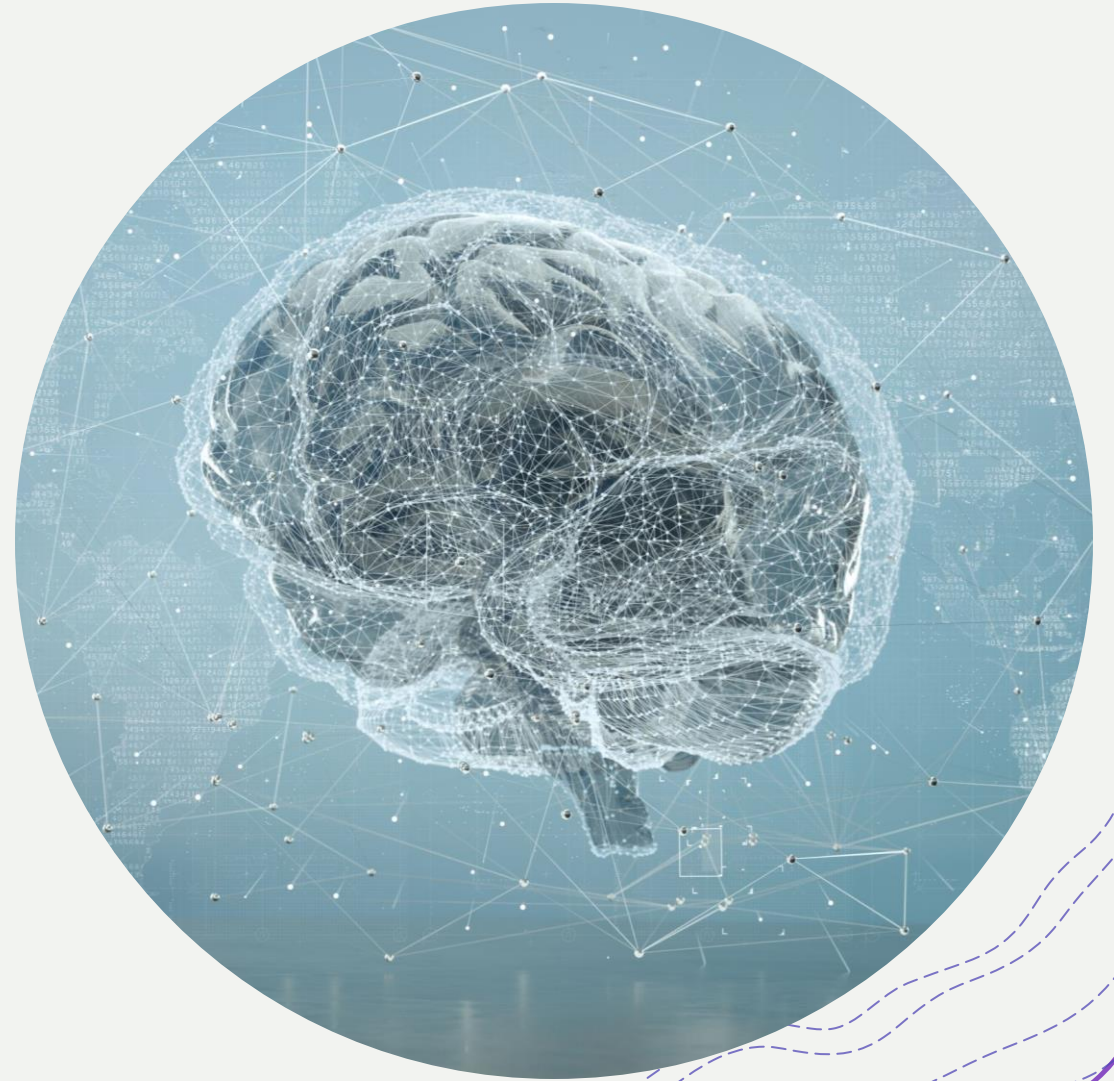


# Intelligent Minds and Machines

PSYC 3043

Week 5: Language





# today's agenda

+ language!



# an experiment

+ <https://dbvmtbylbs.cognition.run>

# activity: arrange on the board

+jhool

+seengh

+komal

+bandar

+kha

+masakkali

+tez

+hil

+ladka

+ber

+qalabaz

+nariyal

+tendua

+gaddi

+kela

+gabbar

+masal

+shatir

+bhaag

+shandaar

+bhediya

+soongh

+shikar

+gulabo

+dekh

+hoga

+pakad

# language model demo

+ code notebook

# concept check: Lake and Murphy (2021)

- + word representations / embeddings
- + dimensionality
- + semantic similarity / cosine similarity
- + testing models



Brendan M. Lake



Gregory L. Murphy

# dimensions and similarity

**lions** are **tigers** are carnivorous predators

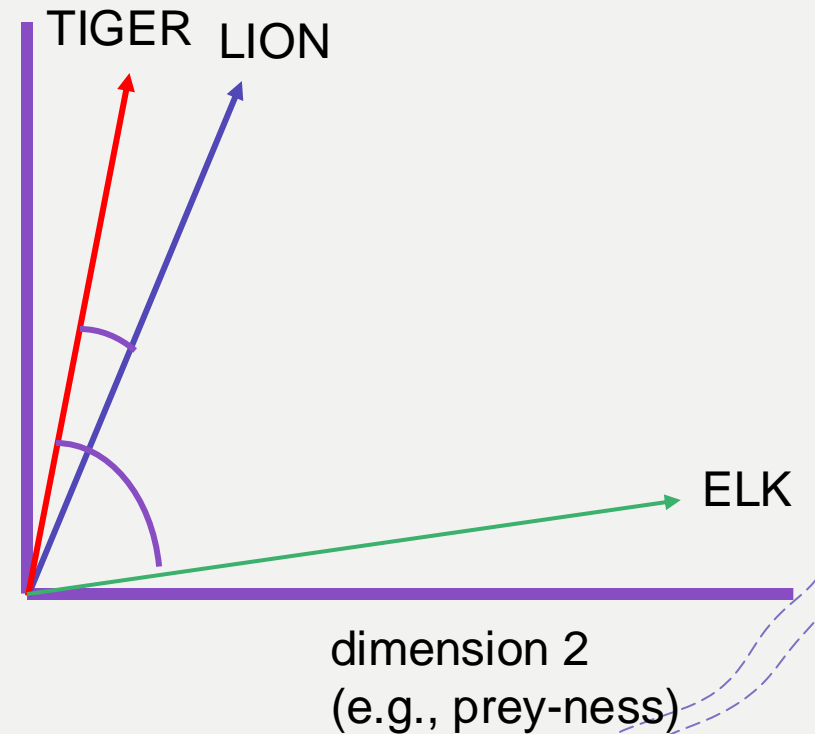
a group of **lions** is called a pride

**tigers** have stripes

**lions** and **tigers** hunt deer and **elk**

**elk** and deer are herbivores

dimension 1  
(e.g., predator-ness)



# concept check: Lake and Murphy (2021)

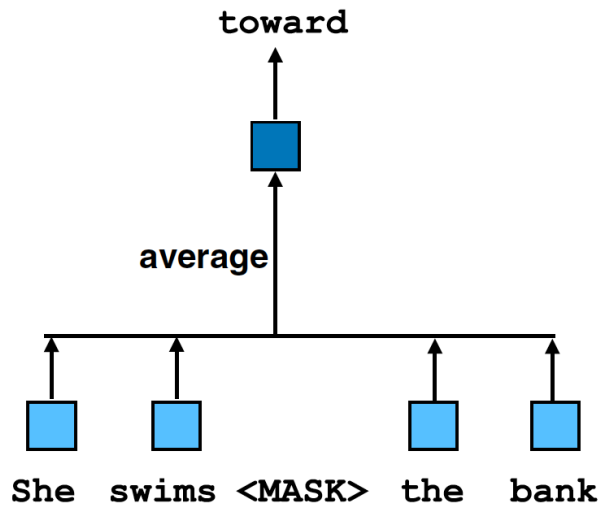
## +four types of NLP models

- + Latent Semantic Analysis (LSA): dimensionality reduction model : unsupervised
- + word2vec: predictive, semi-supervised (autoregressive)
- + RNN (Elman): *recurrent* neural network (semi-supervised)
- + BERT/GPT-2: predictive, autoregressive, attention/Transformer based



# concept check: models

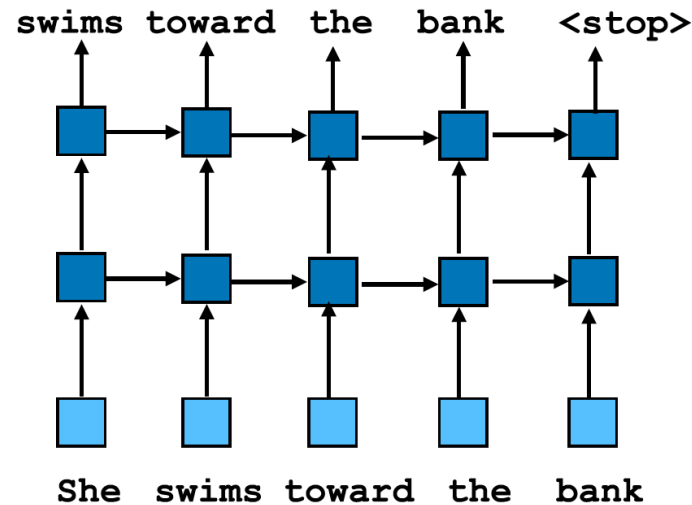
(A)



word2vec

no concept of word order,  
averages all words' representations  
within a window

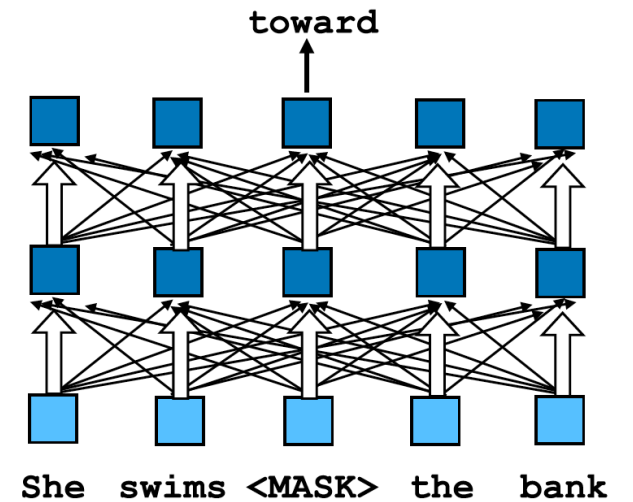
(B)



RNN

predicts each upcoming word  
using an indirect connection  
to previous words

(C)



BERT/GPT-2

all words contribute to different  
degrees in generating a target  
word's representation

# desiderata

**Table 1**

*Five Desiderata. Word Representations Should Support These Basic Functions of Language Use*

Behavior to be explained	Examples
1. Describing a perceptually present scenario, or understanding such a description.	That knife is in the wrong place. The orangutan is using a makeshift umbrella.
2. Choosing words on the basis of internal desires, goals, or plans.	I am looking for a knife to cut the butter. I need a flight from New York to Miami.
3. Responding to instructions and requests appropriately.	Pick up the knife carefully. Find an object that is not the small ball.
4. Producing and understanding novel conceptual combinations.	That's a real <u>apartment</u> dog. The <u>apple train</u> left the orchard.
5. Changing one's beliefs about the world based on linguistic input.	Sharks are fish but dolphins are mammals. Umbrellas fail in winds over 18 knots.

The background is a light gray color. It features decorative elements: a white circle in the top-left corner, a white semi-circle in the bottom-right corner, and several wavy lines. Some of these lines are dashed in a light purple color, while one line in the bottom-right is solid in a darker purple color.

annotations in themes