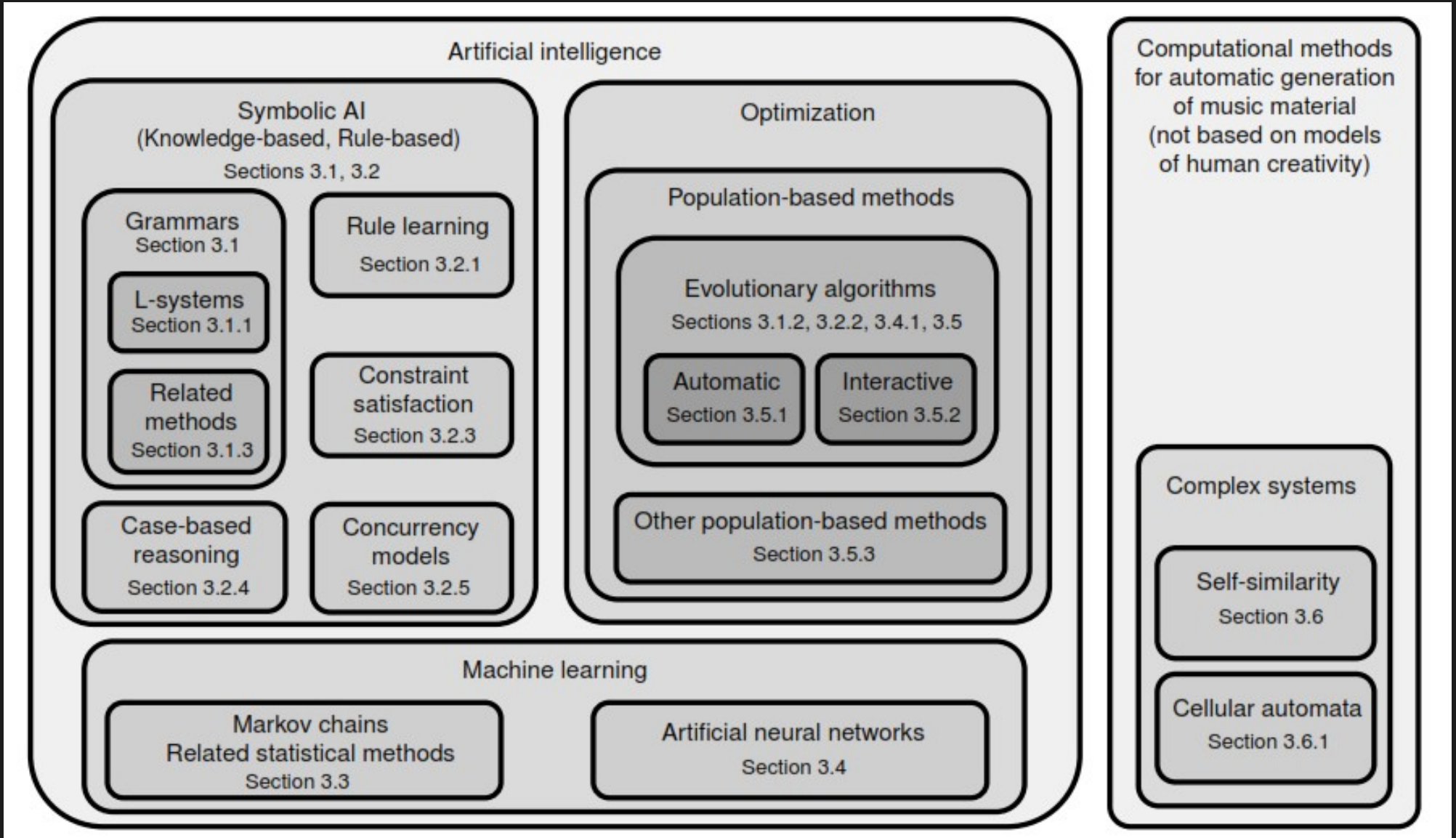


Figure: Fernández/Vico, 2013

How did we get there? Different problems and approaches

TECHNICAL APPROACHES

Immense variety of approaches

Further complication:
Similar approaches are used to achieve different ends

Choice of any one approach needs justification!

WHAT IS A GOOD/CORRECT OUTPUT?

What is good music?

- Question for music theorists and philosophers
- Not particular to algorithmic composition
- Subjective impression of listener/larger audience
- Are there computable measures for algorithms?

What is the aim/expectation?

- “style imitation” vs “genuine composition” (Nierhaus 2009)

- Imitation of a style/corpus vs automation of compositional tasks (Fernández/Vico 2013)

3. Towards a solution

3.1 Motivation

HOW CAN WE DO BETTER?

Switch hats

Composer: “What is my artistic vision?”
“What sounds good to me?”

Scientist: “How can I make that relevant to the scientific discourse?”
“How can I measure that?”

Reminder (Pearce/Meredith/Wiggins)

Specify aims!
Adopt appropriate methodology!
Adopt appropriate means of evaluation!

3. Towards a solution

3.2 Pearce/Meredith/Wiggins' 4 motivations

4 DIFFERENT MOTIVATIONS

Categorisation by motivation

1. “Algorithmic composition” in a stricter sense
2. Design of compositional tools
3. Computational modelling of musical styles
4. Computational modelling of music cognition

Due to Pearce/Meredith/Wiggins

Failure to distinguish between these tasks leads to bad methodology & bad research!

4 DIFFERENT MOTIVATIONS

1. “Algorithmic composition”

Objective is artistic

Algorithm is tool in the compositional process

Reflects composer's needs & vision

When published, the theoretical/practical relevance must be demonstrated!

4 DIFFERENT MOTIVATIONS

2. Design of compositional tools

Software engineering standards should be upheld!

Perform and document analysis, design, implementation, and testing stages!

4 DIFFERENT MOTIVATIONS

3. Computational modelling of musical styles

Allows for hypotheses about the properties of different styles

Tests for over- and undergeneration can be made significant
→ How well does the algorithm emulate the style?

4 DIFFERENT MOTIVATIONS

4. Computational modelling of music cognition

Goal: Test hypotheses about the cognitive processes that are required for musical composition

The relations and differences between algorithmic and cognitive processes must be made clear!

4. Conclusion

WHAT SHOULD YOU TAKE AWAY?

Algorithmic composition...

...is a complex and fascinating topic
...can comprise different tasks
...has seen a plethora of approaches

Pearce/Meredith/Wiggins

The field suffers from a lack of appropriate methods
Categorisation by 4 motivations might help

The mere description of an algorithm that composes music is not a valuable contribution to research!

SOURCES

Print

1. Pearce, Marcus, Meredith, David, and Geraint Wiggins. “Motivations and methodologies for automation of the compositional process.” Musicae Scientiae 6.2 (Fall 2002): 119–147.

2. Fernández, Jose David, and Francisco Vico. “AI Methods in Algorithmic Composition: A Comprehensive Survey.” Journal of Artificial Intelligence Research 48 (2013): 513–582.

3. Papadopoulos, George, and Geraint Wiggins. “AI Methods for Algorithmic Composition: A Survey, a Critical View and Future Prospects.” AISB Symposium on Musical Creativity, 1999.

4. Supper, Martin. “A Few Remarks on Algorithmic Composition.” Computer Music Journal 25.1 (Spring 2001): 48–53.

5. Nierhaus, Gerhard. Algorithmic Composition: Paradigms of Automated Music Generation. Wien: Springer, 2009.

6. Wiggins, Geraint. “Computer Models of Musical Creativity: A Review of Computer Models of Musical Creativity by David Cope.” Literary and Linguistic Computing 23.1 (2008): 109–116.

SOURCES

Web

http://blogs.bodleian.ox.ac.uk/adalovelace/about-ada-lovelace/

https://en.wikipedia.org/wiki/Algorithmic_composition

https://commons.wikimedia.org/

http://www.iannis-xenakis.org/

All retrieved on 21 June 2015