

Constructing a Conceptual Profile Zone: The Example of Chemical Analysis as Everyday Practices

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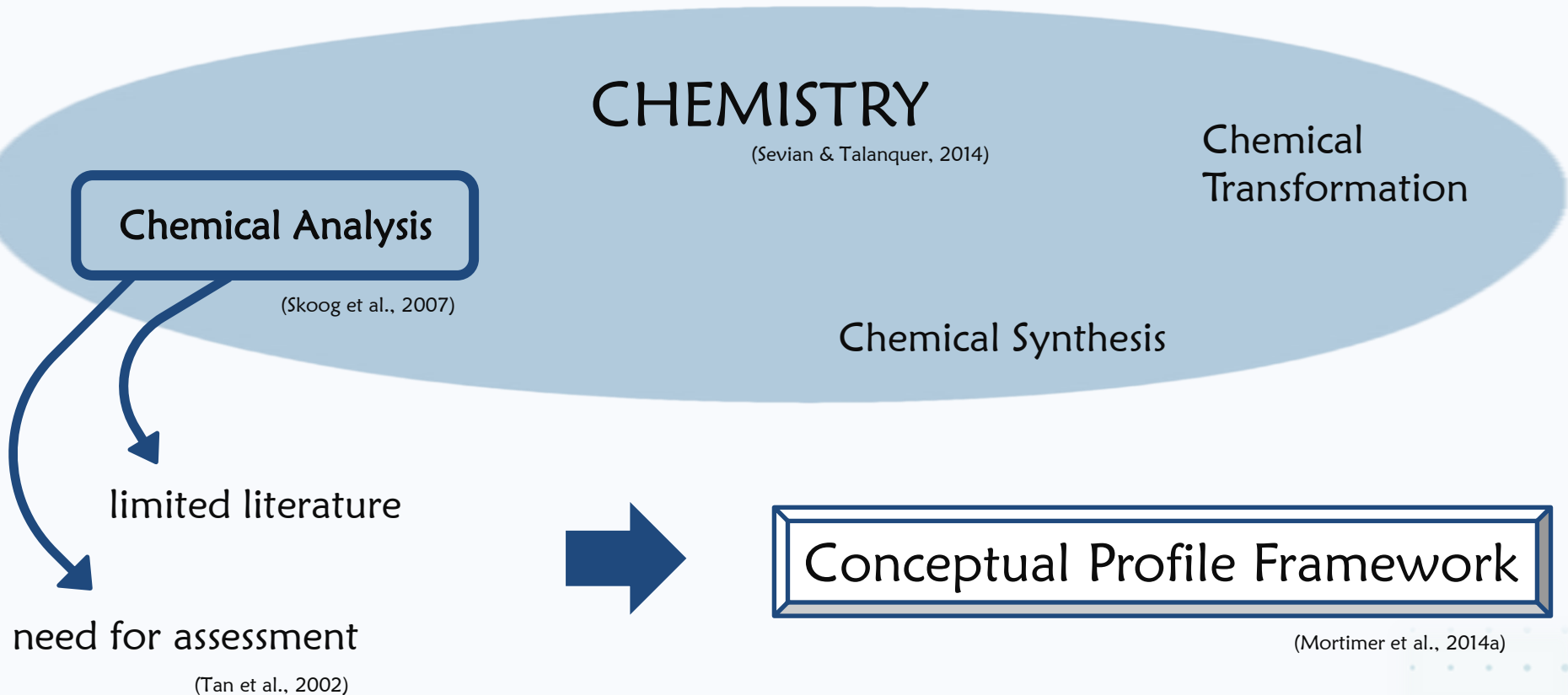




Overview

1. Introduction
 2. Theoretical framework
 3. Purpose
 4. Methodology
 5. Results
 6. Conclusions
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Introduction



Conceptual Profile Framework

Zones: specific ways of thinking about a given concept.

(Mortimer et al., 2014a)

Foundation 1

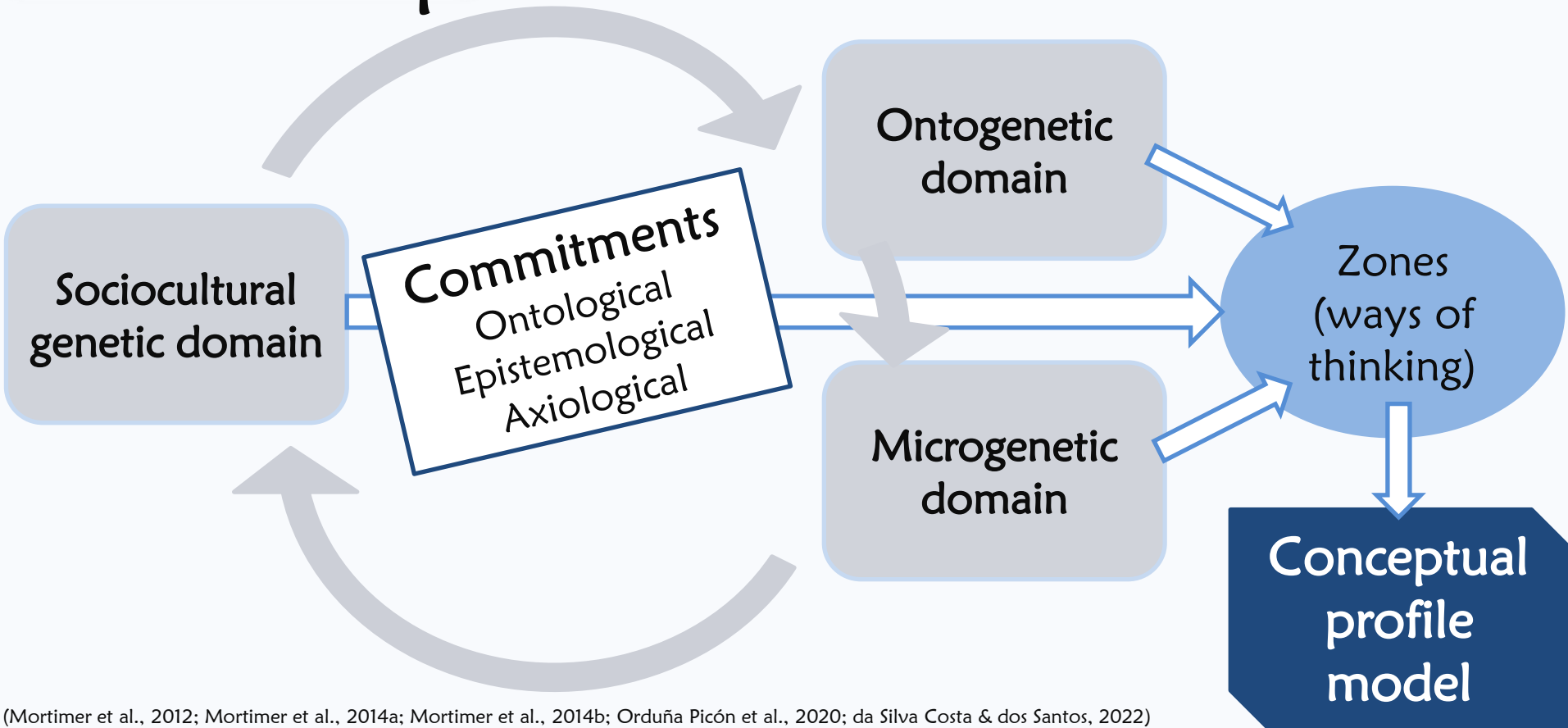
For a given concept
heterogeneity in thinking
is found in the
population

Foundation 2

For a given concept
heterogeneity in thinking
is found in an **individual**

(Mortimer et al., 2014a; da Silva Costa & dos Santos, 2022)

Conceptual Profile Framework



Purpose

Zones
(ways of
thinking)

...

Everyday practices

...

...

...

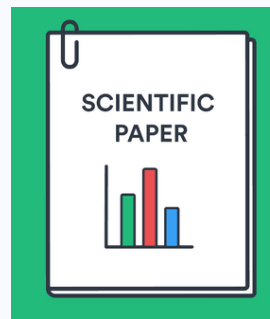
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Conceptual
profile model of
chemical analysis

Data Collection

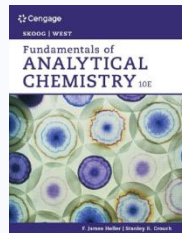
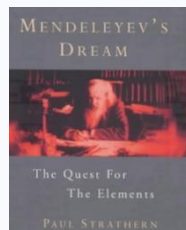
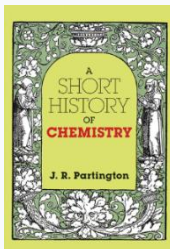
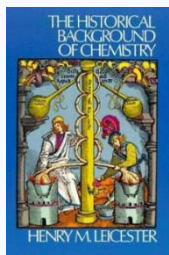
Sociocultural domain

- Secondary literature on the **history of science**
- **Epistemological sources**



(Zuckerman, 1992; Simon, 2002;
Vershinin & Zolotov, 2009;
Ruthenberg & Mets, 2020)

TEXTBOOKS



(Leicester, 1971; Partington, 1989; Strathern, 2000; Skoog et al., 2007)

DICTIONARIES



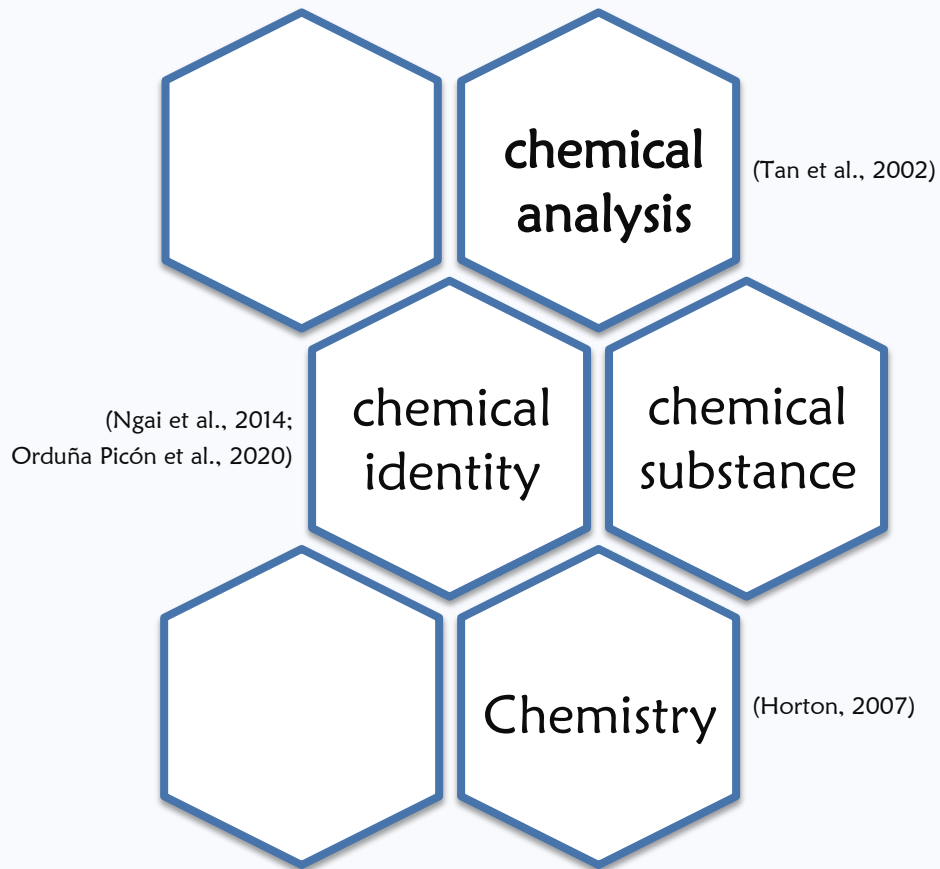
STANFORD ENCYCLOPEDIA
OF PHILOSOPHY



Data Collection

Ontogenetic domain

Literature on students' thinking and alternative conceptions



Data Collection

Microgenetic domain (primary data)

- 44 students
- 11th grade (16-17 years old)
- 2 Greek public high schools

ethanol
ethanoic acid
1-propanol
propanoic acid

properties (organoleptic,
physical, chemical)

spectra (¹³C-NMR, MS)

sources, applications



open-ended questions



1. Which of the information about the materials given to you is important to successfully distinguish between them?
2. Which of the following distinctions of substances is easiest and which is most difficult to make and why?
3. Suggest a way to successfully distinguish between ethanoic acid and 1-propanol.

Data Analysis

Commitments

Ontological

- What kind of **entities** and/or **analytical procedures** one commits to consider present when thinking about chemical analysis?

Epistemological

- On what **basis** one **constructs** his/her **knowledge** about the entities and/or analytical procedures considered present when thinking about chemical analysis?

Axiological

- How one **evaluates** and **affectively judges** the entities and/or analytical procedures considered present when thinking about chemical analysis?

Results

Sociocultural domain

Ontogenetic domain

Microgenetic domain

Ontological Commitment

Sociocultural domain

(Leicester, 1971; Belcher et al., 1977; Partington, 1989; Hudson, 1992; Zuckerman, 1992; Simon, 2002; Vershinin & Zolotov, 2009; Beaney, 2021)

Ontogenetic domain

(Langley et al., 1987; Horton, 2007; Ngai et al., 2014; Orduña Picón et al., 2020)

Microgenetic domain

... the information I have chosen is that which... can remove substances from the mixture or reveal their existence...

objects

complex matter → basic parts

categories or types of stuff

simple processes of isolation and separation

human senses

we first taste or smell it...

*we can distinguish the substances **directly**...*

*I would check its **clarity**...*

*... knowing which **category** they belong to allows for **differentiation**...*

Ontological Commitment

Materials are **complex entities** or **categories of stuff** that can be separated into their basic parts with simple procedures of **isolation** and **separation** involving the use of **human senses**.

Epistemological Commitment

Sociocultural domain

(Leicester, 1971; Partington, 1989; Strathern, 2000)

object-related properties

not necessarily in a lab

in everyday life

Ontogenetic domain

(Langley et al., 1987; Stavay, 1991; Krnel et al., 1998; Liu & Lesniak, 2006; Horton, 2007; Ngai et al., 2014; Ngai & Sevian, 2017; Orduña Picón et al., 2020)

instinct, talent, practice, experience

Microgenetic domain

odour, taste, colour, appearance
– *form and clarity*
smell, taste and see

theory-independent

explicit properties

direct observation, human senses

someone who does not know chemistry... using just these simple words...

they can be observed with the naked eye or without experiments...

I chose the features that are distinct to the human senses

Epistemological Commitment

The basis on which people construct their knowledge about the entities and analytical procedures is **direct observation and use of senses** so as to perceive the **explicit properties** of materials, **independently of theoretical ideas** and **not necessarily in a laboratory.**

Axiological Commitment

Sociocultural domain

(Leicester, 1971; Partington, 1989; Szabadváry & Robinson, 1980; Vershinin & Zolotov, 2009; Ruthenberg & Mets, 2020; Zolotov, 2020)

Ontogenetic domain

(Stavy, 1991; Krnel et al., 1998; Ngai & Sevia, 2017)

Microgenetic domain

information on where each substance is used in everyday products...

origin, habitat, purpose, function, similarity with useful exemplar materials

useful entities

useful analytical processes (metallurgy, cosmetics, etc.)

*simple, easy
not so valid and reliable*

everyday and professional needs

if these materials are part of a food or other products that we use on a daily basis...

Axiological Commitment

Individuals analyze only the **entities** that they find **useful** in their daily and professional lives and employ only the **analytical processes** they find **beneficial**, such as those involving food, metallurgy etc., which are evaluated as **simple and easy** yet **not so valid or reliable**.

Conclusions

Chemical analysis as Everyday Practices

Ontological: materials are complex entities – categories of stuff that can be separated into their basic parts with simple procedures of isolation and separation involving the use of human senses

Epistemological: explicit properties of entities, direct observation - use of senses, independently of theoretical ideas, not necessarily in a laboratory

Axiological: useful entities and processes for daily and professional needs, simple, easy, not so valid or reliable

Next...

Proposed ways of thinking (zones)

Stabilized zones

Proposed conceptual profile model
of chemical analysis

(Mortimer et al., 2014b; da Silva Costa & dos Santos, 2022)

Probing
students'
thinking

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Thank you!