Foundations of Linguistics
WiSe 20/21
Take-home exam 2

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Hand-out of 2nd exam opportunity: Sunday the 11th of April 2021; 23.59 on Teams Hand-in of 2nd exam opportunity: Sunday the 18th of April 2021; 23.59 on Teams

Hand-in form: PDF. Attached to the exam is a .docx answer file which lists the questions numbers. Please use it to answer the questions, convert it to PDF, and upload it to MS Teams. You are not required to use Word, those of you that use Open Office, LaTeX, whatever, you will know how to convert the .docx file. The final product, your exam, should have just your answers, appropriately numbered, in PDF form.

In case there are any technical problems you can reach Annemarie Verkerk at: annemarie.verkerk@uni-saarland.de

You will receive a confirmation message from Annemarie Verkerk when the exam has been successfully received.

Note: this exam is intended to reflect your individual knowledge and skills. Working together and copying each other's work in any way is NOT ALLOWED. Using published work without citing it fully is plagiarism and is NOT ALLOWED. Reframing in your own words published or unpublished work without citing it fully is plagiarism and is NOT ALLOWED. Along with this document (the exam) you will find the "Erklärung über Eigenständigkeit" that relates these issues in more detail. Please hand in a signed version of this document along with your exam.

The exam is divided up into four parts with several questions, which will be graded separately (Morphology & Syntax, Semantics, Pragmatics & Phonetics). For each of the four parts, there is a bonus question. A correct answer on a bonus question gets you +10% on your score for that part. Your overall grade will be calculated as the mean of your scores on all four parts.

Part I: Morphology and Syntax

1.1

Given word	Morpheme boundaries
Netflix	net (Internet)+flix (flicks) [Wikipedia]
operationalizable	operat(e)+ion+al+iz(e)+able
walkie-talkie factories	walkie-talkie factor(y)+ies
overwritten	over+writ(e)+ten
AIDS medicineering	AIDS medicine+er+ing

1.2

Given word	**Root**	**Derivational**	**Inflection**
Netflix	Internet, flicks	Not-possible	Not-possible
operationalizable	operate (Verb)	operable (Adjective)	operating (Verb)
walkie-talkie factories	factory (Noun)	factorylike (Adjective)	Not-possible
overwritten	write (Verb)	writer (Noun)	wrote (past participle)
AIDS medicineering	AIDS (Noun), medicine (Noun)	medicinal (Adjective)	medicines (Noun)

- **Netflix**: There are no derivation and inflection for *Internet* and *flicks* as there does not exist any words that share this word in its root. However, for *flicks*, there exist a different meaning, whose both derivation (flicky (Adj. something that is easily flicked)) and inflection (flicked) exists.
- For the root *factory*, there does not exist any inflection as being a noun, its very difficult for new-word formation.

1.3

Given word	Morphological patterns
Netflix	compounding (net+flix), clipping (internet → net, flicks → flix),
operationalizable	concatenation (operate → operation)
walkie-talkie factories	concatenation (factory → factories)
overwritten	compounding (over+write → overwrite) concatenation (write → written)
AIDS medicineering	alphabet-based abbreviation (AIDS), concatenation (medicine → medicineering)

2.1

- **Morpheme based model**:
  - These models operate between morphemes. E.g. *un-suspicious-ly* and *un-occur-ing-ly*. Here the roots are *suspicious* and *occur* and rest are morphemes.
  - Most of the word formation usually takes places using derivation (between lexemes of word forms) or inflection (between word forms), when two or more morphemes combine.
  - [Hathout, 2009] writes that they are usually represented as tree-like structures.
  - [Bram, 2012] says that these models make use of "item-and-arrangement approach", meaning structure of the word adheres to a series of arrangements observing a set of rules.
- **Word based model**:

- Word based models are associated with most word-formations. Such a rule is common more in fusional languages like Spanish.
- Word-form is the fundamental constituent.
- They make use of "word and paradigm approach" [Bram, 2012] which means that different word forms are legalised to follow the linguistic paradigms.
- It allows morphological patterns like conversion and certain forms of back-formation [Verkerk, 2020].
- E.g. the plural form of words like car—cars, toy—toys, bird—birds can be explained by following a generic word schema $[/X/_N] \rightarrow [/XZ/_N]$ i.e affixing the noun with (Z or S).

2.2

It is true that languages could differ as to which model would fit the best. Concatenative patterns are most common in all languages and are favoured more based on their syntactic strucure [Haspelmath and Sims, 2013]. Hence, the rules that we formulate for such languages should minimize the use of noon-concatenative property ad bring about uniformity in the syntatic structure.

Languages like English and Hindi uses morpheme based morphology where most words are formed by addition of affixes. Affix adds a grammatical dimension or may be change the word meaning.

Inflection and derivation morphology dominates heavily in Hindi where the new word forms are created by insertion of suffixes. For e.g. /hathi/(Noun, Singular) becomes /hathi-yan/ (Noun, Pluaral) (hathi means elephant). An example for a derivational morphology is /kathor/ (meaning- hard, Adj), /kathorta/ (Noun).

3.1

Please refer to Table 1.

- Begin with reading the sentences thoroughly. Look for words occurring commonly e.g. *He*, it can be concluded that all its corresponding sentences have the affix *ki-*. Do this for other common words like *I*, *you*, *his*, *your*, *me* etc. We also separate these affixes with a hyphen.
- Now we can observe some similarity in the tokens of the unknown language. E.g. first and second sentences have the word *slept*, common between them. Therefore, their translation in the corresponding mystery language must be the same. We find the corresponding word to be *Kotʃik*. However, the task is not over. Look at the translation for the sentence *Kipolua kotʃilisli.* $\leftrightarrow$ *He loses sleep.* Carefully observe that here *sleep* in present participle and the *k* in *Kotʃik* is missing. Hence *k* must be acting as a past particle affix verb. We follow a similar procedure for other words as well.

Table 1: Morphological Analysis for mystery language X

Table 2: Morphemes
(X) represents default or hidden S/O

Morphemes	Order
Ni-kotʃi-k	S-V
Kotʃi-k i-ʃolul	V-S
Ti-yuli	S-V
Yuli mo-siwal	V-S
Netʃ-lamatʃiltia	O-V-(S)
Ki-lamatʃilti-k no-siwal	S-V-O
Ti-wehkawa	S-V
Wehkawa no-tʃikawa-lisli	V-S
Ni-lami-k	S-V
Lami mo-lamatʃilti-lisli	V-S
Lami-k i-tʃikawa-lisli	V-S
Mih-tʃikawa-k	O-V-S
Ki-tʃikawa	S-V-(O)
Ki-tʃikawa no-ʃolul	S-V-O
Ki-polua	S-V-(O)
Ki-polua kotʃi-lisli	S-V-O
Ki-poluk i-tʃikawa-lisli	S-V-O
Netʃ-wililtia	O-V-(S)
Mits-wililti-k	O-V-S
Ki-wililtia mo-ʃolul	S-V-O
Netʃ-neki	O-V-(S)
Ki-neki yuli-lisli	S-V-O
Ki-neki i-siwal	S-V-O
Ki-neki-k no wililti-lisli	S-V-O
Ki-maka-k nadita al	S-V-O
Len animal kikwahkwa-k	S-V-(O)
Ni-ktolpaʃka-k	S-V-(O)
Ko-koški in simal	S-V-O

Table 3: Roots

Root	**Meaning**
kotʃi	sleep
ʃolul	child
yuli	live
siwal	wife
lamatʃiltia	inform
wehkawa	endure
tʃikawa	strengthen
lami	finsh
polua	loose
wililtia	empower
neki	love
neki	want
maka	give
nadita	water
kikwahkwa	bite
ktolpaʃka	strangle
koški	woman

Table 4: Affixes

Affixes	**Meaning**
ni-	I
-k	past tense
i-	his
ti-	you
mo-	your
netʃ-	me
ki-	he
no-	my
-lisli	normalization
mih-	he + you
mitʃ-	you
ki-	she
ko-	the

3.2

- **synthesis**: Synthetic. Quite a number of words with morphemes glued to it. E.g. *kotʃi* is *sleep* and *kotʃik* is *slept*
- **fusion**: concatenative (most formatives need other words to complete their meaning). E.g. *tʃikawa* ↔ strengthen, *tʃikawalisli* ↔ strength
- **flexivity**:non-flexive as almost all of the formatives lack allomorphs.
- **exponence**: Separative. Each formative carries its own grammatical functions.

3.3

The basic order (for most of the sentences) is subject-verb-object (for majority), but with few anomalies (e.g O-V-S, V-S, S-V). Table 1 shows the details analysis. This can be seen in the following examples:

- **S**(He ↔ Ki) **V**(lost ↔ poluk) **O**(his strength ↔ i-tʃikawa-lisli).
- **S**(He ↔ Ki) **V**(informed ↔ lamatʃilti-k) **O**(my wife ↔ no-siwal).

3.4

The marked grammatical relations are a combination of head marking + constituent order-

- *Tiyuli* ↔ *You live.* Here subject (*Ti*) is prefixed to the verb root (*yuli*) which is a head. While in *Yuli mosiwal.* ↔ *Your wife lives*, head (*Yuli*) lacks any affix. And, *mo-* is prefixed to the subject (*siwal*). Thus, the grammatical marks appear to be placed on the head, hence a head marking.

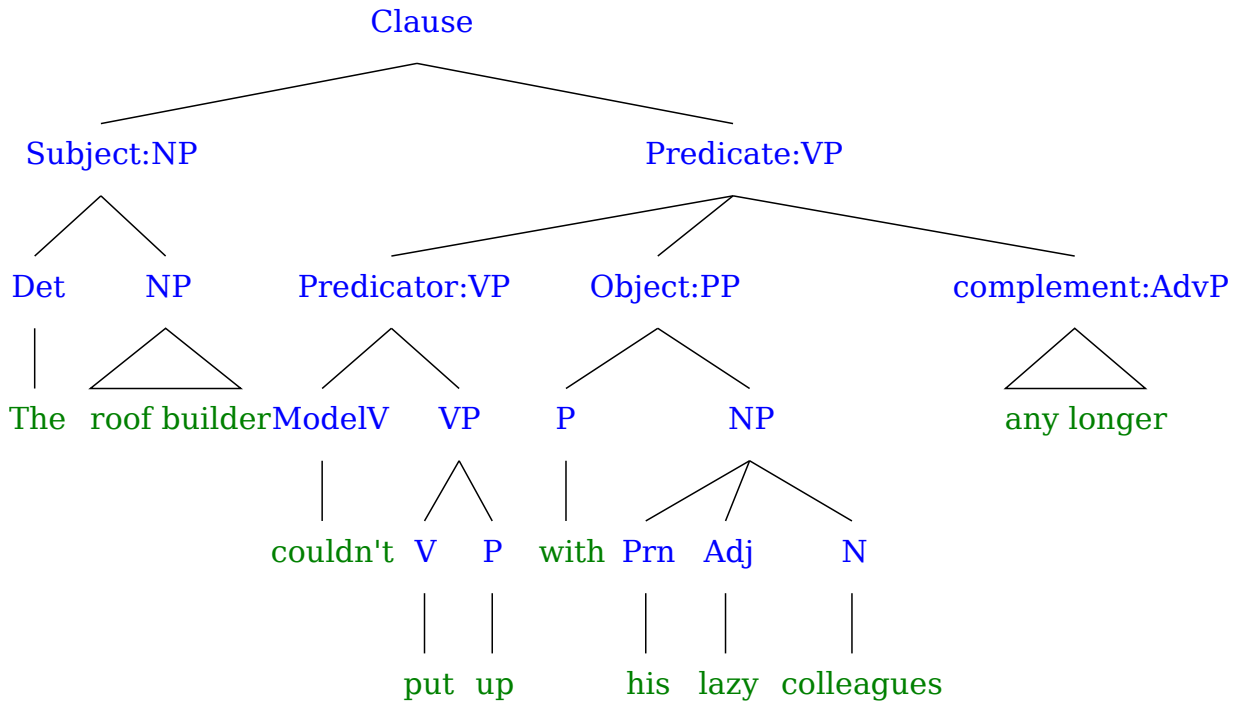
- *kineki isiwal* ↔ *He loves his wife.*
  ki—He (Subject which is verb prefix), *neki—loves* (verb root) *i—his*, *siwal—wife* (Object which is noun root). The words are in constituent order i.e. Subject-Verb-Object.

3.5

Nominative accusative alignment.
***ki**-polua — He loses it.*
***ki**-polua kotʃi-lisli — He loses sleep.*
*Ni-ktolpaSka-**k** — I strangled him.*
The subject and the agent is treated the same (nominative case) and Object is treated distinctly (accusative case). When *He* is subject or the agent, *ki* appears in its base nominative form. But when it's an object, it changes to accusative form *k*.

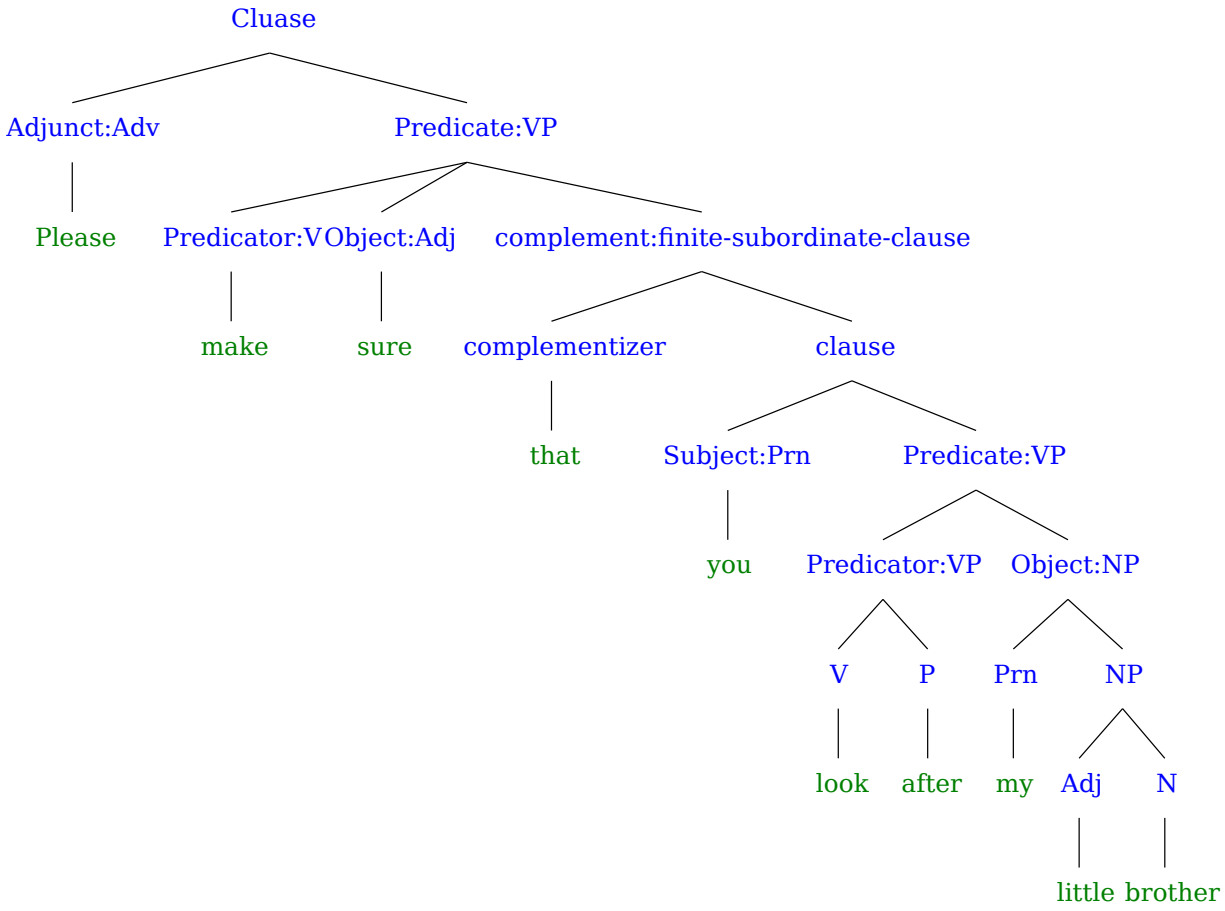
4.1.a

[Clause [Subject:NP [Det The] [NP roof builder]] [Predicate:VP [Predicator:VP [ModelV couldn't] [VP [V put] [P up]]] [Object:PP [P with] [NP [Prn his] [Adj lazy] [N colleagues]]] [complement:AdvP any longer]]]



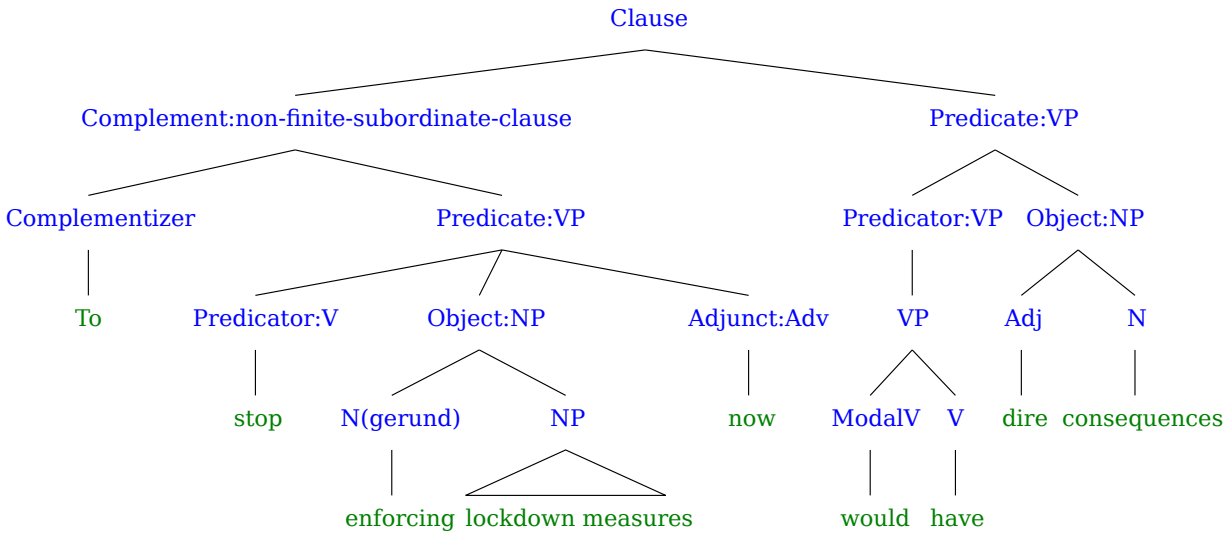
4.1.b

[Cluase [Adjunct:Adv Please] [Predicate:VP [Predicator:V make] [Object:Adj sure] [complement:finite-subordinate-clause [complementizer that] [clause [Subject:Prn you] [Predicate:VP [Predicator:VP [V look] [P after]] [Object:NP [Prn my] [NP [Adj little] [N brother]]]]]]]]



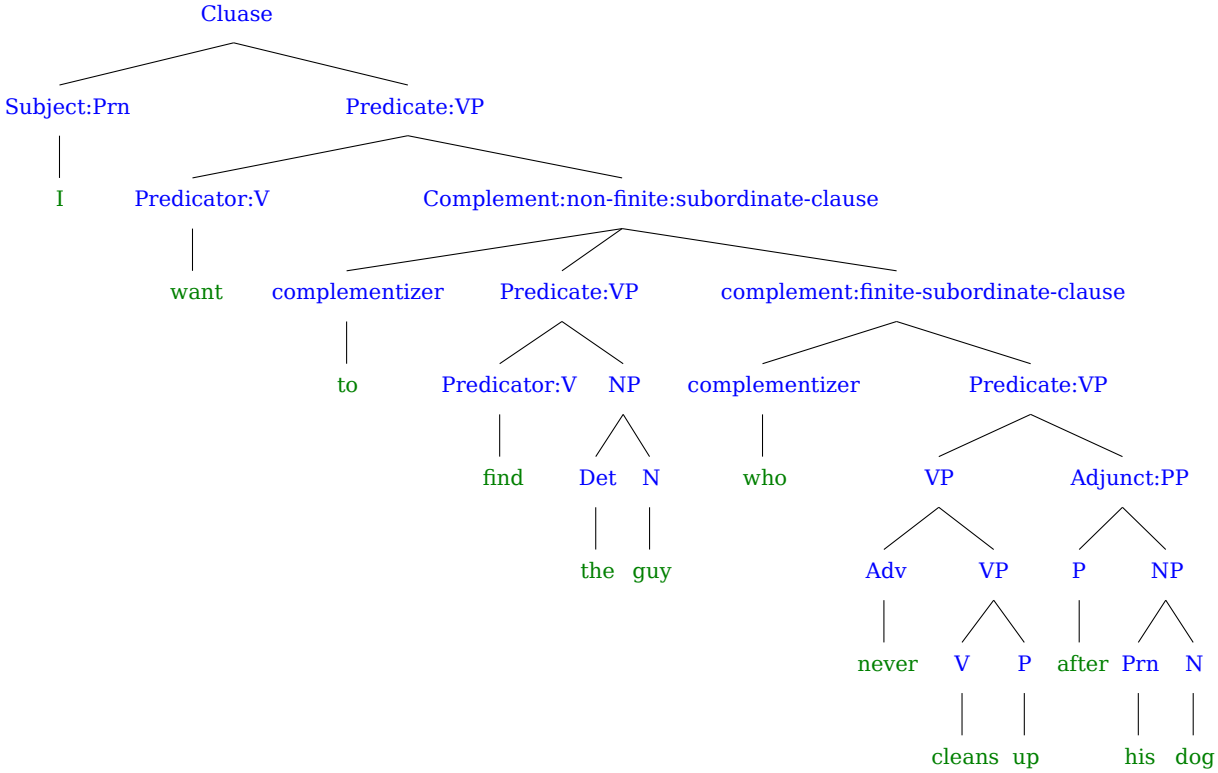
4.1.c

[Clause [Complement:non-finite-subordinate-clause [Complementizer To] [Predicate:VP [Predicator:V stop] [Object:NP [N(gerund) enforcing] [NP lockdown measures]] [Adjunct:Adv now]]] [Predicate:VP [Predicator:VP [VP [ModalV would] [V have]]] [Object:NP [Adj dire] [N consequences]]]]



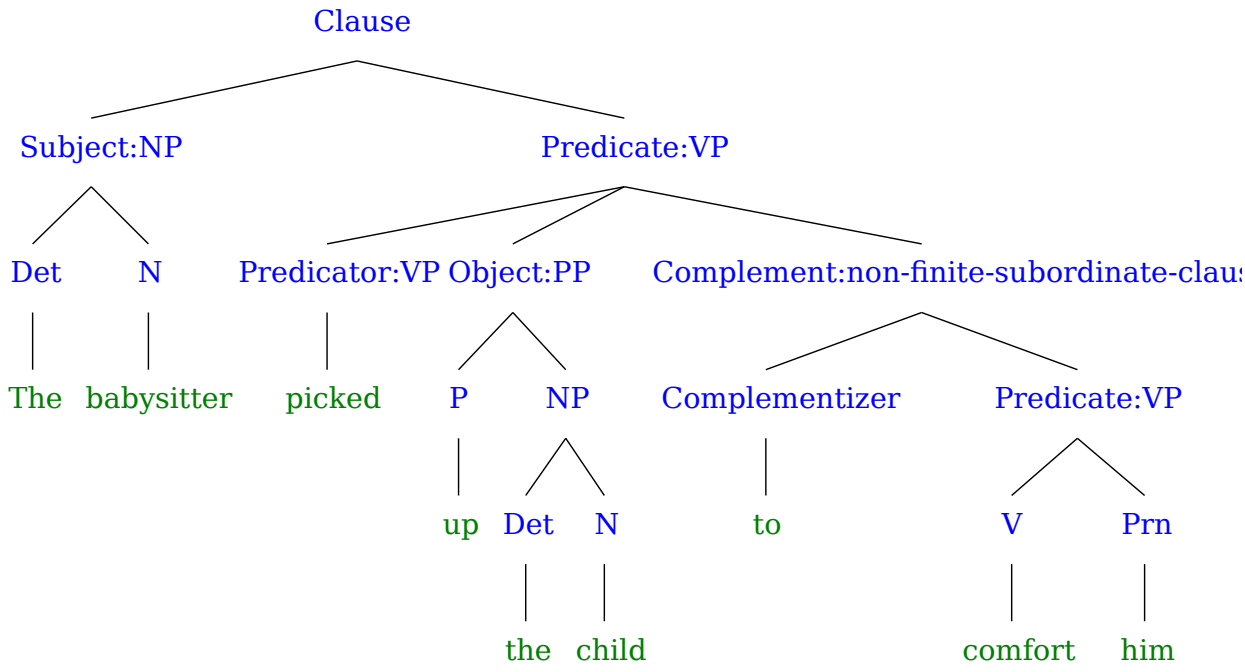
4.1.d

[Cluase [Subject:Prn I] [Predicate:VP [Predicator:V want] [Complement:non-finite:subordinate-clause [complementizer to] [Predicate:VP [Predicator:V find] [NP [Det the] [N guy]]] [complement:finite-subordinate-clause [complementizer who] [Predicate:VP [VP [Adv never] [VP [V cleans] [P up]]] [Adjunct:PP [P after] [NP [Prn his] [N dog]]]]]]]]



4.1.e

[Clause [Subject:NP [Det The] [N babysitter]] [Predicate:VP [Predicator:VP picked] [Object:PP [P up] [NP [Det the] [N child]]] [Complement:non-finite-subordinate-clause [Complementizer to] [Predicate:VP [V comfort] [Prn him]]]]]



4.2

a. *The roof builder couldn't put up with his lazy colleagues any longer.*

- **False**: echo question test.
  Note here, the complement is *any longer*. So, for this to be true, it should have been something like:
  "What couldn't the roof builder put up with any longer? [his lazy colleagues]"
- **True**: sentence fragment constituency test.
  Here the phrasal verb *put up* has been used to raise a question *"What couldn't the roof builder put up with?"*, whose answer is only a constituent of the sentence i.e. a noun phrase *"his lazy colleagues"*, while preserving the meaning of the sentence.

b. *Please make sure that you look after my little brother.*

- **False**: sentence fragment constituency test.
  The phrasal verb *look after* has been used to raise a question *"Who exactly were you asked to* ***look after****?"*, to which the answer should have been the noun phrase, *"my little brother"*. Notice the stress- "Look after whom? *my little brother*"
- **True**: The phrase *that you look after my little brother* is a finite subordinate clause (can be observed form the tree as well) it gives a somewhat complete meaning when isolated from the sentence. Note here that it also carries a verb *look*, that shows the tense.

c. *To stop enforcing lockdown measures now would have dire consequences.*

- **True**: pronoun substitution test.
  It points to the act of stopping the enforcement of lockdown measures. Hence, *[It]* can be used as personal pronoun to refer to the constituent *[To stop enforcing lockdown measures now]*
- **False**: The clause *[To stop enforcing lockdown measures now]* is a non-finite subordinate clause. Infinite clause: *to-*

d. *I want to find the guy who never cleans up after his dog.*

- **False**: do replacement test
  The answer should be *... and Elisa does so* (*does so = wants to find*)

- **True**: sentence fragment test
  Here *[who never cleans up after his dog]* acts a modifier to the noun *the boy* as it adds certain quality to him. What quality?- his act of never cleaning up after his dog. So now the question focuses on finding the guy with this quality. Hence is asks *Which guy do you want to find?* → *the guy who cares less for the dogs cleanliness*

e. *The babysitter picked up the child to comfort him.*

- **False**: Here the incorrect phrase *[up the child]* has been chosen. The focus here instead, should on his/her act of picking.
- **True**: We take the phrasal verb *picked up* for investigation and move it after *It was.*
  It was [picking up] that she did to comfort the child.

5

a. *I **worked** [last week]. — M*

b. *She **seemed** [very annoyed]. — C*

c. *The [longhorned] beetle **seemed to hug its rival**. — C*

d. *The pirates **laughed** [heartily]. — M*

e. *[the] **furnace** [black with soot] — (M, M)*

f. *an **understanding** [of C++, Java, and other programming languages] — C*

g. *the [very young] **child** — M*

h. *[my] [German] **class** — (M, M)*

i. *[her] **criticism** [of my decision]. — (M, M)*

j. *[the] **treasure chest** [in my room] — (M, M)*

k. *[the] **work** [I did yesterday] — (M, M)*

l. *(That was) **nearly** [two weeks ago]. — C*

m. *(I stayed) **until** [after dinner]. — C*

n. *(The student body elected her) **as** [student prefect]. — C*

o. *(We went) [directly] **to** [my room.] — (M, C)*

Table 5: Mystery language X

Nikotʃik	I slept
Kotʃik iʃolul	His child slept
Tiyuli	You live
Yuli mosiwal	Your wife lives
Netʃlamatʃiltia	He informs me
Kilamatʃiltik nosiwal	He informed my wife
Tiwehkawa	You endure
Wehkawa notʃikawalisli	My strength holds out
Nilamik	I finished
Lami molamatʃiltilisli	Your news ends
Lamik itʃikawalisli	His strength gave out
Mihtʃikawak	He strengthened you
Kitʃikawa	He strengthens him
Kitʃikawa noʃolul	He strengthens my child
Kipolua	He loses it
Kipolua kotʃilisli	He loses sleep
Kipoluk itʃikawalisli	He lost his strength
Netʃwililtia	He empowers me
Mitswililtik	He empowered you
Kiwililtia moʃolul	He empowers your child
Netʃneki	He loves me
Kineki yulilisli	He wants life
Kineki isiwal	He loves his wife
Kinekik no wililtilisli	He wanted my power
Kimakak nadita al	She gave him a little water
Len animal kikwahkwak	Some animal bit him
Niktolpaʃkak	I strangled him
Kokoški in simal	The woman is ill

Part II: Semantics

7.1

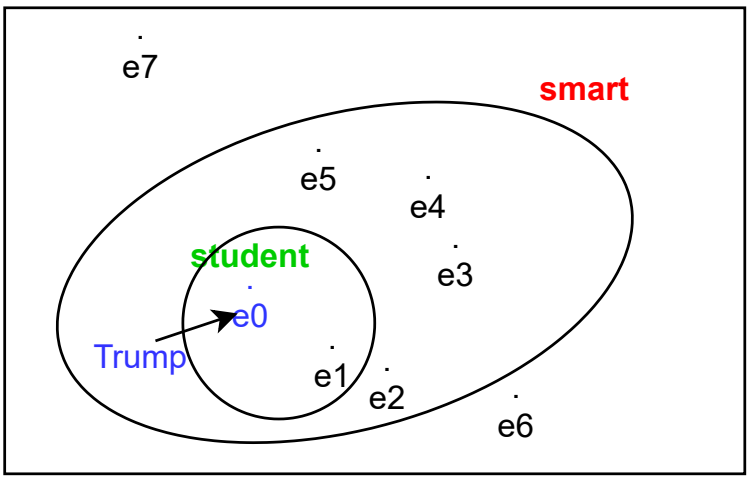
Meaning is a way to transmit information from one to another. It helps understand the concept of the message and perceive it. For e.g. think of a kangaroo, it creates a mental picture of a jumping animal with a pouch and fur body. The message is also related to inferences (conclusion) i.e. additional information meant for communication. For e.g. "Son, there was an accident yesterday near the highway". The purpose of the speaker is not just to tell his son about an accident, but also to warn him to drive safely.

However, meaning is not just about communication or perceiving the information, the goal is also to have it formally represented in terms of mathematical expression so that it could be universally understood. This helps us establish a relationship between an argument, inference under a set of given rules that would be true for all. While a model structure is a formal representation of the given situation in a simplified way, defined by a universe U, and an interpretation function V [Venhuizen, 2020].

Here is an illustration that explains the relationship between meaning, logical representation and meaning.

Trump is a student. All students are smart.

- **Sentence meaning**: There exits a situation in a universe where all students are smart. It also states that Trump is a student therefore it must be true that he is a smart student in this universe.
- **Logical representation**:
  $smart(Trump)$
  $\forall x(student(x) \Longrightarrow smart(x))$
- **Model Structure**: The model structure M for the above logic representation is given by:



  - U_M = {e0, e1, e2, e3, e4, e5, e6, e7}
  - $V_M(smart)$ = {e0, e1, e2, e3, e4, e5, e6}
  - $V_M(student)$ = {e0, e1}
  - $V_M(Trump)$ = {e0}

7.2

In the given section, Scott Soames has criticized the truth conditional semantics on the grounds that it is incorrect and unnecessarily verbose and confusing. He argues that a conjunction of a given truth sentence and a universally true statement, does not change the given truth statement. For example: "Cats are white true". The sentence hold truth only for cats that are white. According to truth conditional semantics, "Cats are white" iff the cats are really white and "Sky is blue". Soames criticizes that adding these necessary truth

conditions is a uselessly circular and should be avoided. We can use infinite such necessary truth, but its fruitless as it has diverted our attention entirely from the truth conditions of a given statement.

I agree with the Scott's argument as the truth of a statement should be based strictly on the conditions of that statement, and not in other necessary truth conditions which adds verbosity to my argument.

8.1

a

$$A \to B \vdash \neg A \to \neg B$$

Using the interpretation rule on premise:
$[\![A \to B]\!]$ iff $[\![A]\!] = 0$ or $[\![B]\!] = 1$;

- if $[\![A]\!] = 1$ then $[\![A]\!] \neq 0$, so $[\![B]\!] = 1$, hence $A \to B \models B$
- if $[\![B]\!] = 0$ then $[\![B]\!] \neq 1$, so $[\![A]\!] = 0$, hence $A \to B \models \neg A$

Therefore, from above

- $A \to B \models B$
- $A \to B \models \neg A$

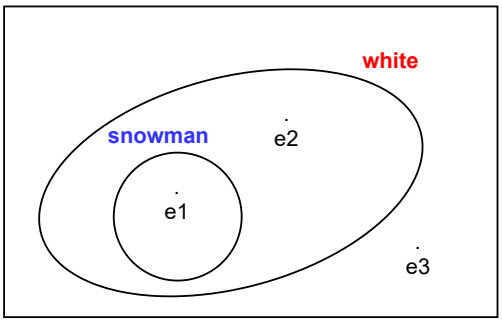
Now, using the interpretation rule on conclusion:
$[\![\neg A \to \neg B]\!]$ iff $[\![\neg A]\!] = 0$ or $[\![\neg B]\!] = 1$;
$\implies$ iff $[\![A]\!] = 1$ or $[\![B]\!] = 0$;
Therefore, from above

- if $[\![A]\!] = 0$ then $[\![A]\!] \neq 1$, so $[\![B]\!] = 0$, hence $\neg A \to \neg B \models \neg B$
- if $[\![B]\!] = 1$ then $[\![B]\!] \neq 0$, so $[\![A]\!] = 1$, hence $\neg A \to \neg B \models A$

Therefore, from above

- $\neg A \to \neg B \models \neg B$
- $\neg A \to \neg B \models A$

For the premise $A \to B$ to entail the conclusion $\neg A \to \neg B$, both of them should entail to the same entity. Whereas in the above steps, they entail to different entities. Precisely, here when the premise is true, the conclusion is false. Thus the entailment relationship does not hold and the given deduction rule is not sound.



Assume "Every snowman is white" in the given model M
The premise says $\forall x(snowman(x) \to white(x))$

- $V_M(snowman) = \{e1\}$
- $V_M(white) = \{e1, e2\}$

Check for the conclusion: $\forall x(\neg snowman(x) \to \neg white(x))$

- $V_M(\neg snowman) = \{e2, e3\}$
- $V_M(\neg white) = \{e3\}$

The conclusion above is false because $V_M(\neg snowman) \not\subseteq V_M(\neg white)$
Hence this conclusion $\neg snowman(x) \to \neg white(x)$ is false.

b

$$A \to B \vdash \neg B \to \neg A$$

Using the interpretation rule on premise:
$[\![A \to B]\!]$ iff $[\![A]\!] = 0$ or $[\![B]\!] = 1$;

- if $[\![A]\!] = 1$ then $[\![A]\!] \neq 0$, so $[\![B]\!] = 1$, hence $A \to B \models B$
- if $[\![B]\!] = 0$ then $[\![B]\!] \neq 1$, so $[\![A]\!] = 0$, hence $A \to B \models \neg A$

Therefore, from above

- $A \to B \models B$
- $A \to B \models \neg A$

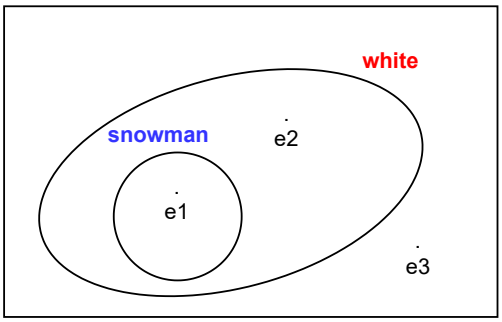
Now, using the interpretation rule on conclusion:
$[\![\neg B \to \neg A]\!]$ iff $[\![\neg B]\!] = 0$ or $[\![\neg A]\!] = 1$;
$\Longrightarrow$ iff $[\![B]\!] = 1$ or $[\![A]\!] = 0$;
Therefore, from above

- if $[\![B]\!] = 0$ then $[\![B]\!] \neq 1$, so $[\![A]\!] = 0$, hence $\neg B \to \neg A \models \neg A$
- if $[\![A]\!] = 1$ then $[\![A]\!] \neq 0$, so $[\![B]\!] = 1$, hence $\neg B \to \neg A \models B$

Therefore, from above

- $\neg B \to \neg A \models \neg A$
- $\neg B \to \neg A \models B$

The premise $A \to B$ entails the conclusion $\neg A \to \neg B$, as both of them entail to the same entity. Here when the premise is true, the conclusion is true. Thus the entailment relationship hold and the given deduction rule is sound.



Assume "Every snowman is white" in the given model M
The premise says $\forall x(snowman(x) \to white(x))$

- $V_M(snowman) = \{e1\}$
- $V_M(white) = \{e1, e2\}$

Check for the conclusion: $\forall x(\neg white(x) \to \neg snowman(x))$

- $V_M(\neg white) = \{e3\}$
- $V_M(\neg snowman) = \{e2, e3\}$

The conclusion above is true because $V_M(\neg white) \subseteq V_M(\neg snowman)$
Hence this conclusion $\neg white(x) \to \neg snowman(x)$ is true and the rule is sound.

c

$$\forall x F(x) \vdash \exists x F(x)$$

Using the interpretation rule on premise:
$[\forall x F]^{M,g} = 1$ iff for all $b \in U_M$; $[A]^{M,g[x/b]} = 1$
Using the interpretation rule on conclusion:
$[\exists x F]^{M,g} = 1$ iff there is a $b \in U_M$; $[A]^{M,g[x/b]} = 1$
This means that,
if $F(x)$ holds true for all $b \in U_M$, then there exists a $b' \in U_M$ for which the condition is also true.
Hence, $\forall x F(x) \vdash \exists x F(x)$ holds the entailment relationship and the rule is sound.

d

$$\forall x(F(x) \to G(x)) \vdash \exists x(F(x) \to G(x))$$

Using interpretation rule in premise:
iff for all $d \in U_M$, $[\![F(x) \to G(x)]\!]^{M,g[x/d]} = 1$
iff for all $d \in U_M$, $[\![F(x)]\!]^{M,g[x/d]} = 0$ or $[\![G(x)]\!]^{M,g[x/d]} = 1$
iff for all $d \in U_M$, $[\![x]\!]^{M,g[x/d]} \notin V_M(F)$ or $[\![x]\!]^{M,g[x/d]} \in V_M(G)$
Using assignment function: $[\![x]\!]^{M,g[x/d]} = g(x)(\in U_M)$ if x is a variable
iff for all $d \in U_M$, $d \notin V_M(F)$ or $d \in V_M(G)$
Using logical reasoning:
iff for all $d \in U_M$, $d \in V_M(F)$ and $d \notin V_M(G)$
iff $V_M(F) \subseteq V_M(G)$

Using interpretation rule in conclusion:
iff there is a $d \in U_M$, $[\![F(x) \wedge G(x)]\!]^{M,g[x/d]} = 1$
iff there is a $d \in U_M$, $[\![F(x)]\!]^{M,g[x/d]} = 1$ and $[\![G(x)]\!]^{M,g[x/d]} = 1$
iff there is a $d \in U_M$, $[\![x]\!]^{M,g[x/d]} \in V_M(F)$ and $[\![x]\!]^{M,g[x/d]} \in V_M(G)$
Using assignment function: $[\![x]\!]^{M,g[x/d]} = g(x)(\in U_M)$ if x is a variable
iff there is a $d \in U_M$, $d \subseteq V_M(F)$ and $d \subseteq V_M(G)$

Therefore, if $V_M(F) \subseteq V_M(G)$ holds true, then there is a $d \in U_M$, such that $d \subseteq V_M(F)$ and $d \subseteq V_M(G)$.
Thus the premise entails the conlusion and the rule is sound.

8.2

P: If all students pass the `exam`, the `teacher` is gratified.

$$\forall_x(student(x) \to pass(x, \texttt{exam})) \to gratified(\texttt{teacher})$$

C: If the `teacher` is displeased, no student passed the `exam`.

$$displeased(\texttt{teacher}) \to \neg\exists_x((student(x) \wedge pass(x, \texttt{exam}))$$

Here:

- `exam` and `teacher` are constants.
- $student(x)$: entity x is a student.
- $pass(x, \texttt{exam})$: entity x who passes the `exam`.
- $gratified(y)$: entity y is gratified.
- $displeased(y)$: entity y is displeased.

Deducing the conclusion from its premise

Given deduction Systems:

$$A \to B \vdash \neg A \to \neg B \quad \text{(A)}$$
$$A \to B \vdash \neg B \to \neg A \quad \text{(B)}$$
$$\forall_x F(x) \vdash \exists_x F(x) \quad \text{(C)}$$
$$\forall_x (F(x) \to G(x)) \vdash \exists_x (F(x) \wedge G(x)) \quad \text{(D)}$$

Introducing additional axioms from WordNet, **gratified** means "having received what was desired" while **displease** means "give displeasure to" which are antonym of each other. Therefore using the biconditional operator $\leftrightarrow$, for e.g. $A \leftrightarrow B$ means A implies B and B implies A.

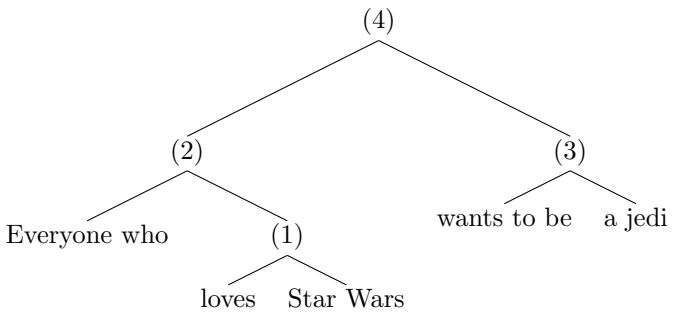
- $gratified(y) \leftrightarrow \neg displeased(y)$ Axiom(1)
  Definition: A gratified entity implies a not displeased entity and a not displeased entity implies a gratified entity
- $displeased(y) \leftrightarrow \neg gratified(y)$ Axiom(2)
  Definition: A displeased entity implies a not gratified entity and a not gratified entity implies a displeased entity.

1. $\forall_x(student(x) \to pass(x, \texttt{exam})) \to gratified(\texttt{teacher})$ P
2. $\exists_x((student(x) \wedge pass(x, \texttt{exam})) \to gratified(\texttt{teacher})$ (D) 1
3. $\neg gratified(\texttt{teacher}) \to \neg\exists_x((student(x) \wedge pass(x, \texttt{exam}))$ (B) 2
4. $displeased(\texttt{teacher}) \to \neg\exists_x((student(x) \wedge pass(x, \texttt{exam}))$ Axiom(2), 2

9.1

1. **To `pass` the exam**
   $\lambda x.[\texttt{pass}(x, exam)]$
2. **To be someone who `loves` Star Wars**
   $\lambda y.[\texttt{loves}(y, sw)]$
   where sw represents the constant $StarWars$.
3. **To `want` to be someone else**
   $\lambda y.\lambda x.[\texttt{want}(x, y)]$
   Entity y wants to someone but not x.
   $y = U - \{x\}$

9.2



Simplifying the given lamda expression for Jedi:
$\Longrightarrow \lambda x.jedi'(x)$
Therefore, using η-reduction:
$\Longrightarrow jedi'$

- For (1)
  $\lambda x.\lambda y.\texttt{loves'}(y, x)(sw')$
  $\Longrightarrow_{\beta}$ $\lambda y.\texttt{loves}'(y, sw')$

- For (3)
  $\lambda x.\lambda y.\texttt{wants'}(y, x)(jedi')$
  $\Longrightarrow_{\beta}$ $\lambda y.\texttt{wants'}(y, jedi')$

- For (2)
  $\lambda P.\lambda Q.\forall x(P(x) \rightarrow Q(x))(\lambda y.\texttt{loves'}(y, sw'))$
  $\Longrightarrow_{\beta}$ $\lambda Q.\forall x(\lambda y.\texttt{loves'}(y, sw')(x) \rightarrow Q(x))$
  $\Longrightarrow_{\beta}$ $\lambda Q.\forall x(\texttt{loves'}(x, sw') \rightarrow Q(x))$

- For (4)
  $\lambda Q.\forall x(\texttt{loves'}(x, sw') \rightarrow Q(x))(\lambda y.\texttt{wants'}(y, jedi'))$
  $\Longrightarrow_{\beta}$ $\forall x(\texttt{loves'}(x, sw') \rightarrow \lambda y.\texttt{wants'}(y, jedi')(x))$
  $\Longrightarrow_{\beta}$ $\forall x(\texttt{loves'}(x, sw') \rightarrow \texttt{wants'}(x, jedi'))$

Part III: Pragmatics

11

There is a subtle difference between lying and flouting a quality maxim. Lying is a natural survival tool, people often use to conceal the truth to protect themselves or someone else, hide from embarrassment, cover their wrongdoing or secret, etc. While flouting a quality maxim, a speaker's utterance does not present the reality. It can include rhetorical figures like metaphor where the speaker makes his utterance enjoyable to read. Let's consider a few examples for both of these situations:

- **Lying**
  Mom: Did you eat the ice cream?
  Son: No I did not, perhaps Dad ate it.
  Her son deliberately lies about not eating the ice cream to protect himself from punishment, even worse he blames his father, which in this situation is unacceptable behavior.

- **Flouting maxim of quality**
  Teacher to a student who is ten minutes late to the lecture.
  Teacher: Oh dear! Aren't you quite early for the lecture? Welcome to the class.
  Student: Apologies Professor! It won't happen again.
  In this situation, the professor teases the student on his late arrival at the lecture. It should be noted that his aim is not to praise the student but speak sarcastically only to make it sound enjoyable to his students.

12

In certain situations or conversations, it happens that the information that we wish to convey goes beyond the meaning and the content that we explicitly assert. In such cases, we would not want the implicature to arise and can be avoided if the speaker signals that he or she does not fully observe the maxim [Demberg, 2020a]. With this, the speaker clears up the air for the hearer so that he does not make any assumptions (unless otherwise stated), and only perceives the meaning of what the speaker says.

E.g.: *Swimming helps burn calories*

If the speaker wishes to prevent the listener from drawing any pragmatic implicature, he could simply say *Swimming is said to help burn calories*. This way, it would mean that the speaker wants to avoid any implicature and rather present it straight to the hearer.

13

In the statement *Anna has three children*, the implicature is that *Anna* does not have more than three children. If we say she has two or five or six children, we would be wrong. Precisely here we are observing the maxim of quantity. We are not contributing more than what is needed. In reality

- if *Anna* has 2 children, then we must not say she has 3 children. This would be wrong and would violate the maxim of quality as we are saying something incorrect.

- if *Anna* has 4 children, then saying 3 children is True and saying 4 children is also True. So both of these do not violate the maxim of quality. But when she has 4 and we say she has 3 then we are violating the maxim of quantity.

So according to the quantity maxim, we would only infer that she has not more than three children otherwise we would be violating the quantity maxim for not being as informative as required.

14

- Conversational implicature (CI) relies more on the linguistic meaning. The meaning conveyed by a CI goes above and beyond the semantic message captured in the sentence uttered. While Conventional implicature arises from the conventional meaning of words i.e rely more on the linguistic meaning, but they are not based on co-operative principles [Demberg, 2020a] and are not dependent on context for interpretation.

- Conventional implicatures are detachable while CI is non-detachable, as they rely on the linguistic message contained in the message, and less on how it is expressed [Karttunen and Peters, 1979].

- CI are cancelable while conventional implicatures are non-cancelable [Karttunen and Peters, 1979].
- In a generalized CI there is no specific word knowledge or context for the implicature. It refers to the meaning that exists by default in any type of context. While in a particularized CI, one needs world knowledge and is linked to a particular context or a piece of specific contextual information. E.g.
  - In the conversation below, *Joe* is very well aware of the fact that *Will* doesn't date women taller than him.
    Joe: Do you want Mary's phone number?
    Will: She's is too tall for me.
    Therefore, in the context of particularized CI, *Will* doesn't want *Marry's* contact number as she is taller than him.
  - *Anna has three children.*
    In the context of generalized CI, Anna has exactly three children, neither more than three nor less than three.

15

In level-1 rational speaker, the utility term and cost term are given as [Demberg, 2020b]:

$$P_S(w|r_S, c) \propto exp(\alpha Utility(w; r_S, c))$$
$$Utility(w; r_S, c) = logP_{L0}(r_S|w, c) - cost(w)$$

In the first equation, it states the probability that the speaker S chooses the word w given the referent r_S and the context c. This is proportional to utility of the word w given the referent and the context.

This utility term consists of two components:

- $log(P_{L0}(r_S|w, c))$: the speaker takes into account the probability by which the listener would figure out the correct referent given the words that speaker can choose.
- $cost(w)$: cost term which implements some notion of effort on the speaker's part.

The role of the utility term is to represent how well the referent (r_S) is communicated to a listener ($L0$). As the speaker (s) chooses the word (w) to communicate the referent (s) to the listener ($L0$), its goal is to **reduce or minimize this effort**". This is something that is controlled by the cost term ($cost(w)$). The listener would need to arrive at the referent from the chosen word while being efficient in communication.

16

- Coreference resolution (CR) is about finding referring expressions in texts. The goal is to find all such referring expressions in a text which point to the same entity. While anaphora resolution (AR) is about finding the predecessor or the antecedent of an anaphor [Demberg, 2021].
- CR requires *extra-linguistic information* or information not involving the given text while AR aims to indetify *intra-linguistic information* or information contained within the text [Stylianou and Vlahavas, 2021].
- E.g.
  - *Look at that girl around the corner, she is wearing high heels. Those look expensive*
    In this phrase, *that girl* refers to an actual girl in speaker's context and the pronoun *she* refers to *that girl* (its antecedent), so this too refers to the same entity- *the girl*. Thus the two expression *that girl* and *she* are coreferential as they refer to a common entity.
    Coreference chains:
    - {that girl, she}
    - {heels, those}
  - *No girl said she hates high heels*
    In this sentence, the pronoun *she* is an anaphor and is refering to its antecedent *no girl*.
    Anaphora resolution:
    - no girl → she

17

- Anaphora resolution in large texts where in presence of multiple (different) attributes, it becomes difficult to find the correct referent. Hence in such cases, it becomes difficult to resolve the anaphora. Lets consider an example:
  Source: Couldn't find an example, so I created one myself.
  A: Look at this dress with such a beautiful scarf.
  B: Can you hand be that blue one?
  Reading this, becomes difficult to infer as to what does "one" here refer to- the colour of the dress or the scarf. Unless there is more information stated in this regard from the real world, both dress and scarf are equally correct.

- Use of "it" without being referred to any entity. Lets understand this better with an example:
  Source: From the Diary of Anne Frank
  *I'm not so worried about my girlfriends and myself. We'll make **it**. The only subject I'm not sure about is maths.*
  Here "*it*" does not refer to any entity, but points to a state reference i.e situational.

- Difficulty in determining the referents as verb phrases. It becomes clear with an example below.
  Source: The Hack Driver
  We'll get the wife to pack up a lunch for us — she won't charge you more than half a dollar, and it would cost you more for a greasy meal in a restaurant — and we'll go up to Wade's Hill and enjoy the while we eat.
  Reading the last phrase *enjoy while we eat*, its unclear what does verb "enjoy" here refer to. The view or his wife's the tasty food.

18

To understand coherence and cohesion in simple terms, think of it in terms of a jigsaw puzzle [Cho et al., 2019]. Cohesion is how two pieces of a puzzle fit together. It refers to the smallest constituent of the puzzle or lexical elements in the context of a text document. While Coherence can be thought of as the way how all pieces of a puzzle fit together to resemble the picture given in the box and presents the global picture. It is about sentences in a document hold together globally and carries meaning in a single direction.

The following points cover the difference:

- Cohesion is about how well are sentences locally connected in a document. While coherence is about how sentences in a document hold together globally.

- Cohesion refers to grammatical and lexical elements on the surface of a text. In contrast, coherence describes the structures of how the sentence/clauses are in a relationship with each other (similar to a pragmatic relationship).

- Cohesion discusses the micro level feature whereas coherence discusses the macro-level features.

- In cohesion we talk about non-structural text forming relations like reference, lexical cohesion [Demberg, 2021]. In coherence, we talk about structural relations between discourse segments. E.g coherence relations [Demberg, 2021]

Examples:

- **Cohesion**:
  Last year I spent my summers in Croatia. Croatian beaches are mesmerizing. Croatia spans across the Adriatic sea. I almost broke my arm cycling in a Croatian city- Split.
  The text above lacks cohesion as it suffers from a repetition of words. The presence of reference words can make this piece of text coherent. *Last year I spent my summers in **Croatia**. **It's** beaches are mesmerizing. **It** spans across the Adriatic sea. I almost broke my arm cycling **there** in a city- Split.*

- **Coherence**:
  Recently imposed new set of restrictions by the federal government of Germany has spoiled my plans for the summer. Last year I spent my summer on the beaches of Croatia. Zagreb is the capital of Croatia. A major earthquake hit Zagreb last year in March.
  The above text lacks coherence, as the meaning of each of the sentences points in a different direction. For the text to be coherent, meaning should have been aligned in a common direction.

19

- **Explicit relation**: When discourse relations are marked with connectors such as "because", "but", "if" "and", "neverthless" etc., it is said to be an explicit relation. E.g.
  [*If Biden and Putin meet, it would be the first such summit between the nations since 2018,*]$_{Arg1}$ ***and*** [*the first since Biden became president.*]$_{Arg2}$
  Source: DW News
  The example above shows explicit relation where the two arguments *Arg1* and *Arg1* are connected using the connective **and**.

- **Implicit relation**: However, when the discourse relation between adjacent sentences lack such connectives or the relation is not expressed using an explicit connective, they are said to be in implicit relation. E.g.
  [*Anant is looking at the road for his bus.*]$_{Arg1}$ [*The clouds starts to roar and lightning is seen in the sky.*]$_{Arg2}$
  Source: Google books
  The text above presents an example of implicit relation, where the two arguments *Arg1* and *Arg1* are devoid of connectives.

- **Alternative lexicalization**: **AltLex** is where a discourse relation is inferred, but if connected using an implicit connective leads to redundancy [Hoek et al., 2017]. The arguments in such cases are lexicalized by alternative pharases and the defined set of connectives such as in explicit relations are not used. E.g.
  "okei...y," she said, by deliberately blinking her eyes, taking it as a compliment. ***(AltLex) She continues****, but for that you need not to miss your bus, I believe?"*
  Source: Google books

20: Bonus

hello

Part IV: Phonetics

21

a. As we all know that lungs are responsible for gas exchange. Any sound that we produce, involves some exchange of these gases either through our mouth or nose. This flow is of air takes a certain path. The air has to first enter through the nose or mouth followed through the windpipe into the lungs. During this process i.e. inspiration, the lungs expand, and then it contracts during expiration. The magic happens exactly during this process that causes speech production. It should also be remembered that the sound utterance for most of the languages like English (say sounds of letters like: "A", "F", "H" etc.), the production of sounds happens during expiration where the air is pumped up towards the voice box and vocal tract. The airflow is restricted because it interacts with the vocal tract where it vibrates producing the sound that we hear.

b. When we utter nasal consonants like [m], [n], etc. the flow of air takes place through the nose rather than the mouth, hence the name "nasal". As discussed above, the magic happens when the inhaled air is about to be expirated, the production of sound takes place. As in the case of nasal consonants, the air is exhaled through the nose as it is blocked by the lips and tongue. This observation can be seen in modern Hindi words [dãt] 'tooth' and [tʃãnd] 'moon' [Ohala and Ohala, 1991] where if one tries to restrict the passage of air by holding their nose, these words become impossible to be uttered. In fact, [m], [n] happen to be the two most commonly occurring nasal consonants.

c. The sounds produced by a human involves simultaneous movement of jaw, tongue, lips, teeth, etc all in coordination. Tongue and lips are a vital part of the speech production mechanism. They participate in the production of sounds like [b], [f]. Various combinations of different interactions of tongue, lips, and teeth produce different sounds. The type of sound produced differs on the height (e.g. try pronouncing "see" and "hot"), backness of tongue and roundedness (e.g. [i] vs [u]) of lips. It should also be noted that different parts of the tongue as the tip, back, and blade participate in producing sounds of different nature. Utterance of sounds like [p], [b], [w] involve lips and then we move them. Therefore, the complex nature of the tongue and lips make them vital organs for speech production. However, the role of the jaw is only to control how wide should the mouth open or close only to regulate the amount of space inside the mouth. For example vowels like [i] [y] with the jaw in a closed position while vowels like [a] involve the jaw in an open position. Hence from the above discussion, it can be concluded that the tongue and lips play a more important role than the jaw in speech production.

d. Oxford defines feedback as an individual's performance of a task. Feedback as an important tool that contributes to one's learning. Providing feedback on fluency can be a trickier task. Commenting on a person's speech's accuracy is as convenient as just pointing his errors. One must not think of feedback in terms of correction. Providing healthy feedback involves talking about ways such mistakes can be corrected, encouragement and appreciation on their correct responses, alternatives ways to make a correct response, etc. [Kerr] also says that there are various ways one can become fluent e.g. looking at the native or the proficient speakers of the language and knowing about their conversational strategies. These tips can certainly help a student to become fluent. Other ways include becoming a good listener so that one can adapt to the fluency of the other speaker and adhering to the art of think before you speak. Also, feedback on correct responses is also a more effective tool leading to a fluent and intelligible speaker.

22

Connected Speech can be defined as when one word runs into next in an uninterrupted and flawless fashion and there is no or very little silences between spoken words. The following points discuss the differences:

- Words sound very different when spoken separately or in isolation than spoken in the form of continuous speech. It is easier to segregate the word boundaries when the words are spoken separately while the boundaries are merged into one another in a connected speech.

- Says that in a connected speech, pronunciation of words leaves certain some vowels. For e.g. in the phrase *We invite you-* there is a transition from the last vowel in *We* i.e. "e" to the first vowel in *invite* i.e. "i" which makes the vowel in the *We* leave the word and merge to the next word.

- There are certain consequences concerning such transition of words in a connected speech. They are-
  - Assimilation: a process where phonemes might change
  - Elision: a process where phonemes can be omitted altogether
  - Weakening: a process where the central vowels of certain words can be reduced
  - Liaison: an effect of linking

  In contrast to this, when the words are spoken separately there does not occur any modification and the words retain their pronunciation.
- Words when spoken separately are easier to perceive and understand than in a continuous speech where it is sometimes difficult to make distinctions between different words.
- Continuous speech often requires speaking longer phrases in a single go thereby needing to hold breathe for a longer duration.

In case you have to work the next day

- The word **case** ends with a consonant (/s/) while **you** starts with a vowel (/j/). In a connected speech when there is a transition between these words (provided that they are not stressed), the boundaries get blended and the consonant gets shifted to the next word- /keɪ sjuː/. Also, there wouldn't be any pause or space between these words in a connected speech.
- There is a consonant to consonant transition in the words **next day** in a connected speech. The consonant (/t/) in **next** gets dropped and the word is bridged to its neighbour **day** as- **nexday**.
- In the given text, the speaker would not need to hold breath as this is a pretty short sentence.
- In a connected speech a listener may find it difficult to make a clear distinction of these word boundaries- *you*, *next*, *work*.

23

Co-articulation is a term when words in a connected speech experience variation of segments. This involves overlapping articulatory movements as speech segments do not occur in isolation in a conversational speech. Following are its causes-

- Co-articulation occurs due to the influence of a word on its neighboring word i.e. one articulatory movement affects next articulatory movement.
- overlapping of phonetic segments during a seamless transition from one word to the next.

Examples of features that are affected by co-articulatory effects e.g. "assimilation" and "elision"-

- In the word *lenth*, the phoneme sound */n/* is voiced alveolar nasal as it is articulated with the tongue close to the alveolar ridge. However, in a connected speech it is pronounced as */θ/* which is a dental consonant.
- Assimilation can also occur with de-voicing. For example in the word- *have*, when followed by a consonant for e.g. *to* there is a loss of voice and the phrase is pronounced as */hQf tu/* [Roach]
- In the phrase *I asked him*, the *d* sound is dropped to produce a voiceless plosive consonant */t/*. This is an example of elision.

As discussed above, co-articulation is more of sounds produced in an overlapping manner. This occurs as one articulatory gesture instigates another articulator at the same time to help produce two or different phonemes simultaneously, hence the phonation of speech sound. For example in the word *thumb*, the *u* sound becomes nasal consonant at the end because of the preceding consonant */m/*

From the speech technology point of view e.g. Automatic Speech Recognition (ASR), coarticulation can be problematic. ASR systems face challenges due to variation in speech. ASR models fail to recognize words that have unclear or overlapping word boundaries in a complex fashion. Because of this, the phonemes do not possess the articulatory characteristics onto which the ASR systems were trained, thereby posing a challenge for speech technologies.

24

Analysing the given examples

- [d]: used at word initial in [drama], [dolor], [dime], [durar]
- A few occurrences of [d]: at intermediate position: [anda]—(a), [sueldo]—(a). Followed by a vowel. But this observation can not be generalized, not enough examples to base our inferences.
- [ð] is used between vowels [kaða]—(a, a), [laðo]—(a,o), [oðio]—(o,i), [komiða]—(i,a).

Check for minimal pair. We want to see if we can find words we are switching one sound for the other gives a completely different word.

- [kaða] → [kada] — No potential pair found.
- [anda] → [anða] — No potential pair found.

We check similarly for all others. No minimal pairs found.
The general rules (# represents the beginning of a word, "_" should be replaced with the given phoneme):

- [d]: Observed context: #_r, #_o, #_i, #_u.
  Phonetic environment: occurrence at word initial position.
- [ð]: Observed context: a_a, a_o, o_i, i_a
  Phonetic environment: between vowels.

Therefore, from above observations the phones [d] and [ð] occur in different phonetic environment (and also for the reason that there does not exist any minimal pair) and they are allophones of one phoneme /d/. Therefore they share a complimentary distribution.
Formulate a rule: /d/ → [ð]/V_V as [ð] occurs between vowels.

References

Barli Bram. Three models of english morphology. *LLT Journal: A Journal on Language and Language Teaching*, 15(1):179–185, 2012.

Woon Sang Cho, Pengchuan Zhang, Yizhe Zhang, Xiujun Li, Michel Galley, Chris Brockett, Mengdi Wang, and Jianfeng Gao. Towards coherent and cohesive long-form text generation, 2019.

Prof. Dr. V. Demberg. Lecture notes in grice: Conversational implicatures, December 2020a.

Prof. Dr. V. Demberg. Lecture notes in rational speech act theory, December 2020b.

Prof. Dr. V. Demberg. Lecture notes in coherence and cohesion, January 2021.

Martin Haspelmath and Andrea D Sims. *Understanding morphology*. Routledge, 2013.

Nabil Hathout. Acquisition of morphological families and derivational series from a machine readable dictionary, 2009.

Jet Hoek, Sandrine Zufferey, Jacqueline Evers-Vermeul, and Ted J.M. Sanders. Cognitive complexity and the linguistic marking of coherence relations: A parallel corpus study. *Journal of Pragmatics*, 121:113–131, 2017. ISSN 0378-2166. doi: https://doi.org/10.1016/j.pragma.2017.10.010. URL `https://www.sciencedirect.com/science/article/pii/S0378216617300231`.

Lauri Karttunen and Stanley Peters. Conventional lmplicature. In *Presupposition*, pages 1–56. Brill, 1979.

Philip Kerr. Giving feedback to language learners the importance of feedback. `https://www.cambridge.org/gb/files/4415/8594/0876/Giving_Feedback_minipaper_ONLINE.pdf`. Accessed: 2021-04-14.

Manjari Ohala and John J Ohala. Nasal epenthesis in hindi. *Phonetica*, 48(2-4):207–220, 1991.

Peter Roach. Connected speech and coarticulation. `http://www.personal.rdg.ac.uk/~llsroach/phon2/asscoareli-into.htm`. Accessed: 2021-04-14.

Nikolaos Stylianou and Ioannis Vlahavas. A neural entity coreference resolution review. *Expert Systems with Applications*, 168:114466, Apr 2021. ISSN 0957-4174. doi: 10.1016/j.eswa.2020.114466. URL `http://dx.doi.org/10.1016/j.eswa.2020.114466`.

Prof. Dr. Noortje Venhuizen. Lecture notes in semantics i, December 2020.

Prof. Dr. Annemarie Verkerk. Lecture notes in morphology ii, December 2020.

Wikipedia. Etymology etymology of netflix. `https://en.wiktionary.org/wiki/Netflix`. Accessed: 2021-04-14.