Facet Theory and Thinking about Human Behaviour

Abstract In this chapter, I focus my attention directly upon facet theory and the mapping sentence. The mapping sentence is employed as a template to account for complex behaviour in everyday scenarios. A mapping sentence is used to define the elements of a behavioural vignette. Details are given of the use of the facet theory within research studies that have incorporated the approach. Facet theory is presented as an integrated orientation to research design and analysis. Answers are provided to the questions: what is facet theory; what are facets; what are facet elements; how do facets combined in real life/what is a mapping sentence; what are facet roles; how can facet driven research be analysed?

Keywords Human Behaviour • Facet Theory • Mapping Sentence • Facets • Facet Elements
Introduction

I face a problematic decision between two choices when I attempt to describe facet theory. If I make my first choice, I may choose to explain the overall nature and use of the facet theory approach. By doing this, I hope to make the readers comfortable in their basic understanding of the facet theory approach and the sort of questions this approach to research is able to achieve. My difficulty in adopting such an approach is that in order to describe facet theory in a way that the reader can digest and assimilate I must assume that, to some extent, they already know what several of the important aspects of the theory are. For example, I will have to use terms such as the mapping sentence, facets, and facet elements. My alternative choice in presenting facet theory to the reader who is unfamiliar with this area is to first describe the constituent parts of facet theory (mapping sentences, facets, facet elements, etc.) and then to unite these elements in a later section of my text. The failing with this approach is that facet theory constitutes an approach to depicting the complex interplay of variables and defining parts of the theory before understanding the whole may lead to difficulties appreciating the way in which a synthesis of parts to whole is achieved. Therefore, my approach so far in this book has been a little of both and in this chapter I will interweave both the generals and specifics of the approach to elucidate aspects of my description as appears appropriate. I will however assume that the preceding chapters of this book have been read.

I claimed and demonstrated in the previous chapter that category formation is a rudimentary characteristic and behaviour of both human and non-human animals. I have also shown that the use of categories is a widely present process in many forms of academic activity in the sciences, humanities, social science, philosophy, and many other streams of scholarship. Being so widespread it is hardly surprising that an enormous literature addresses categorisation in some form or another including the academic areas of ontology, mereology, and hylomorphism, all of which are much concerned with categorisation. In this chapter I present facet theory’s category forming proclivity both as it exists as a commentary upon metaphysics and as an approach to theoretical and applied
behavioural and social research. I will commence by considering facet theory’s knowledge generating capacities.

Generating Knowledge in Facet Theory:
A Brief Overview

Attempting to achieve what seems like an almost impossible task is central to the role of the psychologist: Each day within their work psychologists\(^1\) assail the possibly unachievable quest of comprehending a person’s sense of themselves, both as individuals and as members of social groupings. The types of understanding that psychologists attempt to develop usually takes either the form of being either descriptive or measurement based, with both of these approaches being laden with methodological and philosophical strictures and demands (for further details see for example: Howell, 2012; Williams, 2016), where the former of these is narrative-based and the latter numerical. Knowledge generation is often depicted as progressing along a linear path of discovery, starting with a person sensing of events and then observing this in greater detail and forming conjecture about what they are seeing. Then, through the deployment of our rational capabilities and previous analogous experiences, we formulate hypotheses in an attempt to explain what we are seeing. Components of this sensed and conjectured universe are labelled and categorised through a course of interpretative action and semiosis,\(^2\) where such categorial modelling may be related to research issues and to questions that arise from these.

When using a facet theory approach to one’s research, data gathering is designed based upon the multivariable hypotheses presented in the mapping sentence (later in this chapter, I consider in some detail, what mapping sentences are and how these are used) and meaning is assigned to

\(^1\) Here I am, talking about psychologists as attempting to understand the human condition. They are not alone, of course, in making such an attempt. However, whilst acknowledging their non-exclusive possession of such an aim I speak about psychologists as they are the most frequent users of facet theory.

\(^2\) Semiosis is the process of using signs, codes, texts, in producing meaning: see, Bains (2014), and Danesi and Sebeo (2000).
responses through a semantic and reflexive process. These procedures are undertaken with the hope of producing partial answers to research questions. This leads to knowledge development through the information gathered providing insight into the validity of the mapping sentences initial hypotheses.\(^3\) In a somewhat brusque and abstract manner, and without reference to any specific area of research content, the above paragraph provides an overall view of the process of conducting research using a facet theory methodology, although it is important to note that facet theory research invariably utilises a mapping sentence in its design and analysis. In the following sections of this chapter I clarify the components and processes of facet theory and answer the question, what is facet theory?

**What Is Facet Theory?**

Over three decades ago, David Canter stated that little was known of facet theory within mainstream social sciences (Canter, 1985). In 2015, as I wrote the first edition of this book, the 15th biennial international facet theory conference was in the process of being organised in New York. Because of the Covid-19 pandemic, this year’s meeting has been postponed to 2021, when it will take place in Prague in the Czechia. This will be the 17th international conference. When I attended the first facet theory conference at the university of Surrey in Guildford in 1984, facet theory had been around for 40 years and since then an international community of researchers now uses facet theory. However, whilst the number of users may have increased, facet theory is still little-known outside of those who are its active users. Questions have been asked as to why the popularity of facet theory has not grown more significantly than it has. My answer to this has several components. First, facet theory is an approach to social science research which has been ‘discovered’ by relatively few. This has led to those using the theory being somewhat of a clique and who have supported one another in their use of the approach. Furthermore, facet theory research is truly

\(^3\)In quantitative facet theory there are specific programmes for conducting analyses that enable the veracity of the mapping sentence’s hypotheses.
inter-disciplinary which has resulted in facet theory being taught in a variety of different academic departments and to its publications appearing in a broad selection of journals and book lists.

Facet Theory is an inquiry method for conceiving of and investigating human behaviour. It is primarily a social science methodology that allows the conceptualization and definition of a research content or domain grounded in the context of its everyday existence. This approach aims to facilitate an applied understanding of the domain—*in totem*. Louis Guttman (1950) emphasised the importance of possessing accurate understandings of the phenomena that we plan to manipulate or observe in order to allow us to gather data for scientific investigation and theory generation, facet theory, he suggested provided such an understanding. Traditionally, in the facet theory literature the approach often employs its own specialised terms and communicates in a highly mathematical way. For example, the word and concept of the structuple are frequently hailed as unique to the approach and one of its major characteristics.\(^4\) The intricacies of the approach allow the differentiation of facet theory from other multi-dimensional analysis procedures, for findings to accumulate and for standardised theory in regard to the content area being investigated to be developed.\(^5\)

A research area that is under facet theory investigation is specified in terms of the research domain’s pertinent sub-components, which are called facets and hence the name facet theory: a hypothesis of the pertinent sub-divisions that are important aspects in the experience of the phenomena under investigation. Through this approach, a definition is assembled using facets that are sufficiently encompassing to effectively and expansively represent the whole research domain. The inclusion of a

\(^4\) We will speak more of structuples later.

\(^5\) Facet theory is especially suited for inquiries into complex multivariate events (Shye 1978, 1981). Analysis of the data arising from mapping sentence driven research involves calculating intercorrelations between observations to empirically test inherent hypotheses predicted in mapping sentences. A range of multidimensional scaling procedures have been developed to enable both reduction in data complexity, (however, facet theory not widely used as a post-hoc data reduction method) hypothesis testing and theory development (through the testing of the expected data structure stated a priori in the mapping sentence’s structural hypotheses) (see, Borg 1981; Borg, et al. 2013; duToit et al. 1986; Shepard 1978). It is not the aim of this text to consider data analysis techniques.
facet within a research design is based upon previous research and the investigators experience. Louis Guttman initially developed facet theory, which appeared in a series of articles (1944, 1954, 1957, 1977, 1979). Other researchers (notably for example: Borg 1977; Foa 1958; Canter 1985; Gratch 1973; Hackett 2014; Hackett and Fisher 2019; Runkel and McGrath 1972; Shye 1978) have also produced important texts, which expanded Guttman’s notions and brought facet theory to a wider audience.

Louis Guttman attempted to advance a theory with a procedure that was able to establish templates of content domains sufficiently specific to a specific research study to answer the projects applied questions whilst being broad enough to relate to the general content area of the investigation. By possessing the latter feature, a facet template may be formed which can be used to reliably and consistently investigate a given domain in a variety of different real-world contexts. The consistencies present between research investigations that employed a facet design led Guttman to develop ‘laws’ of human behaviour within these specific areas (attitudes, intelligence; Guttman 1959, 1968) where such laws are embodied in mapping sentences (Hackett 2014, 2020; Lustig and Hackett 2020; Levy 1976).

Indeed, the mapping sentence is at the very heart of facet theory. I will discuss the mapping sentence in greater detail in the following sections but I must here mention that a mapping sentence is, amongst other things, a transparent statement of the facets that have been assembled to be used to design a research investigation. The facet theory approach may differ from many of the theoretical and philosophical understandings of categorical systems that can be used to account for human behaviour and experience (such as those I presented in the second chapter). The unusual aspect of the facet theory approach is that systematic and theoretically stringent empirical observations are made that are designed explicitly to incorporate the facets specified in the inquiry’s mapping sentence. By adopting the mapping sentence as a framework for the design of questions, observations

---

6 Facets are empirically valid components of the content area. It is common procedure in psychometric practice to define the relevancy of a behavioural construct through reference to observations in terms of the inter-item association in the content of the measurement items employed.
or as a thematic framework within a qualitative study, the data so gathered is then able to support or refute the facets of the mapping sentence as being appropriate categories of experience for those being investigated in the specific domain that is being studied. In this way, facet theory is able to provide a systematic methodology for the classification of a complex research domain (White and Mitchell 1976). I would go much further than this statement and claim the mapping sentence provides a framework for the hermeneutically consistent interpretation and understanding of the content area it maps (Hackett 2016). I have briefly described the facet theory approach and have mentioned the mapping sentence. I will now consider both of these in greater detail and I will commence by looking at facets and their component parts.

**Facets and Facet Elements**

Facets are pertinent and important aspects of a given research area. In a qualitative study that uses facet theory, facets are important areas or bodies of meaning for those who are taking part of the study. When conducting quantitative research, facets are the set of variables that allow the researcher to exhaustively account for the important variation (or as much as possible) observed by the researcher. In both qualitative and quantitative research, facets also make reference to previous research that has been undertaken within a specific research domain. David Canter explains how a central feature of facet theoretical research is the identification of contextually and behaviourally relevant facets, the facets that are most useful in explaining underlying psychological processes germane to a given context (Canter 2000) (Canter’s area of interest being criminal offenders).

Süb and Beauducel (2004, p. 313) describe a facet thus: ‘A facet may be any way of categorizing observations in usually mutually exclusive and exhaustive categories and can be formally described as a set consisting of a finite number of elements’. When asking the question, ‘what are facets and what are facet elements? Canter again offers a useful answer. Facets are, he says, ‘… comprised of elements which define the different values
that logically and completely describe all of the variations within any facet.’ (Canter 1985, p. 22).

In Table 3.1, I provide a list of what David Canter (1985)7 claims are the five important characteristics of facets and their elements:

1. Events classified must be categorised using all of the domain facets
2. Each of the facets must be exhaustively broken into a set of values or elements
3. A facet’s elements must be mutually exclusive
4. The research must specify the logical interrelations between the content facets
5. The facets specified must together define the domain of the investigation

Structuple

The combination of elements from all of the facets in a study results in what is known as a structuple profile.

I have mentioned mapping sentences extensively but in the section that follows, I will summarise and exemplify the theory behind this device and its use.

---

7 Canter derives his list from Runkel and McGrath’s (1972) to whom he credits his list’s contents.
The Mapping Sentence

I have to this point described facet theory in somewhat general terms, including my descriptions of facets and facet elements and indeed, mentioned the mapping sentence. I have stated that facets contain elements that constitute the important aspects of a stated research area. The questions now arise of how can facet theory escape from being a purely theoretical account of a research domain and how do facets and facet elements combined in real life situations? These are fundamental questions that any researcher may ask when they are considering the usefulness of adopting a facet-based approach to their work. The answer to both these questions is through the designing and empirical testing of a mapping sentence. The uniqueness and advantage imparted through the use of a mapping sentence as a template for developing the evaluation of complex situations is due to the mapping sentence’s ability to capture the complexity of such situations whilst maintaining a clear designation and subcategorisation of individual variables within the context of the study. The mapping sentence is the main ‘tool’ of facet theory research and may be described as:

something like the hypothesis of the existence of a certain specific combinatorial pattern in the way we [each individual] experience a certain sector of reality. Marmodoro (2014, personal communication)

This description of a mapping sentence by Marmodoro is very clearly expressed and is an accurate depiction of the mapping sentence. The mapping sentence has been, and is, used in the manner Marmodoro suggests, to enable the design of inquiries into specific sectors of reality. The mapping sentence provides a theoretical hypothesis of how individual’s experience and understands the reality of a given sector of his or her life. The mapping sentence is therefore at the same time both a conceptual and empirical framework that allows the exploration of individuals and comparisons between people without imposing propositions of understanding upon individuals. A mapping sentence specifies the logical relationships amongst facets and facet elements and by so doing, it also assists in the identification of redundancy in facets and
their elements. The mapping sentence also suggests areas where adequate description of research content may be missing.

A mapping sentence is therefore a definitional scheme or framework. The sentence is made of multiple facets and facet elements (as described above), and theoretical understandings about how these variables combine in everyday situations. Two sets of events are explicitly specified in both declarative and traditional mapping sentences: (a) details of the population in the study (the population from which the study’s sample is drawn) and (b) the variables that are of interest to the study and the elements of these variables. In traditional mapping sentences, a third set of events are stipulated in the form of (c) an explication of the format and range of the quantitative data that will be collected. The range facet is not included in the declarative mapping sentence in order to avoid binding meaning present in the information collected to being within certain parameters. The above three sets of qualities are enabled as a mapping sentence is designed or adapted to a particular project and suggests both observations and the expected structure of the data that will be collected. The researcher is then able to observe similarities and differences between the expected and gathered data.

I will now demonstrate how the parts of a mapping sentence are assembled by constructing examples of mapping sentences. In each of these illustrations, I will address very different content areas. The first of these is the already referred to mapping sentence for academic dialogue. Following this, I will use a mapping sentence to depict the theoretical content of the aforementioned Categories of Aristotle. Finally, I will produce a mapping sentence to account for a piece of narrative text.

### The Composition of Mapping Sentences

During the initial stages of designing a research project, a scholar is faced with the process of generating new tools and procedures (questions, observations) that they may use in their specific study. The researcher wishing to use a facet theory approach in their inquiries will conduct a literature review and discover that either the content area has been previously investigated using facet theory or it has not. When the research is
into a subject area that has not previously been investigated using facet theory, the initial research activity is the development of a new mapping sentence to address the content area.

**Traditional Mapping Sentence for Academic Exchange**

I have already presented in Fig. 1.1 a mapping sentence that I produced to account for a dialogue with a colleague I had about philosophy in general and Aristotle's ten Categories specifically. I developed this mapping sentence by reading through my email correspondence and highlighting what appeared to be the important aspects of our conversation. I identified whether each of the highlighted words or phrases appeared to subsume another highlighted word or phrase or was itself subsumed within a highlighted word or category. In this manner, I identified the facets (subsuming categories) and facet elements (items that were subsumed). I then put the facets into a sentence format that presented each facet and its elements in a logical manner. Putting the facets into a sentence meant that I stated how I believed the facets related to each other and I therefore connected the facets using everyday language. The connective phrases and words can be thought of as functors or as a connective ontology. These parts of a mapping sentence are of cardinal importance as they determine the meaning and the types of relationships between facets. They are also very frequently ignored in the facet theory literature, or may not even be present in some reductionist mapping sentences. I carefully chose the facets, elements, and connective phraseology and brought these together in a way that suggested how the facets actually structured my understanding of our conversations. The resulting initial mapping sentence is shown in Fig. 1.1.

**Traditional mapping sentence for Aristotle’s Categories**

I now provide another example of a mapping sentence that has been designed to allow exploration of a domain that is novel to facet theory
research. In Fig. 2.1, I listed Aristotle’s *Categories* and below in Fig. 3.1, I incorporate these *Categories* into an initial mapping sentence. I am here presenting Aristotle’s *Categories* in a very superficial manner. Both Aristotle and the many commentaries on his work display a great complexity that the initial mapping sentence I have produced does not attempt to capture. A simple example of this is provided in Thomas Aquinas’ (1225–1274 C.E.) commentaries on Aristotle’s understanding of the senses (Aquinas et al. 2005). Here Aquinas says, for example, that when Aristotle thought of colour he differentiated between things that are coloured of themselves ‘intrinsically’ and things that are transparent or coloured from without, thus he concluded that colour is the limit of transparency: “Thus color is not a category of quantity—like surface, which is a limit of a body—but in the category of quality” (Aquinas et al. 2005, p. 60). Moreover, Aquinas notes how Aristotle’s limiting of the transparent by colour is not opposed to his claim that colour is of itself and will be meaning and limiting this to things that are themselves coloured. If the initial mapping sentence was indeed to be used to guide an actual research project into Aristotle’s *Categories* then considerably greater time would be invested into developing an initial mapping sentence that more adequately reflected Aristotle’s work and commentaries upon this. The initial mapping sentence is a beginning or preliminary instantiation of an exploratory understanding of the Categories.

Notwithstanding the above remarks, my first task in designing a mapping sentence that describes the variability in the content of Aristotle’s *Categories* involved me reading through Aristotle’s text in which he describes the ten categories (many translations and interpretations of this text exist, see for example: Edghill 2013; Frede 1987; Sim 2004). In doing this I was able identify the ten categories, which I wrote as headings. I then read the *Categories* text along with several commentaries upon this and identified the range over which Aristotle appeared to specify each category may exist or exert an influence. This took some time but eventually this resulted in ten categories each with what I propose are appropriate sub-divisions: these formed the facets and facet elements respectively. I then arranged the facets and linked these with connective

---

8 There is a vast literature on the Categories and I simultaneously consulted part of this canon.
substance

person (x) perceives the given \textit{primary} substance, \textit{secondary}

quantity

in terms of its, \textit{continuous} quantity, and its, \textit{discrete}

quality

\textit{habitual and dispositional} quality, which may be in either, \textit{natural capabilities and incapabilities}
\textit{affections and affective}
\textit{shape}

relation \hspace{1cm} place

\textit{isolated} relation, in a given, \textit{near to} relative location, \textit{interacting} \textit{far from}

\textbf{Fig. 3.1} Initial mapping sentence for Aristotle’s ten categories of being
time

and, \{past\} time relative to extrinsic events, whilst having, \{their clothes\}

\{present\} \{ornaments\}

\{future\} \{possessions\}

action

whilst the action of the power a substance, \{upon something else\} is associated with,

\{within itself\}

being in

a position

\{positive\} change, and being the recipient of a given, affection, \{upon the self\}

\{negative\}

affection

range

by which they understand their being from a, \{higher\}

\{to\} extent.

\{lower\}

Fig. 3.1 (continued)
language in accordance with Aristotle’s text to conform to linguistic logic. I actually produced several initial mapping sentences but due to limitation of space, I present just one example here. I chose to include this particular version, as I believe it to form a useful template that may guide future inquiry.

Traditional Mapping Sentence for Understanding the ‘Mise-en-Scène’ of a Narrative Text

After having looked at the first two mapping sentences, I hope that it is now becoming apparent how all mapping sentences embody several features: structural hypotheses, and essentially conjectures about the important variables or aspects (facets); levels of these variables or aspects (facet elements); a specification of the roles of facets; a suggestion as to how facets and facet elements may be combined in an investigation in order to allow for the development of greater understanding of a domain. As well as structuring the design of a research project, mapping sentences are structural in a further sense. In traditional quantitative facet theory, this structure is revealed in multidimensional statistical analyses of data collected using instruments developed with mapping sentence as a template. Using these analyses graphical structure is revealed which demonstrates the similarities in the data set and provides or rejects the hypotheses used in the design of the study’s mapping sentence. In qualitative facet theory using a declarative mapping sentence without a range facet, the information that is gathered from a study is subjected to content analysis, thematic analysis, etc., in order to test the mapping sentence’s proposed structure.

David Canter comments upon the role of an initial mapping sentence and how the sentence’s status as being initial may change after research guided by the sentence has been conducted. Canter notes how a mapping sentence is the initial stage of a research project and it is also frequently its conclusion (Canter 1985). The above mapping sentence for Aristotle’s Categories, attempts to offer a structural configuration to what is obviously an extremely theoretical research domain. However, most often mapping sentences are developed for more everyday human behaviours
and experiences. To illustrate one way in which a mapping sentence may be originated to account for more complex human (perhaps empirical) events in a setting that is more reminiscent of everyday social life, below I have written a brief, fictitious vignette, a literary account of everyday life, a reflection of a personal experience of an individual.

**Narrative**

She was old now, of advanced enough an age that the man next to her, her son, was himself old enough to remember exactly where he had been when he heard that JFK had been shot. The woman was contemplating the room and the house. He was also thinking about the house, the kitchen within which they sat, the wooden chairs. Were those chairs always where they now stood? Green, scraped, they too possessed a history, contemporary with the chills of Soviet relations. The chairs and table perceived by mother and son, all possessed their own story; conflicting and harmonious narratives. He tried to remember where the table stood when he was a child. Did his mother always sit under the window with its erratically painted mullions and transoms? Two windows and a single light bulb in a yellowed-glass pendant provided light over the table. She remembered buying the table and chairs in a yard sale; he still felt the pain of falling from its elevated surface that warm Sunday afternoon. The kitchen had two doors facing each other: one led to his childhood friend who lived in the next house and who called to see him early each Saturday; the day when they would run down the streets screaming a confirmation of their freedom. The other portal from this semi-public space with its verdant tableau took them both into those undisclosed areas where she was in command; his existence beyond this door was not confirmed by yelps of joy.

They both sat and reflected upon the table and chairs and the objects set upon the varnished dining surface. Of these items, some were functional and only appeared with each meal, the vase was less transient in its presence. She questioned whether the room had always been this size, so small with dim recesses at its corners. How had they lived here all those years? She remembered cigarette smoke that was inevitably worn by all
present, coddling their shared stories. The man’s eyes still smarted at the memory of the gaseous wrapping that excluded him from the adult conversation with its controlling intent.

The day at work had been hard for him followed by a slushy walk through the snow to see his mother; through cold damp streets and an empty grey sky that paralleled human absence; his feet numb from the cold. She remembered the frequent visitors who used to come and knock on the door, joining them, sharing cups of coffee or glasses of lemonade; the choice predicted by seasonal divergence. They both saw the others, clustered around the table, sitting, standing in sombre reflection and blithe coterie. He remembered the men, for they were nearly always men, in long winter coats or in shorts and ‘T’s’. She felt the ease of mutual happiness and shared worries, a table and chairs in a kitchen, in uncertain places and at indecisive angles. The mise en scène of their shared lives, faded into the monochrome, an Expressionist movie evoking Dr Calligari, an abstract Cabinet that had differing content for mother and son. A home for their personal recordings of the circumstances and the facts and beliefs within which they lived and through which they understood their lives.

When we read the above narrative, we develop our own informal appreciation of its content, a mereology constituted by allocating the parts of the story to different, qualitatively distinct components of our understanding of the meaning of the whole narrative account. By this, I mean that parts of the narrative are understood as discrete entities by a given individual and these parts will have different relevance to all readers. Directly below is an initial mapping sentence I have developed to help to illuminate understanding of the important components of the ‘Narrative’s Mise-en-Scène’. I am here using the term ‘Miser-en-Scène’ as this is a theatrical term that means the surroundings of an event, the stage settings, for example, and this captures the essence of what this initial mapping sentence that I have formulated portrays.

I developed the above mapping sentence by first reading through the narrative several times and making notes/highlighting words and phrases that appeared to be of particular importance to the content of the story being told. I then listed the words and phrases I suspected to be pivotal in the narrative’s understanding. I attempted to identify any relationships
between these in order to suggest how these words related to each other in terms of the narrative’s flow of meaning. I also made an initial decision as to which of the highlighted words/phrases appeared to be facets (major meaningful sub-divisions) and which may have been facet elements (items that appeared to be subsumed within the experiential category of a facet).

To illustrate what this procedure achieves, in the mapping sentence for the ‘Mise-en-Scène’ of Narrative’, facet C defines the respondent pertinent area of their abode or home. The important sub-aspects of experience within the home are the house itself, the kitchen, other rooms, and outside of the house, which are the abode facet’s elements. The important point here is that if I had attempted to account for the experiences of individuals in the narrative without an explicitly labelled abode facet, a valuable part of my personal understanding would have been omitted. Moreover, if I had included abode as part of my enquiries but had either left this as a holistic concept, or had divided it say into, ‘public rooms’ and ‘private rooms’, this structure would have imposed a form of understanding not present in narrative. I then proceeded to order the facets in a meaningful manner as they related to the content of the narrative and to connect the facets and their elements using simple English phraseology. I repeated all of these stages several times which took some time and resulted in several attempts and deletions of these. I continued doing this until I felt confident that the resulting mapping sentence was an adequate initial representation of the experiential variables (facets) that the fictional narrator used to structure his understanding of the narrative’s content. As a final check of the mapping sentence I had constructed I asked colleagues for their comments.

In three of examples that I have provided above all of the mapping sentences were traditional mapping sentences in which each clearly focused upon assessing understanding of the content they embodied in terms of a single outcome variable. These outcome variables were stated in the range facets for each study and were: (academic exchange) a variable that measured the degree to which a person understood an exchange to have been of greater to lesser a success in terms of their intention within the specific dialogue; the extent from a higher to lesser, to which a person
was able to understand what constituted “being”; functionality rated from positive to negative in terms of their place experiences.

**Initial Declarative Mapping Sentence for Musical Preference**

The three mapping sentences above are all traditional and I now provide examples of declarative mapping sentences. The declarative mapping sentence is similar to the traditional mapping sentence in that you read through the sentence multiple times and each time you slightly change your reading. You do this by selecting a different element from each facet on each reading. These combinations of elements within the declarative sentence are undertaken so as to either comprehensively embody all possible combinations, or if there are a large number of possible combinations then this is done systematically. After establishing a map of structuples that are to be incorporated in the research device, questions, observations or other research instruments are then designed to correspond with these structuples. Through taking this approach, the entirety of the content domain is addressed.

The first Declarative Mapping Sentence I provide as an example is for Musical preference. In this mapping sentence, Lustig and Hackett (2020) developed a declarative statement to account for musical choice. To do this they incorporated the facets that were necessary to understand the important components of these choices in the real world.

In their mapping sentence Lustig and Hackett (2020) the facets that they chose were: (1) musical genre; (2) the era or age from which the music came; (3) the access media. The authors stated that they positioned the genre facet first as this was a more general facet which set the stage of the mapping sentence which followed. They describe how they constructed the mapping sentence and listed a stage-wise progression from adding one facet and then another. They started the sentence thus:

*Music listener (X), prefers music from the:*

**Genre**

- **Vocal**
- **instrumental genre**
In all mapping sentences, it is the element that becomes part of a reading of a mapping sentence and is what is used to design research instruments and to interpret the research findings. In this example, the facet is of genre with the elements of vocal and instrumental, for example:

*Music listener (x), prefers music from the instrumental genre*

The next facet that the authors incorporated was of musical era and they connected this to the genre facet with the following words:

*that originated from the:*

The second facet they chose was the era or age the music came from as this, the authors believed, was an important aspect that differentiated musical preference The facet of era/age was stated with the following elements:

*Age/Era (what era the music originated from)*
  * 18th century (1701–1800)
  * 19th century (1801–1900)
  * 20th century (1901–2000)
  * 21st century (2001–present)

Lustig and Hackett then connect these two facets to a third facet that they called media of access. They said that this facet was included because in discussion with music listeners this facet was mentioned as being an important influence upon their choices of music. They chose the following words to represent how they believed access media related to the previous 2 facets:

*which they access in the media form of:*

They included the following elements in the facet:
**Access media** *(how the music is accessed)*

- Streaming service
- Digital download
- CD
- Vinyl
- tape

Taken together, (see Fig. 3.3 for the completed mapping sentence) the authors stated that they believed that the chosen facets, elements, and the connective phraseology they chose to join the facets together depicted how musical choices were made in a real world situation.

### Initial Declarative Mapping Sentence for Evaluating Study Space for Optimal Productivity

The next example I provide of a declarative mapping sentence is another one from Lustig and Hackett (2020). In this mapping sentence, the authors were interested in attempting to identify for investigation the aspects of a place that were related to how optimal this was as a place in which to study. This resulted in the declarative mapping sentence in Fig. 3.4.

In this illustration, the authors again decided to develop a declarative mapping sentence and to not include a range facet that would have restricted their concern to being with a single quantitative outcome measure of space performance. They identified their domain of interest as being the aspects of space that influenced the ideal space in which to study. The facets that they included in their mapping sentence were lighting, temperature, and organization. As I went into detail about how the mapping sentence was constructed with my last example, I will not repeat this level of detail here. However, in Fig. 3.4, it can be seen that words and phrases were placed between the facets to make a declarative mapping sentence. Again, elements from each of the facets can be selected on any reading through of the mapping sentence which, for example, can be read as:
person X experiences space in terms of the lighting and temperature as well as how it is organised to yield an ideal space conducive for optimal productivity.

The selection of elements focuses a sentence upon specific aspects of the research domain that is of interest (space in terms of its influence on studying) whilst the connective words and phrases between the facets provide precise meaning within the sentence. If a researcher changes either the elements or the connective phraseology, they will alter the meaning of the sentence and consequently they will change the meaning of the research. It should be remembered that changing the connective words can have a profound effect upon the meaning of the sentence even though the facets and elements may have been kept constant.

**Summary of Mapping Sentences**

In the mapping sentences, I have presented of Aristotle’s *Categories* (Fig. 3.1), the *narrative’s mise-en-scène* (Fig. 3.2) and the *academic dialogue* (Fig. 1.1), *musical preference* (Fig. 3.3) and *space evaluation* (Fig. 3.4), none of these content domains have previously been explored using facet theory and this necessitated the designing of *initial* (untested) mapping sentences prior to study commencement. However, the facet theory literature has been growing over the preceding decades, which means that a wide range of content domains have been, at least initially, explored using facet theory. In these cases, the researcher does not need to develop an initial mapping but is able to incorporate a mapping sentence that has been employed to explore their content of interest. A facet study gathers and analyses information to allow necessary modification of its mapping sentence. In this situation, an existing mapping sentence with a structure that has already been investigated may be used not just for theory generation but also for theory extension.

When there is an extant mapping, a researcher may ask the question: “what utility exists in incorporating an existing mapping sentence into their inquiries?” The answer to this is manifold and includes: the ability to ask questions in a similar manner to previous research whist being able
Facet Theory and Thinking about Human Behaviour

| facet (a)       | facet (b)    | facet (c)   |
|-----------------|--------------|-------------|
| person (x) being an, \{mother\} when, \{thinking\} about the, \{house\} |
| \{son\}        | \{remembering\} | \{kitchen\} |
| \{other room\} |               | \{outside\} |

| facet (d)       | facet (e)    |
|-----------------|--------------|
| abode, with its, \{small/bright\} atmosphere, with its, \{furniture\} |
| \{small/dull\} | \{decorative objects\} |
| \{large/bright\} | \{functional objects\} |
| \{large/dull\} |

| facet (f)       | facet (g)    |
|-----------------|--------------|
| furnishings, with which undertake, \{sitting\} activities, to engage in, \{social\} |
| \{standing\}   | \{non-social\} |
| \{movement\}   |

range

engagement, and rate this to be \{positive\} in terms of their functional experiences.

\{ to \}

\{negative\}

Fig. 3.2  Initial traditional mapping sentence for the ‘Mise-en-Scène’ of narrative
Music listener (X), prefers music from the:

**Genre - A**

(1. Vocal )

(2. Instrumental )

genre, that originated from the:

**Age/Era - B**

(1. 18th century (1701-1800) )

(2. 19th century (1801-1900) )

(3. 20th century (1901-2000) )

(4. 21st century (2001-present) )

era, which they access in the media form of:

**Access media – C** (how the music is accessed)

(1. Streaming service )

(2. Digital download )

(3. CD )

(4. Vinyl )

(5. Tape )

Fig. 3.3 Declarative Mapping Sentence for Musical preference #1 (Lustig and Hackett 2020)
Person X is interested in understanding space in terms of studying by evaluating:

**Lighting**

(too bright  )

(to  )

(too dark  )

for optimal sight, and feeling:

**Temperature**

(too hot  )

(to  )

(too cold  )

in addition to:

**Organisation (Cleanliness)**

(too organised  )

(to  )

(too messy  )

in terms of this yielding an ideal space conducive for an optimal productive study session.

**Fig. 3.4** Declarative mapping sentence for evaluating study space for optimal productivity (Lustig and Hackett 2020)
to tailor these to a specific situation; for the findings from the new study to directly relate to existing findings; for differences and similarities between previous and new research to be directly compared and for these to be clearly attributed to context rather than variation in research design. A consequence of not utilizing a common research design may be that findings from different studies have little in common and are non-comparable. This situation is analogous to one research study being conducted into the qualities and usability of ‘Mac’ computers, another study investigating ‘Microsoft’ computers and yet another study investigating ‘Dell’ computers (the actual computer brands are irrelevant). However, if the research studies were conducted independently with no explicit or common definitional understanding of ‘what a computer is and how it is used’ then the results from the three studies will be a series of snap-shots which are unlikely to lead to the development of an overall understanding of computers and their usage. Any similarities in results, or the ability to confidently state why any differences or similarities were observed between the separate research studies, would occur by chance. Moreover, any understanding of the overall concept and usage of a computer based solely upon these results would tend to be fragmented and disorganised. However, research using a mapping sentence has the unequivocal potential to develop a body of cumulative knowledge.

It seems reasonable to claim that we usually experience our own lives as integrated wholes, or as sub-divisions of this whole which in themselves form meaningful experience. Therefore, any attempt to account for human behaviour needs to provide for the integration of behavioural and experiential elements. When taken together, the facets in a mapping sentence provide a combined account for a life area. However, individually facets can have different formats or structure reflecting the various different types of behaviour a facet represents. In the following section, I describe some of these facet structures, which may be thought of as the roles a facet plays. Speaking generically, by combining pertinent variables the initial mapping sentence attempts to explain or illuminate a specific area of behaviour or experience. However, a thorough account of a research domain must identify the ways in which different types of facets affect our lives and must account for the specific ways different facets are understood. To illustrate what I mean we may consider how we
understand the experience of seeing an animal walking down the street be using several different evaluative facets. We may identify the animal to be a dog and not a cat or fox, where *animal* is a categorical facet and also to be medium sized, where *size* is a scaled facet. The former is an all or none understanding, the creature either is or is not a dog, whilst the second evaluation is one of extent, i.e., small, medium, and large. To complicate the situation we may also judge the dog to be important to our experience (for example, the dog is our dog and we are attempting to walk with the dog) or not so important (the dog is a small stray dog on the opposite side of the road, walking away from us). In this simple example I have identified three pertinent facets (species, size, importance) and suggested facet elements for each (respectively: dog, cat, fox; small, medium, large; central importance, peripheral importance). There are many other facets of the experience but for this example, let us concentrate on these three. A declarative mapping sentence could be written to describe this event in the following way:

Person (me) sees the (small, medium, large) *size* (dog, cat, fox) *species*, which in the present context is of (central importance, peripheral importance) *relevance* to me.

I can also add a range of the behaviour that I am interested in investigating in terms of the combined effects of the three facets. In this example, I have chosen approach behaviour as my approach willingness is influenced by the state of the three facets’ elements in combination. The resulting traditional mapping sentence would then read:

Person (me) sees the (small, medium, large) *size* (dog, cat, fox) *species*, which in the present context is of (central importance, peripheral importance) *relevance* to my encounter with the animal, that I *approach* to a lesser to greater extent.

Finally, in this example, it is important to note that the *size* facet is quantitative and measures understanding along a linear dimension of greater or lesser (small to large), the *relevance* facet is also quantitative but has its effect on our understanding of the animal by focusing
judgments through interacting with the *species* facet, whilst the *species* facet involves a qualitative assignment (the *species* and *relevance* facet interact as I own a dog but not a cat or fox and therefore, in my attempts to identify the animal, only a dog species can be of central importance and other species of animals would have been judged to be of more peripheral import). This example has resorted to using the mapping sentence to illustrate three of the different types of roles variables may play when they are depicted within facet theory. In the following sections, I will further explore these roles.

**Roles That Facets Play**

Facets are descriptors that may be used to describe a wide and varied array of personal experience and actions. Above, in the examples of mapping sentence that I have provided, I have highlighted just three of the most elementary facet roles or structures. There are other roles that facets may play in structuring experiences both on their own and together in double and treble facet structures. Paul Kline notes how Louis Guttman developed facet theory and identified facet roles in his seminal works on the subject and that Guttman’s facet roles “are known as the simplex, the radex and the circumplex. These are based on the rank ordering of correlations.” (Kline 2000, p. 87). It should be noted that the formal definition and identification of facet roles has been a component of quantitative facet theory which arise from the analysis of quantitative data and the traditional mapping sentence. However, the roles are not exclusive to quantitative research and have been used to depict the nature of facets in qualitative research. It is interesting to note that the facet roles have even been used by me in a counselling situation where the roles of facets were used to offer insight to a client about their issues (Hackett 2019). I now present some of these facet roles.
Single Facet Structures

Perhaps, the simplest form of an overt or covert human behaviour is one that may be understood using a single facet (most clearly described above in the size facets). Some of the constructs (facets) that we use to make sense of our world operate in isolation and I will turn to these first.

Axial Role

Axial facets represent relatively independent forms of understanding that are not directly affected by or directly affect other facets associated with the content of interest. When they are present in the geometric output plots that result from quantitative facet theory research, axial facets cause plots of content items to be divided into distinct parallel strips or regions (the spatial representation of facets will be considered in greater depth later in this section of the chapter). In an axial facet, events are assessed or understood to possess more or less of a given entity, quality or construct and to form a simple approximation to linearity. The order of facet elements in an ordered facet are derived from the rankings of correlation between event pairs and the geometric arrangement of events is based upon their non-metric inter-correlation. Consequently, items that are close to each other in terms of this linearity are perceived as being more similar in reference to this construct whilst those further apart are more dissimilar. This arrangement is termed a simplex and may be predicted if the basis for ordering is known at the design stage of the research. In the example of the size of animal facet, it seems reasonable to predict that the size facet will be structured from small to large, but this arrangement may often be more idiosyncratic and less apparent.

It is important to note that the partitioning of an axial facet may result in partitioned segments that are in a different orientation to the vertical arrangement given in Fig. 3.5.

---

9 Dancer’s (1990) provides a comprehensive commentary upon facet structure and roles to which I refer during this section.
Radial Facet (Modular Role)

A second type of facet that employs a single facet to structure a person’s understanding of a content area, sometimes independently of the effects of other facets, is a construct called a radial facet that plays a modular role. Here, the understanding embodied in a modular facet will cause events to be seen as more or less related to all other events in terms of a specific construct but not in a linear sense: some items will be general and others more particular in reference to the construct. This form of
psychological process will result in some events being placed centrally whilst other events are located progressively more peripheral as they become less related to other events as understood through the construct. Modular role facets are depicted as concentric rings that emanate from a central point.

The events most highly inter-correlated with other events, when embodied in a modular facet, will fall towards the centre of this geometric space with progressively less inter-related events positioned towards the edges of the space. Adjacent events that are a similar distance from the origin, regardless of where they are otherwise positioned in geometric space, will be equally associated to the facet’s construct. In the example of animals, because of their personal relevance, all dogs may be seen to be understood as more similar in terms of their personal relevance, whilst other species will occupy progressively more peripheral and perhaps isolated locations away from the projection’s origin. It should be remembered here that it is not the species of the animal that is associated with the animals classification on this facet but the importance of a given animal to the person making the evaluations. As this person typically had dogs as pets, the dogs are more important and the notion of species will act as a proxy measure for importance. However, should the person have at one time in their lives been regularly visited by a fox, this creature would also tend to be centrally located in their understanding.

**Modular Facet (Angular or Polar Role)**

A third role that may be played by a single facet is the polar role of the modular facet. This role results in events being qualitatively differentiated in terms of the facet’s content. Events evaluated within a modular facet are understood to have no inherent ordering and are arranged geometrically as wedge shaped sections with a common origin. This is a qualitative arrangement with no ranking between regions. Another characteristic of a modular facet is that due to the lack of ordering present it may be the case that no prior hypothesis may exist for the arrangement of facet elements. However, adjacent elements will be perceived as more similar than those more distantly positioned from each other. In the
animal example, a modular facet arranges the specific species of animal. Dogs, cats, mice, fish, birds, and foxes are not ordered in any terms but rather they are simply distinct from each other and will tend to occupy distinct regions.

It should be obvious to the reader that the facets I have described, whilst being relatively independent in their effects are not completely isolated. Good examples of this are the facets of species and importance, which are inter-associated. I will return to this when discussing the radex facet structure (Fig. 3.7).
The final single facet role that I will consider is the circumplex, which is described by Brown (1985) as a being represented as a circle. This structure must be differentiated from the modular facet’s centrally originating wedges that also has a circular arrangement. Distinct from the modular facet, the circumplex structure embodies qualitative linear differentiations between events where there is an ordering present but without a beginning or end (Lorr and McNair [1963] cited in Brown 1985). In this

Fig. 3.7 Modular facet (angular or polar role)
situation, all items are arranged towards the periphery of the circular projection. An example of this form of arrangement would be of events that are isolated by being representatives of a class but that are not more or less of any type of evaluation.

So far, I have considered the structure of facets that have a relatively independent effect upon the content domain they are classifying. Sometimes however, single facets are found to co-exist and modify each other in reference to a specific domain. In these situations, there are facet structures that are composed of a plurality of facets.

**Two facet structures**

**Radex**

A common example of two facets forming a combined role is when a modular facet is found to co-exist with a second facet playing an angular/polar role. In this situation, a person makes a concurrent evaluation, or possesses an understanding of a situation that is typified by the combined and simultaneous effects of multiple facets in a coalesced role. An example of such a situation would be when an event is understood in terms of its extent (such as importance or centrality) along with differentiations of the same content into relatively discrete and different regions (for instance different species of animals). In this situation, the second facet modifies the former, and vice-versa. The structure formed by the combination of these two facet roles is called a radex (Lingoes 1973). In this amalgamation, events are both conceived as being simultaneously more general or particular when understood by the content of the first facet (a modular role) and to also be understood as being of qualitatively distinctive types of events (polar role). An example of this arrangement of facets is provided in the mapping sentence for animals given earlier in this chapter. This dual facet structure can be seen in the combination of animal species (modular role facet) with personal importance (polar role facet). Here an animal may be, for example, a dog that is of little personal importance.

As well as two facets combining to play a joint role in reference to a content area, it is possible for a greater number of facets to join together (Fig. 3.8).
I have already described the radex, which is formed by the combination of a non-ordered facet with an ordered facet. In this facet combination the non-ordered structure of a polar facet combines with the wedge-like
arrangement of elements from a modular facet (an example of a cylindrex is present in Fig. 5.7). The result is that centrally located events are more generally related to the research domain. A common structure present in facet theory analyses is that of the cylindrex. The cylindrex structure occurs when a third facet is present with the two facets of the radex. When I say a third facet is present, I mean that a third form of understanding (in the form of a third facet) concurrently structures respondents’ evaluations. This third facet plays an axial role, orthogonally associated to the radex structure and causes evaluations to be differentially allocated to parallel regions in geometric space. The structure formed by the facet combination is three-dimensional and results in a stacked series of radex structures each of which exist at each level of the axial facet. The arrangement may be visually depicted as a tube with a top, bottom, and a number of slices parallel to the top and bottom slices: The cylindrex appears as several radexes stacked upon each other. In the animal mapping sentence example, the radex formed by species and importance facets would combine with the size facet, which would form the height of a cylinder with a radex present as several slices through this structure.

Conex and Cubex

Other structures of three facets in combination also occur such as that of the conex and the cubex. The conex structure is similar to the cylindrex but narrows towards one of its ends: The radex that compose the tip of the axial dimension of the cylindrex are more centrally focused than the radex that composes the base of the conex (Levy and Guttman 1989). A cubex is another three-dimensional facet structure that is this time formed by the combination of three simply ordered facets resulting in a cube-like structure. In the above sections, I have provided, in a terse fashion, some of the basic structures that are regularly found to organise human behaviours and experiences. In the following section, I will review, in a similarly epigrammatic manner, the ways in which data that arises from, and is analysed in, facet theory driven research.

10 A more thorough account of the structure and nature of facets are provided by Jennifer Brown (1985) to whom the interested reader is directed.
Analysing Facet Theory Research

In this final section of this chapter, I consider some of the ways in which the data that is produced through traditional quantitative facet theory research is analysed. In a later chapter, I consider analysing information from Qualitative facet theory studies.

Quantitative research designer using a traditional facet theory approach yields complex data sets and demands intricate forms of analyses. Multidimensional scaling (Kruskal and Wish 1978) is used to produce the geometric arrangements of conceptual space that I have been referring to in the preceding paragraphs of this chapter (for example, the cylindrex, radex, simplex, etc.). Details of the statistical procedures that analyse such quantitative data and produce these geometric print-outs are beyond the remit of a book that presents the philosophical evolution and application of facet theory. Readers who are interested in the statistics behind quantitative facet theory are guided to Borg et al.’s (2013) excellent introductory expose on multidimensional scaling (MDS).

However, it is important to briefly note that quantitative facet theory analyses constitute a series of multidimensional scaling techniques, namely, Smallestspace Analysis (SSA); Multidimensional Scalogram Analysis (MSA); and Partial Order Scalogram Analysis with Base Co-ordinates (POSAC). Each of these procedures has its own computer programmes and is found in the HUDAP (Hebrew University Data Analysis Package) suite. The three programmes, and the type of analysis that it performs, has been developed out of a desire by facet theory researchers to economically represent the wealth and richness of the numerical data that they have collected in their research. As a consequence, the analyses procedures were developed as nonmetric statistics to numerically represent qualitative data, ‘… without losing the qualitative features of the data’. (Gratch 1973, p. 38).

As well as using the HUDAP suite of programmes some researchers have employed procedures written in R or have employed other more widely available statistical programmes. For example, some scholars compute correlations and scale the coefficients using confirmatory multidimensional scaling using a widely available MDS statistic and there is
some debate as to whether a non-metric or a parametric MDS procedures should be used. Similarly, some have noted the age of the SSA algorithms, that they may not converge to a local minimum and that the SSA programme does not use an up to date methodology (Borg 2020). It is worthy of note that with small data sets bootstrapping procedures have been used with around one thousand random permutations of the data.

Smallestspace Analysis

Smallestspace analysis has been the most commonly employed form of facet analysis and these analyses are what produce the facet roles of which I have spoken. Smallestspace analysis is often used as a way of analysing and exploring data sets to map content areas. Karni and Levin (1972) described smallestspace analysis as a procedure that employs nonmetric intercorrelation matrices to analyse proximity relations. In this form of analysis “variables are represented as points in Euclidean space so that the rank order of the interpoint distances corresponds to the rank order of the intercorrelations.” (p. 341). The output of smallestspace analysis a series a plots of the research variables and the closer the variables are to other variables the more positively correlated they are. Variables are characterised by one element from each facet and partitioning lines are drawn to capture variables with similar elements for the facets. Being able to successfully partition variables by facet elements supports the veracity of the facets in structuring responses and the shape of the partitioning reflects the psychological processes employed by respondents.

As I previously noted (Hackett 2014), assurance in the psychological inferences arising from specific arrangements of facets is produced in smallestspace analysis through regional partitioning of items to allow boundaries of facet elements to be established. Confidence in the validity of a facet grows when structural consistency is repeatedly demonstrated in different pieces of research: Semantic similarity between variables in smallestspace analysis is calculated from the strength of association between variables and shown graphically in two-dimensional printouts. Example of a resulting smallestspace analysis plots are given in Figs. 3.3,
Two other facet analysis approaches analyse data arising from the same research instruments to uncover different information.

**Multidimensional Scalogram Analysis**

Multidimensional scalogram analysis is an analysis technique that has been productively used to provide understanding of individuals in terms of their profile of responses rather than responses to individual questions. In multidimensional scalogram analysis, the data is recoded to be dichotomous (in terms of presence or absence of the variable’s quality) and a series of data profiles for individual respondents are in this way created: The creation of profiles allowing the comparison of respondents. The multidimensional scalogram analysis procedure examines the relationship between respondents simultaneously across the variables in their profiles. The output of multidimensional scalogram analysis is a two-dimensional geometric plot that reflects the similarity of individual respondents the power of the similarities between individuals across their profiles such that dichotomous profiles are printed as points with similar profiles appearing closer in the plot (Canter 1985; Guttman and Greenbaum 1998). Plots are divided into areas where these areas in the plots identify respondents who are similar in terms of a variable (Borg and Shye 1995; Wilson and Mackenzie 2000).

Multidimensional scalogram analysis also yields an individual item plot for each variable in the profile which allows comparison of plots in relation to characteristics of respondents (Porter and Alison 2006). For example, an item plot may divide respondents in terms of a specified dichotomous variable, with the two groups of individuals so formed located in different regions of the plot. The plots may then be overlapped to allow a determination of the way in which each of the variables contributed to the overall arrangement and areas identified in the main plot (Trojan and Gabrielle Salfati 2010).
Partial Order Scalogram Analysis

The final facet analysis approach is Partial Order Scalogram Analysis, which allows the profiles of respondent to be compared and analysed (see chapters in Canter 1985 for details of these POSAC as well as the MSA approaches and for POSAC see: Levy 1998; Levy and Guttman 1985; Shye 1985; Shye and Amar 1985; Wiley and Levi 1999). Partial order scalogram analysis with base co-ordinates is also a nonmetric statistical method that is similar to multidimensional analysis in that it analyses variable profile scores of individual respondents and produces a series of two-dimensional geometric plots. Partial order scalogram analysis graphically locates profiles so that each profile if located close to other profiles with similar scores on each of the profile variables. Sabbagh et al. (2003) stated that partial order scalogram analysis has abilities that other statistical analyses techniques do not have. As with multidimensional scaling techniques, in general, it reveals the underlying structural qualities present in a complex data matrix and does this spatially by geometrical representing this in a Euclidean space of the lowest meaningful number of dimensions. However, unlike most forms of multidimensional scaling and factor analysis it attempts to discover differences between individual respondents.

Partial order scalogram analysis attempts to reveal differences between respondents that may be lost if averages or other statistics are calculated. For example, if four questions can be answered yes or no, where yes = 2 and no = 1, and one group of respondents replied with a profile of 2,2,1,1 and a second group with a profile of 1,1,2,2 whilst a third group responded 1,2,2,1 and a fourth 2,1,1,2, The average score for each group is the same (1.5). However, the psychological content is totally different for each group. POSAC analyses these profiles in terms of the quantitative differences (summed scores for all items) and qualitative differences (the scores for the individual questions). Using Hasse diagrams, partial order scalogram analysis with base co-ordinates plots items in two-dimensional space where the position of items is determined by both qualitative and quantitative characteristics of the responses and shows subgroups that have distinctive responses styles. It should however be noted that it has
been suggested that using an unfolding procedure instead of POSAC may be more appropriate (Borg 2020).

Having briefly presented SSA, MSA, and POSAC, I will now finish my consideration of statistical analyses, as it is not my purpose in this book to provide details of quantitative analysis procedures but to concentrate upon qualitative and philosophical aspects of the facet theory approach.

Conclusions

Sociologist C. Wright-Mills (2000) spoke of the ‘sociological imagination’ and stated the necessity for a sociologist to have a way of looking at the world that enabled an appreciation of the social forces acting around individuals living amongst and within social institutions and social systems. Dimen-Schein (1977) invoked the ‘anthropological imagination’ or a desire to build knowledge and understanding about our own and other cultures, as being requisite in all anthropological endeavours. The facet theoretical imagination is, I propose, a distinctive understanding of the nature of existence, which embodies a particular way of conceiving the study of human-animal and non-human-animal behaviour. This imagination encompasses ideas of structuring behaviour and experience as identifiable facets of an area of interest and then combining these in holistic narratives, which involves conceptions of individual facets and their elements and the combination of facets within mapping sentences. The facet theoretical imagination impels whoever possesses such an outlook to think of pertinent aspects of individual or social life that is being modelled in terms of each aspect performing as one of the single facet roles: for example modular, planar. This imagination also implicates the holder to envisage behaviour and experience as being complex events and to develop more multifarious awareness through the imagining the complexity of facets being combined in a mapping sentence. Thoughts regarding the confidence in the statistical pertinence of our claims and notions are rejected, as are ideas of linear ‘ladder like’ dimensions with evenly spaced steps that we all ascend and descend in a common manner and which form our thoughts and feelings.
Facet theory has existed for approximately three-quarters of a century and as we have seen, during this time many areas of human endeavour have been subjected to its survey. The Facet Theory Association regularly produces a bibliography that lists facet theory publications and a cursory review of the academic journals in which these publications have appeared provides an idea of the typical content of this research with the most frequent subjects areas being: social indicators; psychology (applied, social, environmental, legal, criminological, cognitive, political) personality and individual differences, assessment and measurement; education (religious, assessment and measurement); behavioural genetics; complementary medical; business management; organisational behaviour. Facet research in these and many other areas has produced insightful results, which has yielded regularities in some of the geometric structures found in facet analysis. This has led to the establishment of predictable roles being played by facets in these situations. Common structures include those previously noted: simplex (Guttman and Guttman 1965), circumplex (Martinez-Arias et al. 1999), radex (Guttman 1954; Shye 2009), axial facets (Hackett 1995), modular facets (Meyer Schweizer 1993), and polar facets (Levy 1981). Facet research has explored and developed theories about many areas of human behaviour and the scope of coverage is indicated in the publication areas listed above. As well as focusing upon many distinct research areas, facet research has often addressed a single research area and this interest has been divided into sub-regions. For example, in education aspects have been considered including: students’ course evaluations (Cohen 2000, 2005), ethnic identity within educational contexts (Cohen 2004), university students’ quality of life and experiences (Cohen et al. 2001; Hackett 2014), the role and membership of parent teacher associations (Fisher 2018), students engagement (Assor et al. 2002), student acculturation (Treister 2005), college student’s feelings of academic challenge, St Clair and Hackett (2012a, 2012b), understanding ethnic discrimination (Kanavou 2003), self-efficacy and other psychological features of high-school principals (Fisher 2011, 2014), students’ perceptions of the learning environment and justice experiences (Alt 2014), professional ethics (Fisher 2013) and school management (Fisher and Friedman 2008).
The interested reader is guided to the many facet research studies listed in the bibliography.

Throughout this chapter, I presented an account of facet theory and mapping sentences. I have attempted to offer the reader with an understanding of both traditional quantitative facet theory with its traditional mapping sentence along with qualitative facet theory using the declarative mapping sentence. I have however concentrated on the traditional quantitative approaches. In Chap. 4 of this book, I will concentrate on qualitative facet theory and the declarative mapping sentence.

References

Alt, D. (2014). Using Structural Equation Modeling and Multidimensional Scaling to Assess Students’ Perceptions of the Learning Environment and Justice Experiences. *International Journal of Educational Research, 69*, 38–49. https://doi.org/10.1016/j.ijer.2014.10.001.

Aquinas, S. T., White, K., & Macierowski, E. M. (2005). *Commentaries On Aristotle’s On Sense And What Is Sensed And On Memory And Recollection*. Washington, DC: Catholic University of America Press.

Assor, A., Kaplan, H., & Roth, G. (2002). Choice Is Good, But Relevance Is Excellent: Autonomy enhancing and Suppressing Teacher Behaviours Predicting Students Engagement in Schoolwork. *British Journal of Educational Psychology, 72*(2), 261–278.

Bains, P. (2014). *The Primacy of Semiosis: An Ontology of Relations*. Toronto: University of Toronto Press, Scholarly Publishing Division.

Borg, I. (1977). Some Basic Concepts of Facet Theory. In J. C. Lingoes (Ed.), *Geometric Representations of Relational Data*. Ann Arbor, MI: Mathesis Press.

Borg, I. (Ed.) (1981). *Multidimensional data representations: When & why*. Ann Arbor: Mathesis Press.

Borg, I. (2020). *Personal Communication*.

Borg, I., Groenen, P. J. F., & Mair, P. (2013). *Applied Multidimensional Scaling, Springer Briefs in Statistics*. New York: Springer.

Borg, I., & Shye, S. (1995). *Facet theory: Form and Context*. London: Sage.

Brown, J. (1985). An Introduction to the Uses of Facet Theory. In D. Canter (Ed.), *Facet Theory: Approaches to Social Research*. New York: Springer Verlag.
Canter, D. (Ed.). (1985). *Facet theory: Approaches to Social Research*. New York: Springer-Verlag.

Canter, D. (2000). Offender Profiling and Criminal Differentiation. *Journal of Criminal and Legal Psychology, 5*, 23–46. p. 30.

Cohen, E. H. (2000). Student Evaluations of Course and Teacher—A Guttman Approach. Presentation # PO21103. In J. Blasius, J. Hox, E. de Leeuw, & P. Schmidt (Eds.), *Social Science Methodology in the New Millennium, Proceedings of the Fifth International Conference on Logic and Methodology*, Cologne, October 3–6, 1–15.

Cohen, E. H. (2004). Components and Symbols of Ethnic Identity: A Case Study in Informal Education and Identity Formation in Diaspora. *Applied Psychology: An International Review, 53*(1), 87–112.

Cohen, E. H. (2005). Student Evaluations of Course and Teacher: Factor Analysis and SSA Approaches. *Assessment and Evaluation in Higher Education, 30*(2), 123–136.

Cohen, E. H., Clifton, R. A., & Roberts, L. W. (2001). The Cognitive Domain of the Quality of Life of University Students: A Re-analysis of an Instrument. *Social Indicators Research, 53*(1), 63–77.

Dancer, S. (1990). Introduction to facet theory and its application. *Applied Psychology: An International Review, 39*, 365–377. Google Scholar.

Danesi, M., & Sebeo, T. A. (2000). *The Forms of Meaning: Modeling Systems Theory and Semiotic Analysis* (Approaches to Applied Semiotics), Berlin: Mouton de Gruyter.

Dimen-Schein, M. (1977). *The Anthropological Imagination*. New York: McGraw-Hill.

duToit, S.H.C., Steyn, A.G.W., & Stumpf, R.H. (1986). *Graphical exploratory data analysis*. Springer Texts in Statistics. New York: Springer Verlag.

Edghill, E. M. (2013). *The Categories: Aristotle*. Virginia: SaltHeart Publishers.

Fisher, Y. (2011). The Sense of Self-Efficacy of Aspiring Principals: Exploration in a Dynamic Concept. *Social Psychology of Education: An International Journal, 14*(1), 93–117.

Fisher, Y. (2013). Exploration of Values: Israeli Teachers’ Professional Ethics. *Social Psychology of Education: An International Journal, 16*(2), 297–315.

Fisher, Y. (2014). The Timeline of Self-Efficacy: Changes During the Professional Life Cycle of School Principals. *Journal of Educational Administration, 52*(1), 58–83. https://doi-org.uos.idm.oclc.org/10.1108/JEA-09-2012-0103.
Fisher, Y. (2018). Concealed and Unconcealed Motives for Joining the Parent-Teacher Association: Mapping Sentence and Smallest Space Analysis. *Frontiers in psychology, 9*, 1705.

Fisher, Y., & Friedman, I. A. (2008). The Pyramid Model of School Management. *Quality and Quantity, 42*(5), 645–664.

Foa, U. G. (1958). The Contiguity Principles in the Structure of Interpersonal Relations. *Human Relations, 11*, 229–237.

Frede, M. (1987). *Essays in Ancient Philosophy*. Minneapolis, MN: University of Minnesota Press.

Gratch, H. (Ed.). (1973). *25 Years of Social Research in Israel*. Jerusalem: Jerusalem Academic Press.

Guttman, L. (1944). A Basis for Scaling Qualitative Data. *American Sociological Review, 9*(2), 139–150.

Guttman, L. (1950). Measurement and Prediction. In *Vol IV of Studies in Social Psychology in World War II*, (with S. A. Stouffer et al.). Princeton: Princeton University Press.

Guttman, L. (1954). A New Approach to Factor Analysis: the Radex. In P. F. Lazarsfeld (Ed.), *Mathematical Thinking in the Social Sciences*. New York: Free Press.

Guttman, L. (1957). Introduction to Facet Design and Analysis. In *Proceedings of the Fifteenth International Congress of Psychology*, Brussels, Amsterdam, 130–132.

Guttman, L. (1959). A Structural Theory for Intergroup Beliefs and Action. *American Sociological Review, 24*, 318–328.

Guttman, L. (1968). A General Nonmetric Technique for Finding the Smallest Coordinate Space for a Configuration of Points. *Psychometrika, 33*, 469–506.

Guttman, L. (1977). What Is Not What in Statistics. *The Statistician, 26*, 81–107.

Guttman, L. (1979). *New Developments in Integrating Test Design and Analysis*. Paper presented to the 40th International Conference on Testing Problems, Educational Testing Service New York, October.

Guttman, R., & Greenbaum, C. (1998). Facet Theory: Its Development and Current Status. *European Psychologist, 3*, 13–36.

Guttman, R., & Guttman, L. (1965). A New Approach to the Analysis of Growth Patterns: The Simplex Structure of Intercorrelations of Measurements. *Growth, 29*, 219–232.

Hackett, P. M. W. (1995). *Conservation and the Consumer: Understanding Environmental Concern*. London: Routledge.
Hackett, P. M. W. (2014). *Fine Art and Perceptual Neuroscience: Field of Vision and the Painted Grid* (Explorations in Cognitive Psychology). New York: Psychology Press.

Hackett, P. M. W. (2016b). Facet Theory and the Mapping Sentence as Hermeneutically Consistent Structured Meta-Ontology and Structured Meta-Mereology. *Frontiers in Psychology, section Theoretical and Philosophical Psychology, 7*, 471. https://doi.org/10.3389/fpsyg.2016.00471.

Hackett, P. M. W. (2019). Facet Mapping Therapy: The Potential of a Facet Theoretical Philosophy and Declarative Mapping Sentences within a Therapeutic Setting. *Frontiers in Psychology, Section Psychology for Clinical Settings*. https://doi.org/10.3389/fpsyg.2019.0122.

Hackett, P. M. W. (2020). *Declarative Mapping Sentences in Qualitative Research: Theoretical, Linguistic, and Applied Usages*. London: Routledge.

Hackett, P. M. W., & Fisher, Y. (Eds.). (2019). *Advances in Facet Theory Research: Developments in Theory and Application and Competing Approaches*. Lausanne, Switzerland: Frontiers Media SA.

Howell, K. E. (2012). *An Introduction to the Philosophy of Methodology*. Thousand Oaks, CA, US: Sage Publications, Inc..

Kanavou, A. A. (2003). Using Facet Theory to Analyse Ethnic Conflict: The Case of Cyprus (1959–1974). In S. Levy & D. Elizur (Eds.), *Facet Theory: Towards Cumulative Social Science* (pp. 113–125). Ljubljana: University of Ljubljana.

Karni, E. S., & Levin, J. (1972). *The Use of Smallest Space Analysis in Studying Scale Structure: An Application to the California Psychological Inventory*. *Journal of Applied Psychology, 56*(4), 341–346.

Kline, P. (2000). *The New Psychometrics: Science: Psychology and Measurement*. New York: Routledge.

Kruskal, J. B., & Wish, M. (1978). *Multidimensional Scaling (Quantitative Applications in the Social Sciences)*. London: Sage Publications.

Levy, S. (1976). Use of the Mapping Sentence for Coordinating Theory and Research: A Cross-cultural Example. *Quality and Quantity, 10*(2), 117–125.

Levy, S. (1981). Lawful Roles of Facets in Social Theories. In I. Borg (Ed.), *Multidimensional Data Representations: When and Why* (pp. 65–107). Ann Arbor, MI: Mathesis Press.

Levy, S. (1998). A Typology of Partial-Order: The Case of Drug Use in Israel. *Quality and Quantity, 23*, 1–14.

Levy, S., & Guttman, L. (1985). The Partial-Order of Severity of Thyroid Cancer with the Prognosis of Survival. In J. F. Marcotorchino, J. M. Proth,
3 Facet Theory and Thinking about Human Behaviour

& J. Janssen (Eds.), *Data Analysis in Real Life Environment: Ins and Outs of Solving Problems* (pp. 111–119). Amsterdam: Elsevier Science Publisher B.V.

Levy, S., & Guttman, L. (1989). The Conical Structure of Adjustive Behavior. *Social Indicators Research, 21*, 459–479.

Lingoes, J. C. (1973). *The Guttman-Lingoes Nonmetric Program Series*. Ann Arbor: Mathesis.

Lorr, M., & McNair, D. (1963). Interpersonal Behavior Circle. *Journal of Abnormal and Social Psychology, 67*, 68–75.

Lustig, K., & Hackett, P. M. W. (2020). *Mapping Sentence Pocket Guide*. San Francisco: Blurb Publishers.

Martinez-Arias, R., Silva, F., Diaz-Hidalgo, M. T., Ortet, G., & Moro, M. (1999). The Structure of Wiggins’ Interpersonal Circumplex: Cross-Cultural Studies. *European Journal of Psychological Assessment, 15*(3), 196–205.

Meyer Schweizer, R. (1993). Modular Orders and their Significance. In I. Borg (Ed.), *Proceedings of the IV. Conference of Facet Theory*. Mannheim: ZUMA.

Porter, L. E., & Alison, L. J. (2006). Leadership and Hierarchies in Criminal Groups: Scaling Degrees of Leader Behavior in Group Robbery. *Legal and Criminological Psychology, 11*, 245–265.

Runkel, P. J., & McGrath, J. E. (1972). *Research on Human Behaviour: A Systematic Guide to Method*. New York: Hold, Rinehart and Winston.

Shye, S. (2009). From the Circumplex of Political Attitudes to the Radex of Universal Values: The Development of the Systemic Top-Down Approach to Value Research. In D. Elizur & E. Yaniv (Eds.), *Theory Construction and Multivariate Analysis*. Ramat Gan: Facet Theory Association.
Shye, S., & Amar, R. (1985). Partial-Order Scalogram Analysis by Base Coordinates and Lattice Mappings of the Items by Their Scalogram Roles. In D. Canter (Ed.), *Facet Theory* (pp. 277–298). New York: Springer Verlag.

Sim, M. (2004). Categories and Commensurability in Confucius and Aristotle: A Response to McIntyre. In M. Gorman & J. J. Sanford (Eds.), *Categories: Historical and Systematic Essays (Studies in Philosophy and the History of Philosophy)* (Vol. 41, pp. 58–77). Washington, DC: Catholic University of America Press.

St Clair, K., & Hackett, P. M. W. (2012a). Defining Academic Challenge: The First Step in Keeping Students on Track. *The Exchange*, 25(4), 6–8.

St Clair, K., & Hackett, P. M. W. (2012b). Academic Challenge: Its Meaning for College Students and Faculty. *Journal on Centers for Teaching and Learning*, 4, 101–117.

Süb, H. M., & Beauducel, A. (2004). Faceted Models of Intelligence. In O. Wilhelm & R. W. Engle (Eds.), *Handbook of Understanding and Measuring Intelligence* (pp. 313–332). Thousand Oaks, CA: SAGE Publications.

Treister, A. (2005). *Examination of the “Acculturation” Process, by Examining Three Different Aspects Amongst Long-Time Israeli Students and Students Who Have Immigrated from the Commonwealth of Independent States [Former Soviet Union]*. Master’s thesis, supervised by E.H. Cohen.

Trojan, C., & Gabrielle Salfati, C. (2010). Comparing the Criminal History Profiles of Serial and Single-Victim Homicide Offenders. *Victims & Offenders*, 6(1), 38–63. https://doi.org/10.1080/15564886.2011.534008.

White, S., & Mitchell, T. (1976). Organization Development: A Review of Research Content and Research Design. *Academy of Management Review*, 1, 57–73.

Wiley, J. A., & Levi, M. J. (1999). Algebraic Representations of Beliefs and Attitudes: Partial Order Models for Item Responses. *Sociological Methodology*, 29, 113–146.

Williams, M. (2016). *Key Concepts in the Philosophy of Social Research*. Thousand Oaks, CA: Sage Publications, Inc.

Wilson, M. A., & Mackenzie, N. E. (2000). Social Attributions Based on Domestic Interiors. *Journal of Environmental Psychology*, 20, 343–354.

Wright-Mills, C. (2000). *The Sociological Imagination*. Oxford: Oxford University Press.