Looking for logic in all the wrong places: An investigation of language, literacy and logic in reasoning
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Chapter 2
‘if $p$ then $q$’ . . . and all that

2.1 Introduction

From any given proposition, a multitude of inferences can be drawn. Yet most of them are not. Take a simple proposition, such as “Today is Tuesday”. Would you expect anyone to conclude, on hearing that, “Oh, so it’s Tuesday or Saturday”? No. More generally, for any $p$ we may infer the weaker $p \lor q$. But this is not something we can expect to see commonly occurring. Why not? One explanation is that $p \lor q$ is less informative than $p$, and this violates Grice’s maxim of quantity: be as informative as possible. As such, we would expect the use of $p$ to conclude $p \lor q$ to be infrequent in reasoning and communication contexts. Undoubtedly there are contexts to be thought up, in which it would be a natural conclusion to draw – for example, when the disjunction is needed as input for further reasoning – but these are circumscribed.¹

Now observe that reasoning research doesn’t focus on the percentages of people who generate $p \lor q$ on presentation of $p$, nor on developing theories of why people don’t draw such inferences. Though there is some work on reasoning from disjunctive premises – see for instance Van der Henst, Yang and Johnson-Laird, 2002 – reasoning research overwhelmingly focuses on premises with conditional and quantified phrasing. Why should this be so? There are at least two places to look for an answer.

One is in the history of the field. There are historical reasons why some inferences are studied above others, and the syllogism is just such a case. Aristotle

¹Imagine a tax form, with Category B defined as the group of people who either earn less than a certain amount or don’t work at all. Then if you are working as a PhD student, say, you would conclude that you fit into Category B. Under some description you’ve concluded the disjunction holds on the basis of one of the disjuncts, and used this to conclude that you belong in Category B. Compare this also with normal use of disjunction, which carries the implication that the speaker does not know which of the disjuncts is true: “When is Peter leaving?” “Monday or Tuesday.” Note also that inferring a disjunction is a different discourse ‘move’ from that when a disjunction is offered as a correction of a simple proposition.
thought that all valid inferences could be represented in the form of a syllogism. Although medieval logicians were well aware of the limitations of the syllogistic system, Aristotle’s view was definitively overruled only in the nineteenth century, when Boole and Frege laid down new formalisms, for propositional and predicate logic respectively, and which formed the beginnings of modern symbolic logic. Early studies of reasoning (such as Wilkins, 1928, Woodworth & Sells, 1936, but also Luria, who conducted his research in the 1930’s) focused exclusively on syllogistic arguments.

A second reason for the dominance of certain types of premises might be that inferences based on them are more natural, recognisable, common, than others; that they ‘make sense’ to experimenters and subjects alike. A conditional premise would seem to be just such a candidate. And, we might assume, so would the basic syllogistic form. Yet, when one looks at the transcripts from Luria’s study, one gets the distinct impression that for unschooled subjects the intended inference from syllogistic premises doesn’t ‘make sense’ at all, as evident in the following transcript:

E: In the Far North, where there is snow, all bears are white. Novaya Zemlya is in the Far North and there is always snow there. What color are the bears there?
S: I don’t know what color the bears are there, I never saw them.

... E: But what do you think?
S: Once I saw a bear in a museum, that’s all.
E: But on the basis of what I said, what color do you think the bears are there?
S: Either one-colored or two-colored ... [ponders for a long time]. To judge from the place, they should be white. You say that there is a lot of snow there, but we have never been there!

Subject: Khamrak., age forty, miller from remote village, illiterate (Luria, 1976, p. 111.)

We have already seen this transcript in the previous chapter, as an example of the characteristic illiterate responses found by Luria in syllogistic reasoning tasks. Such transcripts crop up all over psychological literature, and are commonly used in psychological textbooks (such as Gray, 1991, p. 389) in the section on cross-cultural psychological differences. It seems clear that their illustrative appeal stems from obvious, even comical, misunderstanding – from our point of view – on the part of the subject, of the purpose of the exercise. What to us looks like a rather boring schoolish enquiry is responded to with any manner of off-chart replies. The exchange is in a sense a failure of exchange, from the experimenter’s perspective, and shared by us, because the subject does not answer the question as it is put to him. “Refusal” was how Luria put it: “refusal to resort to logical inference from the given premises” (Luria, 1976, p. 108); “refusal to draw conclusion because of lack of personal experience” (ibid, p. 110).
2.1. INTRODUCTION

But what if the subject isn’t refusing to answer so much as trying to figure out what the question is? This would occur if the subject could not easily discern the purpose or structure of the exchange. That illiterate subjects often give a non-answer, rather than a wrong answer, gives this idea initial plausibility. At the level of the discourse, this mismatch would be driven by the relative availability of discourse ‘templates’ or genres, trickling down to the level of the sentence where a mismatch could be caused by atypical use of the linguistic forms found in the premises. The idea that there are more or less natural ways of describing situations is by no means new – already in, say, Donaldson (1978) we find discussion of why it is much more ‘natural’ to say “The flowers are on top of the television set” than “The television set is under the flowers”; additionally, plenty of recent research within psychology of reasoning has exactly the aim of relating reasoning task performance to everyday language use (for example, Stenning & Cox, in press, Politzer & Noveck, 1991). Understanding the reasoning task as a linguistic structure, a discourse, with more or less similarity to typical language use, opens up the possibility of understanding that the so-called failure to reason on behalf of the subject can also, possibly more justly, be characterised as a failure of communication between two interlocutors.

In this chapter I explore the hypothesis that Luria was led to an overly negative conclusion regarding his subjects’ reasoning ability because of his focus on syllogistic premises. This is suggested by the results reported in the previous chapter, where we saw that subjects in all groups fared better with conditional premises, and group differences were more muted with such premises. Support for the hypothesis is found in the use of quantified constructions in spontaneous speech; and a comparison of this with the use of conditional sentences in spontaneous speech.

Yet, on the other hand, the simplest formal analysis of quantified statements gives them a implicational structure, viz: \( \forall x(Px \rightarrow Qx) \). Hence I aim also to explain why the apparent similarity between quantified forms and conditionals does not result in similar inferential properties for the two types of sentences. As we will see, there are subtle differences in the semantics and use of such sentences, in both spontaneous language, and in the context of the task, which go some way to explaining this phenomenon. It should be stressed that the present proposal is surely not the only one which explains the data; nor does that matter here – our aim is to showcase what a semantically-grounded analysis of reasoning data looks like, and to hopefully thereby illustrate its value.

If it can be shown that subjects are in fact exhibiting normal language use in the tasks as explained, the charge of illogicality loses force. The claim can then be made that they are the normal conversants, and that in the schooled case the

\[^2\]This should be understood to include some traditionally pragmatic concerns. The intensive interplay between pragmatic and semantic factors in reaching an interpretation – and indeed the very sense of drawing a sharp boundary between pragmatics and semantics – are discussed extensively in Chapter 4.
subject ‘colludes’ with the experimenter on a special kind of artful discourse. The chapter should not be understood as a comparison of two experimental conditions; if this were the case the premise sets would differ in only one regard, namely the use of conditional or quantified phrasing. Rather this is a comparison between two experiments, which were primarily conducted with the aim of replicating previous paradigms (namely Luria, 1976 and Byrne, 1989). The two test paradigms differ not only in the phrasing used in the premises but also in the content of the premises. A number of suggestions are made as to further empirical means to further assess the impact these factors have on reasoning performance.

The plan of the chapter is as follows. First, a pilot corpus study, which distinguishes categories of usage of all, is reported. The significance of the categories, especially with respect to the relation between the quantifier and its domain, is discussed in the light of formal work on quantifiers and domains. It is argued that different types of generalisation are associated with differential relations of all to its domain, but that this association is distorted in syllogistic reasoning materials.

Next, I aim to explain the better response to conditional premises despite the aforementioned apparent similarity with universally quantified forms. Analysis of the semantics of the (types of) conditionals used in reasoning tasks indicates that the way they are used in reasoning tasks is very similar to how they are typically used in spontaneous spoken language. On the basis of this their inferential properties can be contrasted with the more problematic inferences from universal generalisation.

2.2 Are all premises equally difficult?

As we have seen in the previous chapter, Luria tested his subjects’ reasoning by means of what he calls ‘syllogistic’ problems. This means that the major premise takes the form of a universal statement, either expressed with the use of a universal quantifier, translated as the English all, as in “In the far north, all bears are white”, or as a simple generalised statement such as “Precious metals do not rust”. Moreover, we saw that Luria’s subjects had great difficulty with reasoning from such premises, seemingly either reluctant to draw a conclusion on the basis of them or adapting them to their own version of the premise. This difficulty was to be observed also in the current study, especially as reflected in the differential rates of immediate assent to quantified premises, as compared to conditional premises, given in table 2.1. In other words, subjects in the current study had greater difficulty in reasoning with quantified premises such as “All birds in Cape Town are penguins”, than with conditional premises such as “If Thembi wants to visit her friend she goes to East London”. The question is what causes this discrepancy, and the aim of this chapter is to seek an answer in possible discrepancies between everyday language use and the use of premises
2.2. ARE ALL PREMISES EQUALLY DIFFICULT?

<table>
<thead>
<tr>
<th>Group*</th>
<th>quantified premises</th>
<th>conditional premises</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ratio</td>
<td>percentage</td>
</tr>
<tr>
<td>1</td>
<td>7/23</td>
<td>30%</td>
</tr>
<tr>
<td>2</td>
<td>25/38</td>
<td>66%</td>
</tr>
<tr>
<td>3</td>
<td>24/33</td>
<td>73%</td>
</tr>
</tbody>
</table>

* Recall the group division from the previous chapter is as follows:
  
  Group 1: No education (6 subjects)
  
  Group 2: Between four and ten years of education, left the educational system more than ten years ago (13 subjects)
  
  Group 3: Graduated from high school within the last twenty years (10 subjects)

Table 2.1: Comparing initial responses across premise forms

in reasoning tasks. We start by comparing everyday use of universal quantifiers with their use in syllogistic tasks. Since only explicitly quantified generalised statements were used in the current study, I concentrate on them. Comments regarding difficulties with generalised statements are to be found in the previous chapter and also in the section on ‘recall data’ in the next chapter.

2.2.1 all in spoken discourse

To be able to judge whether the quantifier is being used in a natural or recognisable way, we need to know how it is used in contexts of spontaneous speech. Unfortunately, I could find no previous corpus-based research on this topic, so a small study was made for the purposes of this chapter. The reported results are preliminary, and were garnered with the express intention of exploring their power to explain the data reported in the previous chapter.

The use of English all in discourse

A small sample of all in the spoken British National Corpus formed the basis for the study. First, a random sample of 50 occurrences was analysed (where all is being used as a determiner according to the corpus coding, excluding, for example, adjectival modifier use, as in ‘all grumpy’, ‘all fired up’) and at least four different usages were discerned. After the first fifty the classification was applied to a second fifty occurrences as a check on validity. The only change made after analysis of the second fifty was inclusion within the category ‘forward quantification’ of sub-categories for science, law and religion. Apart from this, all uses could be subsumed under the first categorization. The following numbers are based on a second pass through the samples with the amended classification.

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3Located at http://www.natcorp.ox.ac.uk/.
4The vast majority are deemed determiners: 236 518 of the 277 147 in the corpus.
which is given in table 2.2. As will become evident, the categories often overlap: for instance, emphatic contexts are also often formulaic and could be grouped under stock formulations. It is thus worth bearing in mind that the treatment of the categories as disjunct is somewhat artificial, and the categories should be seen as points along a continuum rather than partitions of a space, for reasons which will be highlighted later. There were only a few overlaps, and these do not affect the contour of the findings, as will become clear.

A notable initial finding is that there were but a few occurrences of sentence initial all: three in the sample I looked at, all in subcategory of law-giving contexts. Clause-initial all was however much more common, especially in the anaphoric and forward categories. I first report results for the English term all. A similar study was made of the Xhosa equivalent, the suffix -onke, and the categorization applied equally well there, as we will see. In fact, there was an even stronger tendency towards anaphoric/deictic use, this being the biggest category at 30% of usage, with forward quantification accounting for only 11% of occurrences.

These categories are now discussed in more detail:

1. **Stock phrases** included conventionalised constructions such as ‘all night’, ‘all the time’, ‘all around him’, ‘all his heart’, ‘that’s all’, ‘all but impossible’, ‘all the same’, ‘and all’, ‘all in all’, ‘first of all’, ‘after all’. These are phrases which are to be interpreted figuratively – in many cases a ‘literal’ reading is not even apparent, as with ‘all the same’, or ‘all in all’. By literal meaning I mean that the domain, over which the all quantifies, can be properly specified. In English this appears to be a very common usage, accounting for 14 of the 50 occurrences analysed in the first sample and 10 in the second one – averaging 24% overall. It remains to be seen whether this category is significant cross-linguistically. A rule of thumb to judge this category is to try replacing all with other quantifiers – try ‘most’ or ‘some’ – and see if the new phrase is useable. If it is, then it doesn’t fit into this category. This heuristic also suggests that stock phrases are a kind of fossilised universal quantification. For this reason we’ll exclude them from further analysis. Examples of stock phrases in context:

<table>
<thead>
<tr>
<th>Category</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. stock phrases</td>
<td>24</td>
</tr>
<tr>
<td>2. emphatic usage</td>
<td>22</td>
</tr>
<tr>
<td>3. anaphoric or deictic use</td>
<td>23</td>
</tr>
<tr>
<td>4. forward quantification</td>
<td>27</td>
</tr>
<tr>
<td>5. miscellaneous</td>
<td>4</td>
</tr>
<tr>
<td>total</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2.2: Categories of ‘all’ usage
2.2. ARE ALL PREMISES EQUALLY DIFFICULT?

- ‘Maybe I’m not too late **after all**’ (FS1 1299)\(^5\)
- ‘Mr(sic) sent for an ambulance and **all**’ (KDU 570)

2. **Emphatic** use. This is related to the above category in that there doesn’t seem to be true quantification going on. Rather, **all** seems to serve to emphasise what’s being said, often also in conventionalised formulations. The heuristic I used to assign this category was the following: if **all** is omitted, or replaced with a determiner (as in ‘**all three countries**’ becoming ‘the three countries’), would the sentence get a different reading? If not, then it belongs here. Also fairly large, this category accounted for 22% of occurrences. Examples are:

- ‘**Let’s all** get the hell out of here’ (B1N 459)
- ‘Joanne and her parents agree that having the baby has **brought them all** closer together as a family’ (FU1 1037)
- ‘The kouroi and early female figures **all** carry the aura of the block’s four faces’ (FPW 343)
- ‘**Tell me all** about this woman’ (GV8 2583)
- ‘**First of all**’ (F9D 729)
- ‘20% of **all dialogue**’ (GOW 2835)
- ‘in **all three countries**’ (AP7 474)

In the example about ‘Joanne and her parents . . . ’, the pronominal ‘them’ apparently refers only to Joanne and her parents according to the rest of the excerpt. If there were siblings or other family members mentioned in the previous discourse then the **all** would function as a means to let ‘them’ refer to the whole family and not just the closest ‘Joanne and her parents’ candidate for reference. In this case the **all** could be seen to be functioning anaphorically. Another example where the same situation might hold is in (A6N 1988): ‘**They all** went on to be priests’. This case also is counted as emphatic in the current tally, and addressed in more detail in the next category.

Observe also that in the majority of cases of emphatic usage given above, the quantifier is ‘floating’. It occupies the position normally occupied by an adverb. Adapting one of the corpus examples, compare

(1) **All** the kouroi carry the aura of the block’s four faces.

(2) The kouroi **all** carry the aura of the block’s four faces.

\(^5\)This number gives the tag used in the British National Corpus to identify this excerpt.
A discussion of the relations between such sentences is beyond the scope of the current study; for our purposes it is enough to know that they are considered to be logically equivalent to each other in the linguistic literature. As quoted in Bobaljik (2002), their “quantificational properties” are considered “identical” (Sportiche, 1988, p. 426).

3. **Anaphoric** or **deictic** use. This is what I have termed the coupling of the quantifier with an anaphoric or deictic terms such as ‘which’, ‘this’, ‘those’, ‘the others’, so that the kind of entities to be quantified over are given either in the previous discourse, or by the context of utterance. Bare *all* counts here too – see examples below. Sometimes the phrasing is quite conventionalised, but replacement by for instance ‘most (of)’ is generally unproblematic – suggesting there’s some live quantification going on. Anaphoric and emphatic usage serve a similar function: in many cases the emphatic could be seen as a reinforcing or contrasting with the default reference to a group; the anaphoric serves to do this where the anaphoric or deictic reference might not clearly distinguish between a group and subgroups of its members. Anaphoric use was also a big category – accounting for 23% of the sample (12 occurrences in the first sample and 10 in the second one). Examples from the corpus are:

- ‘Of course I know all that’s no reason I can’t have a bike’ (G3P 1937),
- ‘all this will take time to negotiate’ (ABE 2666),
- ‘…some of which have a less visible protestant ethos, but all of which have a loyalist ethos as well.’ (A07 1375)
- ‘All can be reached by public transport and offer quiet and relaxing woodland walks.’ (FTU 808)

In this category I have also included anaphoric/deictic reference which also have some descriptive content, such as the following:

- ‘In spite of acknowledging all these factors’ (BLW 480),
- ‘where all these views would concur’ (CD9 371),
- ‘But after the vote on Mr Craxi, parliamentary leaders agreed to take all such decisions by a show of hands’ (CR9 1860),

There was again here a case on the border between emphatic and anaphoric/deictic, but which have been tallied as anaphoric, such as: ‘All this industry must be sign of things looking good’ (HA6 1031).

4. **‘Forward’ quantification.** This is the category which most closely resembles how *all* is used in syllogistic arguments. The entities to be quantified over are explicitly mentioned after the *all*, as in ‘all ethnic minorities’ or ‘all or part of the primary school cycle’, ‘all denominations’ etc. I have splintered off a number of subcategories here, based on the clear context
2.2. ARE ALL PREMISES EQUALLY DIFFICULT?

for use of such sentences. These are: statements of policy or law; as part of religious doctrine; in writing about scientific research. I think that these subcategories deserve special attention because they are probably the only place where quantification truly ‘globally’ quantifies, and, perhaps related to this, they are more or less directly derived from textual discourses. We examine first some examples which fall outside these subcategories:

- ‘Thanks were extended to all the Kent teachers who had hosted the event’ (KAE 91)
- ‘The bank gave consideration to all matters relating to the company in question’s affairs’ (AHB 588)
- ‘It has rendered untenable the simplistic belief that members of all ethnic minorities are part of one undifferentiated black mass . . . ’ (A1T 40)
- ‘And all the water courses been blocked up and then it was swampy as well.’ (HER 499)

Then we come to the subcategories:

(a) Statement of laws/rules/policies:
- ‘All penalties are cumulative, but penalties for disobedience depend on . . . ’ (BPB 301),
- ‘A complementary excursion to the Dolomites for all guests staying 14 nights’ (ECF 3790),
- ‘Issued to all Gulf warmen . . . ’ (K1M 4027).

(b) Ideological (religious, political) doctrine:
- ‘It is the mystery of the Creation, the God of all Jews . . . who transcends all beings’ (A3F 55)
- ‘Christ had died for all, all men and women’ (CLM 268)

(c) Scientific research:
- ‘Patterning in all systems occurs in small groups of cells, . . . ’ (ASL 992)

What can be said about this category? Although there is explicit description of entities to be quantified over in this category, in almost all instances there must be further domain restriction in order to pick out the appropriate group quantified over – the latter excerpt is a good example, where the ‘systems’ quantified over are clearly of a pre-specified sort, or range, given elsewhere, but which are currently under discussion. In fact the only cases for which quantification can truly be said to operate over a universal domain are the religious categories – what that means I’m not sure!

5. Miscellaneous:
- Proper names: ‘All Saints’, ‘All Angels’
These proper names could be seen as part of the ‘stock phrase’ usage since they represent fossilized quantification and not live quantification, so to speak.

The use of Xhosa -onke in discourse

The above classification is based on an English corpus study; ideally, the classification would be cross-linguistic. Obviously any argument to explain syllogistic reasoning data is greatly strengthened if the discourse function of universal quantification in Russian, Vai, Kpelle, (Turkish, Berber) and Xhosa is similar to that of English all, as reflected in the above categories. I make a start with a corpus study of spoken Xhosa. I made use of the only electronically available corpus of spoken Xhosa, drawn mostly from telephone and face-to-face conversations and interviews, and which is still fairly small (around 60 000 words). Nevertheless, the above classification applied surprisingly well to Xhosa.

The Xhosa translation of all is the suffix -onke, which attaches to one of z, y, s, w, l or b, or stands alone, depending on the type of entities being quantified over – people, animals, or things (with for instance l prefixing quantification over locations, b and s prefixing to people). For example, ‘sisebenza sonke’ translates as ‘we all work together’ (we+work all); ‘lonke elo’ translates as ‘the whole area’ or ‘all over (the place)’. The -onke suffix has a slightly wider usage than English all, as we see in the categorization.

The categories found for English sufficed here except for the fact that -onke also translates as every and whole as well as all. These cases are discussed below. More significantly, difference with English was found in the distribution of occurrences across the categories. Use in stock phrases and for emphasis was much less frequent, as was ‘forward’ quantification. By far the biggest category was the anaphoric/deictic usage of the -onke suffix. This is a very suggestive finding in the light of the current claims about the usual function of all in everyday discourse; possible implications are drawn out in detail below.

First, the use of -onke when translated with every and whole. These could easily be paraphrased with all in English by, say, ‘all people’ in place of ‘everyone’ and ‘all the world’ instead of ‘the whole world’, ‘all day’ instead of ‘the whole day’. But I will analyse them as they have been translated; nothing rests on the choice for one or other translation since what we are interested in is the use of the constructions in discourses, and how they are related to categories already

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6 The excerpts from the corpus have been translated by Johannesburg-based Xhosa translator Amanda Blossom Bulelwa Nokwele.

7 The data is drawn from the Spoken Language Corpora for the Official Languages of Southern Africa Project, a still-ongoing collaborative research project between the Linguistics Departments at the University of South Africa (UNISA) and the University of Göteborg. The aim is to create the first online textual corpora of “spoken and phatic language use in a variety of social activities in a natural environment” for the nine official African languages of South Africa, one of which is Xhosa.
2.2. ARE ALL PREMISES EQUALLY DIFFICULT?

<table>
<thead>
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<th>% of ‘all’ subset</th>
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<td><strong>total all</strong></td>
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<td>100%</td>
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<tr>
<td>‘everything/one/where’</td>
<td>13</td>
<td>19%</td>
<td>–</td>
</tr>
<tr>
<td>‘whole’</td>
<td>11</td>
<td>16%</td>
<td>–</td>
</tr>
<tr>
<td><strong>total</strong></td>
<td>67</td>
<td>100%</td>
<td>–</td>
</tr>
</tbody>
</table>

Table 2.3: Categories of ‘-onke’ usage

identified. In many cases of ‘every’ it is used in a stock or conventional phrasing which can only be figuratively interpreted. In other cases it adds emphasis, and would easily fit into the ‘emphatic’ use of all. Central to use of every- phrases (everything, everyone, everywhere) is the necessity to interpret them on restricted domains. This fits with the observation from English that interpretation of quantification is often accompanied by contextually-given domain restriction (about which more later). The following examples illustrate these points:

- ‘zonke ke ziza kwenziwa kakhule enzele ukuba iimali zingene endaweni eyione amnike yonke le nto ayifunayo’
  all you see, SUBJ.will do.PASS well SUBJ.will.do so that the monies SUBJ.will enter at the place that is one
everything will be done so that the money is channelled to one place.’ (69)

- ‘ukuze izinto zonke sizibone zihamba kakhule kungoba …’
  so that things all PL.SUBJ.see PL.go well it is because ...
  ‘so that we were able to see that everything goes well, because …’ (16)

- ‘Kulo lonke eli lizwe kumdaka.’
  At this all this country there.be.filthy.
  ‘Everywhere in this country it is filthy.’ (25)

In very few cases was the ‘every’ what could be called ‘forward’ quantification, and even then it is clear that there is an anaphoric aspect to it:

- ‘and ikhona enyeinto evela ku msoma ethi makusubmithwe zonke izinto ezenzeke ezicenteni, ipersonnel, iimali, zonke ezo zinto’
  and it is there something else SUBJ.come from Msoma SUBJ.say there
  SUBJ.must.submit.pass all the things SUBJ.happen.PL at the centres, the personnel, the monies, all those things
  ‘… and there is something else from Msoma, everything that is happening at the centres must be submitted, the personnel, money/funds, everything.’ (68)
The need for pragmatic restriction of the domain in the case of ‘every’ is made more explicit by the lack of precision in what entities are quantified over: the ‘body’, ‘one’, ‘thing’, ‘where’ are generic terms for people, objects or locations – more we cannot tell. In this sense the phrasing is anaphoric/deictic: e.g. the use of ‘everybody’ is functioning like ‘all of them’ or simply all.

The case of ‘whole’ is even more clear-cut: it’s emphatic or stock.

- ‘umhlaba wonke wonke akho mntu ungamziyo laa tata lowa.’
  the whole whole world there.NEG person SING.SUBJ.do.NEG.know that father there.
  ‘in the whole whole world there is nobody who does not know that man (colloq.) there.’ (17)

- ‘nay(e) udisappointed because kaloku yonke laa process kwathiwa mayibuyelemva
  yonke laa process’
  s/he is also disappointed because you see all that process it.SUBJ.said.PASS it.must.go back all that process
  ‘s/he is also disappointed because, you see, it is said the whole process must be reversed, the whole process.’ (65)

- ‘(i)mini yonke nje kutyiwa idina’
  the whole day there is SUBJ.eat.PASS dinner
  ‘dinner is served the whole day’ (63).

We now discuss those examples translated with all.

1. Stock phrases were much less frequent than in English but they were still present:
   - ‘naku itishala zigcwele yonke le ndawo kunzima ... ’
     there teachers PL.SUBJ.full all this place it.be.difficult ...
     ‘there are teachers all over the place, struggling ... ’ (11)

2. Emphatic usage:
   - ‘sisebenza sonke emsebenzini’
     PL.SUBJ.work all at work
     ‘we all work together at work’ (52)

   - ‘nihleli ninonke apha esikolweni’
     PL.SUBJ.sit PL.SUBJ.all together here at school
     ‘you are all seated here at school’ (14)

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8Sic. The English phrases which crop up in the Xhosa transcript are examples of code-switching, not typos!
2.2. ARE ALL PREMISES EQUALLY DIFFICULT?

3. The largest group: anaphoric/deictic use – and even larger as a proportion of occurrences which are translatable as all: anaphoric usage accounts for 47% of this subset. The group is classified by the same criteria as the English category, i.e. followed by pronominal or deictic elements. Examples are:

- ‘xa bebonke yithathe le nto uyise emapoliseni’
  when they all SING.SUBJ(2P).IMP.take this thing to police
  ‘when all of them take this to the police’ (34)

- ‘ayiyeke yonke laa nto yoba bendize apha ndizosebenza’
  SING.SUBJ(3P.).MOD.ignore all that thing SING.SUBJ(1P.) SING.came here SING.SUBJ(1P).work
  ‘they must ignore all that, I came here to work’ (35)

- ‘bonke sebesifundisa enye into’
  all PL.SUBJ.OBJ.teach other thing
  ‘all of them are now teaching something else’ (47)

4. And finally, ‘forward’ quantification was much less frequent in Xhosa than in English. The law-giving and science writing contexts were not represented at all in this corpus. It is impossible to say conclusively whether this is because Xhosa is a predominantly spoken language or whether this arises from bias in the corpus. Xhosa certainly is much less a text-based language than English. The first Xhosa dictionary was compiled in the twentieth century, and in South Africa all tertiary education institutions are still English- or Afrikaans-medium; there are no textbooks beyond the school level written in Xhosa.9

Examples are:

- ‘kuthiwa ngenxa yalo myalelo wenkundla onke amabhinqa akhulelweyo anentsho-longwane ihiv atsho anethemba’
  there SUBJ.say.PASS because of this order of the court all females that that are pregnant that have the virus of hiv they have become having hope
  ‘it is said that because of this court order all expectant females living with HIV are hopeful.’ (73)

- ‘kwindwe kwanyanzela onke amakristu ukuba abe ngamajoni’ (6)
  personal SING.PAST.force all Christians that they be soldiers
  ‘it was imperative that all Christians become soldiers’

9We also see many English phrases in the excerpts which are concerned with science or political affairs:

‘...hayi igovernment yonke ... abanye individuals ...’
‘no, the whole goverment, ... others, individuals’ ...
The Xhosa corpus analysed in the foregoing was small but nevertheless the use of the universally quantifier -onke was found to be similarly classifiable to the English quantifier all. Differences lay only in the distribution over the categories, -onke being used predominantly anaphorically or deictically and much less frequently in other contexts. This finding bolsters the claim all or equivalents are typically used ‘anaphorically’ in combination with a previously or pragmatically specified domain, especially in spoken language, and supports our explanation of the difficulty in reasoning with such premises, as outlined over the next two sections.

**Summarising the corpora data**

Categorising the occurrences of all and the equivalent Xhosa -onke in spoken discourses has yielded a perhaps unexpected picture of their typical usage, one that suggests that the “quantifier” is often not actively quantifying. As already mentioned, in most of the stock phrases it is impossible to interpret it literally as quantifying. In most examples it is used in a metaphorical way: ‘all his heart’. But these stock phrases are language-specific and hence this category might not have as much significance cross-linguistically. Similarly emphatic usage seems to represent an ossified version of quantification, in which all cannot be traded in for any other sort of quantifier – in fact, it can usually be done without. And also here, it is unclear what the cross-linguistic significance of emphatic usage of universal quantifiers would be.

Discounting the appearance of the quantifier in stock phrases and emphatic usage, we are left with two large categories where all or its translation is used: anaphoric/deictic and what we’ve called ‘forward’ quantification. In the anaphoric/deictic category, all performs a summarizing function, acting as a kind of fishing net for aforementioned or contextually given referents, about which something further can then be said. This is more plausibly a universal usage – witness the frequency of this usage in Xhosa. Here all may be truly quantificational, but it quantifies over an extremely restricted domain: that given by the previous discourse or the context of utterance.

By contrast, the cases that have been labelled ‘forward’ quantification don’t seem to sum up anything previously mentioned, but are ‘forward-looking’ in the sense that what they quantify over is introduced after all is: ‘Thanks were extended to all the Kent teachers who had hosted the event’, ‘Christ had died for all, all men and women’. It is in these cases that all is most likely to be available
2.2. ARE ALL PREMISES EQUALLY DIFFICULT?

as a premise (the argument ‘Christ died for all men and women, therefore Christ
died for you’ sounds vaguely like Catechism class).

Observe, however, that in both the large categories of all usage there appears
to be a division of semantic labour between linguistic and contextual input (ei-
ther from the previous discourse or the non-linguistic environment) by which the
domain of quantification is determined. In some cases – the legal, religious, and
science contexts – the burden lies more on the linguistic side, and can potentially
be contained totally in the quantifying sentence. Although ‘anaphoric’ and ‘for-
ward’ usages have been presented as separate categories, they could be better
viewed as points on a slide of determining quantification – the one side being
quantification items being determined by ‘new’ linguistic information, the other
side by previously or contextually given information. The large category of quan-
tifier usage for which the domain is determined ‘purely’ anaphorically should thus
be understood as an articulated continuation of what extends below the threshold
of linguistic explicitness – determination of the domain by context.

Contexts in which ‘forward’ quantification was used were often derived from
written discourses – think about the religious and law contexts. What is in-
teresting is that the quantification in these subcategories is the closest thing to
strict quantification. Any exceptions to the universality would at least have to
be specified. For example, consider (ECF 3790) the following, ‘A complementary
excursion to the Dolomites for all guests staying 14 nights’. We might well expect
exceptions: guests who benefit from some other special offer, or stay on reduced
rates, might not be entitled to their free trip to the Dolomites – but this would
have to be explicitly mentioned (the small print!), as a caveat to the rule ‘all
guests get a free trip’. And of course, ‘all guests’ is understood to apply only to
a certain group of guests – those who stay at whichever hotel made the offer.

As this illustrates, the common condition in uses of all as quantifier is the
pairing of its usage with determination of its domain. Quantification always
functions over a domain. When we say ‘The burglar took everything’ we take it
that ‘everything’ ranges only over the valuable objects in a certain house. When
we say ‘All students sat the exam’ we mean all students who were registered for
a particular course at a particular university in a given term. In these cases
the exact domain will be either explicitly or implicitly given by the previous
discourse or by the context of utterance: in the first example, the speaker will
have introduced the topic by saying who the burglary ‘happened to’, say, Mr
and Mrs Bloggs, and the hearer infers that the ‘everything’ in the sentence refers
to the valuable objects in the Bloggs’ household. In the second sentence, the
identity of the conversants might be enough to deduce what all quantifies over:
if the speaker is the teaching assistant for Maths 101 at the University of Cape

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10 Sometimes phrasing even betrays a written text underneath the spoken one: ‘all of the
above’ (CET 1734) (and occurs again in FTB 1394), a visual metaphor only appropriate for
written texts (possibly the transcript is from a text being read aloud).

11 Example from Recanati (1996).
Town in the second semester of 2006, and is addressing the professor teaching the course, then they could reasonably conclude that the registration list for this course comprises the domain of quantification.

These informal remarks are made more precise in the following, in which we explore the matter of fixing an appropriate domain of quantification and how exactly the type of quantification interacts with its domain of quantification.

### 2.2.2 The semantics of all that

The most intriguing category of all usage is that of anaphoric/deictic usage, where what is quantified over is not made explicit in the quantifying statement but is indicated by demonstrative elements presumably referring to the previous discourse context or extra-linguistic context, as for instance in

(3) ‘Of course I know all that’s no reason I can’t have a bike’ (G3P 1937)

(4) ‘all this will take time to negotiate’ (ABE 2666)

Now given the fact that all so often combines with anaphoric or deictic elements, we might wonder what kind of formal machinery is needed to enable this to function well. What is needed to fix in each case ‘this’ or ‘that’ which is being quantified?

**Domains are given by context sets**

The pervasiveness of the anaphoric/deictic category highlights a distinction which has already been proposed in formal work on quantifiers. For instance, Westerståhl (1985) argues that in providing a semantic analysis for all one needs to distinguish three types of universe – as opposed to just two as is usually proposed in the ‘flexible universe’ strategy, in which pragmatic processes are assumed to continuously adjust the discourse universe appropriately.\(^{12}\)

In more detail, his account is as follows. Model-theoretic semantics routinely makes reference to a universe of models, or discourse universe, \(M\), in a model \(\mathcal{M} = < M, \llbracket \cdot \rrbracket >\)\(^{13}\) as well as the denotation of the noun in the model (where NP = determiner + noun), which can be viewed as the NP universe. But Westerståhl (1985) argues that semantics should distinguish also a context set, a contextually selected sub-universe of \(M\). The role of selecting this sub-universe is usually assigned to pragmatics; as Westerståhl says, “in practice this means identifying context sets with (temporarily chosen) model universes” (p. 46). He offers two types of argument why context sets cannot be identified with discourse universes, the first methodological, and the second via concrete examples. Methodologically

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\(^{12}\)He goes on to show how this three-way distinction can be implemented in an enriched version Barwise and Cooper’s Logic for Generalised Quantifiers.

\(^{13}\)\([\cdot]\) is an interpretation function assigning interpretations to natural language expressions.
2.2. ARE ALL PREMISES EQUALLY DIFFICULT?

the two do not match because discourse universes are large and constant over pieces of discourse while context sets are not, and determiners are ‘universe-independent’ (pp. 48 – 51) in the sense that their interpretation is not affected by the discourse universe in which they occur, as long as it’s large enough (a property referred to as EXT in many logic textbooks\textsuperscript{14}).

The vivid second argument offered by Westerståhl is in the form of examples for which there is simply “no way to make sense of [the] sentences if the discourse universe is identified with the context set” (p. 49), viz:

(5) The English love to write letters. Most children have several pen pals in many countries. (emphasis mine)

Now this sentence only makes sense if we understand most to be quantifying over children in England but several to be quantifying over children anywhere in the world. Were we to identify the context set with the discourse universe, either the first NP-universe would be ‘most children in the world’ or the second one would be ‘several children in England’ – clearly neither of which is intended in the context of utterance. In fact, the first NP does not operate on the discourse universe but on a restricted context set, given by the previous sentence, while the second NP operates over a bigger set. Obviously, the discourse universe must include this bigger set of children anywhere. The possibility remains open that in certain sentences the context set coincides with the universe of discourse $M$ – for instance in the amended example below the context set remains the same for both NPs and can be taken to coincide with the discourse universe:

(6) Children love to write letters. Most children have several pen pals in many countries.

Specifying a role for the context set as apart from the NP-universe in determining the domain of quantification can explain how anaphoric and deictic usage works. In these cases, the context set gives the sub-universe in which the anaphoric or deictic elements are interpreted – and the NP-universe restriction is minimal. Moreover, the size of the category anaphoric/deictic illustrates the importance of the context set in determining the domain of quantification in everyday use of the quantifier all. For demonstratives such as ‘that’, ‘this’, ‘those’ can only get the appropriate denotation when interpreted in a restricted sub-universe of the discourse universe, i.e. in a context set. Westerståhl proposes just such an explanation for bare or pronominal use of all, arguing that “the lack of an argument is a visible context set indicator, which signals the implicit occurrence of a context set” (ibid, p. 49, his emphasis).

\textsuperscript{14}Formally expressed by

\begin{equation*}
\text{If } A, B \subseteq M \subseteq M' \text{ then } D_M AB \text{ iff } D_{M'} AB
\end{equation*}
To place Westerståhl’s proposal in context, more recent work in linguistics makes this same kind of distinction albeit with different terminology. Apart from explicitly quantified formulations such as

\[(7) \text{ All the girls jumped in the lake.}\]

there are ‘bare’ plural noun phrases such as

\[(8) \text{ The girls jumped in the lake.}\]

Yet these are often taken to imply quantified formulations such as

\[(9) \text{ Every girl jumped in the lake.}\]

This phenomenon has lead many theorists to posit a so-called “D operator”, an implicit distributivity operator which introduces quantification in the denotation of the plural ‘the girls’ (Brisson, 2003). Note though that the first sentence above is slightly ‘weaker’ in that, as will be discussed below, its truth can in many situations withstand a few non-swimming girls. In linguists’ lingo, the quantification is nonmaximal. The influential paper by Brisson (2003) uses Schwarzschild’s (1996) idea “that a D-operator has a domain variable in its restriction whose value is contextually specified” (p.130, my emphasis), to propose that all is in fact not a determiner-quantifier, “but rather interacts with the quantification introduced by the D operator to rule out the nonmaximality that a D operator normally allows” (p. 141). ‘Nonmaximality’ here means allowing for exceptions, so in this respect resembles genericity. Brisson’s proposal is that all, as witnessed in (7), functions as a means to adjust the domain to make it maximal, where the domain is contextually-selected by a variable within the D operator. In this function all is different from quantifiers such as every or each, which also cannot combine with plural noun phrases, viz:

\[(10) \text{ *Every the girls jumped in the lake.}\]

Although Brisson’s proposal is very suggestive in the light of the current analysis, the further details go beyond our purpose and scope. Westerståhl’s relatively simple proposal suffices make the general idea of local domain determination precise, but it should be clear from the above that alternative formulations are available.

To return to Westerståhl’s terminology: as we will see, in the context of the reasoning task the context set is considered identical with the discourse universe, from the experimenters’ point of view, but in certain conditions the two could – and even should – sensibly be distinguished, and this leads to a divergence in denotation for the determiner NP for the experimenter and the unschooled subject. But under which conditions is the domain of quantification given by context set as different from the universe of discourse, and how does the quantification relate
2.2. ARE ALL PREMISES EQUALLY DIFFICULT?

to the context set in such cases? We now turn to address this question.

Law-like and contingent generalisations

Two main interpretations for all sentences are considered and discussed in relation to domain determination and the role of the context set. The first type of interpretation considers statements of the form ‘All \( x \) are \( y \)’ as expressing some kind of theory-supported or causal generalisation. This does not necessarily mean that the quantification is interpreted strictly. Certainly in English all can be used to make a generic statement.\(^\text{15}\) Consider the sentences

\[ \begin{align*}
\text{a.} & \quad \text{All doctors wear white coats.}\quad \text{\((\text{16})\)} \\
\text{b.} & \quad \text{All bears have four legs.}\quad \text{\((\text{17})\)}
\end{align*} \]

One can read the sentences as expressing something about the prototypical doctor, or bear, and thus equivalent to the bare generic formulation

\[ \begin{align*}
\text{a.} & \quad \text{Doctors wear white coats.} \\
\text{b.} & \quad \text{Bears have four legs.}
\end{align*} \]

This only goes through in the case of a conventional or causal, that is, a law-like, connection. In such cases, the generalisation can withstand counterexamples, or rather, exceptions, so that the odd three-legged bear, having perhaps been caught in a hunter’s trap, does not shake our belief that ‘All bears have four legs’. This does not work for contingent generalisations. Borrowing from an example in Pelletier & Asher (1997), if by some cruel twist of fate all bears in the world lost a leg, we would not assent to ‘Bears have three legs’, but would maintain the generic ‘Bears have four legs’ – even while admitting that ‘All the bears have three legs’. In other words, the generic reading of a universally quantified statement is not available when it expresses a mere contingent generalisation. Here genericity is expressed with a bare noun phrase – a point to which we shall return. In general, the degree of robustness to exceptions seems to vary with the degree of theoretical basis for the generalisation.

Notice however that in certain contexts the generic reading of all is ruled out and it gets a strict reading while paired with a law-like connection. This is the case for statements expressing scientific or theory-based laws, such as ‘All bears are mammals’, and Goodman’s example ‘All butter melts at 150\(^\circ\) centigrade’, as will be discussed in more detail further on. In these cases one can read the quantification as applying to kinds (of bears, or butter) rather than individuals (single bears or pats of butter). Combination with deontic modals in imperative

\(^{15}\)Later on in this chapter it is suggested that such a reading of all statements might be an artifact of linguistic theorising and not one common in naturally occurring language use.

\(^{16}\)Example from Partee (1985).

\(^{17}\)Example from Pelletier & Asher (1997).
statements also yields an exceptionless reading: ‘all doctors must wear white coats’, although an exception here does not falsify the rule but violate it.\textsuperscript{18} As we saw in the previous chapter, many subjects seemed to take a deontic interpretation of some reasoning premises, such as ‘All people who own houses pay house tax’.

A second available interpretation for an \textit{all} sentence is that of a contingent generalisation, where the connection described by the predication is accidental. Imagine, if you will (after Goodman, 1947), that upon checking my pockets this morning at home, I found only silver coins in my right pocket. Then the universal generalisation ‘All the coins in my right pocket are silver’ is true. But now suppose that on the way to work I bought a coffee and slipped the change into my right pocket. Does the generalisation still hold? Maybe, maybe not. It depends what I put in my pocket. Certainly we wouldn’t say that the additional coins \textit{became} silver on being put into my right pocket. If there was a copper coin among my change then it’s no longer a true generalisation. The generalisation may be ‘universal’, but only in the small and rather gloomy universe comprising the inside of my pocket on a particular winter morning. It’s a very circumscribed and contingently constituted domain.

These can be compared to universal generalisations which express physical laws, such as
\begin{equation}
(11) \quad \text{All butter melts at } 150^\circ \text{ F}
\end{equation}
This is a statement of a law-like relationship, and can be distinguished from true contingent generalisations like
\begin{equation}
(12) \quad \text{All the coins in my pocket are silver}
\end{equation}
by the fact that the first statement can be accepted as true before all cases of it have been determined – these undetermined cases being predicted to conform with the law. In contrast, a statement like (12) “is accepted as a description of contingent facts \textit{after} the determination of all cases, \textit{no prediction of any of its instances being based upon it}” (Goodman 1947, p. 124, second emphasis mine). In other words, there are different criteria of acceptance for the two kinds of statement. For the case of a law, a few positive instances may lead us to accept the statement as true, but in the case of an accidental generalisation we need to have tested all instances before we can accept it as true.

Why did I assent to the sentence ‘All the coins in my pocket are silver’ this morning? I could do so precisely because the sentence is taken to refer to all coins that were in my pocket \textit{at the time of utterance} – and not the coins which have been or will be in my pocket. This is what makes it a contingent generalisation. It’s a description of a part of the world at a particular point in time. We might say, the generalisation operates on a context set which can be, and probably is, much smaller than the discourse universe. The only instances which counted
\begin{footnote}{See Stenning and van Lambalgen (2001) for an extended discussion of this in the context of the Wason selection task.}
\end{footnote}
were those known of in the specific situation. Sometimes this can also involve past instances – ‘All my boyfriends are short’ – but essentially nothing can be claimed about future instances which will fall under the generalisation, i.e. future coins in my pocket, or future boyfriends, or even instances which fall beyond the domain in some other sense – like coins in the trousers hanging over a chair in my bedroom. So we see that, in cases where we do accept contingent, un-lawlike generalisations it is because there is a limited range of instances to which they apply, and these have been checked.

There is a further difference in the examples offered by Goodman contrasting law-like with contingent generalisation: the latter is expressed with a definite article. In English, the use of the definite article ‘the’ after all supports a contingent reading because it suggests an identifiable and finite domain. For example, compare

(13) All women have two children

to

(14) All the women have two children.

In the latter it is clear we are talking about a specific group of women to whom the generalisation applies; in the former this reading is not available without considerable contextual support. But although the bare version does not get a contingent reading, the reverse is not always the case. For example, ‘All the bears in the North shed their winter coat’ can be read as generic, but, again, in that case it does suggest quantification over types of bears rather than individual animals. Note that an accompanying definite article rules out tolerance of counterexamples, so that a single woman in the relevant domain with only one child falsifies the generalisation ‘All the women have two children’.\(^{(19)}\)

For English materials the use of the definite article would create a lurking confound when testing syllogistic premises, if it is indeed associated with contingent generalisations, because, as we’ll see, a contingent generalisation makes for an awkward premise. In the current study, we can ignore this issue because in Xhosa, there is no distinct part of speech corresponding to the definite article in English (Tsowana, 1996), so that, for example, ‘all women’ and ‘all the women’ both get translated as ‘bonke abafazi’. This means that the difference between generic/law-like and contingent generalisation is not expressed by the use of the definite article. This will turn out to be an important point in our later analysis.

The two kinds of generalisations can be seen as opposite poles on a scale of domain-sensitivity. On the law-like end, we have generalisations which are often based on causal relations, and which can therefore be judged on the basis of few instances. They are in this way true universal generalisations, beyond any given

\(^{(19)}\)This is often called the ‘maximising’ character of all, contrasting with the nonmaximality of ‘The women have two children (each)’ (Brisson, 2003). See previous section for more discussion of this feature.
domain (the lab, say, where the experiment is conducted). There are two things
to note about this: 1) even, or rather, especially, here, ceteris paribus clauses
hold, qualifying extrapolation to new cases; 2) these generalisations are usually
not explicitly quantified: for example, ‘butter melts at 150° F’ expresses the same
law as that expressed in (1). Simply by virtue of being butter it falls under the
generalisation. In fact, law-like regularities are probably not expressed in natural
language with universal quantifiers, but with generic statements. Goodman’s
distinction between the two types of generalisation might only be relevant in the
domain of scientific language. Should this be so, it only strengthens the current
claim that universal statements are usually used contingently and with a pre-
specified domain.

What about all statements which are read generically such as described above,
but which are not interpreted strictly and are thus not falsified by single ‘coun-
terexamples’? These are the generalisations which describe stereotypes, patterns,
habits, typicalities, which are more predictable than simple accidents, but which
are not as reliable as laws of nature. These can cross domains but the ceteris
paribus clause will become more difficult to enforce and the presence of instances
which serve as exceptions will increase. A key aspect of these exceptions is that
they are not real counterexamples because they need not negate the quantifica-
tion. As illustration here consider the example

(15) All chairs have four legs

or the previous example

(16) All doctors wear white coats.

One might agree that these statements hold in some general sense while also grant-
ing that in certain contexts – respectively, say, an avant-garde design exhibition
and a surgical operating theatre – exceptions will abound.

On the other end of the scale we have these descriptions of states of affairs
which express entirely contingent or accidental generalisations, which do not ex-
tend beyond a known domain. This is what we might call local universal general-
isation. Here quantifying expressions do real work because there is no inherent
property of the entities involved which makes them fall under the generalisation:
there’s nothing causal connecting my pocket and silver coins. As such, should
anything change about the domain – such as new coins get added – we can say
nothing about the status of the generalisation. It’s hyper domain-dependent in
a way that laws aren’t. Another way to see this is to compare the quantified
formulation of generalisation with conditional formulation of it: ‘if something is
butter, it melts at 150°F’ holds, under ceteris paribus clauses, for undetermined
entities. But ‘if something is a coin in my pocket, it is silver’, apart from being
a very awkward paraphrase of the quantified statement, we can only be sure to
be true for entities in the original domain. (See the next section for more discus-
sion of conditional formulations.) Here especially, we might expect context sets
2.2. ARE ALL PREMISES EQUALLY DIFFICULT?

to play a key role in domain determination – i.e. contextually-given, surveyable sub-universes in which instances of the generalisation are known or visible.

If we grant that quantifiers are usually interpreted on a contextually-given sub-universe of the discourse universe, then we also have a means to explain the difference between law-like and contingent generalisations. The current proposal is that contingent generalisations are interpreted on a context set which is varying from context to context, while law-like generalisations do not rely on a context set for their interpretation: they can be interpreted on any universe of discourse. The phenomenon that Goodman observed, that one can extrapolate to new untested instances which were not necessarily part of the original domain, stems from the theoretical basis for the generalisation.

The next section shows why, in experimental conditions, the failure to distinguish a role for the context set might lead the experimenter to project an inaccurate – and perhaps unwarranted – interpretation for the quantified premises onto unschooled subjects’ reasoning.

2.2.3 When all sentences make lousy premises

In the syllogistic task, the subject is first presented with a universal generalisation, say “All bears in Novaya Zemlya are white.” One can interpret this either as a strict law-like, or a generic, or a contingent generalisation. Next, the subject is presented with a possible instance of this generalisation, in the second premise “My friend saw a bear in Novaya Zemlya.” Then, depending on which reading of the generalisation is taken, the subject should answer the question: “What colour was the bear?”. Herein lies the anomaly:

Option 1: Strict law-like. All instances of bears are predicted to conform, so answering that the bear is white is minimally informative, given that the subject presumes that their interlocutor knows what she’s asserting (i.e. the premises). The answer would be more informative if there was some reason to believe that the bear was a counterexample to the law, or if the question is understood to be about the basis for a law-like connection, including specifying what the ceteris paribus clauses involves – i.e. what determines the certainty of prediction. A response which fits this reading is found in the following excerpts (see especially emphasised parts):

Abdurakhm., age 37, illiterate.

S: There are different sorts of bears.
[The syllogism is repeated.]
S: I don’t know; I’ve seen a black bear, I’ve never seen any others . . .

Each locality has its own animals: if it’s white, they will be white; if
it’s yellow, they will be yellow.\textsuperscript{20}

**Ishankul, age 63, illiterate.**

S: If you say that they are white from the cold, they should be white there too. Probably they are even whiter than in Russia.

Recall also our discussion of the strictly unnecessary use of *all* for expression of law-like regularities, something which might contribute to the improbability of the law-like reading of the premise.\textsuperscript{21}

Preliminary evidence that subjects have problems taking a ‘law-like’ reading of the generalisation are given in the following two excerpts. Firstly, the sheer impossibility of a truly universal reading of the quantification is voiced:

**Florence, group 2:**

E: OK. So one more question. So suppose that all lawyers are alcoholics. And all alcoholics smoke cigarettes. Do all lawyers smoke cigarettes?
S: No, they can’t all smoke.
E: But suppose we make it true.
S: *But even though we make it true, there will be others that don’t smoke.*
E: It’s impossible to make it true?
S: Yes.

The exchange indicates a tension in her to accept the generalisation on a universal domain because of its inherent implausibility. She seems to be saying: it can only be true in a limited domain.

The second excerpt contains an incisive query about the sense of a law-like reading – recall the coins which surely do not turn silver on being slipped into my pocket. This query comes from a schooled subject.

**Nontembeko, group 3:**

E: So suppose there’s this imaginary country called Markia. And all the women who live in Markia are married. And Fatma is a woman who lives in Markia. Is Fatma married?
S: If Fatma is a lady then definitely she’s married because all the women who live in Markia are married.

\ ...

S: *Is it the law that all the women there are married? Is that possible if it’s me, I’m going there, and I’m not married?*
E: You can go there as a visitor. If you visit, you don’t have to be married.

The outcome, as seen in the last turn, is that the experimenter is forced to qualify the generalisation to exclude visiting women!

\textsuperscript{20}Where I read ‘it’ as referring to the locality. An intriguing suggestion of natural selection? (Compare with the case of the English Peppered Moth.)

\textsuperscript{21}Obviously, this only applies to generalisations expressed using *all*.
2.2. ARE ALL PREMISES EQUALLY DIFFICULT?

Option 2: Generic. As discussed above, these tolerate counterexamples. So for example, bears in Novaya Zemlya might usually be white, and the odd roaming brown bear wouldn’t threaten this generalisation. Any individual bear could thus be an exemplar or an exception. It might even be that singling one out suggests exception rather than exemplification. Support for this is given by Clark & Bangerter’s (2004) review of research which shows that subjects identify referents according to salience against the common ground, where common ground includes for instance ‘given’ information. Witness, for example, Nofezile from my study, upon presentation of the problem ‘In Markia all women are married, and Fatma is a woman who lives in Markia. Do you think she’s married?’:

Nofezile, group 2:
S: Does she stay alone?
E: We don’t know. All we know is that all the women in Markia are married.
S: I don’t think she’s married if she stays there.
E: Why?
S: I will say so because you said all the women in Markia are married and then you say her, living in Markia alone.

There are two ways to interpret the subject’s initial response, ‘Does she stay alone?’ Firstly, one can read this as a question about the law-like basis for the generalisation: on what basis can we go beyond the known instances? This suggests a law-like reading is available to the subject, but note that we can get away with positing a deontic law-like reading, something like: ‘All women in Markia must marry their live-in boyfriends’. Alternatively we can understand the question as one after further specification of the domain, trying to establish a context set so to speak. The last turn indeed suggests that the subject has introduced her own context set, and decided that the protagonist must fall outside the putative – restricted – domain of application, that is, cohabiting women in Markia. And indeed, why would we mention Fatma unless she was somehow exceptional?

Option 3: Contingent. Now either this is an untested instance about which we strictly can say nothing, or it’s a known instance in which we’re in situation of Option 1. The countless refusals along the lines of ‘I don’t know, I’ve never been there’ can be understood as one of two possibilities on this analysis: either the subject is saying that he has interpreted the premise as a contingent generalisation, in which case it’s a moot point whether any new instance falls under it or not – he would have to know what the context set was as it were – or that he has no grounds for a theoretical basis for the generalisation, which would enable him to predict the colour of the next bear simply on the basis of the given generalisation. An informative answer here would be to give conditions under which
you could determine which of the cases you’re in – i.e. to specify whether or not and why the bear in question falls under the domain of the generalisation or not. This is what we find: witness Nozuko seemingly resorting to a limited-domain interpretation when no theoretical grounds for a law-like reading are forthcoming:

**Nozuko, group 3:**

E: Suppose all the women in Nigeria are married. Now there’s a woman called Connie and she’s not married. Can we say she lives in Nigeria or not?
S: What kind of clothes do they wear in Nigeria?²²
E: Just suppose the world is a strange one in which all the women in Nigeria are married.
S: We can say she’s a Nigerian but she hasn’t got married yet.

This last turn – especially the ‘yet’ – can also be understood as a plea for a temporally-delimited interpretation of the concept “woman” as females of marrying age.

After surveying these three options which are open to a subject on hearing the question ‘What colour is the bear?’, we see that answering ‘white’, is not as straightforward as it might seem. In fact, the given range of options suggests that the subtext of the question is a question after the applicability of the generalisation. Especially the generic reading of the generalisation suggests the question be best interpreted thus. On the other hand, to simply use the generalisation as a premise, thus taking a ‘straight’ reading of the question, seems to result in either being uninformative, or rash. If this is indeed the case, we would expect reactions to include further suggestions or queries about specification of the domain; or about the relation of the named particular to the domain. This type of reaction is indeed present in a good many responses.

An alternative means to capture the oddity of the syllogistic question is in terms of the difference between an instance being known to conform and predicted to conform. Using the given premises as intended implicates that the conclusion is foregone because the instance is known to conform, but this is uninformative. On the other hand, assessing whether the instance is predicted to conform results in an informative response, but involves assessing the domain and type of quantification, and thus going beyond the question as asked.

This mismatch between domain and interpretation can explain the frequent asking for or volunteering specification of the limits of the domain of quantification. This occurred in all groups but was less common in the schooled group. An example:

²²In Xhosa custom a married woman indicates her status by wearing a specific kind of dress: she always covers her head, and wears an apron. There is also special language only for married women: some objects (e.g. cattle, stones) have two names, one for use by married women, one for use by everybody else.
Nonkululeko, group 2:

Preamble: ‘All people who own houses pay house tax. Sabelo does not pay house tax. Does he own a house?’
S: He doesn’t have a house if he’s not paying.
E: And now suppose that none of the people in Cape Town pay house tax. Do they own houses or not?
S: They have houses.
E: Why?
S: They can have houses because there are places where you don’t pay tax, like the squatter camps.
E: So they can have houses and not pay?
S: They may, they can live at the squatter camps.

The subjects’ response to the question, ‘Do [the people in Cape Town] own houses or not?’ might be taken as a Luria-style ‘ignoring the premises’ response, or even as inconsistent with her previous turn, if it were not for her next response, in which she justifies her conclusion, that people in Cape Town do have houses, by explaining that the given generalisation does not hold in Cape Town – that is, we’ve gone beyond a restricted domain – the context set – in which the quantification was strict. She is in essence saying, in her second turn, ‘I am free to assert they have houses in Cape Town because the given statements do not apply there.’

So if the generalisation is so problematic for some subjects, how is it supposed to function from the experimenter’s point of view? The domain restriction is intended to be ‘self-contained’, i.e. given only by the NP, with no further domain restriction given by a previously determined context set. Now we can connect this with the insights of both Westerståhl and Goodman with regards the nature of domain-relations. In anaphoric use of quantification this means that all elements of the domain are ‘known’ – or at least they have been previously indicated by the context. ‘Forward’ quantification, so long as it introduces the elements to be quantified over only in the generalisation itself, leaves open the extent of the domain, thus allowing for previously unmentioned or unknown elements to still fall under it. I would like to speculate that interpreting the generalisation on an unspecified context set (or, as a putative default, the universal domain), which is required for correct response in the syllogistic task, might be more common in scientific or literate discourses, and the assumption that the unschooled subject understands it as a law is thus problematic. For instance, witness Luria’s observation that: “In all instances, when a subject repeated the premises he did not give them the character of universal assertions” (1976, p. 106). As we have seen, taking the strict (unrestricted) universal reading of all, where a ceteris paribus clause suffices for domain restriction, is atypical for everyday spoken language use of universal quantifiers. In fact, I would speculate that the whole idea of
a universal domain is a literate idiosyncrasy. Yet this is the default domain in syllogistic tasks.

If this is indeed the case, then the difficulties that unschooled subjects have with quantified premises should not be attributed to their faulty reasoning ability, but rather to the experimenter’s chauvinistic view of what interpretations are available and plausible for such premises. The implicit theory of language supporting such chauvinism, one which is maintained in much reasoning research, is articulated and critically evaluated in Chapter 4.

The most obvious prediction that follows from the account given here of difficulties with all premises is that such premises would become unproblematic when the nature of the generalisation is clarified. So, for instance, if the context set was specified then subjects should be able to answer questions about particular instances of the generalisation. Recent work (Haan, 2007) addresses this question and verifies that this is indeed the case. Haan conducted two reasoning tasks with an explicit context set, designed to test whether an explicit domain aids unschooled subjects. The results from the tasks confirm that this is the case.

In the first task, the ‘box task’ (versions one and two), subjects were presented with a tray containing three red boxes and shown that each box contained a ping-pong ball. The content of the boxes was then hidden and the subjects were asked the following questions:

i. ‘Is it true that all red boxes contain a ball?’

ii. (On one of the boxes being produced again): ‘What is in this box?’

and in a third version which rules out yes-bias the subject was first shown three blue boxes, only two of which have a ball in them, and asked

iii. ‘Is it true that all blue boxes contain a ball?’

The rates of correct answers for the tasks were respectively 100%, 69%, and 100%, thus confirming our prediction that using universal generalisations in a typical fashion (that is, contingently on a specified domain) removes difficulty for unschooled subjects in reasoning with them. Such a task set-up looks to be very fruitful for further investigation because the multi-modal sources of information avoid many of the problems of informativeness often present in purely linguistic tasks.

We should however give some attention to the lower elicitation rates for the second question, which Haan labels the second “version” of the Box task. In fact, given that the order of questions was not counterbalanced, we should see the second question as a follow-up on the first, and thus as part of the same ‘version’ of the task. Asking the question ‘what is in this box?’ when the previous question ‘is it true that all red boxes contain a ball?’ certainly changes the informativeness of various answers from the situation in which it would be asked first-off. For instance, the subject might read the second question as some kind of trick;
2.3. WHAT IF CONDITIONALS ARE EASIER?

a ‘straight’ reading of the question puts us back to a question-answer situation comparable to the purely linguistic tasks, with their attendant pathological information structure. But even if the question had been asked first, uncertainty remains as to what kind of answer is required. What level of detail would be informative? Was the box empty to start with? Any of all of these factors could explain the lower rates of correct answer to the second question.

Haan’s second task designed to test the role of domain-specification did not yield such high performance. In this task subjects were presented with the following set of premises:

I have three brothers and one sister. All of my three brothers live in Rotterdam. Jan is one of my brothers. Where does he live?

On this task, perhaps surprisingly, subjects gave the answer ‘Rotterdam’ only 25% of the time. However there are several differences to the box task which make the ‘brothers’ task more problematic. Firstly, the question as phrased is underspecified. ‘Where?’ could mean ‘which city?’ ‘which street?’ or ‘where in relation to the rest of the family?’. Given the fact that the premises already state the brother lives in Rotterdam the subject could judge it uninformative to give this as an answer and would then be stuck for a specific answer. A further issue with this question-answer set-up is that of authority: the experimenter tells of his own situation, so he clearly is the authority on the matter and once again we have anomalous epistemic asymmetry (the questioner knowing more than the person he’s asking) as described in the previous chapter. Moreover the naming of brother Jan separately and after the quantified statement leads to the same unclarity of the relation of the named individual to the domain: does he belong to the original domain or not? Although on the standard reading ‘brothers’ is a closed set, a metaphorical interpretation of the concept, something which is certainly very common in South Africa, would allow new members to be added indefinitely. If the same reading is available in Moroccan or Turkish culture then this would introduce another interpretation of the premises. For these reasons I take the outcome of the ‘brothers’ task to be non-consequential for the predictions outlined here.

2.3 What if conditionals are easier?

In the foregoing, I identified aspects of the use and interpretation of the universal quantifier all, which can explain the difficulty unschooled subjects have with syllogistic-style premises. In this section I focus on conditional premises with aim of finding candidate explanations for the relative ease with which subjects reasoned in the simple condition of the suppression-effect task materials.

A variation on this, the ‘daughters’ task, is judged to suffer from the same ambiguities as discussed above so I will not discuss it further.
As described above, unschooled subjects were much less inclined to give ‘non-
answers’ (what Luria termed ‘refusals’) when presented with this type of condi-
tional premises. Perhaps even more interestingly, within the schooled group sub-
jects were more inclined to give elaborations to such conditional premises than
they were with quantified premises. In other words, the gap between the two
groups narrows, from both sides, when subjects are presented with conditional
premises.

There are several factors which may play a role in explaining why this is so.
Firstly, the conditional premises were presented within a ‘story’ context, so that
subjects were, for instance, first told,

‘This is about a girl Thembi. She lives in Hamburg.’

Then the premises are presented:

‘If Thembi wants to see her boyfriend she goes to East London, and Thembi
does want to see her boyfriend. So will she go to East London?’

Now this embedding in a narrative context might partially explain subjects’ com-
fort with the material; it has been argued that narrative discourse is the most
basic type of discourse (Bruner, 1991). It would indeed be interesting to compare
this presentation of premises to unschooled subjects with the original premises
used by Byrne (1989) which opened cold with: ‘If she has an essay to write . . .’
(Who’s she? The cat’s mother?) In the conclusion I return to this point when
suggesting new experimental conditions.

However, simple narrative embedding does not tell the whole story, because
in the syllogistic task subjects also got some sort of introduction to the material
before the premises are presented:

‘Suppose there’s an imaginary country called Markia. And in this country
all (the) women are married. Fatma is a woman who lives in Markia. Is
she married?’

Moreover, as we have just seen in Haan’s (2007) ‘brothers’ task (and even more
so for the ‘daughters’ task), simply embedding syllogistic premises further does
not improve performance on the task. The difference lies rather in the quality
of the embedding. In both problems the subject is asked to draw a conclusion
about a specific named individual, a ‘protagonist’. One factor in the conditional
task is that the protagonist is introduced before the generalised premise – here
in the form of a conditional – is given. By contrast, in the syllogistic task,
the particular individual about whom a conclusion must be drawn is introduced
after the generalisation. As discussed in the previous section, this might make
a subject more inclined to view the protagonist as somehow contrastive, and
therefore deviating from the generalisation. But the plausibility of such a reading
of the protagonist’s position is more dependent on the form of the generalisation
than the order in which it is presented – as will become clear as we further
2.3. WHAT IF CONDITIONALS ARE EASIER?

our analysis. Given these considerations, the difference between conditional and quantified formulations of a generalisation remains a potentially significant factor in the different tasks, especially given the foregoing analysis of all and its ‘misuse’, so to speak, in syllogistic problems. It is to this which we now turn.

This variation across premises is by no means obvious because, as mentioned, both quantified statements and conditional statements are typically given a logical form containing an implication. Both can express generalisations and thus say something about more than one entity or event, meaning that in both cases ‘domains’, understood in a loose sense (and which we’ll make more precise later on), are important. It has been argued in the previous section that all premises are difficult because they are used in reasoning tasks with hanging semantic parameters; more specifically, an unspecified context set. No distinction is made between the universe of discourse and context set even though, especially in the case of contingent generalisations, this is usual. In Chapter 1 it was argued that conditional premises also have hidden elements, namely abnormality clauses, which have not been taken into account in the analysis of experiments. We might just as well expect subjects to stumble with such premises, because of the unaccounted-for elements, as they did with all premises. In this section the aim is to distinguish reasons why the conditional sentences used in the study are easier for our reasoning subjects. As with all, a start is made by investigating how if phrases are used in everyday spoken language. This then guides a semantic analysis of experimental materials.

2.3.1 if in conversation and reasoning

Unlike the situation for universal quantifiers, there is much existing research on the use of if conditionals in practice. Firstly, conditionals have consistently found to be more common in spoken than in written discourse: Hwang’s (1979) analysis of a corpus of spoken (of 63 746 words) and written English (357 249 words) found 4.2 if conditionals per 1000 words in speech against 2.7 per 1000 in text, and Ford & Thompson (1986) found 7.2 per 1000 words in speech versus 4.6 per 1000 in text. Secondly, initial conditional clauses – that is, a preposed if clause – outnumber final conditional clauses by about three to one, or even more in spoken language; Ford & Thompson (1986) found initial if clauses in 82% of spoken occurrences of the conditional. Comrie (1986), in a typological study, found no counterexamples to a preference for initial conditionals. So far so good: if-clauses, and especially pre-posed ones, are common in spoken language.

Conditional constructions are ubiquitous, complex, and varied. Apart from if, conditionality can be expressed in English with many other expressions, including when, whenever, whether, even and, or (‘Do it and/or I’ll punish you!’) or simply co-subordination (‘The more I work, the more I earn’). As for typologies of

24Both examples are from Declerck & Reed, 2001. They distinguish 14 different syntactically
conditional constructions, there are several available (Comrie, 1986; Declerck & Reed, 2001, but also Haegeman, 2003, and from a reasoning perspective, Bonnefon & Hilton, 2005). So for instance, Comrie (1986) offers a cross-linguistic typology of conditional phrases, and judges clause order, marking of conditionality, degrees of hypotheticality and time reference to be relevant parameters in classifying conditional constructions.

Here we are interested in conditionality as expressed with *if* clauses. Since Comrie is dealing with a much wider class of constructions than those, not all of his parameters are relevant for us. Only varying degrees of hypotheticality and the matter of time reference will be a feature of the typology offered here. Similarly, Declerck and Reed’s analysis is broader than that needed here. For this reason, the taxonomy of *if* phrases given in Athanasiadou & Dirven (1995, 1997) will be employed.

As for what *kind* of *if* conditionals are frequently used, Hwang found the structure ‘if + pres., pres’ to be most commonly used (19.2% of spoken conditionals, 16.5% of written), closely followed by ‘if + pres., will/going to’ (10.9% spoken, 12.5% written). Elsewhere the latter construction, often known as future or predictive conditionals, has been found to be most common (Comrie, 1986). We now go into these kinds in more detail.

**Categorising conditionals**

Athanasiadou and Dirven’s (1995) analysis of 300 instances of *if* clauses from the COBUILD corpus yields a category classification into, principally, event conditionals and marginal conditionals. This split becomes one between event conditionals and pragmatic conditionals in their 1997 analysis. For reasons described later on, however, we should not just rely on the 1997 study categorization. We focus initially on the largest category as reported in the 1995 study, event conditionals, which itself clefts into course-of-event and hypothetical conditionals. These are both considered event-based conditionals and differentiated from marginal conditionals, which divide further into logical and conversational *if* clauses. By far the largest group is the course-of-event sub-type, covering 44.7%, and followed by hypothetical conditionals at 36.9%. Examples of these two types are, respectively:

If there is a drought at this time, as happens so often in central Australia, the fertilised egg in the uterus still remains dormant.

If there is no water in your radiator, your engine will overheat immediately.

In a later analysis (Athanasiadou & Dirven, 1997) which was extended over five corpora, the authors found hypothetical conditionals to be the largest group, at 42%, and course-of-event conditionals slipped to 30%. The latter had an
especially low presence in the Leuven Drama corpus of modern British plays (9%), which perhaps skewed the outcome; plays are a very specific literature genre. By contrast, the COBUILD corpus represents a large variety of English registers. At any rate, the significance of the precise percentages should not be overestimated; suffice to say that both course-of-event and hypothetical conditionals represent sizeable categories of usage. As will become evident, these categories represent the vast majority of conditionals used in reasoning tasks.

The other change from the 1995 to the 1997 study is that the category ‘marginal conditionals’ from the earlier analysis is replaced by that of ‘pragmatic conditionals’. Pragmatic conditionals are characterised by their discourse-interactional function, as in,

If you are thirsty, there’s beer in the fridge.

This subtype entails its consequent, and is given the generic form “If there is a need x, let me give you information y, so that you can arrive at solution z” by Athanasiadou and Dirven. Haegeman (2003) characterises pragmatic conditionals as ‘discourse-structuring’. The broad distinction between event conditionals and pragmatic conditionals is one which has been consistently upheld in the literature on conditionals even since before Athanasiadou and Dirven’s study – see for example Haegeman (2003) for an overview of authors who have proposed such a distinction, albeit with different labels.25 Pragmatic conditionals are not central to our current interests because they are not the type typically used in reasoning tasks. However, for just this reason, they provide a key means to test experimental predictions generated by our explanation of reasoning behaviour with event conditionals. They are discussed further when suggestions for further experimental work are made.

How are course-of-event conditionals (henceforth CECs) and hypothetical conditionals (HCs) characterised? There are three main differences between them.

1. **Recurrence.** CECs refer to “generally or occasionally recurring events”, while HCs mostly refer to a singly-occurring event. This is highlighted by the fact that “in CECs we can always substitute if by means of the temporal conjunction whenever” (1995, p. 617).

2. **Seriality.** CECs can refer to simultaneous or consecutive events, whereas the events of an HC must be consecutive.

3. **Immediacy.** CECs refer to real time, while HCs refer to “hypothetical time”: events situated in the future, combined present and future, or in the imagined past or present (pp. 612–613), as is illustrated in the following two formulations (adapted from Athanasiadou and Dirven, 1995, p. 628):

25For instance, Sweetser (1984) differentiates between content and epistemic conditionals; see also Bonnefon & Hilton (2005) who make use of this terminology.
If there is no water in the radiator your engine overheats immediately.

If there is no water in the radiator your engine will overheat immediately.

These differences come together in a difference in the level of commitment to the realisation of the events mentioned in the antecedent and consequent, only CECs being committed to both of these actually occurring. Apart from tense differences, there are other means to indicate the speaker’s “epistemic distance” to the events described in the conditional. Indeed, the authors follow Langacker (1991) in assuming that tenses “do not in the first place denote time but the more abstract distinction ‘immediate’ vs. ‘non-immediate’ ” (pp. 616–617). So for instance, modal auxillaries such as will, can and may can also be used to create epistemic distance from the described events. CECs are distinct from HCs in that past tense cannot be used to create distancing effects there but must be interpreted as past time (such as in telling a story), while the modal auxillaries can occur in both types of conditionals. In CECs especially those evoking a near reality such as going to or can are in evidence, for example in the following:

If there are distance problems, when engaged in conversation, then there are clearly going to be even bigger difficulties when people must work privately in a shared space. (p. 620, emphasis mine)

Also adverbs such as normally, always and even sometimes are used in CECs, as a means to simultaneously establish “an effect of generality and reality” (p. 619).

Within CECs, Athanasiadou and Dirven distinguish three further sub-types. These are descriptive, inferencing and instructional CECs, illustrated respectively in the following examples (p. 616):

But if there has been rain and there is good pasture, then the egg now restarts its development.

He looked at his watch: if the soldier was coming, it was nearly time.

It is wise to call the doctor in all cases of sore throat, especially if there is a fever of 101°.

In descriptive conditionals both the antecedent and consequent have been observed in reality, while in inferencing conditionals although both events are ‘real’, the second event of the conditional has been inferred from the occurrence of the first event, rather than observed directly. In instructional CECs the consequence has imperative force, forming an instruction of what is to be done in case of the situation described in the antecedent. Presumably such CECs are to be distinguished from pragmatic counterparts by the recurring nature of the described situation, indicated by the phrasing “in all cases”. This last example does however serve to highlight that Athanasiadou and Dirven’s classification depends also on contextual factors, not simply on the form or content of a given conditional, and as such sometimes delivers seemingly overlapping categories.
Conditional constructions in Xhosa

In an ideal world the classification of if clauses used here would be based on typological data. This is unfortunately not possible, but most relevant for the current argument is the comparison with Xhosa, the language in which the experiment was conducted. This fortunately is feasible.

All conditional sentences in the task materials were translated with the *xa* construction. According to Mncube’s ‘Xhosa manual’ (n.d.) *xa* is used for the simple conditional expressing a present or future oriented relation. The consequent can take several forms in this construction. Here the antecedent is introduced by *xa* and followed by an indicative consequent, as in the following:

(17) *Xa* umntu etshayela kughuma uthuli.
    When a person SING.SUBJ. sweep there rise dust
    When one sweeps, dust rises.

The *xa* construction can also be used for a conditional expressing doubt or ‘inexpectancy of fulfilment in present or future time’, viz:

(18) *Ndingambetha, xa ungandinika ikhulu leeponti*.
    SING.SUBJ.MOD.OBJ.beat if SING.SUBJ(2nd pers.).MOD.OBJ+give one hundred pounds
    I would beat him if you would give me a hundred pounds

Mncube describes a third construction for expressing conditionality involving doubt or inexpectancy of fulfilment: the consequent is introduced by the optative *nge*, in participial mood, followed by the antecedent in the indicative mood introduced by *ukuba*:

(19) *Nge ehlala ukuba ndiya funa*.
    SING.SUBJ.MOD.stay if SING.SUBJj(1st pers.).want
    He would stay if I wanted him to.

The *nge* conjunctive can also be used with *ukuba*, as above, to express counterfactuality. According to Mncube the *ukuba* construction is usually used to express a counterfactual, what he calls an ‘unfulfilled past condition’. The antecedent is introduced by *okokuba* or *ukuba* and generally followed by the participial mood.

A more recent source (Pinnock, 1994) also gives *xa* as the equivalent to English *if*, *when*, *whenever*, and offers *noxa* as a translation of ‘even if’ and *nangona* for ‘although’.

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26 The book must have been published between 1931 and 1961. This can be deduced because the ‘settlement of the orthography question’ in 1931, and the work of a late Xhosa scholar on grammars and dictionaries in the new orthography are mentioned in the foreword, so the book is definitely published some years after 1931. Also, there are sample sentences referring to the pound. The rand was introduced as the currency of South Africa in 1961, so the book was published before then.
So the two main conditional operators in Xhosa are *xa* and *ukuba*. As we’ve seen in the analysis of the transcripts from the current study, the majority of conditionals are interpreted as habitual or CEC conditionals, which can in English also be expressed with *when* or *whenever*, and in Xhosa with the *xa* construction. The *xa* construction was indeed the predominant translation used in the current study.

### 2.3.2 Why some conditionals make natural premises

The majority of the conditionals used in reasoning studies (and the few used in Scribner’s 1977 and Cole et al’s 1971 materials) can straightforwardly be classified as course-of-event conditionals, recognised by the fact that *if* can unproblematically be substituted with *when* or *whenever*. It is also most plausible to interpret them as describing recurring events, consecutively occurring and probably both observed, hence falling into the sub-type descriptive CECs. For example, I used:

If Ntombi wants to see her boyfriend then she goes to East London.

And from Scribner, 1977:

If Sumo or Saki drinks palm wine, the Town Chief gets vexed.

A second type used in reasoning studies uses the future tense in the consequent clause, and can be characterised as inferential CECs:

If Thembi works hard then she will pass her exams.

This last example might also be adequately characterised as descriptive, or even hypothetical. Luckily this does not matter greatly for the current analysis. Again, it does however illustrate that the categorization into descriptive CEC or hypothetical conditional can depend on contextual factors. This applies equally to Byrne’s original (1989) suppression effect materials, such as:

If it is raining then she will get wet.

If she has an essay to finish then she will study late in the library.

The first example given can be doubly classified as hypothetical and inferential CEC, since the latter express inferences about time-bound relationships and often contain modal auxiliaries. The second example from Byrne can, despite the future tense, be read as a descriptive CEC, as above, as it can be seen to instantiate a stable relationship rather than express a singular connection. In fact, other studies based on this material (Lechler, 2001, and the current one) used a present tense formulation of the conditional premise in some of the conditions, viz:

If Rosa meets her friend Liz then she goes to the cinema.

and

If Maria studies hard then she gets high grades in the exams.
2.3. WHAT IF CONDITIONALS ARE EASIER?

In summary, the materials used in conditional reasoning tasks are classifiable as expressing either descriptive or inferential course-of-event conditional relationships, and in some cases they may also be viewed as hypothetical. Recall that CECs are recognised by the fact that they describe the “normal course of events”, simultaneous or consecutive events which are both assumed to occur on a recurring basis. We now turn to semantic analyses of such conditionals.

The common characteristic of both course-of-event and hypothetical conditionals lies in the stability of relation between the antecedent and consequent they seem to convey, at least in unmarked usage. The presumption of a relevant relation is illustrated by the unacceptability of conditional statements in which the antecedent is irrelevant to the consequent, such as ‘If 2+2=5, then Utrecht is the capital of the Netherlands’. Otherwise expressed: it is difficult, if not impossible, to read event conditionals (including CECs and HCs) ‘contingently’. Rather, event conditionals seem to tell us something about stable relationships playing out in the world. Marked usage plays with exactly this setting by connecting events which have nothing to with each other, such as in ‘If <unlikely event>, then pigs can fly’ or ‘<unlikely event> when hell freezes over’.

The unmarked event conditional is to be contrasted with the other major category of conditionals, premise conditionals, in which a stable connection between antecedent and consequent is not necessarily evident, such as in

If you’re hungry, there’s pizza in the fridge.

or, to echo an earlier example:

If you’re looking for a silver coin, check my pockets.

In these examples there relation between the antecedent and the consequent is extremely context-dependent: there’s no intrinsic connection between one’s hunger and the contents of the fridge (or a type of coin and the inside of my pocket). Rather, in a specific context this connection could be made for the specific purpose of alleviating one’s hunger (or need for a silver coin!). I would argue that this is a marked use of conditionals and that the unmarked usage is in course-of-event conditionals where some kind of intrinsic connection, often but not necessarily causality-based, between antecedent and consequent. This is emphatically not the unmarked usage of quantified phrasing. To illustrate, consider the contrast in

\footnotesize{Example from Veltman (1986). Such statements are nevertheless true if the conditional is attributed the semantics of the material implication – a phenomenon often labelled as a ‘paradox of material implication’. More discussion on this can be found in Chapter 4.}

\footnotesize{This allows for the possibility of a third event as common cause; also convention may explain the connection, such as in}

If it’s Tuesday, I go swimming.
All the coins in my pocket are silver

vs

If a coin is in my pocket, it is silver.

In the second phrasing, the conditional, we feel the need for a story about why it would be so – it cannot be a mere accidental fact. By contrast, the quantified version is most naturally read as a happy accident. Here also Fillenbaum’s (1978) data – as reported in Chapter 3 – indicates the seemingly inexorable tendency to attribute a sensible intrinsic relation to the events conveyed in event conditionals.

Haan (2007) makes the suggestion that the difference between quantified and conditional generalisations may originate in what they generalise over – namely, typically entities and events, respectively. Perhaps events are inherently more causally related to each other than predicates? The following example, in which only events are quantified over, argues against this.

Consider first the sentence

Every time this button gets pushed, the alarm goes off.

We can imagine the first sentence being uttered to the alarm system technician, perhaps from a disgruntled user. The correlation between the button-push and the alarm going off is puzzling, unintended, accidental, even indicative of a mistake. By contrast, the conditional variation,

If this button gets pushed, the alarm goes off.

lends itself much more to utterance from the alarm system technician, as explanation of how the system works. The alarm in this case is supposed to go off. Very clearly here, it is the conditional phrasing which brings out the causal, or law-like, nature of the relation, and not the mere fact that the relation described is between two events.

A note on formalisms: dynamic semantics for the conditional

An issue we’ve come across in evaluating subjects’ reasoning is the mismatch between the argument structure viewed from a classical logical perspective, and the argument as a discourse. One of the limits of classical semantics is that it works on a sentence-level translation of terms from natural language into a formal language. This means, for example, that classical logical translations will not distinguish between

(20) Bill fell and John hit him.

(21) John hit him and Bill fell.

But this limitation has been overcome by recent developments such as dynamic semantics which enable us to deal with sequences of sentences (Veltman, 1986). Within a dynamic semantics framework it is possible to elucidate formally the
reasoning steps that happen against an epistemic background, a ‘hearers cognitive state’, as opposed to a background of no information.

In this brief note I give some indications how this could be applied to modelling the data from reasoning tasks from a reasoner’s perspective. In the above a speaker’s reasons for the choice of one or other conditional construction, such as course-of-event, or hypothetical, was discussed, but once a construction has been chosen and needs to be interpreted the focus shifts to that of a hearer’s perspective. We now turn our attention away from the speaker to the hearer, as it were.

Much work has been done on understanding the semantics of conditional constructions from a hearer’s perspective; attributing the truth conditions of the material implication to indicative conditionals in natural language (as has commonly been done in psychology of reasoning) leads to the apparent truth of highly unintuitive if not downright unacceptable constructions such as ‘If 2+2=5, Utrecht is the capital of the Netherlands’. In such cases, the antecedent seems irrelevant to the consequent. One approach which is aimed at overcoming this paradox is that of dynamic semantics, where the meaning of a sentence is analysed to be an operation on the hearer’s cognitive states (i.e. beliefs) – in keeping with the slogan: ‘meaning is change in information’. On this approach, a conditional is interpreted as a step-wise ‘test’ on the current cognitive state, rather than the incorporation of new information into it. The ‘test’ works as follows: it returns the current state, if the adding the antecedent \( p \) to the current state generates a new state which supports the consequent \( q \), and the absurd state otherwise. A state supports a sentence if adding that sentence to the state does not change it – that is to say, if the sentence could already be deduced from that stock of beliefs. This interpretation of the conditional captures the intuition behind the Ramsey test for conditionals, which is the hypothetical adding of the antecedent \( p \) to one’s stock of beliefs and subsequent check for the truth of the consequent \( q \) as a means to evaluate the conditional as a whole. This account predicts a difference between course of event and hypothetical conditionals as the former involve actual addition of the antecedent and consequent to the state, according to Athanasiadou and Dirven’s analysis. So the reasoning process is augmented by belief revision in this case.

Pragmatic constraints on quantity and quality of utterances ensure that the normal context in which to assert an indicative conditional ‘if \( p \) then \( q \)’ is one in which both \( p \) and \( q \) are uncertain – i.e. none of \( p, q, \) or their negations \( \neg p, \neg q \) has previously been asserted and taken up into the listeners’ stock of beliefs. This is because if \( \neg q \) had already been asserted (and accepted), it would be impossible to have a successful ‘test’ of the conditional – the second step would generate

\[29\] Or more fully, “You know the meaning of a sentence if you know the change it brings about in the cognitive state of anyone who wants to incorporate the information conveyed by it” (Veltman, 1994).
the absurd state. Likewise for a prior assertion of \( \neg p \) – here the first step would already generate the absurd state. These two cases nicely explain the workings of constructions such as ‘If <unlikely event>, then pigs can fly’ or ‘<unlikely event> when hell freezes over’ – they rest on forcing accommodation (of the presupposition) of the negation of the unlikely event, if we take ‘pigs will fly’ or ‘hell freezing over’ to represent the absurd state. This also explains why the above example is an abnormal case, because it is uttered in a context where the antecedent is known to be false. Further, if either \( p \) or \( q \) would already be known, then asserting the conditional would be non-informative because, in both cases, \( q \) would already be deducible from the initial belief state.

Note that this analysis is intended for a series of assertions from a single source; a dialogue would introduce other constraints again, involving the intentions of each interlocutor regarding moves in the foregoing discourse as well as assumptions about the hearer’s belief states.

The dynamic account of conditionals can be related to the abnormality-sensitive reading of the conditional given in the previous chapter\(^{30}\), by considering the relevant abnormalities, or necessary preconditions, as salient elements of a hearer’s belief state which would impact on the support for \( q \) in the updated-with-\( p \) state – thereby determining whether or not it is felicitous to utter the conditional in the context, according to the hearer.

As we did with quantified premises, let us consider the position of the reasoning subject, this time in a conditional reasoning task. First the subject is presented with a conditional premise, say “If Thembi wants to see her boyfriend then she goes to East London.” This describes two events, which can be understood as simultaneous or consecutive, but also generally recurrent. The speaker indicates they are committed to the realisation of these events by the use of the simple present tense. Then the second premise is presented: “Thembi does want to see her boyfriend”, followed by the question, “Does she go to East London?”

Recall that course-of-event conditionals suggest that the speaker is committed to both of the events described actually occurring. To give the answer ‘Yes, Thembi goes to East London’ is for the hearer to indicate acceptance of the conditional. There are two possible reasons that this is a sensible response, perhaps mutually strengthening. First, it is general conversational convention to indicate comprehension of the speaker’s assertions (often accomplished by non-verbal indications such as nodding or murmuring ‘mm-hmm’). Secondly, the dynamic analysis of the conditional suggests that a question after the consequent is a question after the success of the test expressed by the conditional. To answer ‘yes’ is to answer ‘pass’ to the conditional test. The hearer agrees, as it were, that if one adds \( p \) to one’s set of beliefs, one can infer \( q \).\(^{31}\)

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\(^{30}\)This was the reading for a sentence of the form ‘If \( A \) then \( B \)’ as ‘If \( A \), and nothing abnormal is the case, then \( B \)’.

\(^{31}\)The given account is very compatible with the broadly-accepted discourse-functional thesis that conditionals provide topics, as first proposed in Haiman (1978), concisely expressed, the
2.3. WHAT IF CONDITIONALS ARE EASIER?

However, once the hearer has indicated the conditional test has ‘passed’, we might expect them to volunteer reasons why this is possible, that is, what other conditions have to be met for the conditionality to be captured in the premise as given. This is where the abnormality clauses become explicit, and as mentioned in the previous chapter, this was a commonly occurring phenomenon in my data – seen in excerpts such as:

**Nomhle, group 2:**

E: If Ntombi wants to see her friend then she goes to East London. And she does want to see her friend. Will she go to East London?
S: Yes.
E: Why will she go to East London?
S: Is it because she wants to see her friend?
E: Yes, she wants to go.
S: Maybe she can talk to her parent and tell her that she wants to go and see her friend. Maybe Ntombi is interested to go and to see her friend but now she doesn’t have enough money. So maybe her parent will give her money to go to East London to see her friend.

On this account, the modus ponens condition in these reasoning tasks is more a test of communication, or acceptance than anything else. This would not necessarily be the case when other conditional-based inference schemas are tested, nor when types of conditionals are used – for instance premise conditionals. Some suggestions for investigating other types of conditionals empirically are given below.

As for other schemas, if acceptance of a CEC conditional means commitment to both the antecedent and consequent occurring, then modus tollens, i.e. reasoning from the negation of the consequent, becomes problematic.

**Nothabile, group 1:**

After premises ‘If Thembi has to fetch water then she goes down to the river. If she washes her clothes then she goes down to the river.’

E: And she doesn’t go down to the river today, does that mean she will fetch water or wash clothes or not?
S: She can’t wash her clothes if there’s no water, and she can’t stay at home if there’s no water, so she must go to the river if she has to fetch water or wash clothes.

Now this excerpt is difficult to interpret, but it is at least clear that the subject resists drawing the conclusion, “Thembi doesn’t fetch water or wash clothes” on the basis of the fact that she doesn’t go to the river. Although the subject short of asserting the consequent and antecedent, as a CEC classification predicts, her words do seem to imply she feels unable to reject either of them. She emphasises

thesis is that: “A conditional clause is (perhaps only hypothetically) a part of the knowledge shared by the speaker and his listener. As such, it constitutes the framework which has been selected for the following discourse” (1978, p. 581).
again the connection between the situations, as if to say, “You can’t have the one without the other” and resists taking on board what is intended as a premise, i.e. the negation of the consequent. It is as if she feels caught in a contradiction. This is certainly consistent with a CEC interpretation for the conditional in this case. With a similar argument we can predict affirmation of the consequent to proceed automatically as modus ponens does; and denial of the antecedent to be difficult for subjects with CEC premises.

This is of course a far too brief introduction to the possible application of a dynamic semantic approach to modelling the conditional-based inference; the reason for including it is to indicate that there are available formalisms which are equipped to deal with some of the phenomena associated with a discourse-based view of reasoning. Unfortunately a fuller analysis is beyond the current scope.

2.4 Summary, conclusions and outlook

In the first half of the chapter I explored the use of the universal quantifier all and its Xhosa equivalent -onke in spontaneous speech and was able to categorise them in four main categories. Stock and emphatic usage was not further analysed; the focus of the analysis was on the differences between anaphoric or deictic usage and so-called ‘forward quantification’. It was argued that this latter usage comes closest to the usage of all-sentences as premises, but that it is atypical for spoken usage, and possibly even derived from written contexts.

Reasons for these findings were sought in a semantic analysis of all. I argued for the finding that all sentences are chiefly used with a pre-given context set, to express contingent generalisations. I proposed that reasoning with all sentences is difficult for the unschooled subject because the context set is not specified; when this is absent the subject cannot make inference about individuals, because their relationship to the domain is not known. An alternative law-like reading is less context-set dependent, but this is specialized use of all, and moreover results in an uninformative answer. We can summarise by saying that all is used primarily to pick out a pre-given domain and that this makes all sentence unnatural first premises.

In the second half of the chapter I investigated features of conditional sentences, focussing on the type used in reasoning tasks so far, which can be categorised in Athanasiadou and Dirven’s (1995, 1997) classification including course-of-event conditionals, hypothetical conditionals, and premise conditionals. It was found that conditional premises used in for example the suppression effect task closely resemble common course-of-event conditionals. Relevant features of this type of conditional are the recurrent nature of the events described and the commitment to their occurrence implicit in use of the conditional. I argued that this makes this type of conditional sentences natural bases for drawing inferences and can at least partially explain the greater inclination of subjects to assent to
the *modus ponens* conclusion in the conditional reasoning tasks studied. Brief suggestions were made regarding available appropriate formalisms for these and other response patterns observed in the data.

This chapter is a first attempt to relate reasoning behaviour to everyday language usage and remains very much a first attempt. Corpora data was matched with a range of more theoretical semantic work to explain the differences between kinds of premises, specifically those between quantified and conditional formulations. Although the findings in the corpus study were preliminary and there remains much to address regarding the match between data and formal work, it seems reasonable to conclude that the approach taken here is a fruitful one and one which deserves further study.

### 2.4.1 Experimental predictions and evaluations

If the account given here about difficulties with *all* premises is correct, then we should expect subjects to reason more easily with the following variations of quantified premises:

- *all* sentences for which the context set is specified. As we’ve seen, Haan’s work (2007) bears this prediction out.

- *every* sentences, since these do not lend themselves to a generic reading, but rather to a purely contingent one. Here specification of the domain would be necessary; otherwise the task would become purely a matter of prediction, based on similarity judgements between the particular instance named and those known to belong to the domain.

- conditional phrasings of generalisations, such as ‘If a bear lives in the north, it is white’, to encourage law-like readings.

Regarding conditional premises, event conditionals are to be contrasted with pragmatic conditionals in terms of their role in a discourse. Specifically, pragmatic conditionals play a discourse-interactional role – a very different discourse function from event conditionals. Hence we might expect subjects to exhibit different patterns again when reasoning with such conditionals. In particular, as Athanasiadou and Dirven (1997) point out, in premise conditionals the truth of the consequent is always presupposed. Given this, we can predict that the *affirmation of the consequent* and *denial of the antecedent* inferences will be much less common. See if you find yourself committing a fallacy with either of the following:

If you’re hungry, there’s pizza in the fridge.
There’s pizza in the fridge.
What follows?
CHAPTER 2. ‘IF P THEN Q’ . . . AND ALL THAT

and

If you’re hungry, there’s pizza in the fridge.
You’re not hungry.
What follows?

Also worth further exploration is the depth of the posited distinction between course-of-event and hypothetical conditionals. In several examples offered by Athanasiadou and Dirven it was clear that the distinction between these categories is only to be determined by contextual indicators. However, if experimental differences could be found in more clear-cut examples of one or other type, this would lend credence to the suggested categorical distinction between them. For instance, it could be investigated whether subjects do commit to both the antecedent and consequent occurring in CEC formulations, but not in hypothetical conditionals. Suitable materials would differ only in the tense phrasing, for instance,

If it is raining then she will get wet.
If it rains then she gets wet.

In my data, as mentioned above, the fact that some subjects had resisted the modus tollens inference with conditionals expressed in the simple present (“If Thembi has to fetch water then she goes to the river”) suggests the distinction is a semantic one. If however, this turns out not to be the case, Athanasiadou and Dirven’s categorization should be simplified accordingly.

Other avenues

The idea that illiterate reasoning behaviour can only be judged within the communicational context of the task forms the backbone of the current chapter. Indeed, the ‘meta’ goal was to emphasise the value of usage-based studies of language in helping us to understand inferential behaviour.

But the ‘flesh’ given to this idea here is a kind of experiment, there are other possible explanations which might fit the data just as well. In this chapter I have pursued some aspects of the materials used in reasoning tasks related to their role in discourses. There are aspects which have been left unexplored so far but which could well yield just as rich an explanation of behaviour as that given here. For example, I have no more than touched on the positioning of the protagonist in the premises, and the ways that this could contribute to the ease or difficulty of drawing a conclusion from conditional or quantified premises. A preliminary consideration of the varieties of relation the protagonist can have towards a generalisation suggests this would be worth further analysis: they may be examplar, exception or counterexample, all of which would impact on the conclusions one can draw about them and the relation of these to the generalisation.
Neither have I explored the widely-accepted idea that narratives are a ‘basic’ type of discourse (Bruner, 1991). The relative strength of fit of the various premise sets to a narrative structure might also be a fruitful means to explain variation in responses.

Finally, a feature of these tasks which has persistently cropped up both in the category analysis of the previous chapter and in the information-structure sections of the current chapter is their peculiar epistemic structure. Usually, when one asks a question, it is because one doesn’t know the answer. Rhetorical questions are no doubt a universal phenomenon, but whether or not the subject understands that the questions asked in the context of a reasoning task are of a sort with these is unclear. One reason to suppose that the subject did not understand the question as rhetorical is that such questions don’t require answers, whereas in the experimental setting an answer is clearly expected from them. In many cases, the subject replied with a question, asking for confirmation from the experimenter for a ‘correct’ answer. In other cases it was clear that unschooled subjects simply couldn’t understand the question they were supposed to be answering – they are looking for the ‘question under discussion’ as it were. The idea that this ‘QUD’ is determined by the ‘genre’ of the task is touched on in the next chapter, but further exploration of the contrast between this type of question-answer situation and that occurring in spontaneous dialogue would certainly be worthwhile.