Chapter 1

Introduction

The main title of this dissertation is a curious thing. Without the commas, it would at least be a noun phrase, which is a common element in such titles -though as we can see not quite a sufficient one.
However, removing the commas would actually greatly reduce the amount of sense the title makes as a title for this work. Rather than being important in combination, each of these words forms a key example of an issue we will confront: *Very* illustrates the evolution of non-vague words into vague ones, *Many* shows that an intensional approach to Generalized Quantifiers is appropriate, *Small* is a typical gradable adjective, a class of adjective we shall characterize and explore through a natural logic fragment; finally, *Penguins*, as non-flying birds, are used in the classic 'Tweety Triangle' example in the literature on default rules. These, then, are the issues dealt with in this dissertation.
Now, some elaborate mental gymnastics could be performed to come up with ways these topics are connected. But this would not be a very appropriate thing to do. As the subtitle suggests, the connections between these topics are actually not particularly strong, and those who go in expecting nice cross-references and interconnections leading to grandiose overarching insights shall be disappointed: these chapters stand alone.

Chapter 2 concerns the habit of interpreting the use of certain numbers as 'round', which is to say as an expression which encompasses not only that exact number but also other numbers which are close enough that they would be rounded to that number when rounding. Through the use of game theory and Bayesian statistics, this chapter shows that round interpretation can generally be defended as a rational decision.
The same mechanism also contributes to a loose interpretation of other words. When such a loose interpretation then becomes standard, the same loosening can then happen to this looser standard. If this happens repeatedly enough, a word which was not originally vague can end up becoming vague over time.

A key example of this is the word *Very*, which originally meant 'true, genuine, really' (cf. Ger. *wahr*, Du. *waar*), and turned into a booster in the Middle English period.[1]
Thus, this mechanism offers a (partial) explanation of the origin of (some) vagueness in natural language, and suggests that every natural language will eventually come to contain traces of vagueness.

Chapter 3 concerns the word *Many*, a vague quantifier. In the theory of Generalized Quantifiers, *Many* has long been a problematic case, since there did not appear to be an appropriate formal interpretation of it satisfying Conservativity, a property virtually all other natural language determiners do possess.
This chapter argues that there is a problem with one of the most important examples long used to conclude that *Many* is a problematic case, specifically that *Many* requires an intensional approach, which is otherwise hardly found in the literature. By using an intensional system and an intensional notion of Conservativity, *Many* is no longer problematic.
Beyond this, this chapter adresses intensional versions of several other key properties, provides a general form for intensional quantifiers which guarantees compliance with these properties, and offers a brief look at the logical properties of both *Many* specifically and intensional quantifiers in general.

Chapter 4 offers a syllogistic logic for subsective adjectives, an important category of which *Small* is a key example. Chapter 5 uses this logic to investigate the properties of gradable adjectives, a category containing many standard examples of vagueness (including *Small*). It shows that, when gradable adjectives are defined as those subsective adjectives which are based on an underlying weak order, they can be characterized based solely on their extensions, without having to know the underlying order per se.
Following up on this, it defines and characterizes the notion of a set of gradable adjectives being commensurable, which means roughly that they are based on the same underlying order. This allows a further look into how antonyms, personal taste adjectives, degree modifiers and boolean connectives fit into the framework. Finally, a means is discussed to extend the system to deal with vagueness.

While not particularly concerned with vagueness in the specific sense the other chapters touch on, chapter 6 deals with another vague issue: when we use a bare plural in a construction like "Birds fly", what do we mean? These constructions, referred to as default rules, cannot be taken to simply hide a universal quantification. Penguins (hence the last part of the title) and various other kinds of birds cannot fly, but these counterexamples are not considered to invalidate the truth, such as it is, of the general statement that birds fly.

[1] See Section 2.4.1 for further examples and citations.

Nor can they be interpreted as simply being about a majority. The sentence "It is not the case that most Dutchmen are blond" implies "Most Dutchmen are not blond", but "It is not the case that Dutchmen are blond", with the latter part being a default rule, does not in any way license a conclusion like "Dutchmen are not blond" Furthermore, having default rules of the form "A's are B" and "A's are C" allows the conclusion that "A's are B and C"[2], while "Most A are B" and "Most A are C" do not jointly imply "Most A are B and C".
A more apt interpretation of "Birds fly" would be along the lines of "All normal birds fly" or "All good examples of birds fly", statements which are rather vague indeed. The way we analyze defaults in chapter 6 is to look at what effect default rules (should) have on the reasoning of those who accept them as true. The main question there is what if anything may be concluded when multiple default rules appear to contradict each other. Based on a single underlying principle about the meaning of default rules, we provide a systematic answer to this question.
In the second half of the chapter, the same answer is given in terms of inheritance networks, which are a way of codifying and analyzing sets of default rules without using models of specific objects. The inheritance network approach is proven to give the same results as the model-theoretic approach in cases where either may be used, and furthermore gives rise to a convenient algorithm by which to determine the correct exceptions to make.

Sources of the Chapters. The material in chapter 2 previously appeared in (Bastiaanse 2011). A preliminary version of the material in chapter 3 appeared in (Bastiaanse 2013). For both of these, the final publication is available at http://link.springer.com.
The material in chapters 4 and 5 has not yet appeared elsewhere at the time of writing, but is to be published separately at a later date. Chapter 6 is based on joint work with Frank Veltman, and the material therein is also to be published separately at a later date.

[2]Or at least, the conclusion that a given A of which we know nothing else is (presumably) B and C.