

# First, let's try it out:

NICK

SHAVE

DRESS

POCKET

TIDY

BRUSH

SMART

KEY

TOUCH

SHOWER

PALM

SHARP

PINCH

MILE

NEAT

BIRTH

# Summer '25: Connections!

NICK

SHAVE

DRESS

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TIDY

BRUSH

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# Summer '25: Connections!

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# Summer '25: Connections!

**STEAL**

NICK, PALM, PINCH, POCKET

**SHAVE**

**DRESS**

**TIDY**

**BRUSH**

**SMART**

**KEY**

**TOUCH**

**SHOWER**

**SHARP**

**MILE**

**NEAT**

**BIRTH**

# Summer '25: Connections!

**STEAL**

NICK, PALM, PINCH, POCKET

**DO SOME GROOMING**

BRUSH, DRESS, SHAVE, SHOWER

TIDY

SMART

KEY

TOUCH

SHARP

MILE

NEAT

BIRTH

# Summer '25: Connections!

## **STEAL**

NICK, PALM, PINCH, POCKET

## **DO SOME GROOMING**

BRUSH, DRESS, SHAVE, SHOWER

## **DAPPER**

NEAT, SHARP, SMART, TIDY

**KEY**

**TOUCH**

**MILE**

**BIRTH**

# Summer '25: Connections!

## **STEAL**

NICK, PALM, PINCH, POCKET

## **DO SOME GROOMING**

BRUSH, DRESS, SHAVE, SHOWER

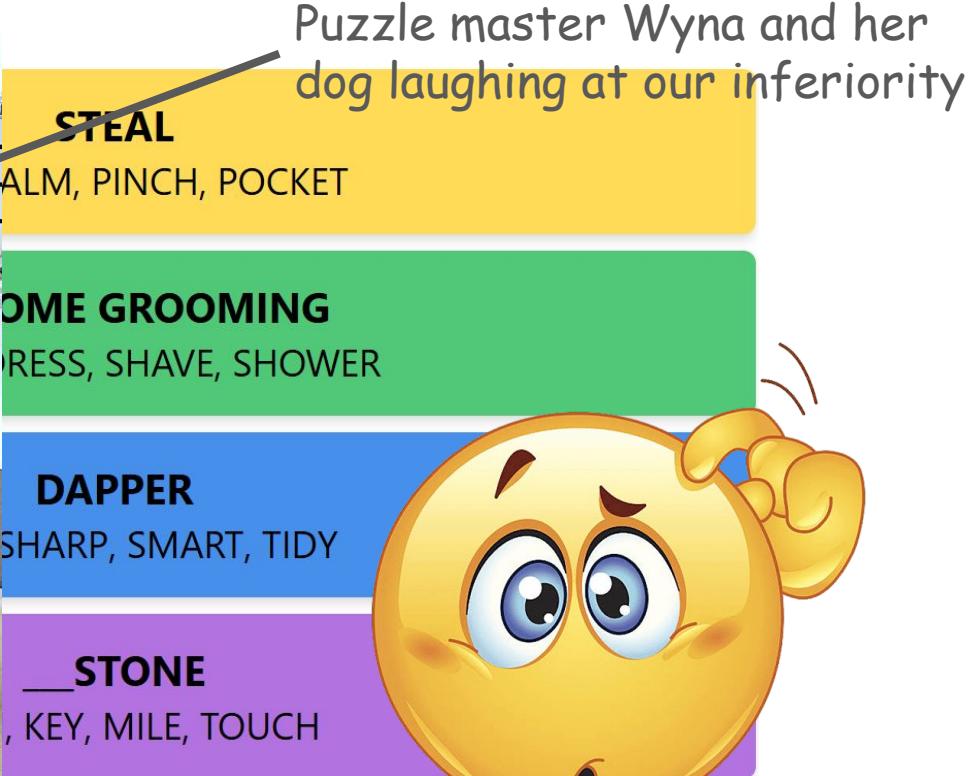
## **DAPPER**

NEAT, SHARP, SMART, TIDY

## **STONE**

BIRTH, KEY, MILE, TOUCH

# Summer '25: Connections!



# Solving Connections!

BRUSH

PINCH

MILE

SMART

TOUCH

DRESS

SHAVE

KEY

TIDY

POCKET

BIRTH

PALM

NICK

NEAT

SHARP

SHOWER

# *Solving Connections!*

**BRUSH**

**PINCH**

**MILE**

**SMART**

**TOUCH**

**DRESS**

**SHAVE**

**KEY**

**TIDY**

**POCKET**

**BIRTH**

**PALM**

**NICK**

**NEAT**

**SHARP**

**SHOWER**

# *Solving Connections!*

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# *Solving Connections!*

**BRUSH**

**PINCH**

**MILE**

**SMART**

**TOUCH**

**DRESS**

**SHAVE**

**KEY**

**TIDY**

**POCKET**

**BIRTH**

**PALM**

**NICK**

**NEAT**

**SHARP**

**SHOWER**

# *Solving Connections!*

BRUSH

PINCH

MILE

SMART

TOUCH

DRESS

SHAVE

KEY

TIDY

POCKET

BIRTH

PALM

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SHARP

SHOWER

# *Solving Connections!*

BRUSH

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# *Solving Connections!*

BRUSH

PINCH

MILE

SMART

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DRESS

SHAVE

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TIDY

POCKET

BIRTH

PALM

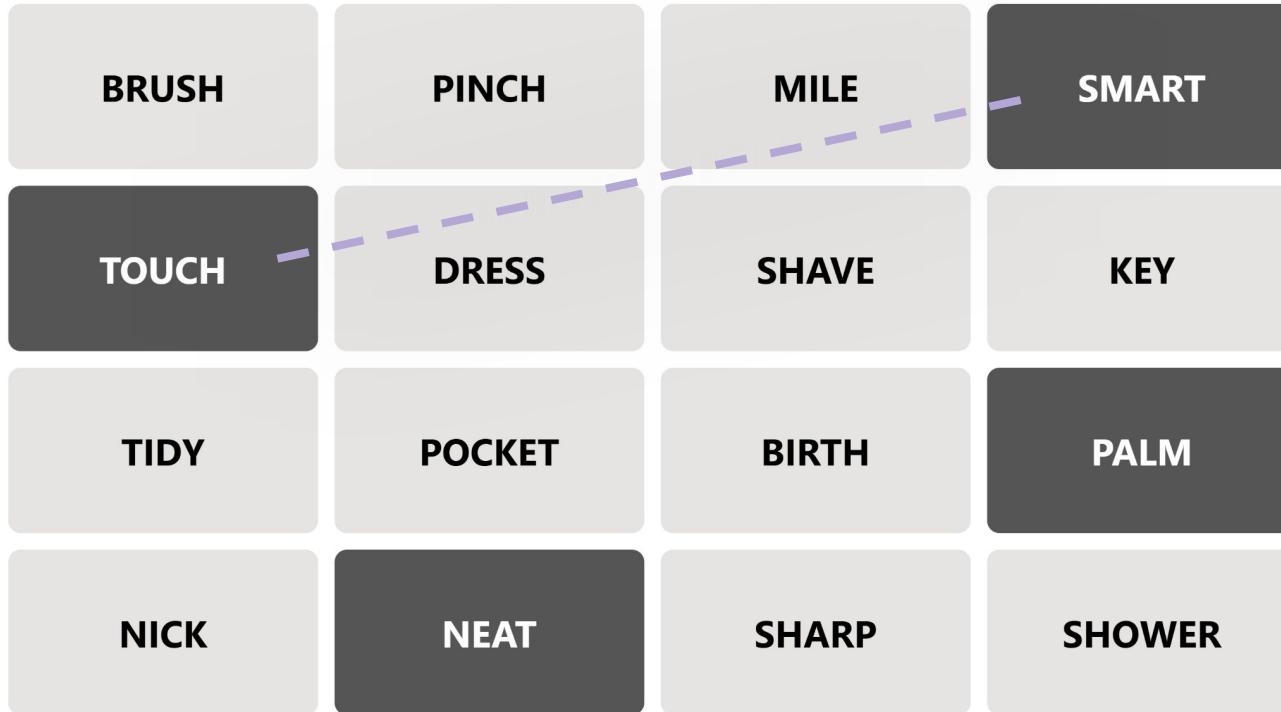
NICK

NEAT

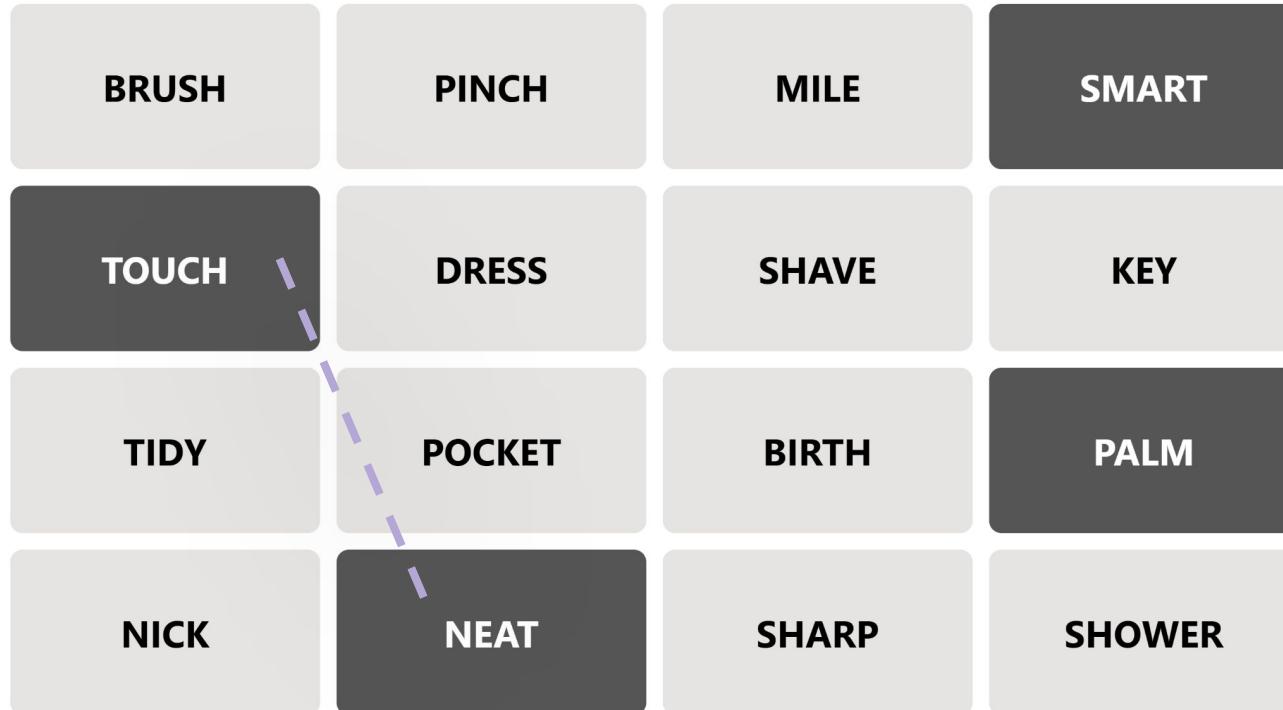
SHARP

SHOWER

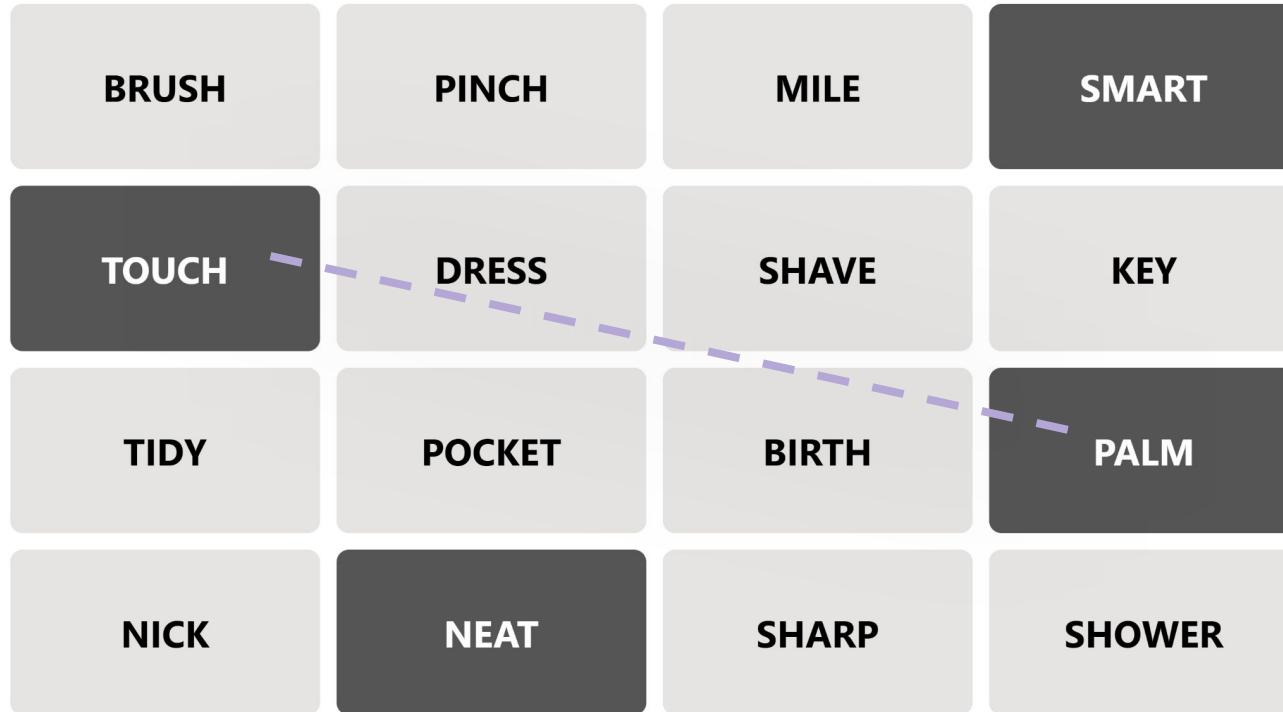
# *Solving Connections!*



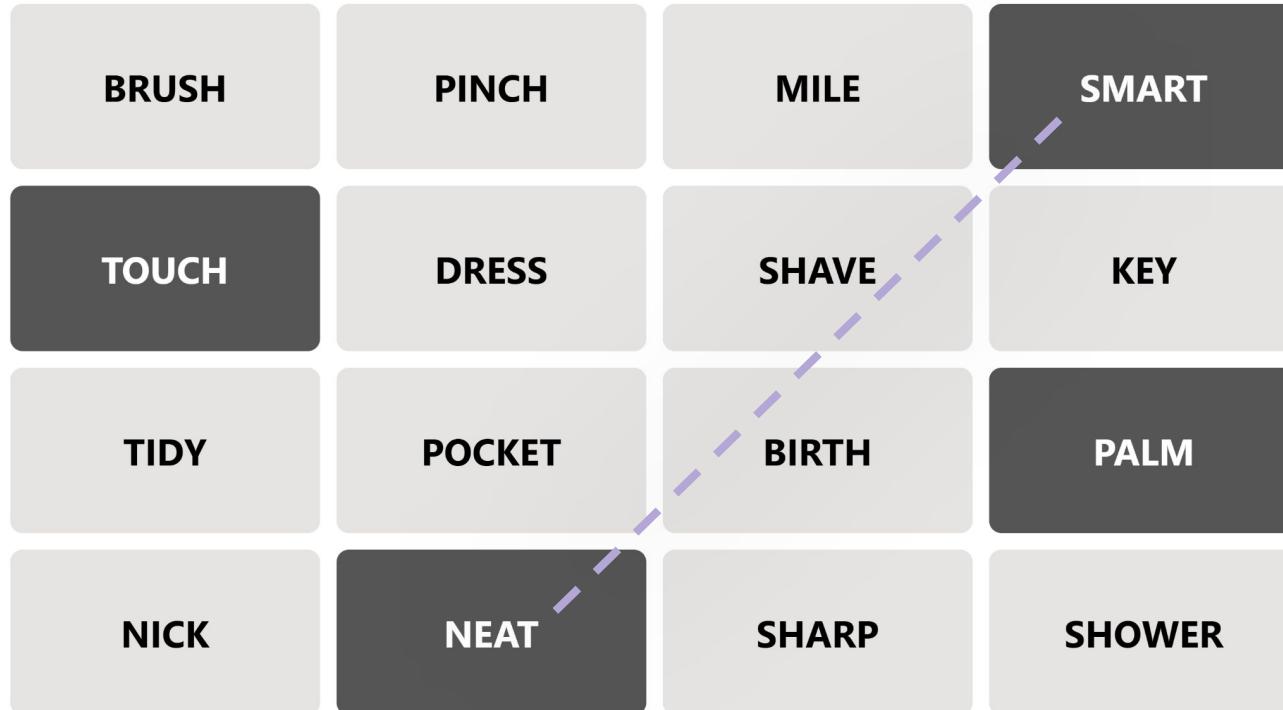
# *Solving Connections!*



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# *Solving Connections!*

**BRUSH**

**PINCH**

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**SMART**

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**DRESS**

**SHAVE**

**KEY**

**TIDY**

**POCKET**

**BIRTH**

**PALM**

**NICK**

**NEAT**

**SHARP**

**SHOWER**

# Solving Connections!

## STEAL

NICK, PALM, PINCH, POCKET

## DO SOME GROOMING

BRUSH, DRESS, SHAVE, SHOWER

## DAPPER

NEAT, SHARP, SMART, TIDY

## STONE

BIRTH, KEY, MILE, TOUCH

let's focus on  
this group  
for now!

# *Solving Connections!*



# Solving Connections!

current group:

[ "brush" ]

to form a group, we need four similar words.

BRUSH	PINCH	MILE	SMART
TOUCH	DRESS	SHAVE	KEY
TIDY	POCKET	BIRTH	PALM
NICK	NEAT	SHARP	SHOWER

# Solving Connections!

current group:

[ "brush" ]

to form a group, we need four similar words.

if we're given the word "brush", how do we find the word most similar to it?

BRUSH	PINCH	MILE	SMART
TOUCH	DRESS	SHAVE	KEY
TIDY	POCKET	BIRTH	PALM
NICK	NEAT	SHARP	SHOWER

# Solving Connections!

current group:

[ "brush" ]

BRUSH	PINCH	MILE	SMART
TOUCH	DRESS	SHAVE	KEY
TIDY	POCKET	BIRTH	PALM
NICK	NEAT	SHARP	SHOWER

a quick detour:

each word can be encoded as a list of a thousand or so numbers correlated with its meaning

this is called its *embedding*!

# Solving Connections!

current group:

[ "brush" ]

BRUSH	PINCH	MILE	SMART
TOUCH	DRESS	SHAVE	KEY
TIDY	POCKET	BIRTH	PALM
NICK	NEAT	SHARP	SHOWER

a quick detour:

each word can be encoded as a list of a thousand or so numbers correlated with its meaning

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"brush" -> [ -0.01645724, 0.00556806,  
-0.01460918, ..., -0.00528129,  
-0.02016928, 0.01229912 ]

# Solving Connections!

current group:

[ "brush" ]

BRUSH	PINCH	MILE	SMART
TOUCH	DRESS	SHAVE	KEY
TIDY	POCKET	BIRTH	PALM
NICK	NEAT	SHARP	SHOWER

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"brush" -> [ -0.01645724, 0.00556806,  
-0.01460918, ..., -0.00528129,  
-0.02016928, 0.01229912 ]

"pinch" -> [ -0.02502958, 0.00547522,  
0.00308219, ..., 0.00761457,  
-0.01443429, 0.00258118 ]

# Solving Connections!

current group:

[ "brush" ]

BRUSH	PINCH	MILE	SMART
TOUCH	DRESS	SHAVE	KEY
TIDY	POCKET	BIRTH	PALM
NICK	NEAT	SHARP	SHOWER

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"pinch" -> [ -0.02502958, 0.00547522,  
0.00308219, ..., 0.00761457,  
-0.01443429, 0.00258118 ]

"Gojo" -> [ 0.00575743, 0.00923347,  
0.00602719, ..., -0.00349531,  
-0.01574622, -0.01466718 ]



rip jagoat and fraudkuna

# Wait! Where do these numbers come from?!

**Challenge:** We know what we mean by the  
*"meaning of a word or a sentence"* ...

How do we represent this *computationally*?

From Kevin!

# Solving Connections!

current group:

[ "brush" ]

BRUSH	PINCH	MILE	SMART
TOUCH	DRESS	SHAVE	KEY
TIDY	POCKET	BIRTH	PALM
NICK	NEAT	SHARP	SHOWER

a quick detour:

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rip jagoat and fraudkuna

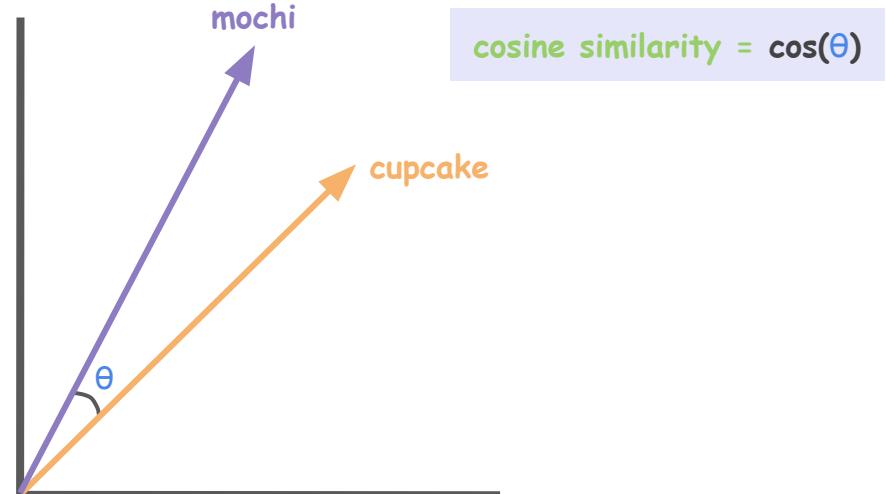
# Solving Connections!

current group:

[ "brush" ]

BRUSH	PINCH	MILE	SMART
TOUCH	DRESS	SHAVE	KEY
TIDY	POCKET	BIRTH	PALM
NICK	NEAT	SHARP	SHOWER

we can now *quantify semantic meaning!*



computing the cosine of the angle between the vectors of **mochi** and **cupcake** gives us an idea of how similar these two words are!

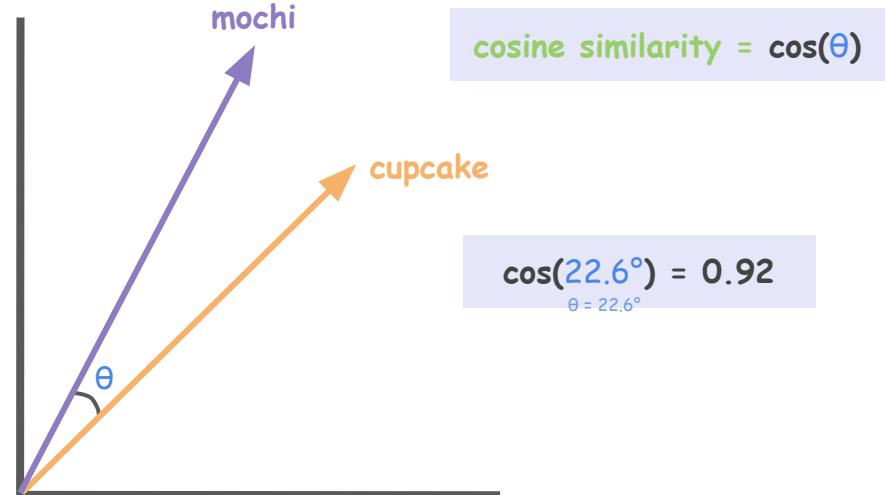
# Solving Connections!

current group:

[ "brush" ]

BRUSH	PINCH	MILE	SMART
TOUCH	DRESS	SHAVE	KEY
TIDY	POCKET	BIRTH	PALM
NICK	NEAT	SHARP	SHOWER

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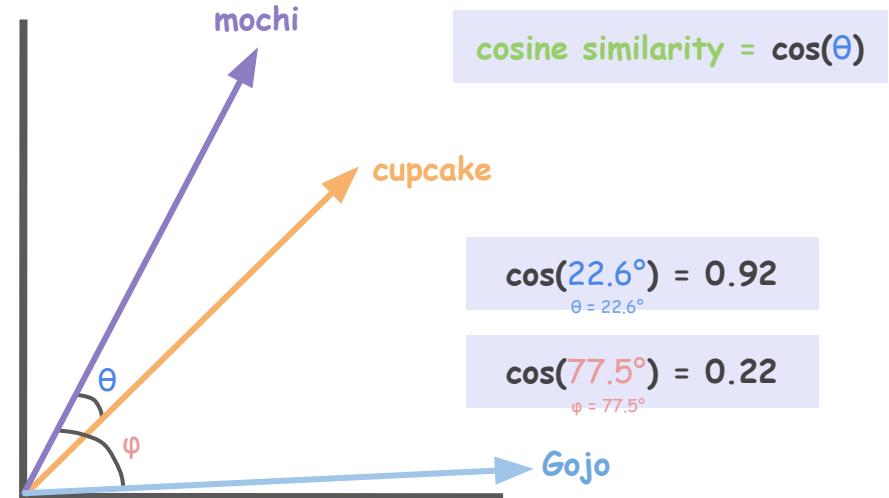
# Solving Connections!

current group:

[ "brush" ]

BRUSH	PINCH	MILE	SMART
TOUCH	DRESS	SHAVE	KEY
TIDY	POCKET	BIRTH	PALM
NICK	NEAT	SHARP	SHOWER

we can now *quantify semantic meaning!*



computing the cosine of the angle between the vectors of **mochi** and **cupcake** gives us an idea of how similar these two words are!

# Solving Connections!

**cosine\_similarity("brush", every other word)**

current group:

[ "brush", "shave" ]

BRUSH	PINCH	MILE	SMART
TOUCH	DRESS	SHAVE	KEY
TIDY	POCKET	BIRTH	PALM
NICK	NEAT	SHARP	SHOWER

words closest to *brush*:

1. shave : 0.433187069
2. touch : 0.404343943
3. sharp : 0.395909358
4. dress : 0.391803022
5. palm : 0.370301644
6. tidy : 0.365545869
7. shower : 0.351645449
8. smart : 0.340190449
9. pinch : 0.333210517
10. key : 0.330013010
11. birth : 0.315602717
12. neat : 0.311982945
13. mile : 0.291023022
14. pocket : 0.280039570
15. nick : 0.260040996

# Solving Connections!

cosine\_similarity("shave", every other word)

current group:

[ "brush", "shave", "shower" ]

BRUSH	PINCH	MILE	SMART
TOUCH	DRESS	SHAVE	KEY
TIDY	POCKET	BIRTH	PALM
NICK	NEAT	SHARP	SHOWER

words closest to shave:

1. **shower** : 0.443414579
2. sharp : 0.427791720
3. tidy : 0.351318709
4. pinch : 0.345400970
5. neat : 0.331289627
6. palm : 0.326569655
7. dress : 0.325805417
8. pocket : 0.287402062
9. smart : 0.270388154
10. touch : 0.260474996
11. birth : 0.239102507
12. key : 0.221870229
13. nick : 0.216678789
14. mile : 0.215445350

# Solving Connections!

`cosine_similarity("shower", every other word)`

current group:

[ "brush", "shave", "shower", "dress" ]

we've formed a group!

BRUSH	PINCH	MILE	SMART
TOUCH	DRESS	SHAVE	KEY
TIDY	POCKET	BIRTH	PALM
NICK	NEAT	SHARP	SHOWER

words closest to *shower*:

1. **dress** : 0.363065770
2. pocket : 0.298010453
3. touch : 0.297677139
4. pinch : 0.296881988
5. birth : 0.290482146
6. tidy : 0.286506916
7. sharp : 0.282095871
8. smart : 0.261799253
9. palm : 0.254501245
10. neat : 0.251521963
11. mile : 0.203786344
12. key : 0.188346438
13. nick : 0.186536711

# Solving Connections!

cosine\_similarity("shower", every other word)

current group:

[ "brush", "shave", "shower", "dress" ] 

we've formed a group!

DO SOME GROOMING  
BRUSH, DRESS, SHAVE, SHOWER

PINCH

MILE

SMART

TOUCH

KEY

TIDY

POCKET

BIRTH

PALM

NICK

NEAT

SHARP

words closest to *shower*:

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12. key	: 0.188346438
13. nick	: 0.186536711

# *Solving Connections!*

*we continue this process until we have four groups of four...*

## **DO SOME GROOMING**

BRUSH, DRESS, SHAVE, SHOWER

**PINCH**

**MILE**

**SMART**

**TOUCH**

**KEY**

**TIDY**

**POCKET**

**BIRTH**

**PALM**

**NICK**

**NEAT**

**SHARP**

# Solving Connections!

how does our greedy heuristic fair?

brush	shave	shower	dress
nick	sharp	smart	neat
pocket	pinch	touch	palm
tidy	key	birth	mile

**STEAL**

NICK, PALM, PINCH, POCKET

**DO SOME GROOMING**

BRUSH, DRESS, SHAVE, SHOWER

**DAPPER**

NEAT, SHARP, SMART, TIDY

**STONE**

BIRTH, KEY, MILE, TOUCH

# Solving Connections!

how does a refined (?!?) greedy heuristic fair?

brush	shave	sharp	smart
dress	shower	touch	pinch
nick	key	neat	tidy
pocket	palm	mile	birth

**STEAL**

NICK, PALM, PINCH, POCKET

**DO SOME GROOMING**

BRUSH, DRESS, SHAVE, SHOWER

**DAPPER**

NEAT, SHARP, SMART, TIDY

**STONE**

BIRTH, KEY, MILE, TOUCH

# Solving Connections!

how does a beam search algorithm fair?



palm	pocket	pinch	touch
shave	brush	shower	dress
tidy	smart	neat	sharp
birth	nick	key	mile

**STEAL**

NICK, PALM, PINCH, POCKET

**DO SOME GROOMING**

BRUSH, DRESS, SHAVE, SHOWER

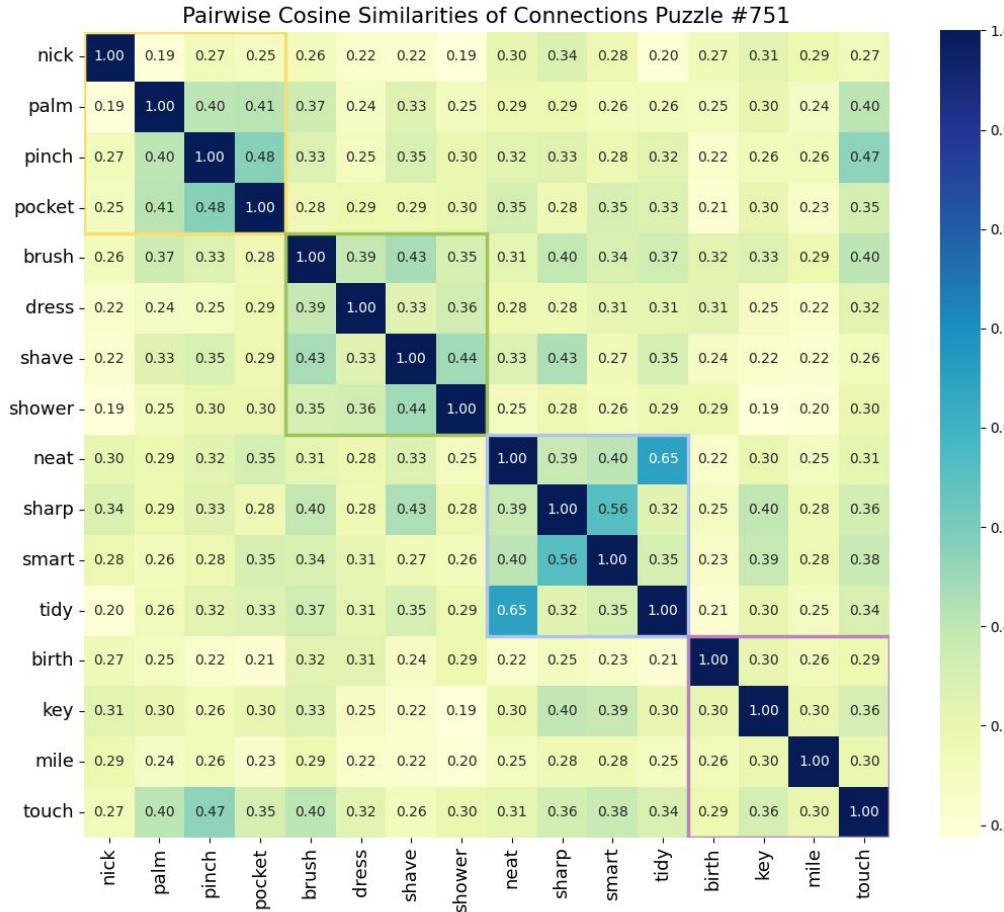
**DAPPER**

NEAT, SHARP, SMART, TIDY

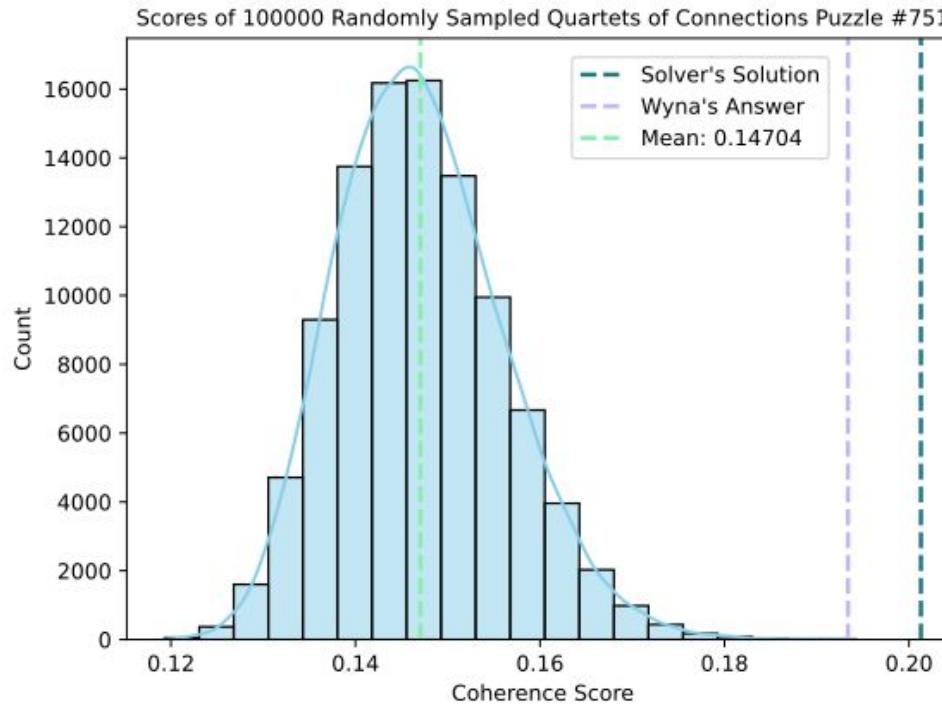
**STONE**

BIRTH, KEY, MILE, TOUCH

# Solving Connections!



# Solving Connections!



# *Solving Connections!*

**GATHERING SPOT OUTSIDE A RESIDENCE**

DECK, PORCH, STOOP, YARD

**LOWDOWN**

DISH, DOPE, INFO, SCOOP

**KINDS OF REELS**

BLOOPER, DEMO, HIGHLIGHT, SIZZLE

DROOP

GOOF

SNOOP

LAD