1 Fundamental Concepts

Reference: How does the mapping between form and meaning work? Does it work at all?
Compositionality: How are complex utterances built from smaller units? Are they built from smaller units at all?
Combinatorial structure: a small number of meaningless building blocks (phonemes, parts of syllables) combined into an unlimited set of utterances (words and morphemes)
Compositional structure: meaningful building blocks (words and morphemes) are combined into larger meaningful utterances (phrases and sentences)

2 Information Theory

Information Content (Surprisal)

$-log_2 p(x)$: the more frequent the word, the lower its information content. e.g. the word type "blue" occurs ca. 3750 times in 10000 tokens, and its information content is $-log_2(3750/10000)$ ≈1.42 bits.

Shannon Entropy

$H(X) = -\sum p(x) log_2 p(x)$: entropy as probability, the average information content of information encoding units in the language. Measure of information encoding potential of a symbol system. The higher the uncertainty, the larger the entropy. e.g. $H_{char}(Morse) = -(\frac{86}{136} * log_2(\frac{86}{136}) + \frac{50}{136} * log_2(\frac{50}{136})) \approx 0.949$ bits per character.
A series of studies proposed to use entropic measures to distinguish human writing from other types of symbol systems.

Joint Entropy, Conditional Entropy

Joint Entropy: $H(X,Y) = -\sum\sum p(x,y) log_2 p(x,y)$
Conditional Entropy: $H(Y|X) = -\sum p(x) \sum p(y|x) log_2 p(y|x)$ The more ambiguity in language (uncertainty), the higher conditional entropy. No ambiguity -> 0.
Ackerman & Malouf (2013) propose two entropic measures for morphological complexity: the average entropy of a paradigm as a measure of enumerative complexity, and the average conditional entropy of cells as an integrative complexity measure.They are related to learnability.

Probability Estimation

Maximum Likelihood (ML)
Problems: unit problem, sample size problem, interdependence problem, extrapolation problem
Methods: frequency-based, language models, experiments with humans

Mutual Information

$I(X;Y) = H(X) - H(X|Y) = H(Y) - H(Y|X)$ reduction in the uncertainty of X given Y.
compromise between minimum learning cost H(Y) and maximum expliciteness I(X; Y).
Entropy is the upper bound on the mutual information between forms and meanings
Is the entropy rate zero? -> asymptotic determinism of human utterances.

3 Propositional Logic

Why formal logic? overcome ambiguity, determine relationships between meanings of sentences, determine meanings of setences, model compositionality, recursive system.

Definition

Proposition: The meaning of a simple declarative sentence
Extensions: real-world situations they refer to.
Frege's Generalization: The extension of a sentence S is its truth value
The proposition expressed by a sentence is the set of possible cases [situations] of which that sentence is true.
propositional variables: p, q, r...
propositional operators: $\neg, conjunction \wedge, disjunction \vee, XOR, \rightarrow, \leftrightarrow$

Syntax: Recursive Definition

(i) Propositional letters in the vocabulary of L are formulas in L.
(ii) If ϕ is a formula in L, then $\neg\phi$ is too.
(iii) If ϕ and ψ are formulas in L, then $(\phi\wedge\psi), (\phi\vee\psi), (\phi \rightarrow \psi), (\phi \leftrightarrow \psi)$ are too.
(iv) Only that which can be generated by the clauses (i)-(iii) in a finite number of steps is a formula in L.
invalid: $\neg(\neg\neg p), \neg((p \wedge q))$

Construction Trees

$(\neg(p \vee q) \rightarrow \neg\neg q) \leftrightarrow r$ $(iii. \leftrightarrow)$
$(\neg(p \vee q) \rightarrow \neg\neg q)$ $(iii. \rightarrow)$ $r (i)$
$\neg(p \vee q)$ (ii) $\neg\neg q$ (ii)
$p \vee q$ $(iii.\vee)$ $\neg q$ (ii)
p (i) q (i) q (i)

Valuation Functions

For every valuation V and for all formulas ϕ: $V(\phi \leftrightarrow \psi) = 1 iff V(\phi) = V(\psi)$.

4 Predicate Logic

Introduce constants and variables representing invididuals and predicates to capture the main structural building blocks of sentences. Introduce quantifiers to allow for quantified statements.

Definition

constant symbols: a, b, c, ...
variable symbols: x, y, z, ...
n-ary/n-place predicate symbols: A, B, C, reflect relations between n elements (n>0)
connectives: $\neg, \wedge, \vee, \rightarrow, ...$
quantifiers: $\forall, \exists$
round brackets (), equal sign =

Syntax: Recursive Definition

(i) If A is an n-ary predicate letter in the vocabulary of L, and each of t1,..., tn is a constant or a variable in the vocabulary of L, then At1,..., tn is a formula in L.
(ii) If ϕ is a formula in L, then $\neg\phi$ is too.
(iii) If ϕ and ψ are formulas in L, then $(\phi\wedge\psi), (\phi\vee\psi), (\phi \rightarrow \psi), (\phi \leftrightarrow \psi)$ are too.
(iv) If ϕ is a formula in L and x is a variable, then $\forall x\phi$ and $\exists x\phi$ is too. (v) Only that which can be generated by the clauses (i)-(iv) in a finite number of steps is a formula in L.
invalid: $a, A, \forall(Axy)$

Construction Trees

$\forall_x\forall_y((A_{xy} \wedge B_y) \rightarrow \exists_x A_{xb})$ $(iv.\forall)$
$\forall_y((A_{xy} \wedge B_y) \rightarrow \exists_x A_{xb})$ $(iv.\forall)$
$(A_{xy} \wedge B_y) \rightarrow \exists_x A_{xb}$ $(iii. \rightarrow)$
$A_{xy} \wedge B_y$ $(iii.\wedge)$ $\exists_x A_{xb}$ $(iv.\exists)$
A_{xy} (i) B_y (i) A_{xb} (i)

Semantics

domain (D): set of entities
interpretation functions I = $\{< m, e >, < s, e >, < v, e >\}$, I(m) = e, I(s) = e, I(v) = e.
model M: consists of a domain D and an interpretation function I which conforms to: (i) if c is a constant in L, then I(c) ∈ D
(ii) if B is an n-ary prpedicate letter in L, then I(B) ⊂ D
valuation function V_M:
If Aa1,...,an is an atomic sentence in L, then V_M(Aa1,...,an) = 1 iff <I(a1),...,I(an)> ∈ I(A).
...
$V_M(\forall x\phi) = 1$ iff $V_M([c/x]\phi) = 1$ for all constants c in L.
$V_M(\exists x\phi) = 1$ iff $V_M([c/x]\phi) = 1$ for at least one constant c in L.
If $V_M(\phi) = 1$, then ϕ is said to be true in model M.

Formula vs. Sentence

A sentence is a formula in L which lacks free variables.
Sentence: Aa, $\forall x(Fx)$, $\forall x(Ax \rightarrow \exists y By)$
Not a sentence (but Formula): Ax, Fx, $Ax \rightarrow \exists y By$

5 Second-Order Logic

e.g. CR (CX: X is a predicate with the property of being a color; Rx: x is red)
$\exists X(CX \wedge Xm)$: Mars has a color.
$\exists X(Xj \wedge Xp)$: John has at least one thing in common with Peter.
$\forall x(\exists X((AX \wedge Xx) \wedge Jx) \rightarrow \exists Y(Yx \wedge CY))$: All animals that live in the jungle have a color.
$\forall x(\exists X((Xx \wedge AX) \wedge Gx) \rightarrow Ex)$: If an animal is grey, then it is an elephant.

Vocabulary extention

1st-order predicate variables: X, Y, Z
2nd-order predicate constants: A, B, C
e.g. AX: X is a property with the property of being an animal

Syntax: Recursive Definition

(i) If A is an n-ary first-order predicate letter in the vocabulary of L, and each of t1,..., tn are individual terms in L, then At1,..., tn is an (atomic) formula in L.
(ii) If X is a [first-order] predicate variable and t is an individual term (both constants and variables) in L, then Xt is an atomic formula in L;
(iii) If A is an n-ary second-order predicate letter/constant in L, and T1,...,Tn are first-order **unary** predicate constants, or predicate variables, in L, then AT1,...,Tn is an (atomic) formula in L;
(iv) If ϕ is a formula in L, then $\neg\phi$ is too.
(v) If ϕ and ψ are formulas in L, then $(\phi\wedge\psi), (\phi\vee\psi), (\phi \rightarrow \psi), (\phi \leftrightarrow \psi)$ are too.
(vii) If ϕ is a formula in L and x is a variable, then $\forall x\phi$ and $\exists x\phi$ is too.
(viii) If X is a [first-order] predicate variable, and ϕ is a formula in L, then $\forall X\phi$ and $\exists X\phi$ is too.
(viiii) Only that which can be generated by the clauses (i)-(vii) in a finite number of steps is a formula in L.
invalid: $x, X, Xab, \forall(Xa)$

Semantics

just as a 1st-order predicate denotes a set of entities, a 2nd-order predicate denotes a set of a set of entities.

6 Type theory

Tools to get to grips with frequent compositional structures in natural language (adj-n, adv-v, art-n, prep-np... combis), a higher-order logic

Definition

(i) $e, t \in T$
(ii) if $a, b \in T$, then $< a, b > \in T$
(iii) nothing is an element of T except on the basis of clauses (i) and (ii).
invalid: et, <e,e,t>, <e,<e,t>

Functional Application

If α = <e,t> and β = e then $\alpha(\beta)$ = t.
If α = <t,<t,e» and β = <t,e> then $\alpha(\beta)$ is not defined.

Semantic Types

individual: e
sentences: t
1-place predicates (intransitive verb): <e,t>
2-place predicates (transitive verb): <e,<e,t»
3-place predicates (ditransitive verb): <e,<e,<e,t»>
common nouns (e.g. dog): <e,t>
NP (e.g. the dog): e
determiners (e.g. the): <e,<e,t»
adjectives: <e,t>
adjectives as predicate modifiers(e.g. *happy* dog): «e,t>,<e,t»
adverbs(predicate modifier): «e,t>,<e,t»
sentence modifier(e.g. not): <t,t>
function(entity to entity) (e.g. the farther of): <e, e>
1-place 2nd-order predicate: «e,t>,t>
2-place 2nd-order predicate: «e,t>,«e,t>,t>

Syntax: Recursive Definition

(i) If α is a variable or a constant of type a in L, then α is an expression of type a in L.
(ii) If α is an expression of type <a,b> in L, and β is an expression of type a in L, then $(\alpha(\beta))$ is an expression of type b in L.
(iii) If ϕ and ψ are formulas in L, then so are $\neg\phi, (\phi \wedge \psi), (\phi \vee \psi), (\phi \rightarrow \psi), (\phi \leftrightarrow \psi)$.
(iv) If ϕ is an expression *of type t* in L and v is a variable (of arbitrary type a), then $\forall v\phi$ and $\exists v\phi$ are expression of type t in L.
(v) If α and *beta* are expressions in L which belong to the same type, then $(\alpha = \beta)$ is an expression of type t in L.
(vi) Every expression L is to be constructed by means of (i)-(v) in a finite number of steps.
formulas: expressions of type t.
Difference to Predicate Logic:
Jumbo befriends Maya.
Predicate Logic: Bjm
Type-theoretic logic: (B(m))(j) or alternatively B(m)(j)

Semantics

Truth valuations via paritcular interpretation functions defined for different types of expressions. e.g. interpretation function I for which it holds that: I(W)(d) = 1 iff d∈W, otherwise 0.

7 Lambda Calculus

To represent parts of sentences or predicates in a fully compositional account. Allows to capture the compositionality of language

Syntax

Add another clause to the type-theoretic language syntax
(vii) If α is an expression of type a in L, and v is a variable of type

b, then $\lambda v(\alpha)$ is an expression of type <b, a> in L.

Lambda-Abstraction

We say that $\lambda v(\alpha)$ has been formed from α by abstraction over the formerly free variable v. Hence, the free occurrences of v in α are now bound by the λ-operator λx.
e.g. expression: S(x) of type t
λ-abstraction: λx(S(x)) of type <e,t>
λx(x) of type <e,e>
λx(B(y)(x)) of type <e,t>
λX(X(a) $\wedge$ X(b)) of type «e,t>,t>

Lambda-Conversion

remove the λ-operator and plug an expression into every occurrence of the variable which is bound by the λ-operator.
e.g. λx(S(x))(c) = S(c)
λx(λy(A(y)(x)))(c)(d)=λy(A(y)(c))(d)=A(d)(c)
λ-conversion is only valid when variable v is not bound by a quantifier $\forall$ or $\exists$

Modelling Compositionality

John smokes: λx(S(x))(j)=S(j)
smokes: λx(S(x))
smokes and drinks: λx(S(x)$\wedge$D(x))
Jumbo is grey: λx(G(x))(j)=G(j)
is grey: λx(G(x))
Jumbo is: λX(X(j)
is: λX(λx(X(x)))

Truth Valuation

For all entities d in the domain D it holds that h(d)=1 iff I(W)(d)=1. This illustrates that the denotation if $\lambda x(W(x))$ is indeed the same as one would expect for just the word walks represented by W.

8 Modality

A category of linguistic meaning having to do with the expression of possibility and necessity.

Modal Strength(Force)

Statements can express stronger or weaker commitment to the truth of base proposition.
High: Arthur must/has to be home.
Medium: Arthur should be home.
Low: Arthur might/could be home.

Modal Type(Flavor)

Epistemic modality: relative to speaker's knowledge of the situation
John didn't show up for work. He must be sick. (spoken by coworker)
The older students might/may(?) leave school early (unless the teachers watch them carefully).
It has to be raining. [Seeing people outside with umbrellas]
Deontic: relative to authoritative person or code of conduct
John didn't show up for work. He must be sick. (spoken by boss)
Visitors have to leave by 6pm.
Dynamic: Concerned with properties and dispositions of persons
John has to sneeze.
Anne is very strong. She can list this table.
Teleological: achieving goals or serving a purpose
To get home in time, you have to take a taxi.
Anne must be in Paris at 5pm. She can/must take the train to go there.

Polysemy Controversy

In some languages, modal auxiliaries can be used for different types of modality.
Ambiguity(polysemy) vs. Indeterminacy
Contradiction test (If a sentence of the form *X but not X* can be true, then expression must be ambiguous.
e.g. They are not children any more, but they are still my children.
John must be sick, but he must not be sick.
John can be sick, but he cannot be sick...
If considered non-contradictory, then the modal auxiliaries are polysemous with regards to modal type
Adverbial Phrase Test:
e.g. Dynamic: (In view of his physical abilities,) John can lift 200 kg.
If adverbial phrases in parentheses are not redundant, type of modality is not lexically specidied but inferred from context, i.e. indeterminate

Modal Logical Operators

$\Diamond p$: it is possible that p...
$\Box p$: it is necessary that p...
modality as quantification over possible worlds: $\Diamond p \equiv \exists w[w \in p]$, $\Box p \equiv \forall w[w \in p]$
Modal propositional logic: add one more syntactic clause to the syntax of propositional logic:
(v) if ϕ is a formula in L, then $\Box\phi$ and $\Diamond\phi$ are too.
valid formulas: $\Box\Diamond p$, $\neg\Diamond(p \wedge q)$, $p \rightarrow \Box\Diamond p$
Fundamental tautologies:
$\Diamond\phi \leftrightarrow \neg\Box\neg\phi$: something is possible if and only if it is not the case that it is necessarily not the case
$\Box\phi \leftrightarrow \neg\Diamond\neg\phi$: something is necessary if and only if it is not the case that it is possibly not the case.

Modality and Truth-Conditions

Both epistemic and root modality can be part of the proposition and contribute to its truth conditions.
Challenge Test: Is the epistemic modal marker part of what can be challenged about a proposition?
A: John profited from the old man's death, he must be the murderer. B: That's not true; he could be the murderer, but he doesn't have to be.
Yes-No Question Test: Can the epistemic modal marker be the focus of a yes-no question?
A: Must John be the murderer? B: Yes, he must. or: No, he doesn't have to be.
Negation Test: does negation scope over and hence include the modal marker as part of the negated proposition?
Smith cannot be the candidate. $\neg\Diamond p$ √
Smith might not be the candidate. $\Diamond\neg p$

8.1 Cross-Linguistic Variation

Epistemic possibility: verbal constructions/affixes on verbs/other
Situational possibility: affixes on verbs/verbal constructions/other

9 Evidentiality

covers the way in which information was acquired, without necessarily relating to the degree of speaker's certainty concerning the statement or whether it is true or not. To be considered as an evidential, a morpheme has to have 'source of information' as its core meaning; that is, the unmarked, or default interpretation.

Definition

1st claim: It is a "linguistic category", i.e. a grammatical category with grammatical markers (same as for modality).
2nd claim: These evidential markers have source of information as their core meaning.
markers can develop polysemy, e.g. tense marking and evidential marking, can be used recursively without being redundant
3rd claim: Evidentiality is not "necessarily relating to the degree of speaker's certainty", i.e. it is distinct from epistemic modality.

Evidentiality vs. Epistemic Modality

There is good evidence that evidential markers in a number of languages do not contribute to propositional content but function as illocutionary modifiers, and so must be distinct from epistemic modality.
Negation Test: If negation can scope over the evidential marker, then the evidential marker is considered to contribute to the truth-conditional content.
Challenge Test: The hearer can challenge the truth of the statement of the speaker given more direct evidence, but the source of information cannot be challenged.
Two types of evidentials:
Illocutionary: markers of evidentiality that do not contribute to the truth-conditional content, but that "add to or modify the sincerity conditions of the [speech] act"
Propositional: markers of evidentiality that also contribute to the truth-conditional content. e.g. Es soll regnen.

9.1 Cross-Linguistic Variation

Semantic distinctions of evidentiality: no grammatical evidentials/indirect only/direct and indirect
Coding of Evidentiality: no grammatical evidentials/verbal affix or clitic/part of the tense system/separate particle/modal morpheme/mixed

10 Introduction to Pragmatics

Semantics: word meaning, sentence meaning Pragmatics: utterance meaning

Definitions

Anomaly Definition:study of those principles that will account for why a certain set of sentences are anomalous, or not possible utterances.
Functional: attempts to explain facets of linguistic structure by reference to non-linguistic pressures and causes.
Context: part of performance, explicate the reasoning of speakers and hearers in working out the correlation in a context of a sentence token with a proposition.
Grammaticalization: study of those relations between language and context that are grammaticalized, or encoded in the structure of a language.
Truth-Conditional: those aspects of the meaning of utterances which cannot be accounted for by straightforward reference to the truth conditions of the sentences uttered.
Inter-Relation: interation of context-dependent aspects of language structure and principles of language usage, relations between language and context
Appropriateness/Felicity: study of the ability of language users to pair sentences with the contexts in which they would be appropriate.
List: study of deixis (at least in part), implicature, presupposition, speech acts, and aspects of discourse structure.
More promising: Inter-Relation, Truth-Conditional

11 Discourse Representation Theory

To deal with issues in the semantics and pragmatics of anaphora and tense
Discourse representation structures:a hearer builds up a mental representation of the discourse as it unfolds, and that every incoming sentence prompts additions to that representation.

Anaphora Resolution

Anaphora as co-reference: *John* likes *his* donkey.
Anaphora as binding: *No farmer* likes *his* donkey.
Anaphora as neither co-reference nor binding: John owns *a donkey*. *It* is grey.

Discourse Representation Structures

Merging: [x, y: farmer(x), donkey(y), chased(x,y)] + [v, w: caught(v, w)] = [x, y, v, w: farmer(x), donkey(y), chased(x,y), caught(v, w)]
Anaphora Resolution: = [x, y, v, w: v=x, w=y, farmer(x), donkey(y), chased(x,y), caught(v,w)] = [x, y: farmer(x), donkey(y), chased(x,y), caught(x,y)]

Complex DRS Conditions

Negation: John doesn't own a donkey. It is grey. [1x,z: John(x), $\neg$[2y: donkey(y), owns(x,y)], grey(z)]. y is not accessible to z. x and z are accessible to y.
Conditionals: If John owns a donkey, he likes it. [1:[2x,y: John(x), donkey(y), owns(x,y)]$\rightarrow$[3v,w: likes(v,w)]]=[1:[2x,y,v,w: v=x, w=y, John(x), donkey(y), owns(x,y)]$\rightarrow$[3: likes(v,w)]]=[1:[2x,y: John(x), donkey(y), owns(x,y)]$\rightarrow$[3: likes(x,y)]]. x and y are accessible to v and w.
Quantification: Every farmer who owns a donkey, likes it. [1:[2x,y: farmer(x), donkey(y), owns(x,y)]$\forall x$[3v,w: likes(v,w)]]

Accessibility

K' $\vee$ K", then K is accessible to K' and K". Note: in this particular case K' is not accessible to K".

Semantics

The truth-conditional semantics of the DRS language is given by defining when an embedding function verifies a DRS in a given model M.
Embedding function f in DRT:
f verifies a DRS K iff f verifies all conditions Con_K. f verifies P(x1,...,xn) iff <f(x1),...,f(xn)> $\in$ I(P).

12 Implicature

Tools to get to grips with frequent compositional structures in natural language (adj-n, adv-v, art-n, prep-np... combis), a higher-order logic

Grice's Maxims

The cooperative principle: contribution as required
Maxim of Quality: nothing false or lacks evidence
Quantity: as informative as required
Relation(or Relevance)
Manner: clear and easy to understand
Failure to fulfill a maxim:
(i) quietly violate a maxim. Politician: Yes, this is what we stand for.
(ii) opt out from adhering to the maxim or the cooperative principle. Politician: I won't answer this question.
(iii) a clash, impossible to adhere to one maxim without not adhering to another. Politician: We are still deciding on the matter. I'm hopeful that yes, but I cannot tell you for sure.
(iv) flout a maxim. Politician: I personally think this is a good idea.

Conversational Implicature

a type of pragmatic inference about what is said by the speaker (literal meaning) in relation to what they actually intend to convey (communicative intention).
Group A: no maxim is violated. A

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C doesn't seem to have a partner these days. B: He/she has been paying a lot of visits to New York lately. Implicature: He/she might have a partner in New York.

Group B: a maxim is violated, can be explained by a clash with another maxim. A: Where does C live? B: Somewhere in the South of France. Implicature: I don't know the exact name of the place where C lives.

Group C: exploitation, a maxim is flouted for the purpose of deliberately creating a conversational implicature. Recommendation letter: Dear B, C's command of English is excellent, and he has attended tutorials regularly. Kind regards, A. Implicature: I cannot recommend C as a philosopher.

Types of Implicature

Conversational Implicatures:

Particularized: the intended inference depends on particular features of the specific context of the utterance. A: C managed to brake his car and get arrested for arrousing public annoyance when he was drunk last night. B: Yeah, he is smart like that.

Generalized: Scalar, *Connectives*, *Indefinite*: does not depend on specific features of the utterance context, but is instead normally implied by any use of the triggering expression in ordinary contexts.

Scalar: non-maximal degree modifiers. The water is warm -> The water is not hot. John has most of the documents -> John does not have all of the documents

Connectives: sentence connectives. Susan gave Peter the key and Peter opened the door. -> She gave him the key and then he opened the door. Peter is either Susan's brother or her boyfriend -> The speaker does not know whether Peter is Susan's brother or boyfriend.

Indefinites: indefinite article. I walked into a house. -> The house was not my house.

Conventional Implicatures:

not context-dependent or pragmatically explainable [in contrast to conversational implicatures], and must be learned on a word-by-word basis. (controversial, similar to presuppositions?)Alfred has still not come -> His arrival is expected. I was in Paris last spring too -> Some other person was in Paris last spring. Even Bart has passed the test -> Bart was among the least likely to pass the test

Entailment

1. whenever p is true, it is logically necessary that q is also true;
2. whenever q is false, it is logically necessary that p is also false;
3. these relations follow from the meanings of p and q, independent of the context of utterance

I broke your Ming dynasty jar (lexical) -> Your Ming dynasty jar is broken. Hong Kong is warmer than Beijing (comparative) -> Beijing is cooler than HK

Tests

	Entailment	Convers. Implicature
cancellable	no	yes
suspendable	no	yes
reinforceable	no	yes
negation	no	no
question	no	no

Cancellation HK is warmer than BJ, but BJ is not cooler than HK (NO). There is a garage around the corner, but unfortunately you cannot buy petrol there (YES)

Suspension HK is warmer than BJ, but I'm not sure if BJ is cooler than HK (NO). There is a garage around the corner, but I'm not sure if you cannot buy petrol there (YES)

Reinforcement HK is warmer than BJ, and BJ is cooler than HK (NO). There is a garage around the corner, and you cannot buy petrol there (YES)

Negation HK is not warmer than BJ (BJ is cooler than HK: NO). There is no garage around the corner (you cannot buy petrol there: NO)

Question Is HK warmer than BJ? (BJ is cooler than HK: NO). Is there a garage around the corner? (you cannot buy petrol there: YES)