

*language and
Semantics*

CSCI
373

what is
this?





Ceci ~~est~~ ~~pas~~ une pipe.

a pipe



language

semantics
(meaning)



a pipe

language is just a string of characters
it has no intrinsic meaning

烟斗

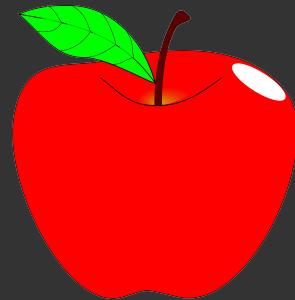
苹果

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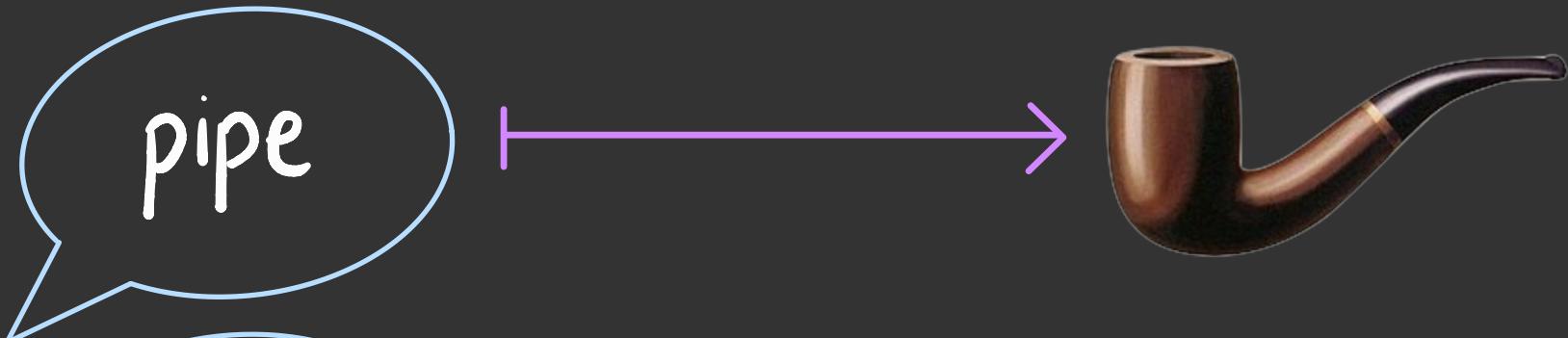
烟斗



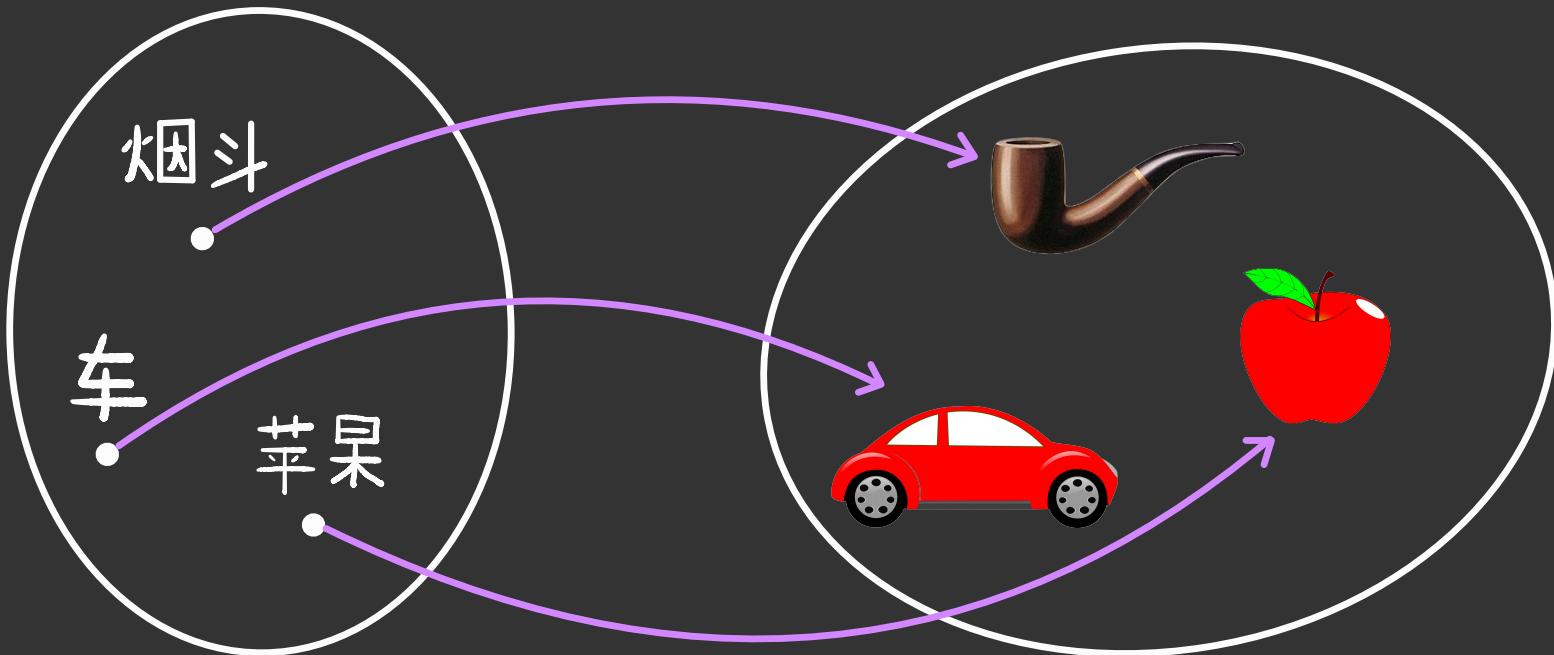
苹果



language — interpretation function → semantics



language — interpretation
function → semantics



language

interpretation
function

semantic
space

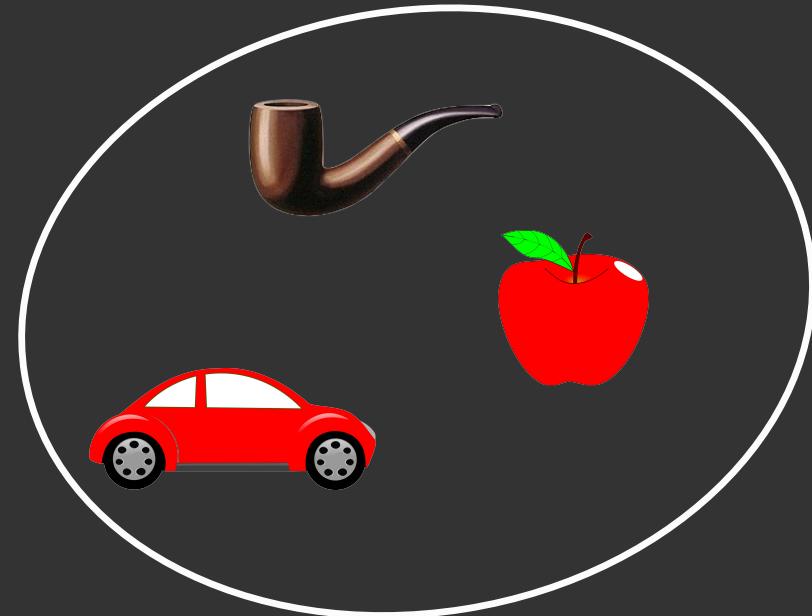
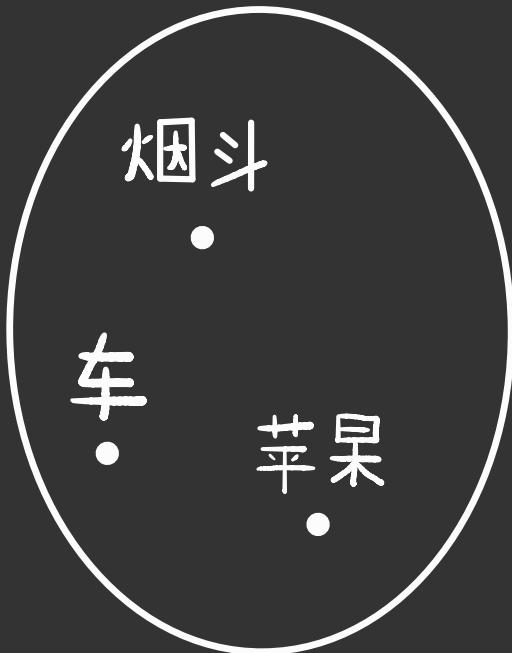


language
space

- ▶ define an alphabet as a set of symbols
e.g. $A = \{ \text{烟, 车, 斗, 果, 苹} \}$
- ▶ a string of alphabet A is a sequence of symbols from A and let A^* denote the set of all strings of alphabet A

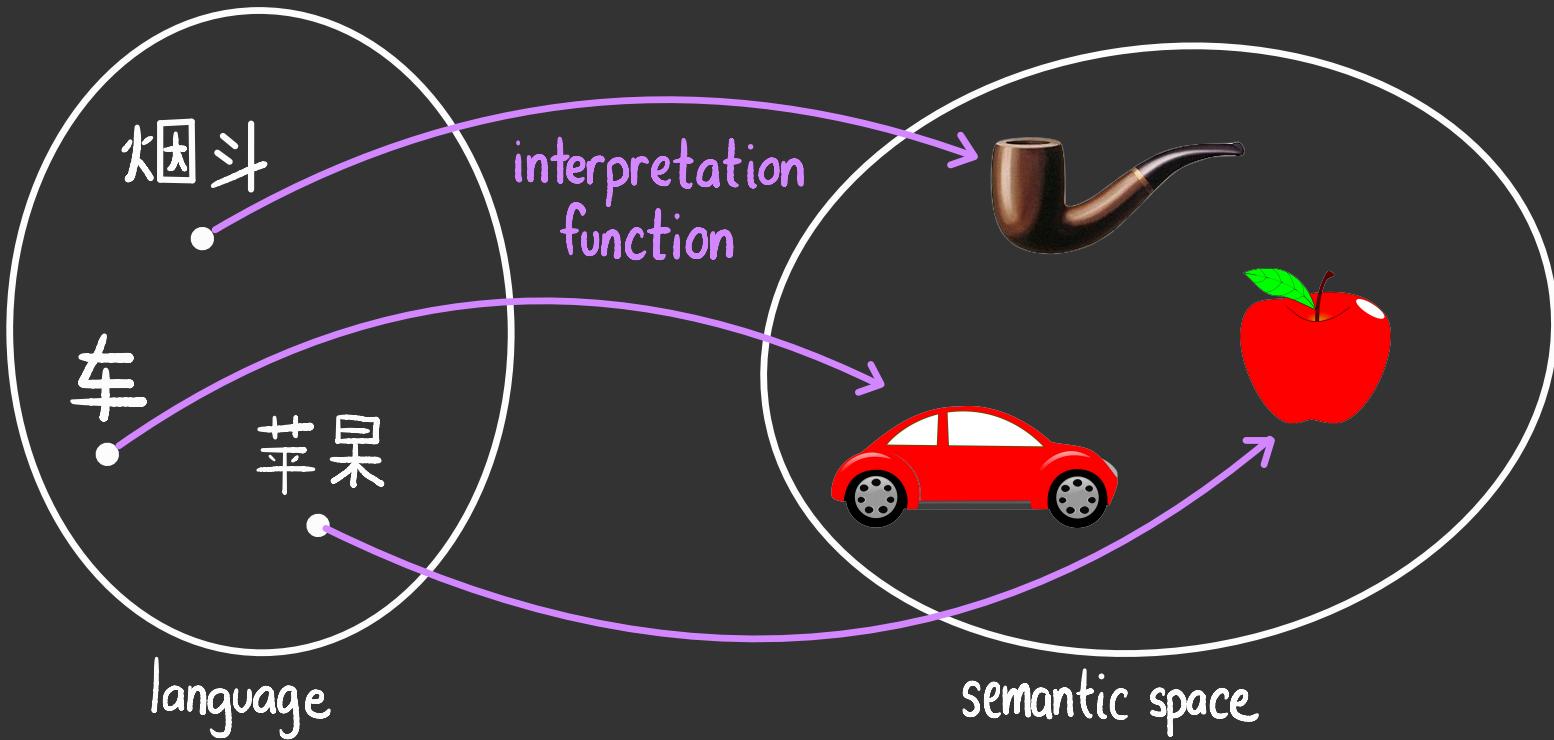
e.g. $A^* = \{ \text{烟斗, 车斗斗, 车果车, ...} \}$

- ▶ a language with alphabet A is a subset of A^*
e.g. $\{ \text{烟斗, 车, 苹果} \}$



a language with alphabet A
is a subset of A^*

a semantic space is a
set of arbitrary objects



an interpretation function is any function
from the language to the semantic space

interpretation
function

```
1 def isPrime(n):
2     for i in range(2,n//2+1):
3         if (not (n%i)):
4             return 0;
5     return 1;
6
7 numPrimes= 0
8
9 for i in range(2,250001):
10    numPrimes+=isPrime(i);
11
12 print(str(numPrimes));
```

language

```
1 .section .data
2 f: .string "%d\n"
3 .section .text
4 .globl main
5 main:
6     movl $., %eax
7     xor %8d,%8d
8     loop:
9     cmpl $250000,%eax
10    jg end_loop
11    movl $.,%10d
12    movl %eax,%11d
13    shr $.,%11d
14    prime_loop:
15    cmpl %r11d, %r10d
16    jg prime
17    push %rax
18    xor %edx,%edx
19    div %r10d
20    test %edx,%edx
21    pop %rax
22    je not_prime
23    inc %r10d
24    jmp prime_loop
25 prime:
26    inc %r8d
27 not_prime:
28    inc %eax
29    jmp loop
30 end_loop:
31    movl f(%r10),%eax
32    addl $1,%eax
33    orl %eax,%eax
34    call printf
```

semantic space

language provides a compact
representation of thought

$$(P \Rightarrow B \wedge \neg F)$$



language

can fly?	penguin?	bird?	
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0



semantic space

and will enable more
efficient reasoning