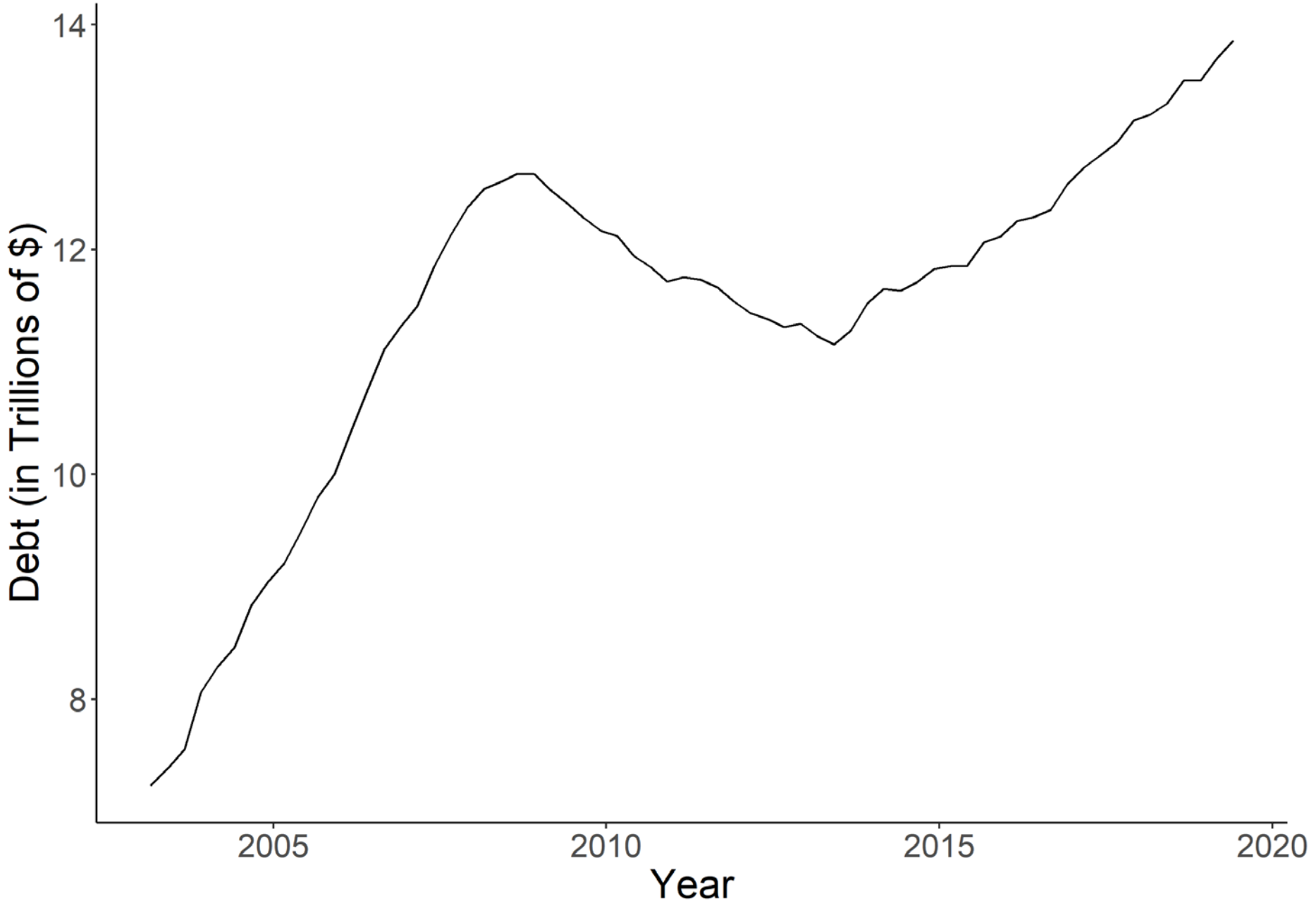
Semantic Similarity Underlies Multiple Mental Accounting Phenomena

Daniel Wall

Gretchen Chapman

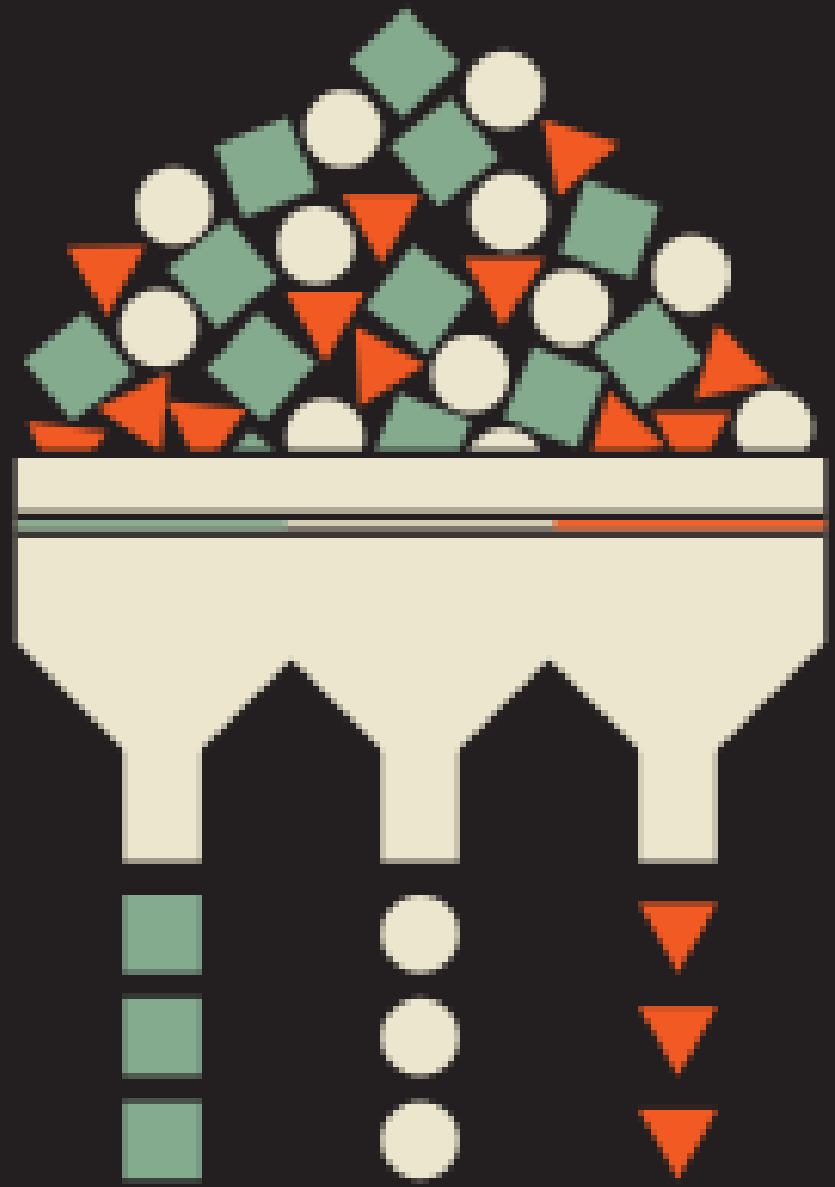

14
12
10
8
Debt (in Trillions of $)
2005
2010
2015
2020
Year

The set of cognitive operations used by individuals and households to organize, evaluate, and keep track of financial activities

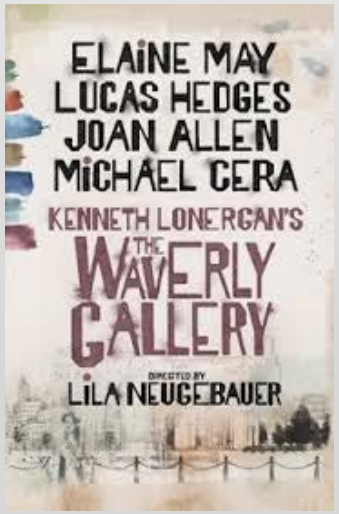
Thaler (1999)

Where do mental accounts come from?

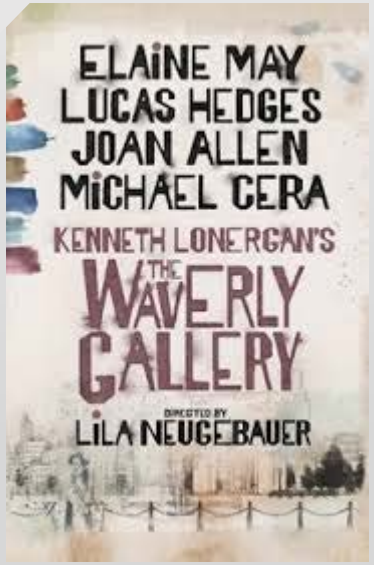
Mental Accounts are based on Categorization



La Brasa Peruana



Entertainment



Food

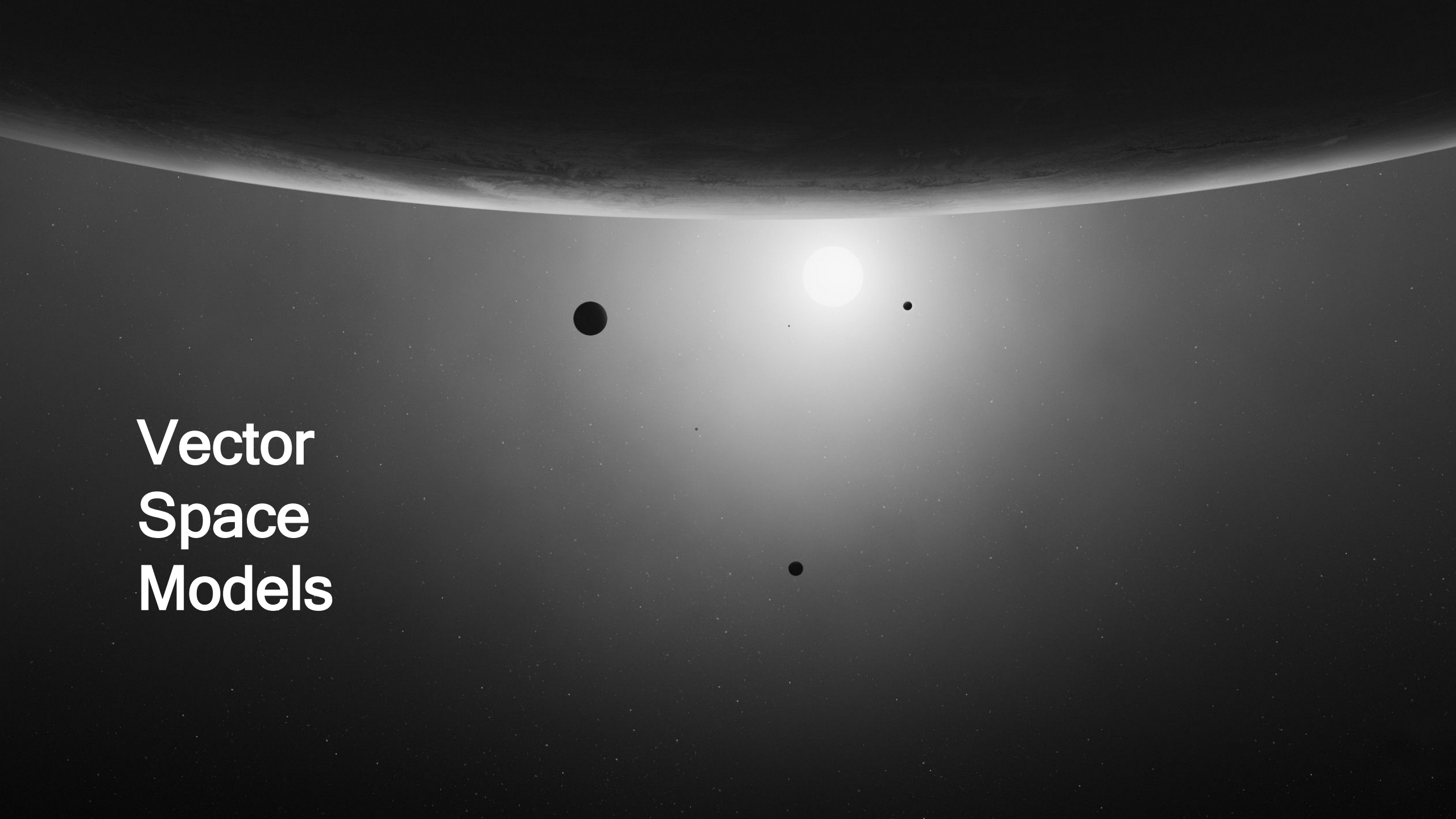
La Brasa Peruana

Mental Representation

Informational structures in the mind
which represent reality

Building block for cognitive processes

A complete theory of mental accounts requires a theory of the underlying representations

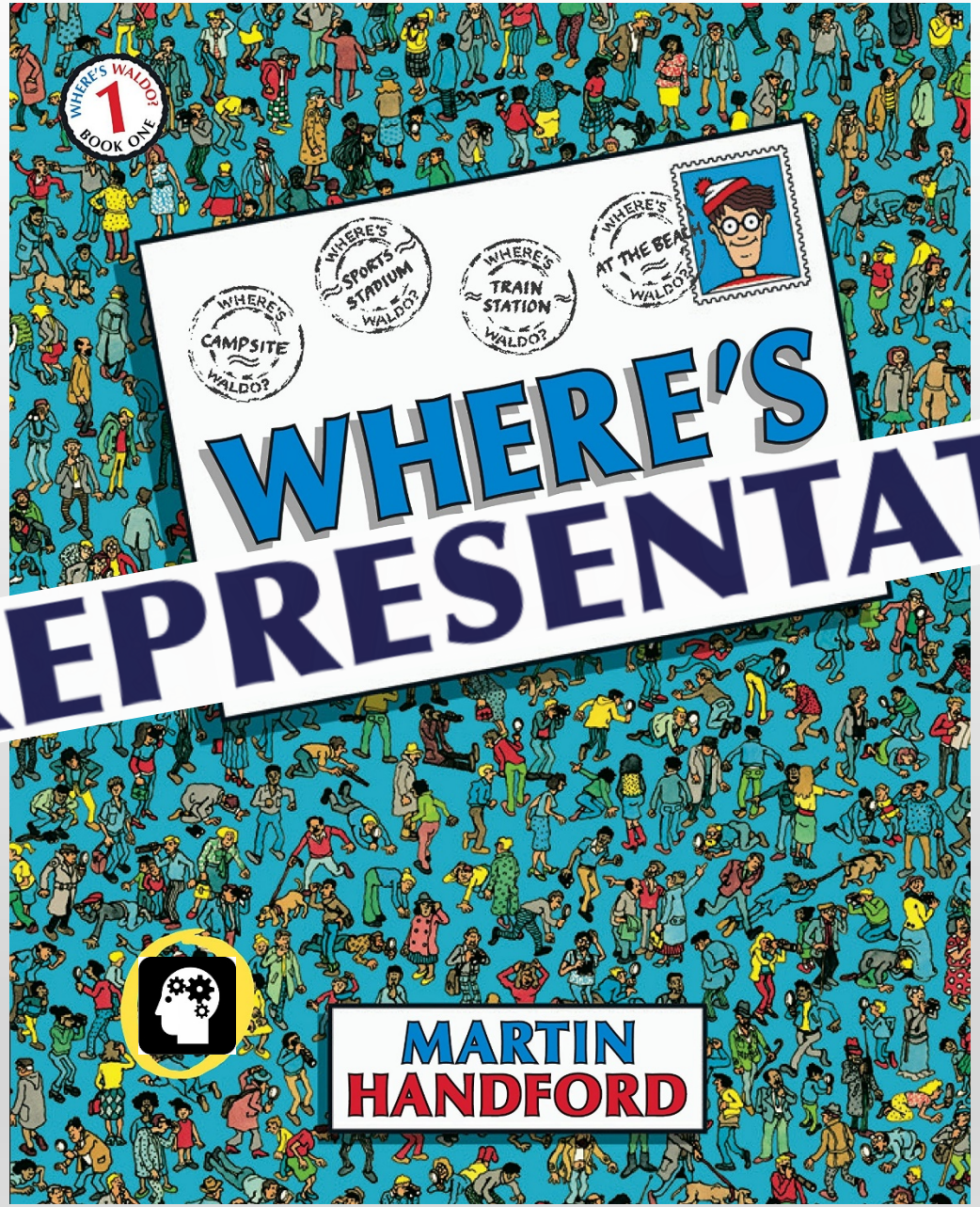

Vector
Space
Models

Predict structure of taxonomic categories

(Jones & Mewhort, 2007; Laham, 1996)

(Bhatia, 2017)

(Bhatia & Stewart, 2018)



WHERE'S REPRESENTATION

I pet the dog

I pet the cat

I drive the van

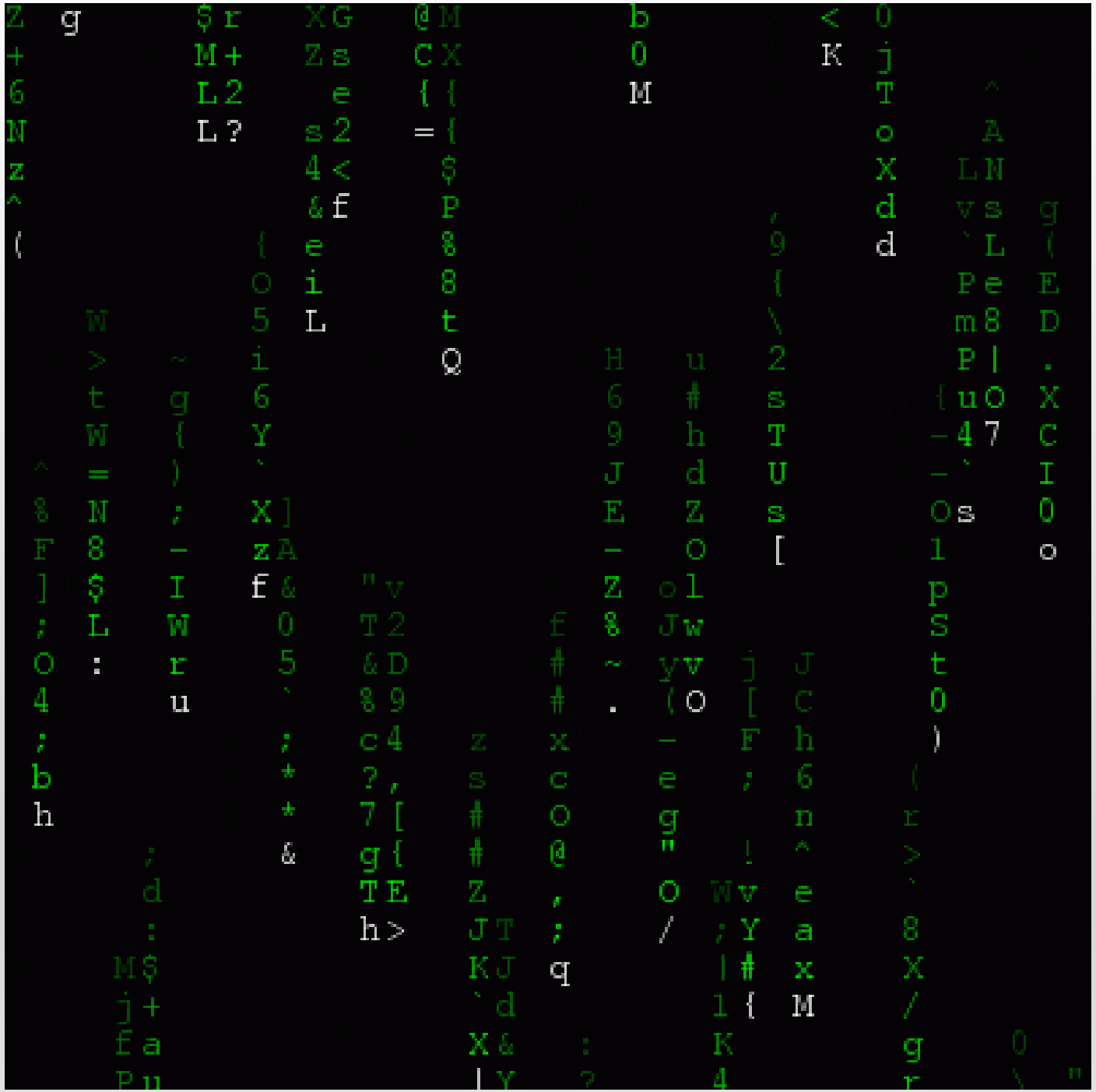
I drive the car

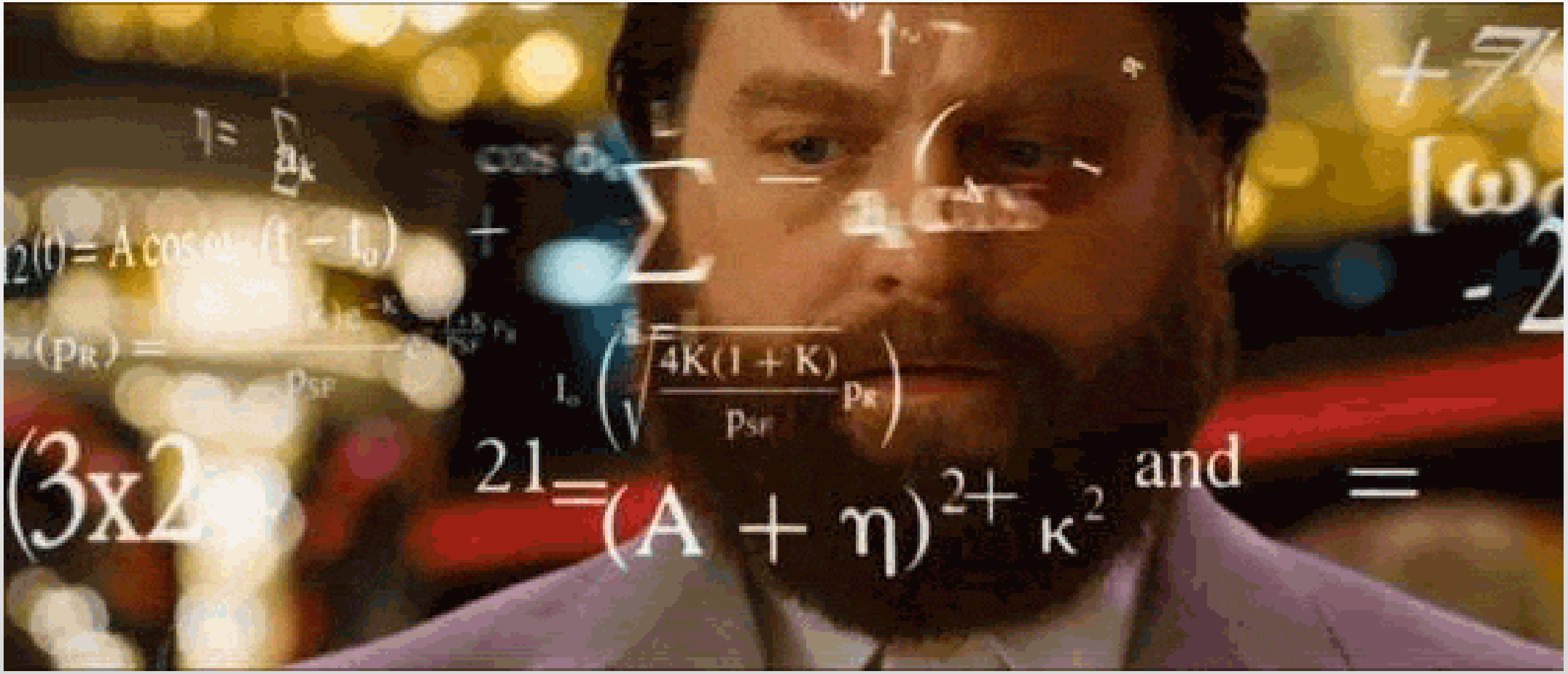
I drive the dog

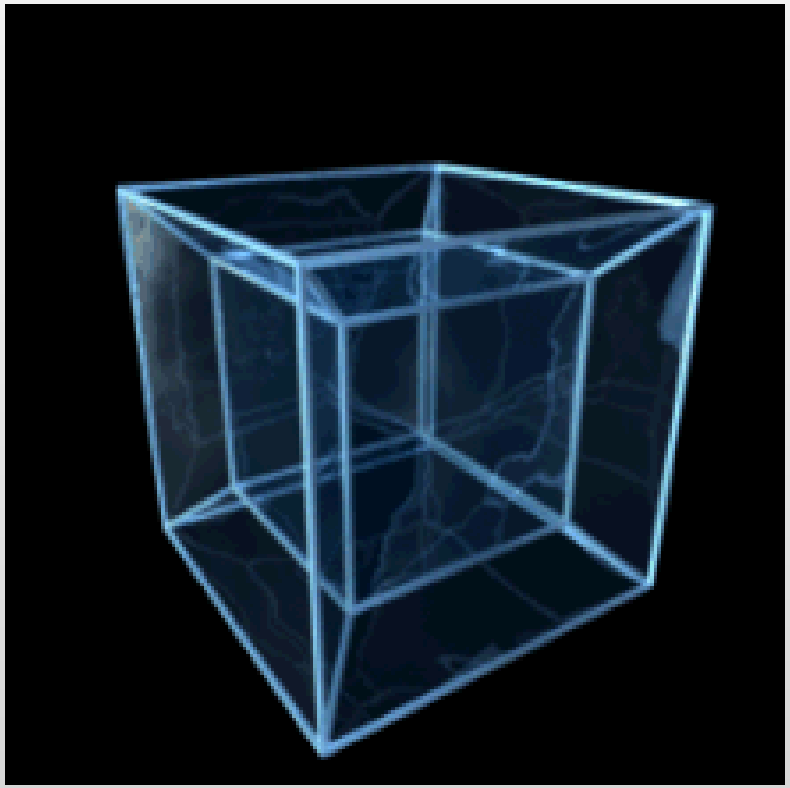
I drive the cat

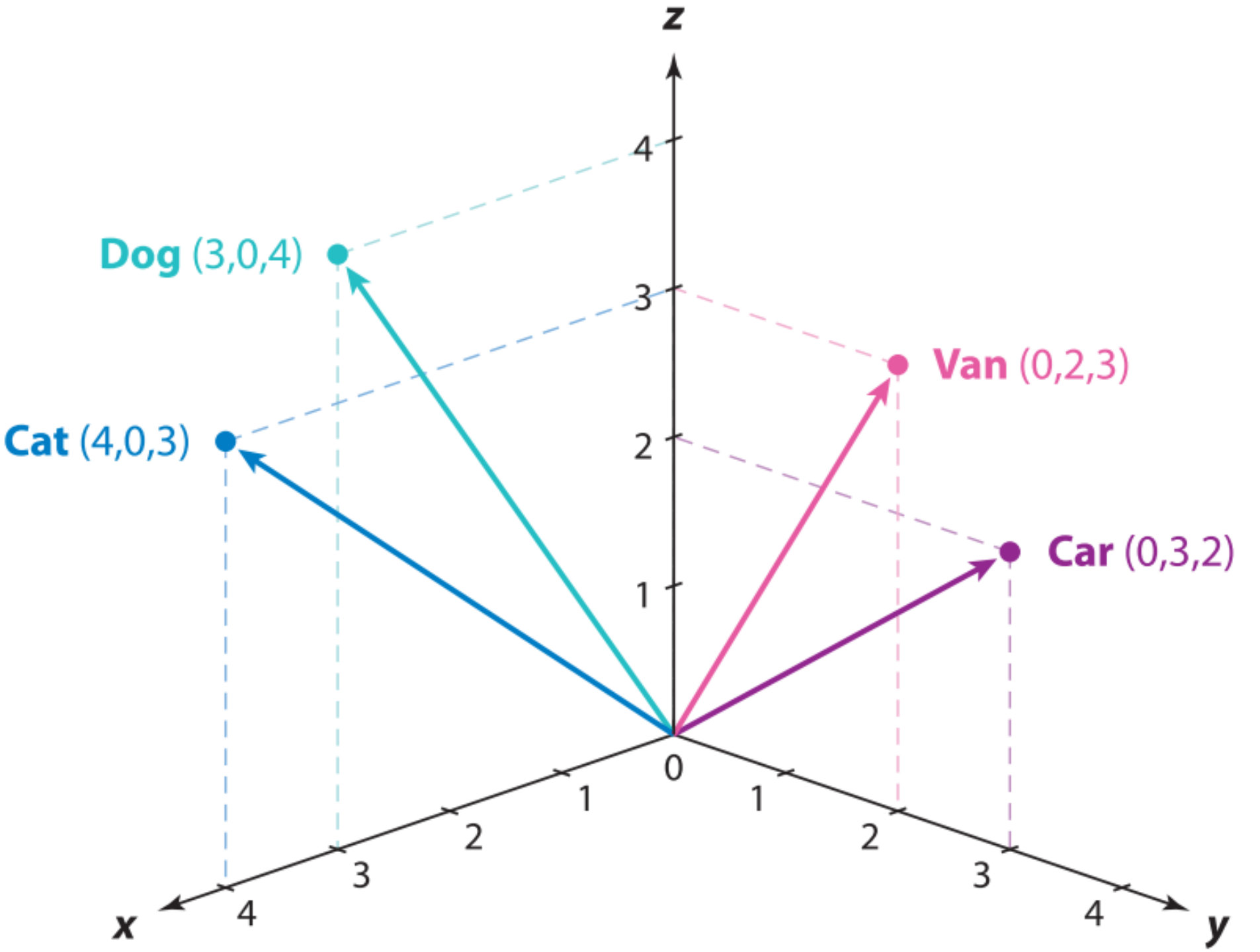
I pet the van

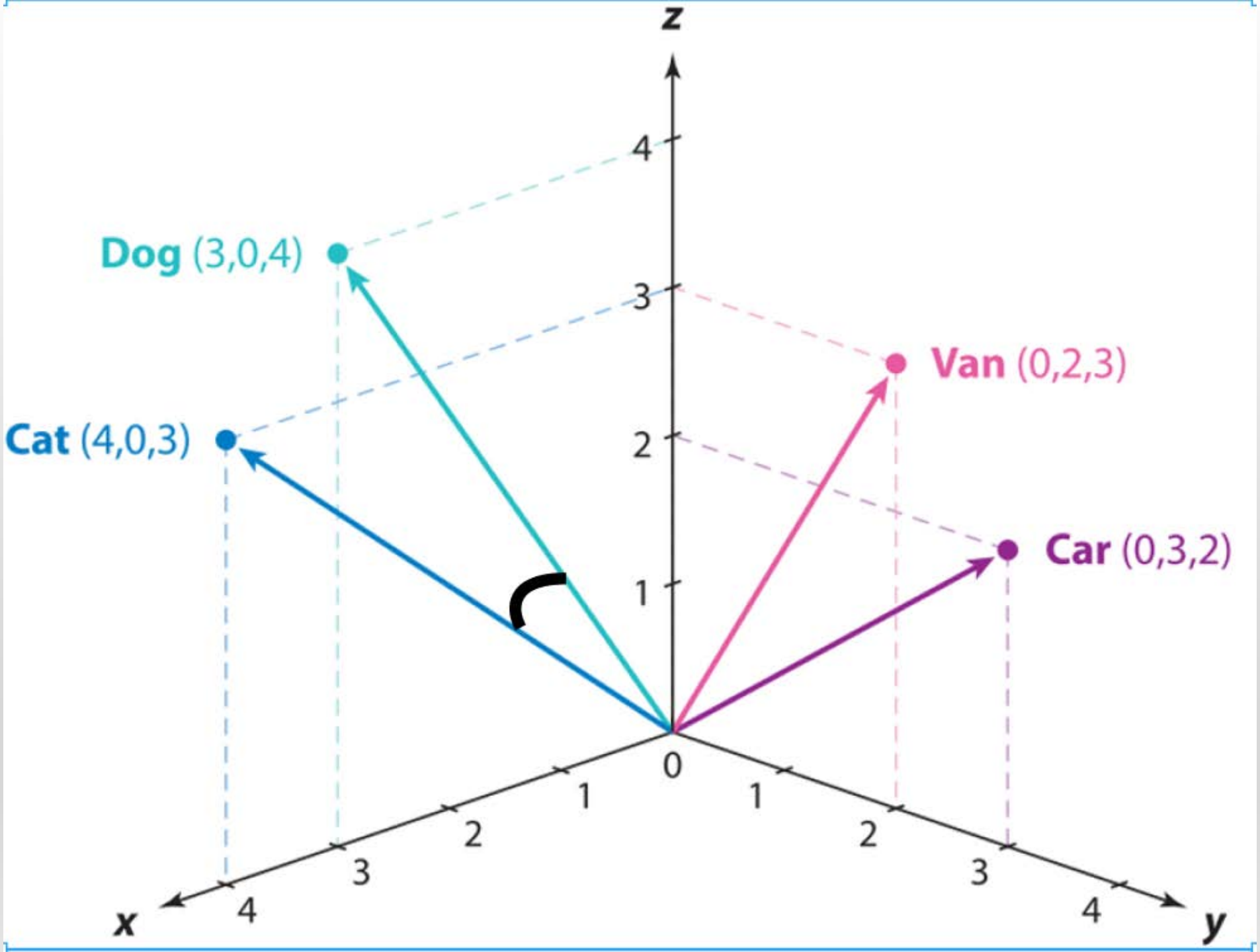
I pet the car

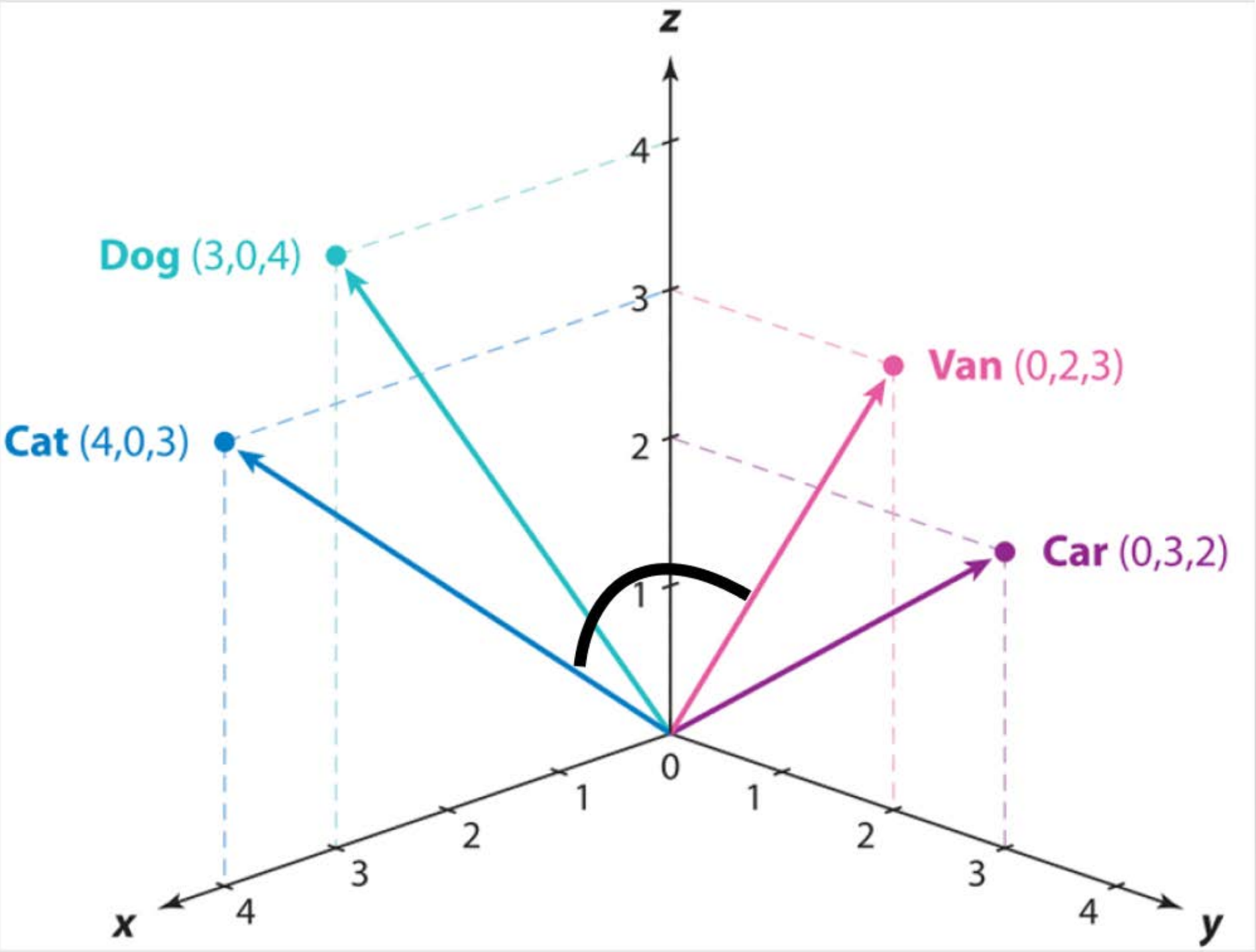



(3x2
21=(A + η)²+ κ²
and
=



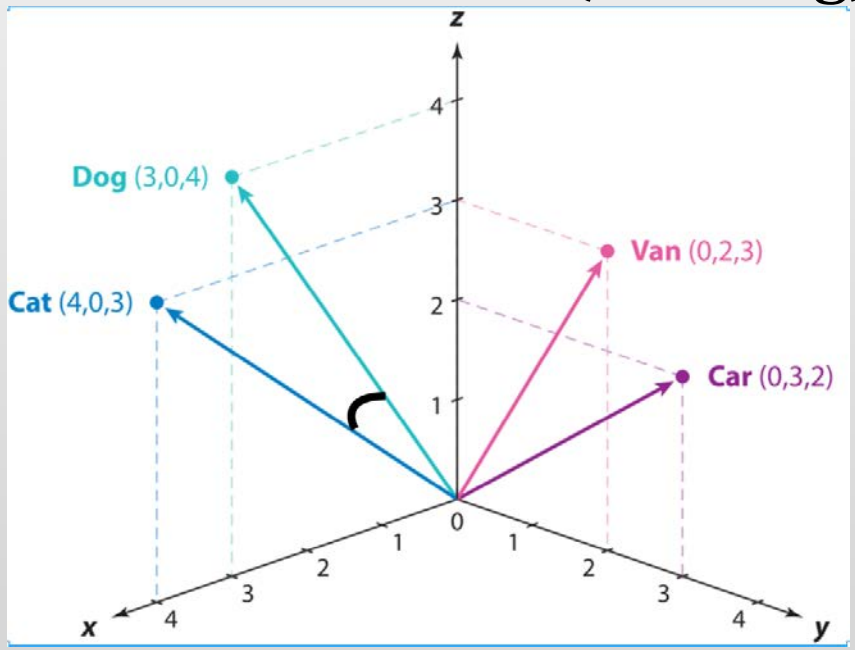

z
4
3
2
1
Dog (3,0,4)
Van (0,2,3)
Cat (4,0,3)
Car (0,3,2)
0
1
2
3
4
x
1
2
3
4
y

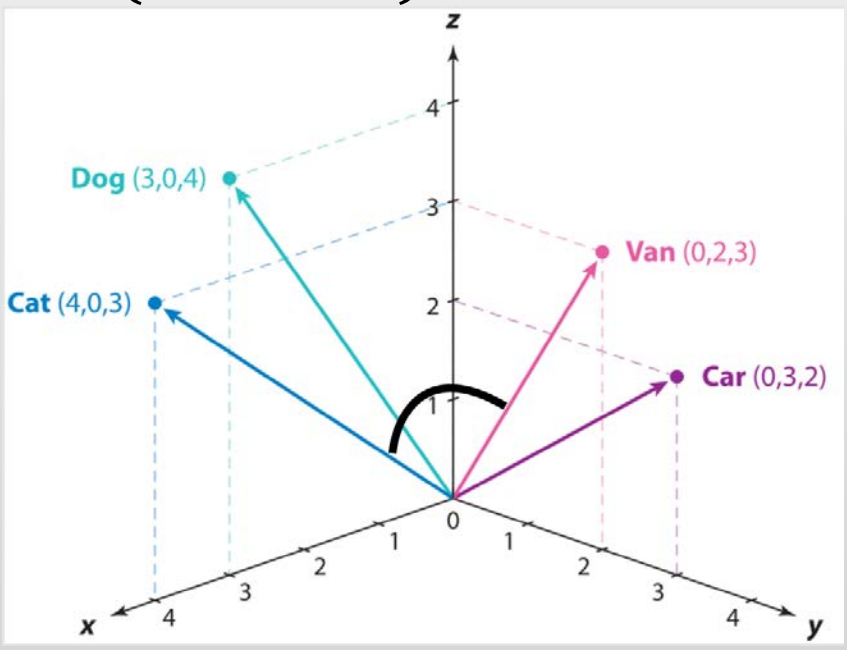

z
4
3
2
1
Dog (3,0,4)
Van (0,2,3)
Cat (4,0,3)
Car (0,3,2)
0
1
2
3
4
1
2
3
4
x
y

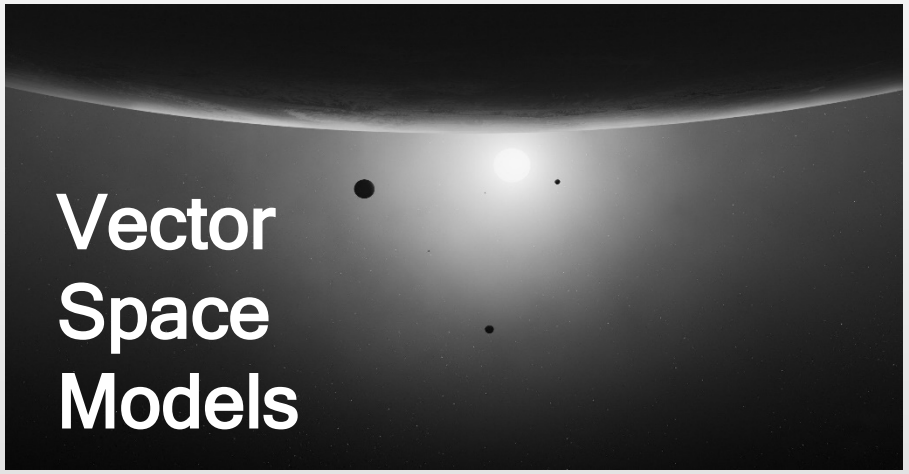

z
4
3
2
1
Dog (3,0,4)
Van (0,2,3)
Cat (4,0,3)
Car (0,3,2)
0
1
2
3
4
x
1
2
3
4
y

Similarity

$$cos(\text{Cat}, \text{Dog}) > cos(\text{Cat}, \text{Van})$$







(Jones & Mewhort, 2007; Bhatia, 2017)

Literature Review

Mental Accounting is based on categorization

Vector space semantic models predict both category structures and higher-level judgments

Vector space semantic models should predict mental budgeting phenomena


DATA


jupyter

GloVe vectors (Pennington, Socher, Manning, 2014)

300-dimensional vector for each word

Used cosine similarity to predict purchase decisions, typicality ratings, and semantic clustering

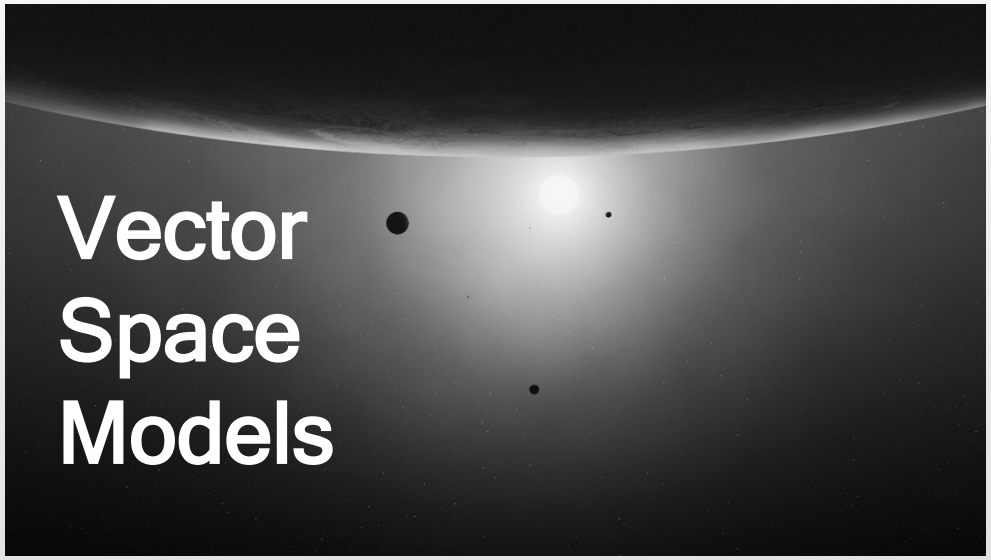
- Only presenting 4 of 7 studies

Predict how expenses are budgeted

Predict why exceptional expenses are grouped into more categories than ordinary expenses

Predict when people flexibly categorize expenses

Predict creation of topical mental account better than participant ratings of similarity.

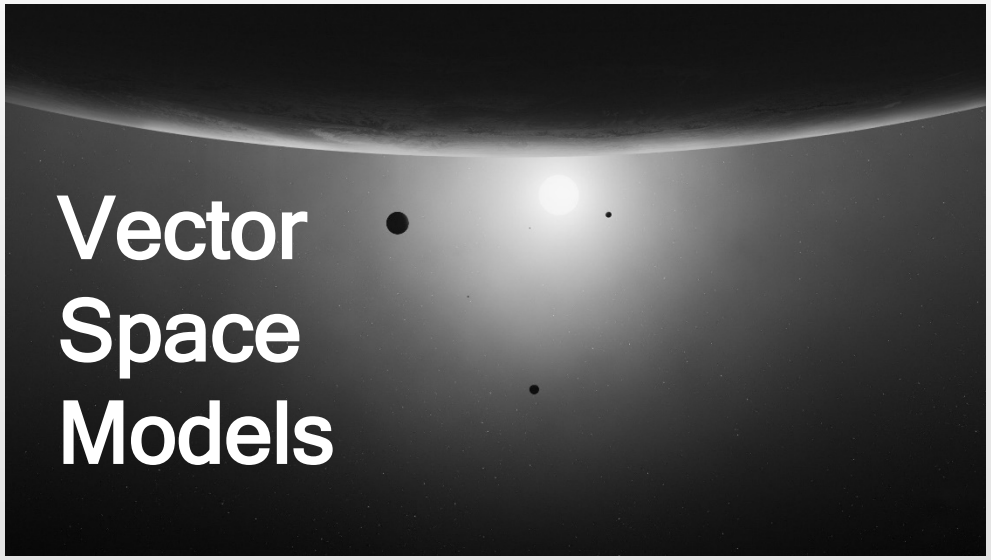


Predict how expenses are budgeted

Predict why exceptional expenses are grouped into more categories than ordinary expenses

Predict when people flexibly categorize expenses

Predict creation of topical mental account better than participant ratings of similarity.

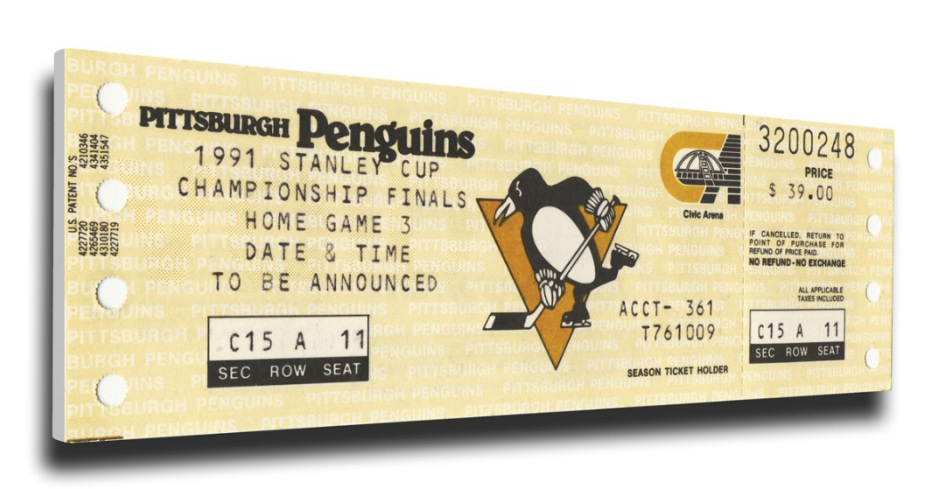


Food

Entertainment

Clothes

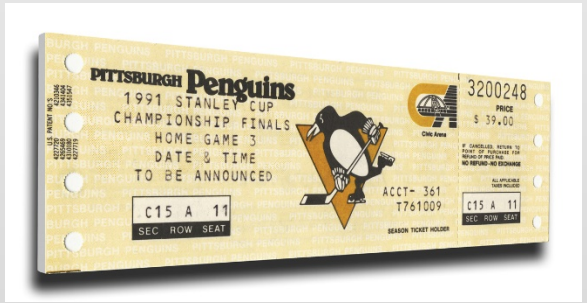
(Heath & Soll 1996)


PITTSBURGH Penguins
1991 STANLEY CUP
CHAMPIONSHIP FINALS
HOME GAME 3
DATE & TIME
TO BE ANNOUNCED
C15 A 11
SEC ROW SEAT
Civic Arena
3200248
PRICE
$ 39.00
IF CANCELLED, RETURN TO POINT OF PURCHASE FOR REFUND OF PRICE PAID.
NO REFUND - NO EXCHANGE
ALL APPLICABLE TAXES INCLUDED
ACCT- 361
T761009
C15 A 11
SEC ROW SEAT
SEASON TICKET HOLDER


TRADER JOE'S

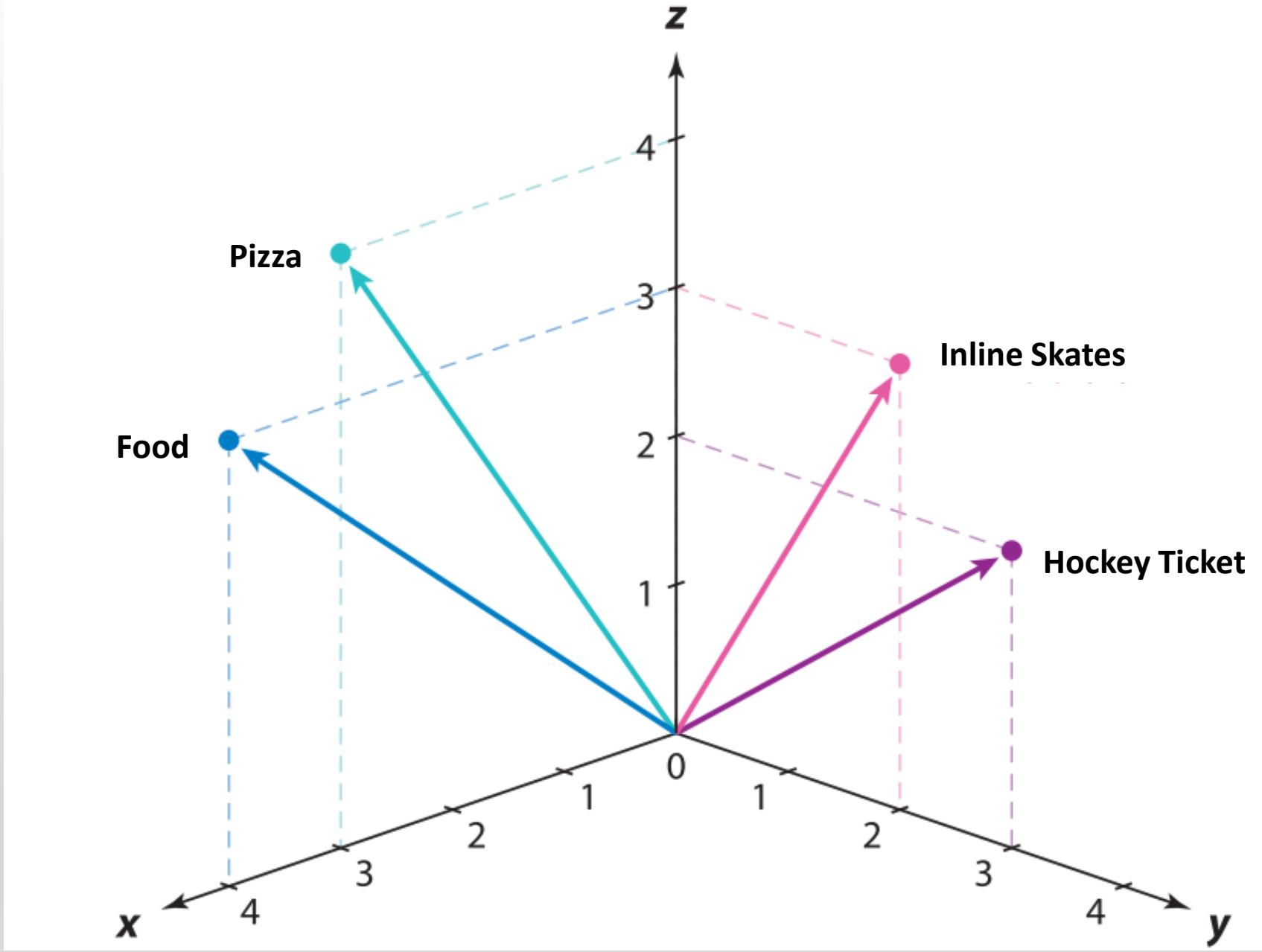
Food

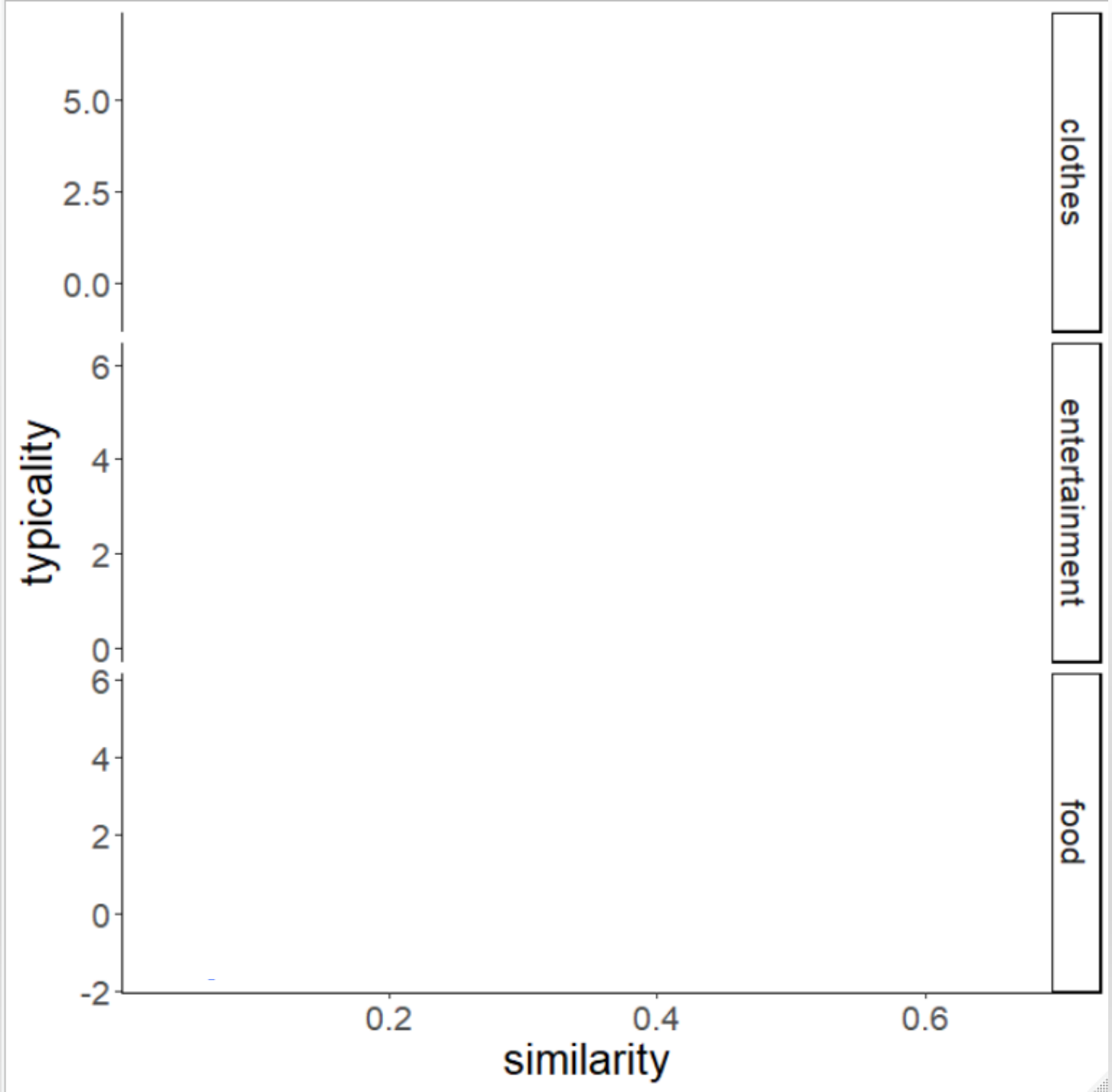
Entertainment

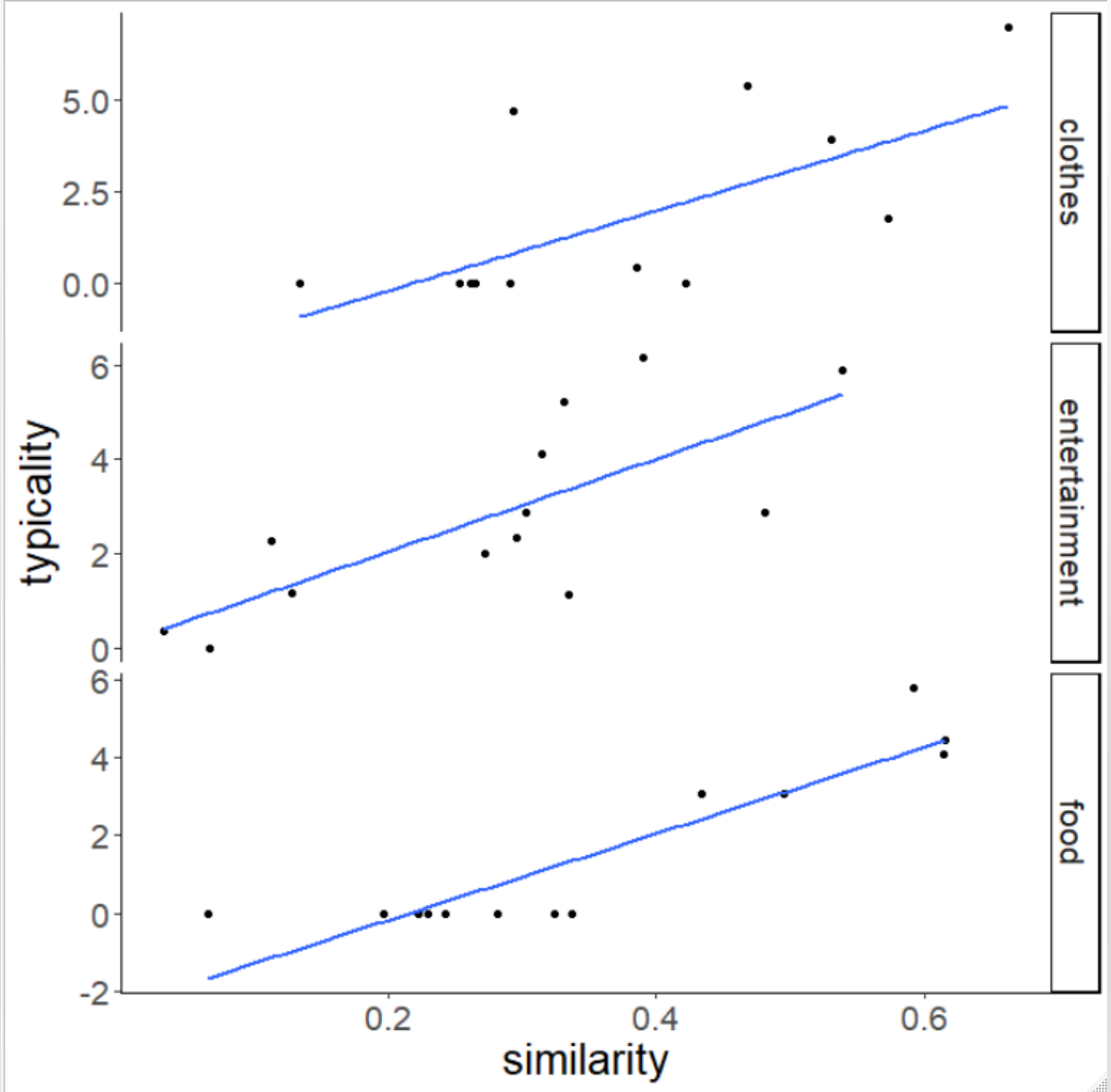


Clothes

Heath & Soll 1996

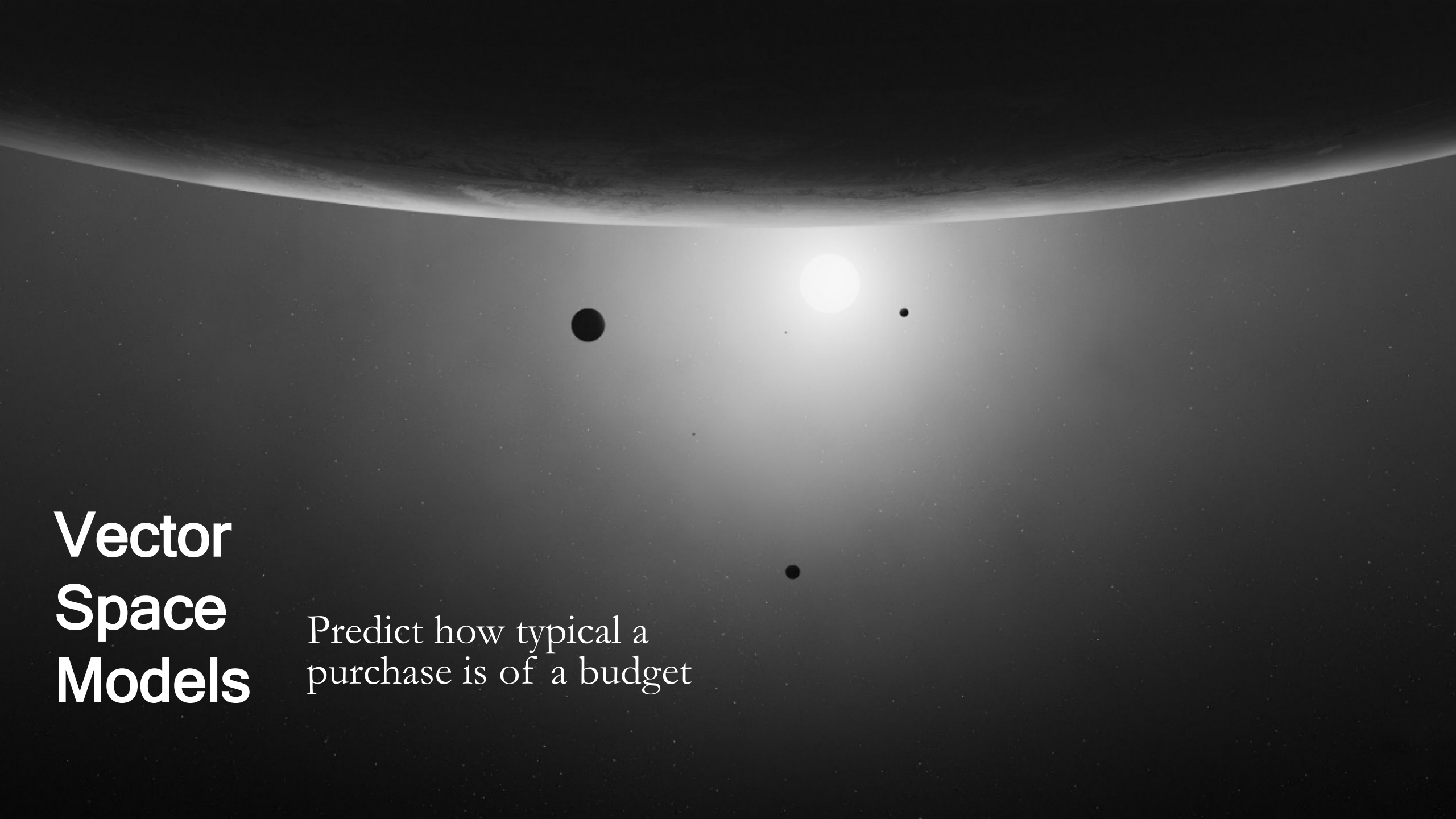

z
4
3
2
1
Pizza
Food
Inline Skates
Hockey Ticket
0
1
2
3
4
1
2
3
4
x
y


clothes
entertainment
food
typicality
5.0
2.5
0.0
6
4
2
0
-2
0.2
0.4
0.6
similarity



$\beta = 10.42, SE = 1.52, \mathrm{p} < .0001$

$R^2 = .66$



Vector Space Models

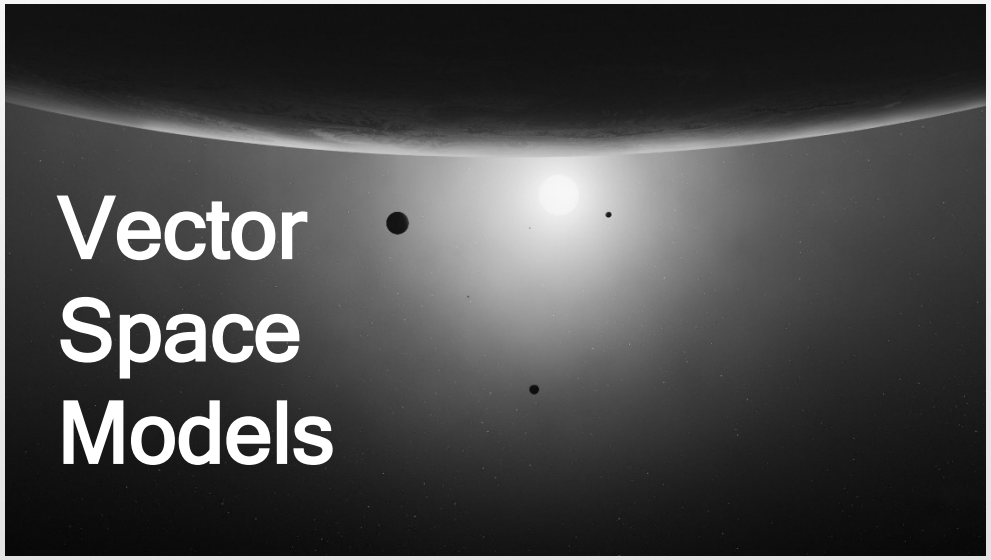
Predict how typical a purchase is of a budget

Predict how expenses are budgeted

Predict why exceptional expenses are grouped into more categories than ordinary expenses

Predict when people flexibly categorize expenses

Predict creation of topical mental account better than participant ratings of similarity.



Ordinary versus Exceptional Expenses

Sussman & Alter, 2012

Ordinary versus Exceptional Expenses

Sussman & Alter, 2012


WESTIN


BILLS
COINS
CONNECTCARD


Greyhound


BILLS
COINS
CONNECTCARD


WESTIN


KORBEL
EXTRA DRY
KORBEL
Cook's
BRUT

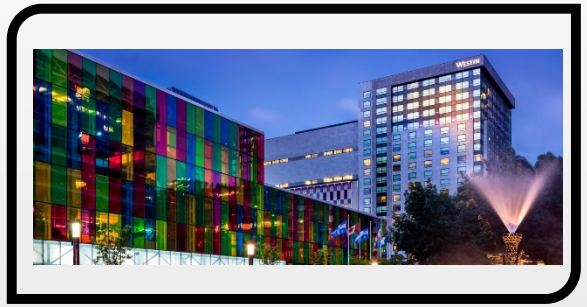

Greyhound


BILLS
COINS
CONNECTCARD
ABOARD!

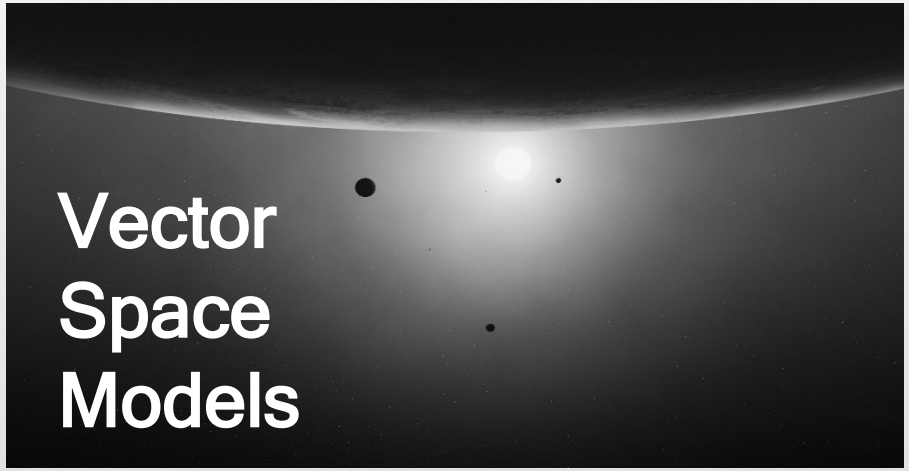

WESTIN

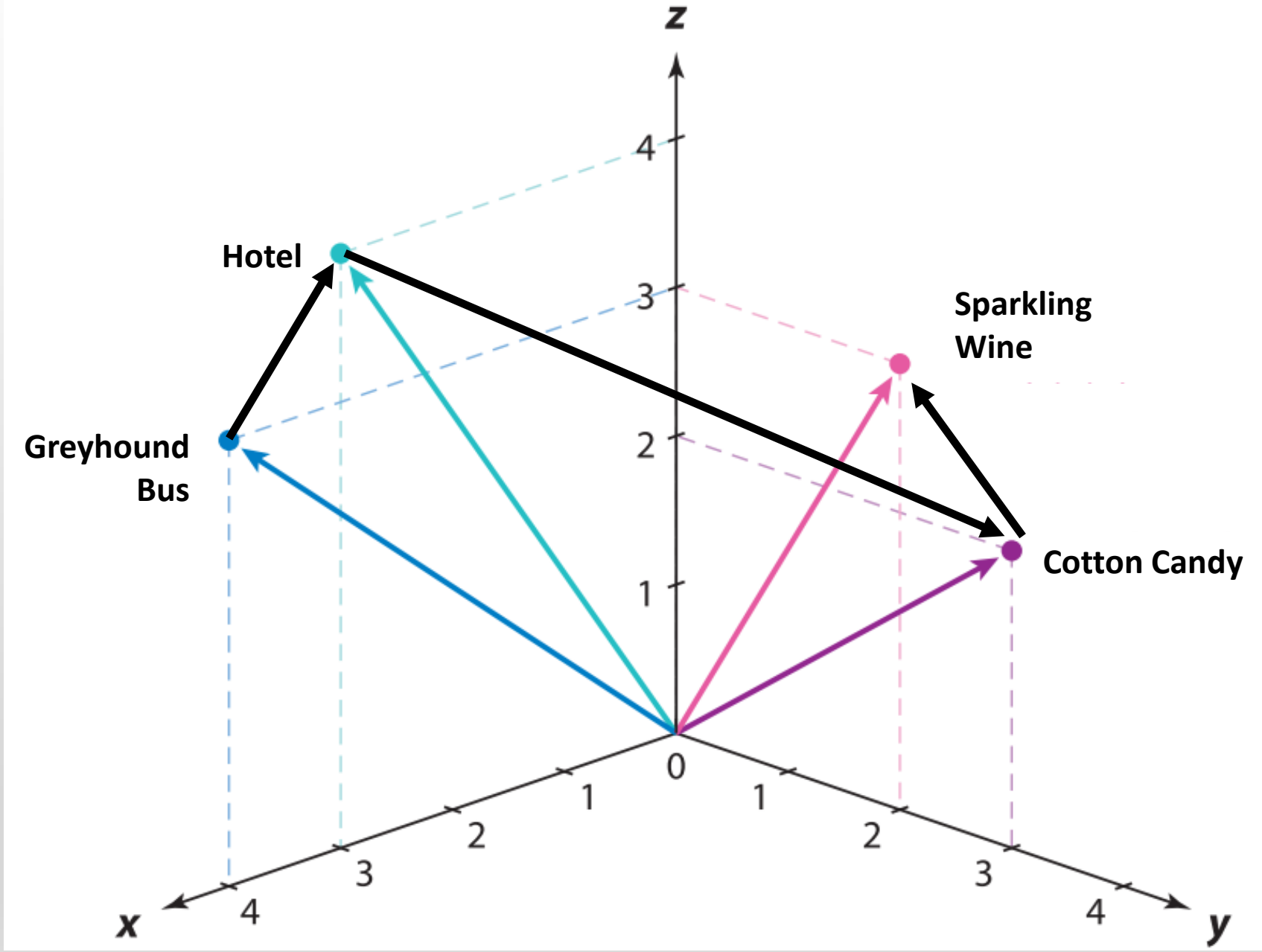

greyhound


BILLS
COINS
CONNECTCARD

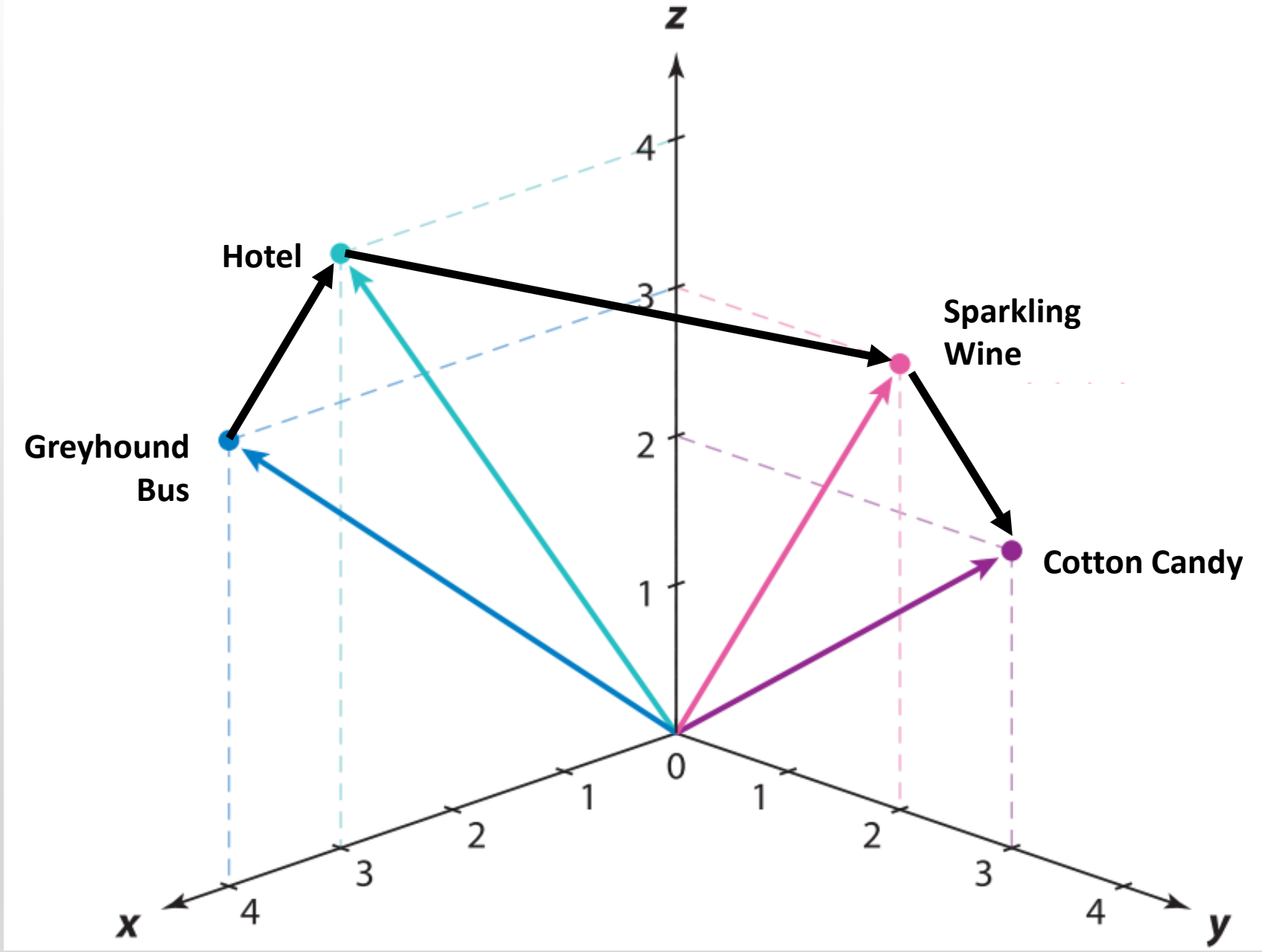


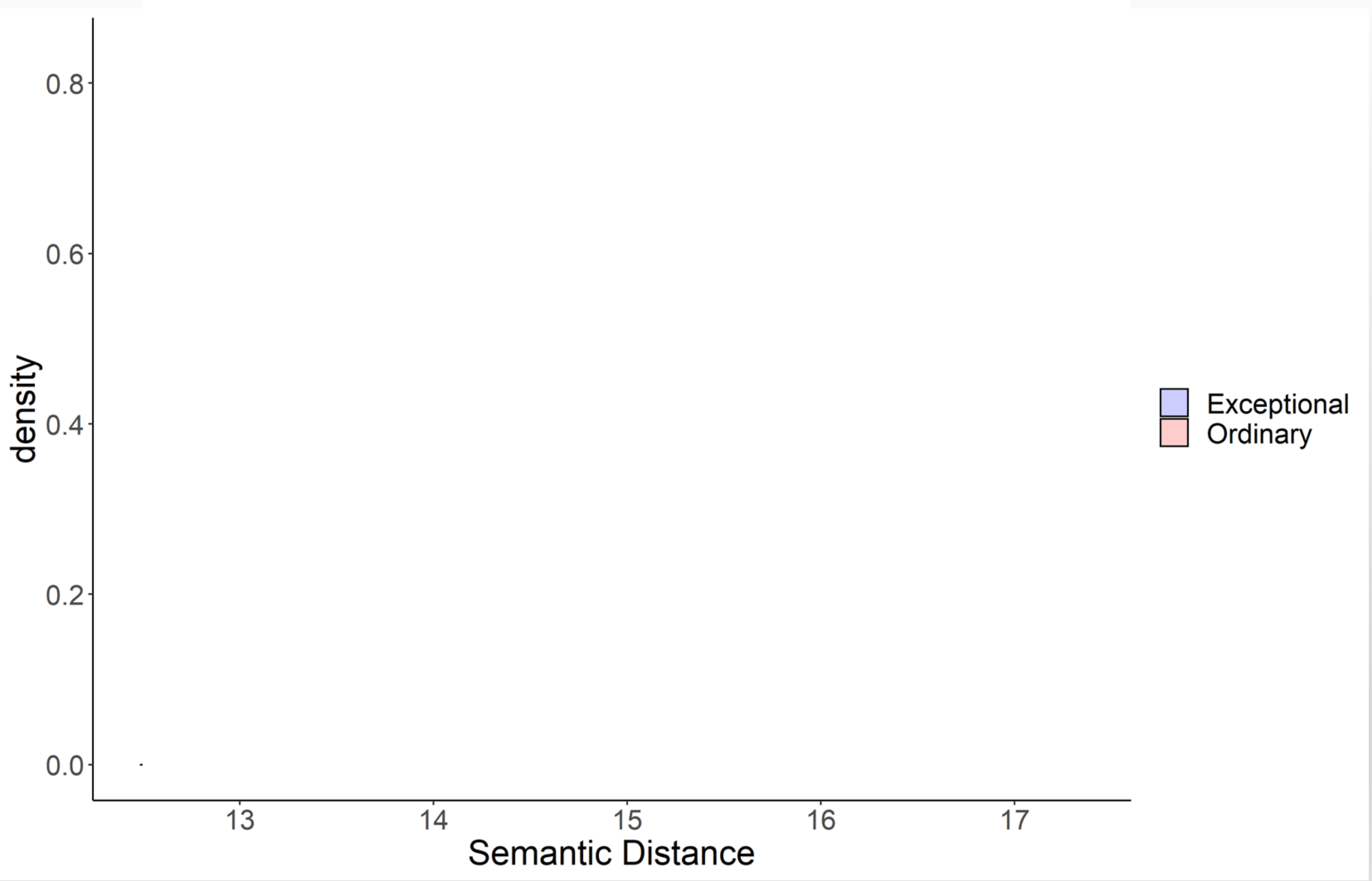

express
from $1*
megabus.com
low-cost express bus service
stay connected...

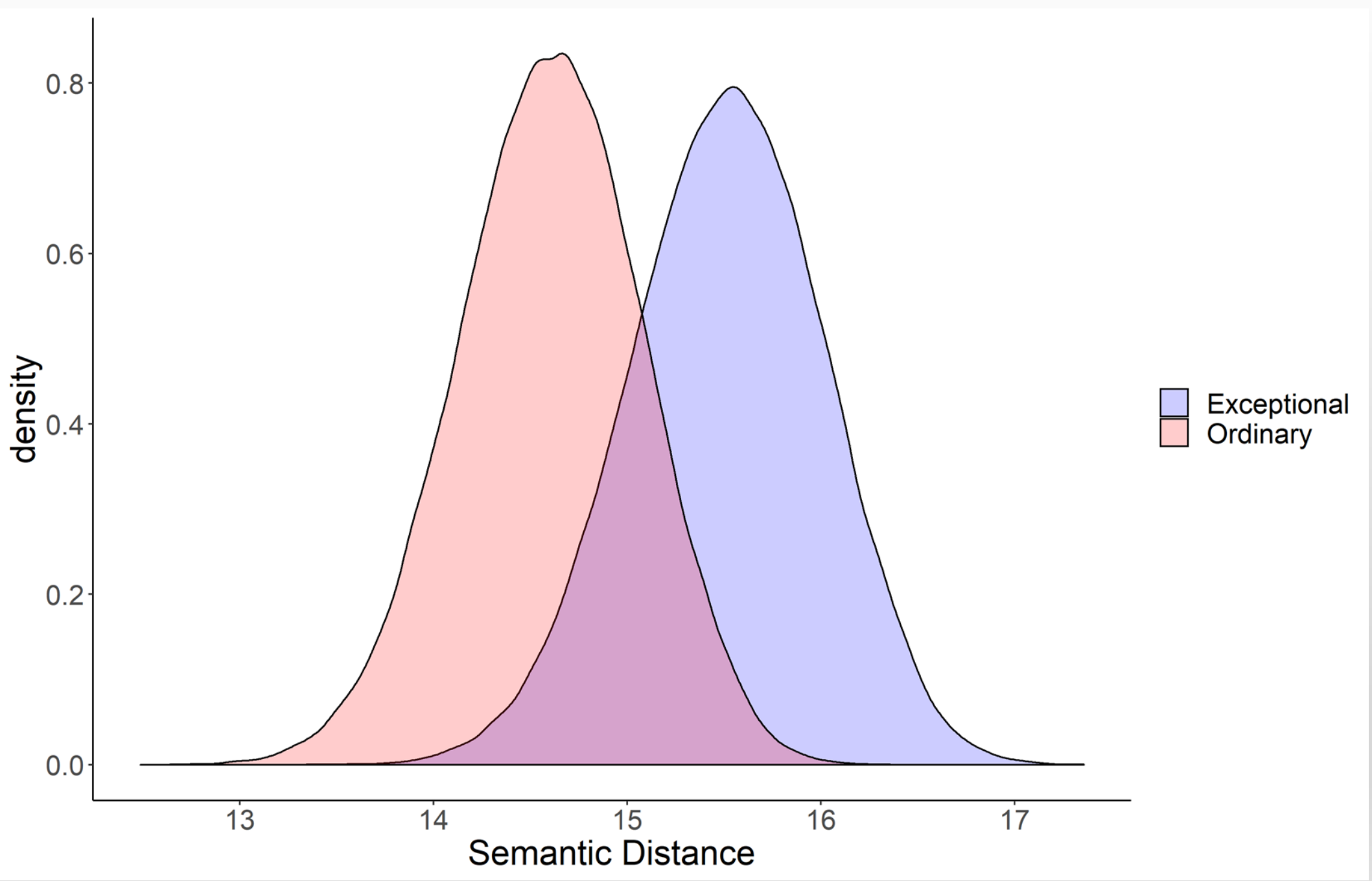

Vector
Space
Models


z
4
3
2
1
Hotel
Sparkling
Wine
Greyhound
Bus
Cotton Candy
0
1
2
3
4
1
2
3
4
x
y


1
2
3
60 in


z
4
3
2
1
Hotel
Sparkling
Wine
Greyhound
Bus
Cotton Candy
0
1
2
3
4
1
2
3
4
x
y


0.8
0.6
0.4
0.2
0.0
density
13
14
15
16
17
Semantic Distance
Exceptional
Ordinary



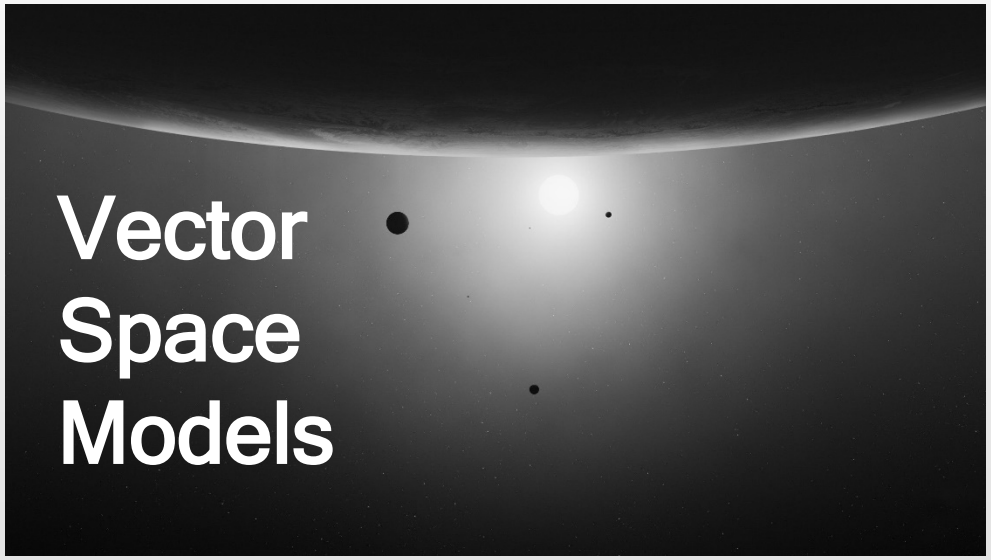
$t(199397) = 420.95$
$p < .0001$
$D = 1.88$

Predict how expenses are budgeted

Predict why exceptional expenses are grouped into more categories than ordinary expenses

Predict when people flexibly categorize expenses

Predict creation of topical mental account better than participant ratings of similarity.

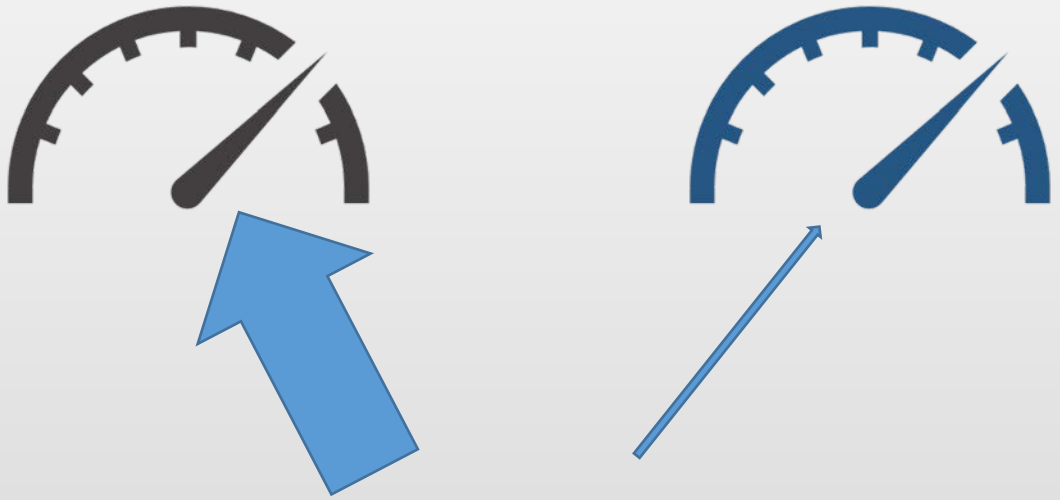


Malleable Mental Budgeting

(Soman & Cheema, 2006)

Food

Entertainment

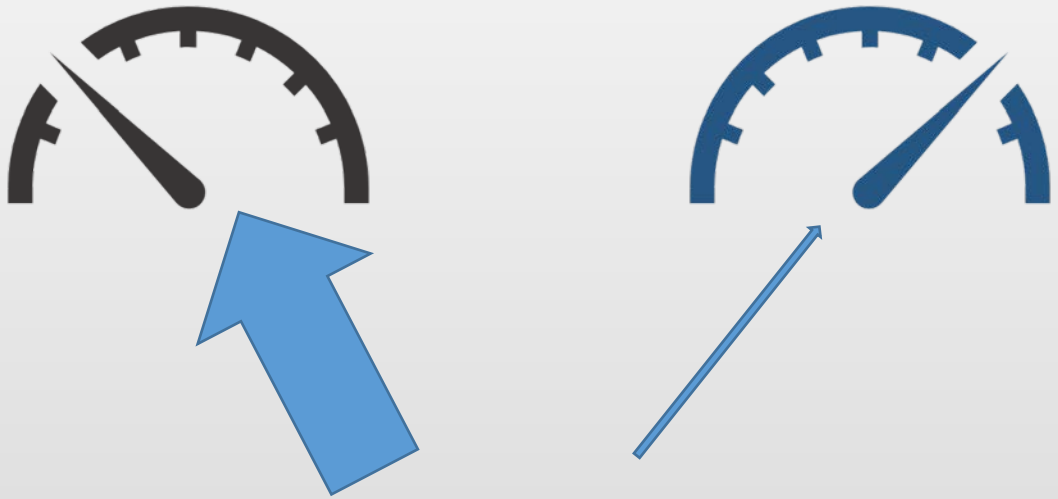


GRUBHUB

Restaurants you love, delivered.

Food

Entertainment



GRUBHUB

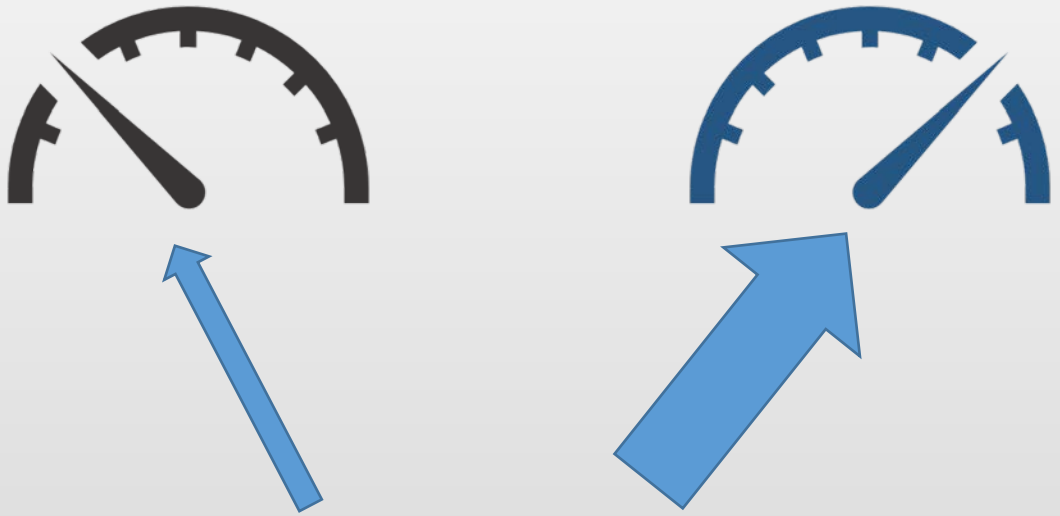
Restaurants you love, delivered.

Food

Entertainment

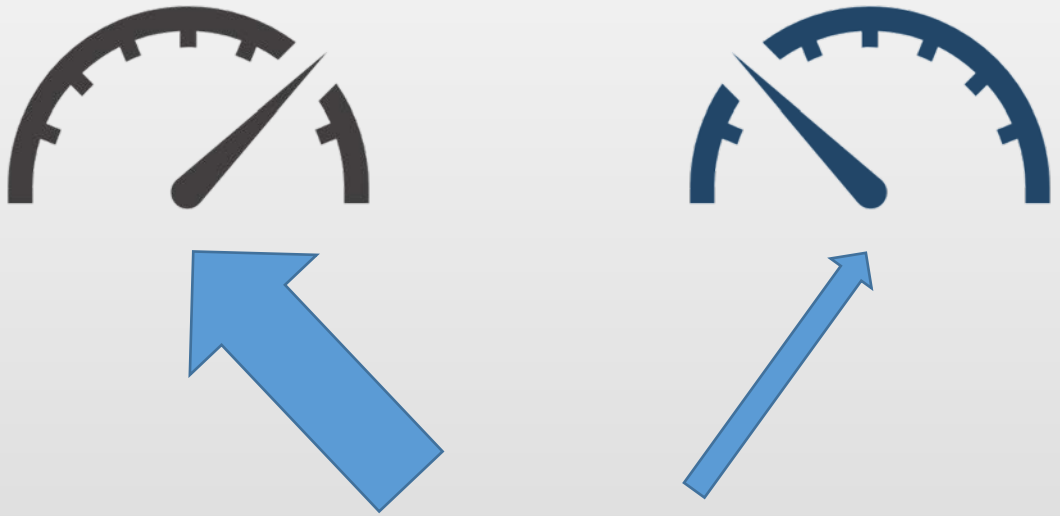
Food

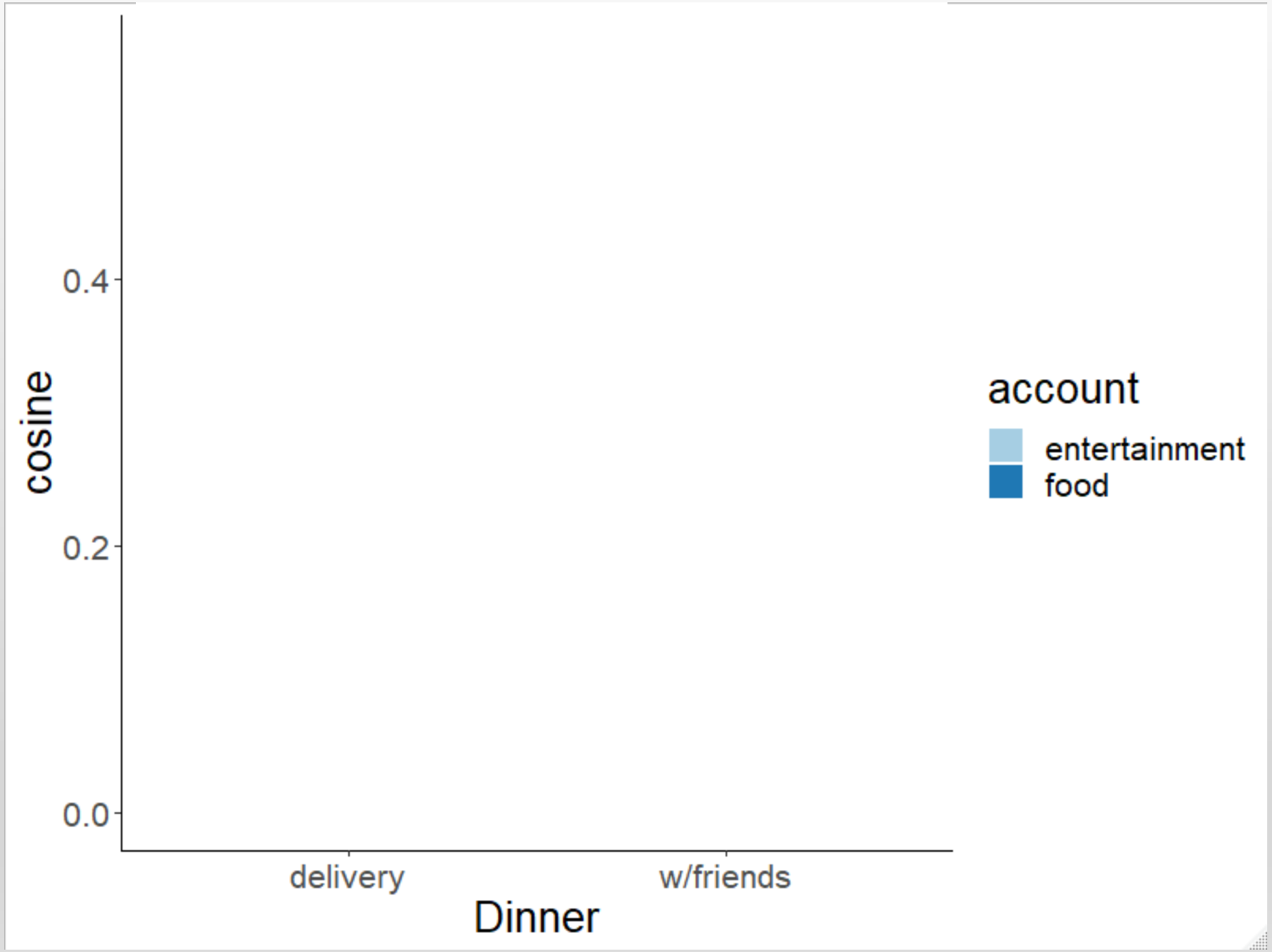
Entertainment

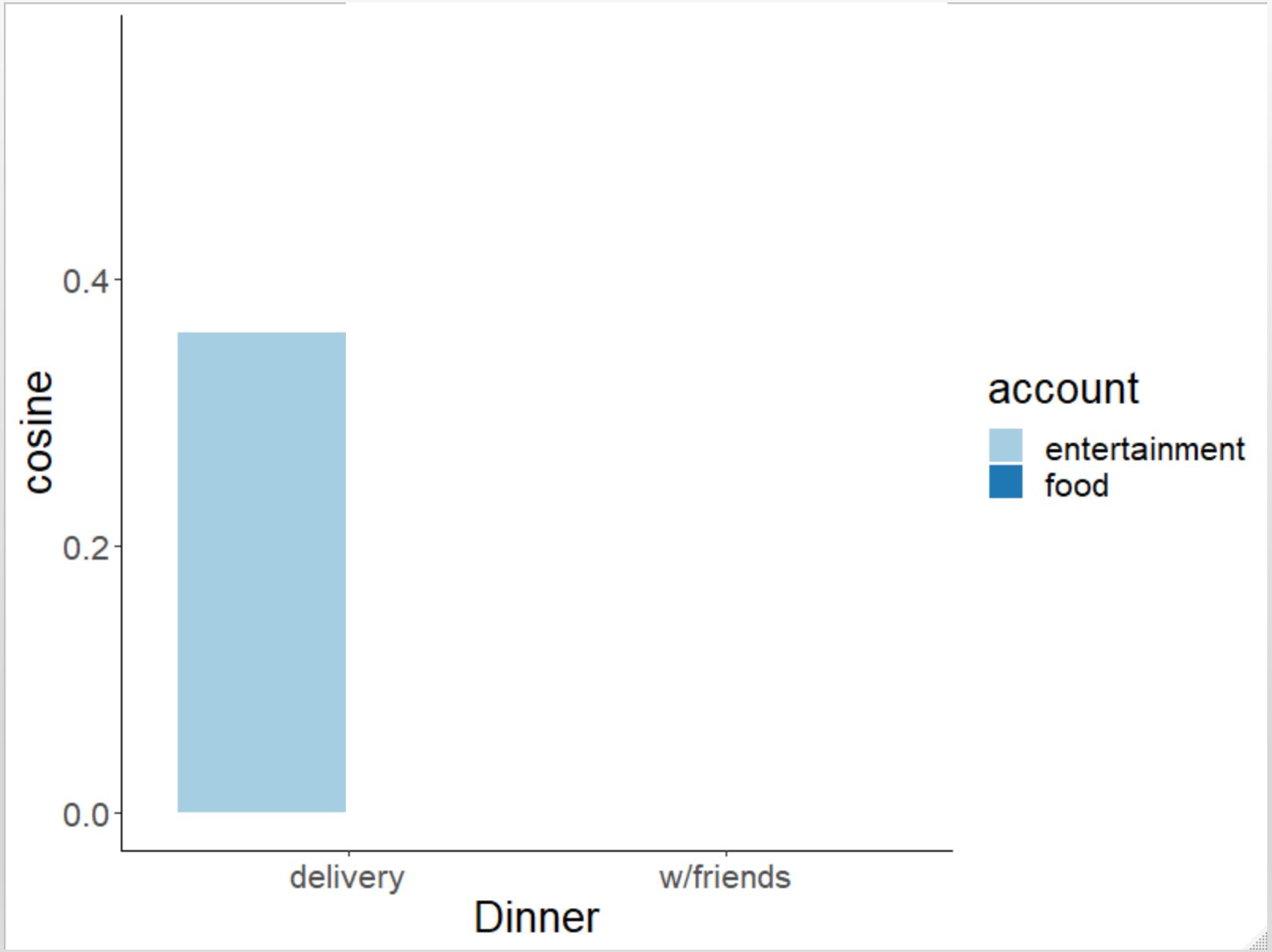


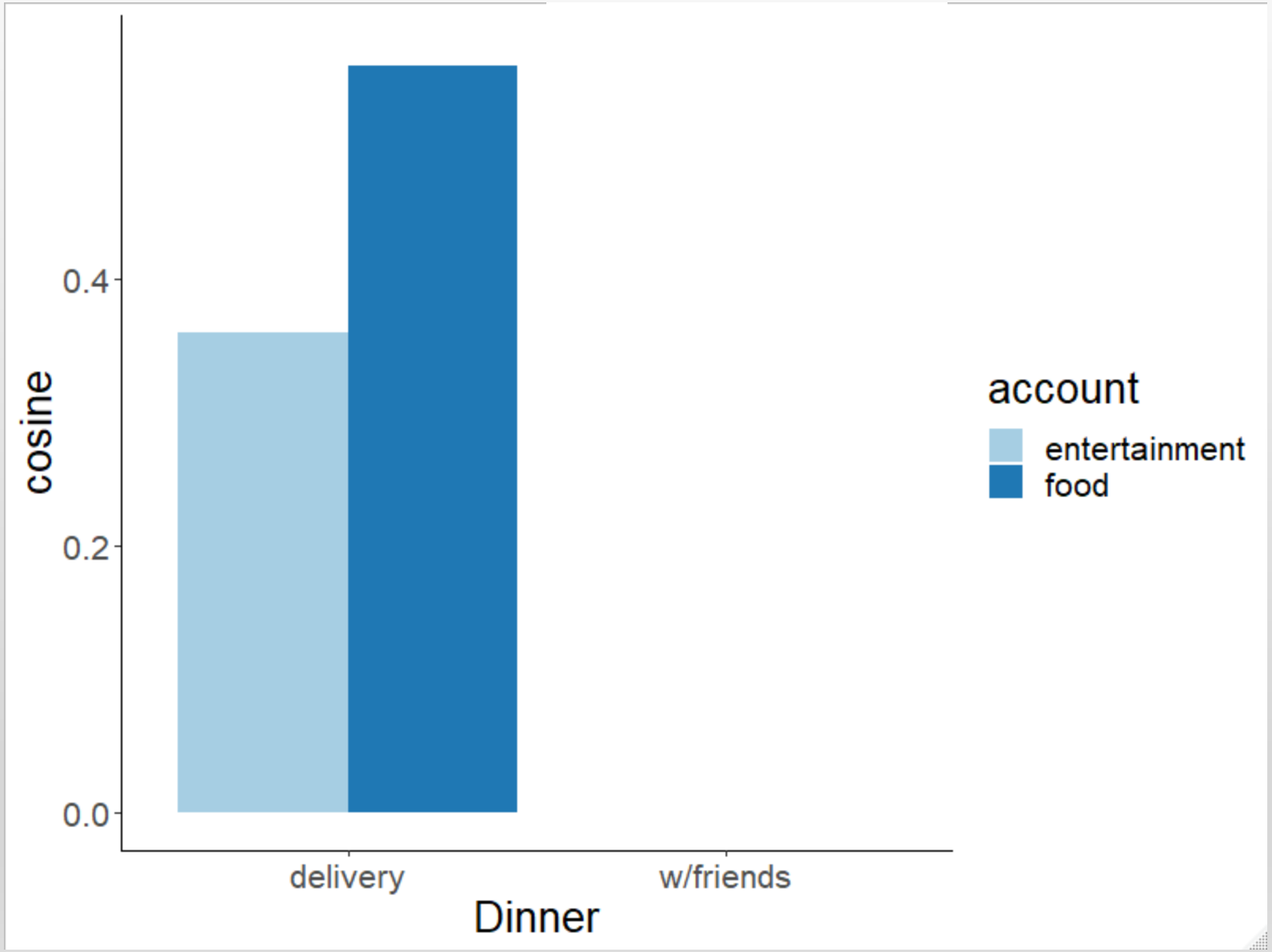
Food

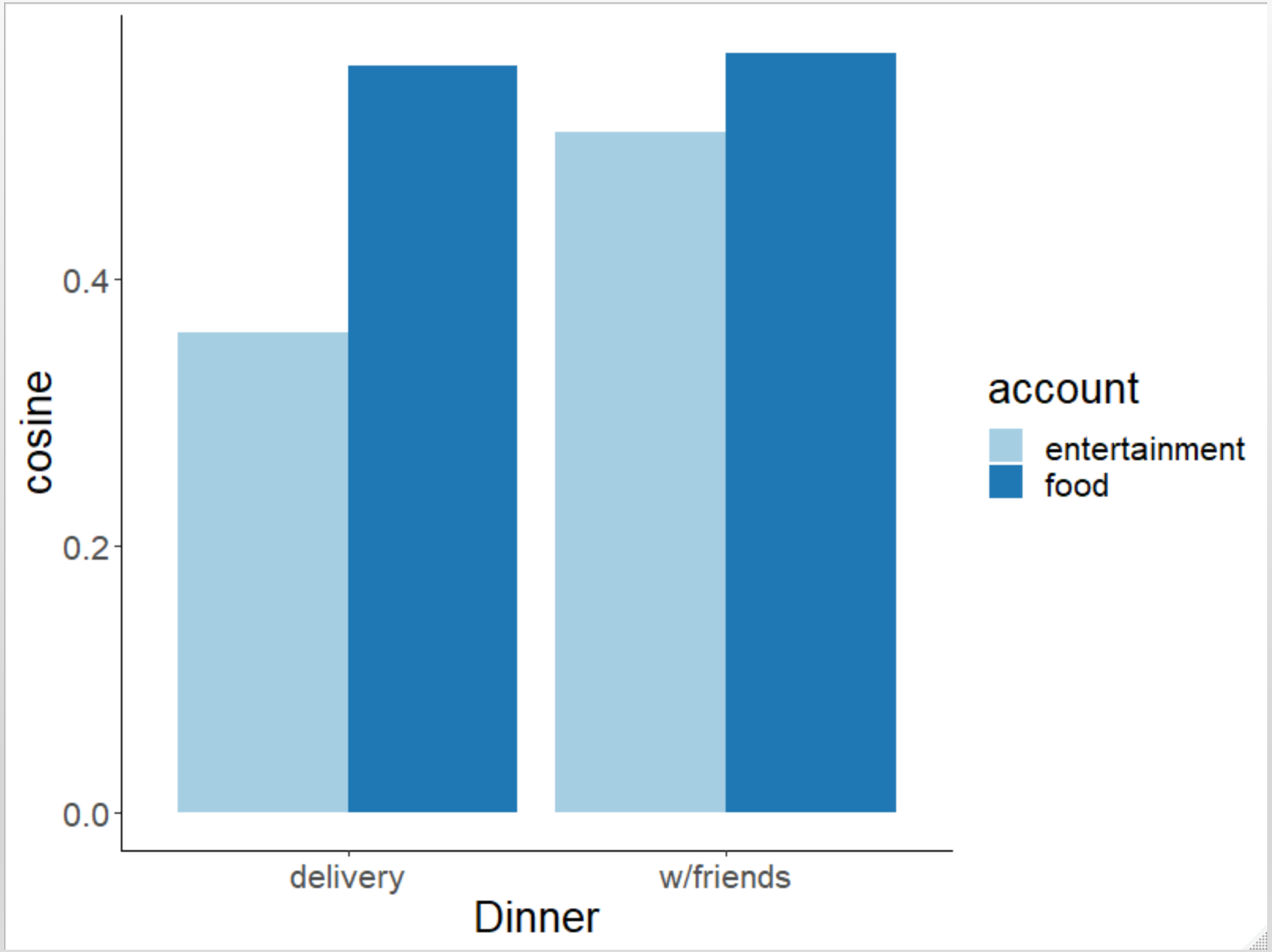
Entertainment




0.4
0.2
0.0
cosine
account
entertainment
food
delivery
w/friends
Dinner


0.4
0.2
0.0
cosine
delivery
w/friends
Dinner
account
entertainment
food


0.4
0.2
0.0
cosine
delivery
w/friends
Dinner
account
entertainment
food

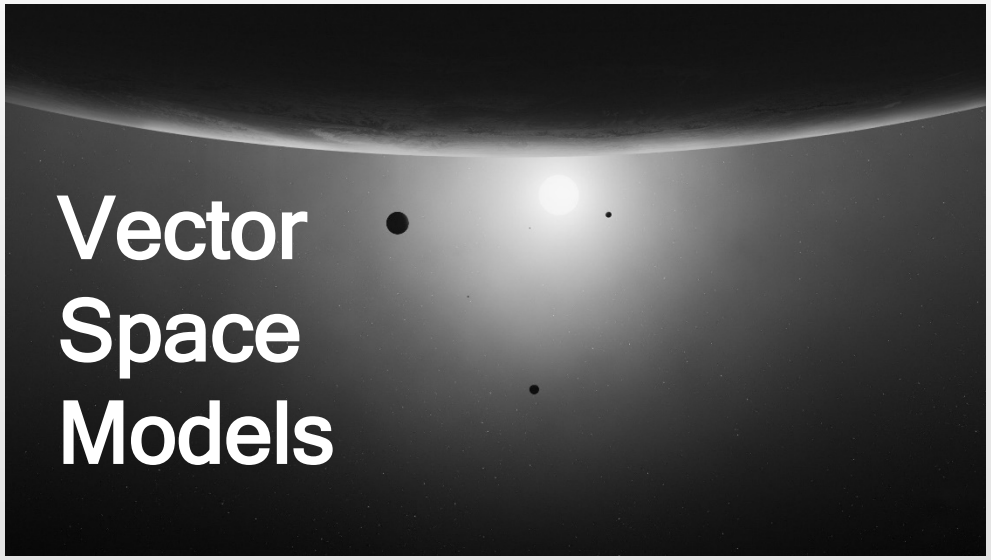

cosine
0.4
0.2
0.0
delivery
w/friends
Dinner
account
entertainment
food

Predict how expenses are budgeted

Predict why exceptional expenses are grouped into more categories than ordinary expenses

Predict when people flexibly categorize expenses

Predict creation of topical mental account better than participant ratings of similarity




Texas Instruments
TI-89
F1
F2
F3
F4
F5
2nd
ESC
alpha
APPS
HOME
MODE
CATALOG
CLEAR
ON
ENTER

Willing to drive?

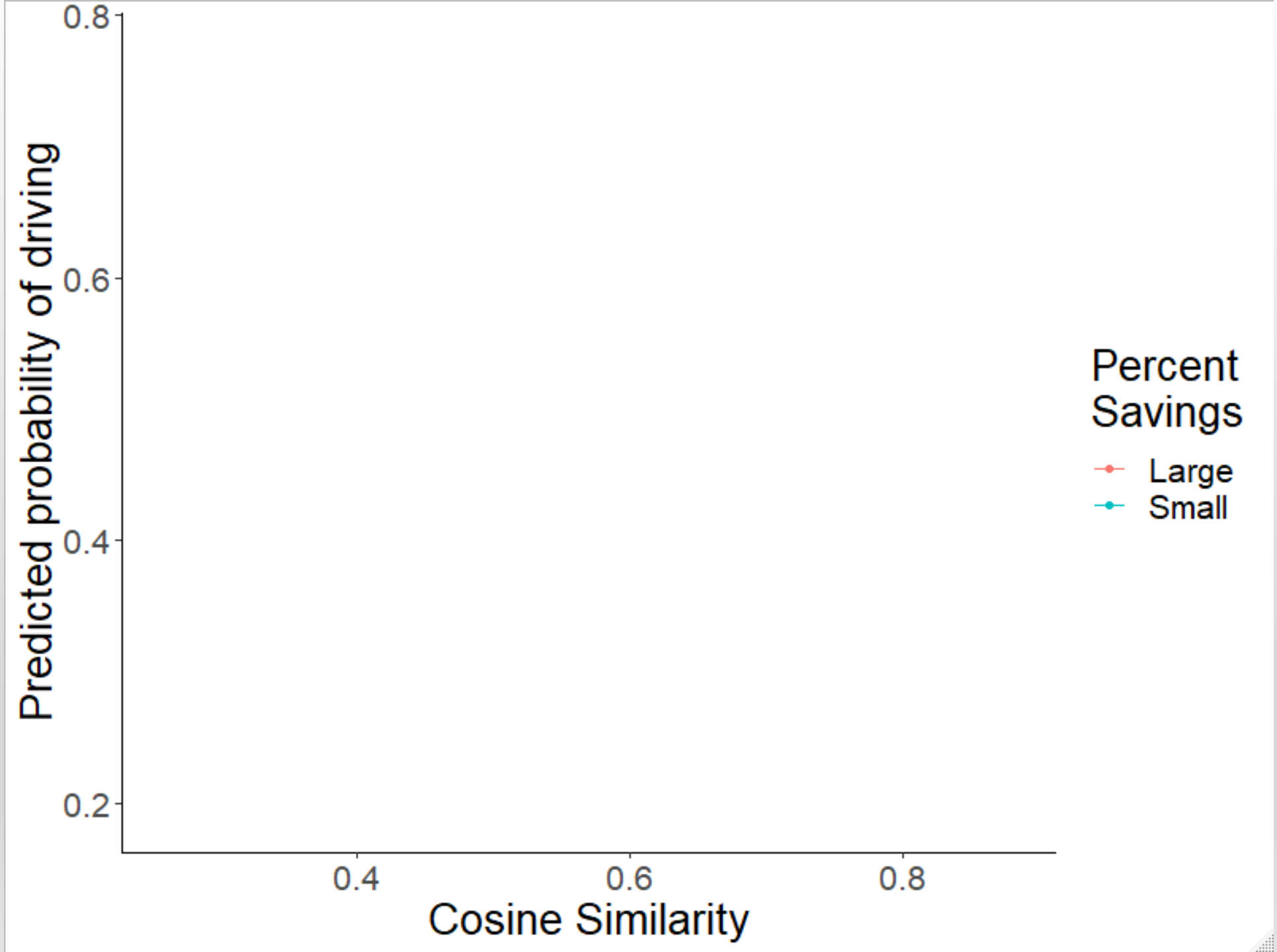

Canon LS-822
12345678

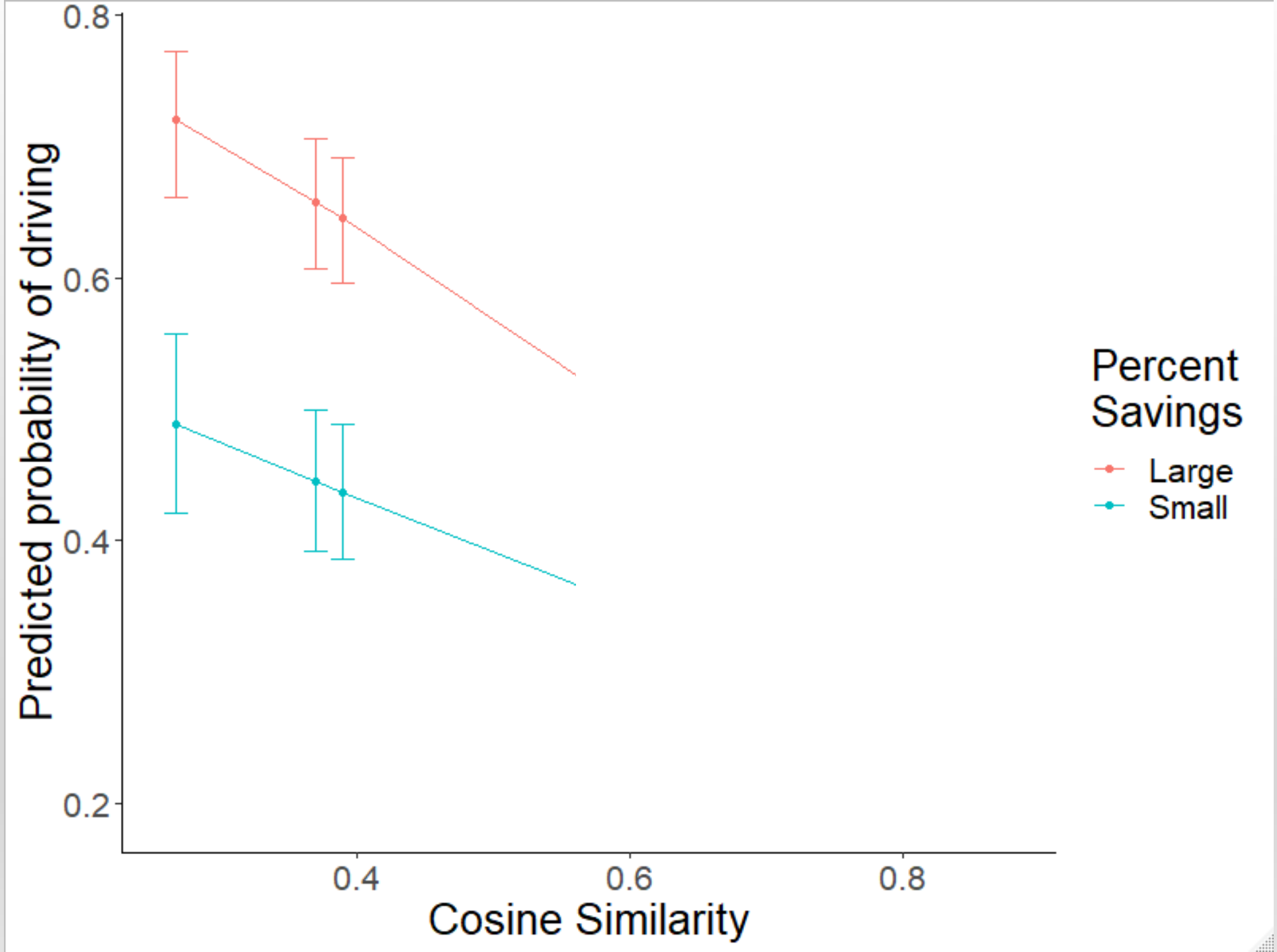

EXPENSIVE
JACKET

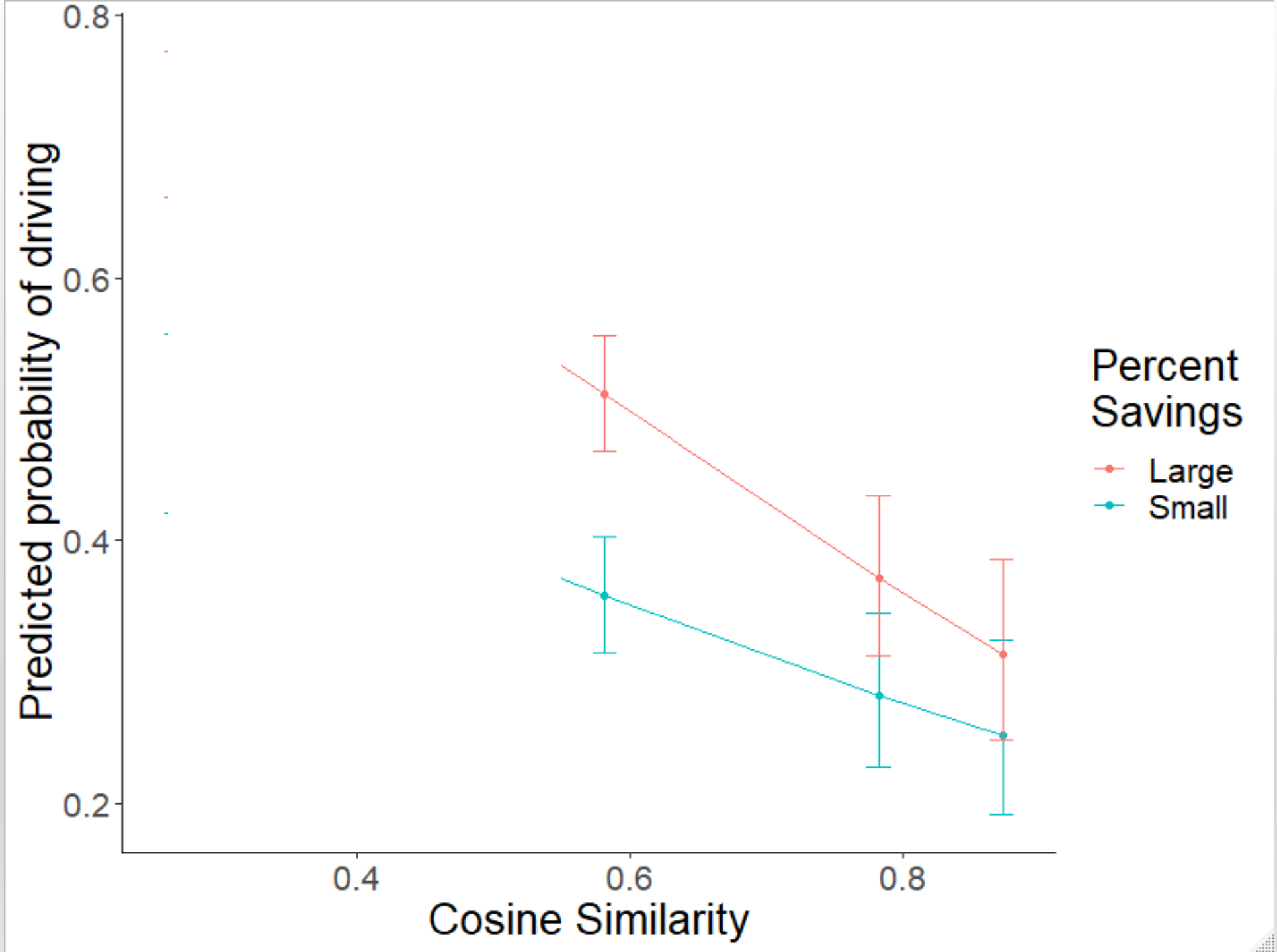

Texas Instruments
TI-89
F1
F2
F3
F4
F5
2nd
ESC
alpha
APPS
HOME
MODE
CATALOG
CLEAR
ON
ENTER

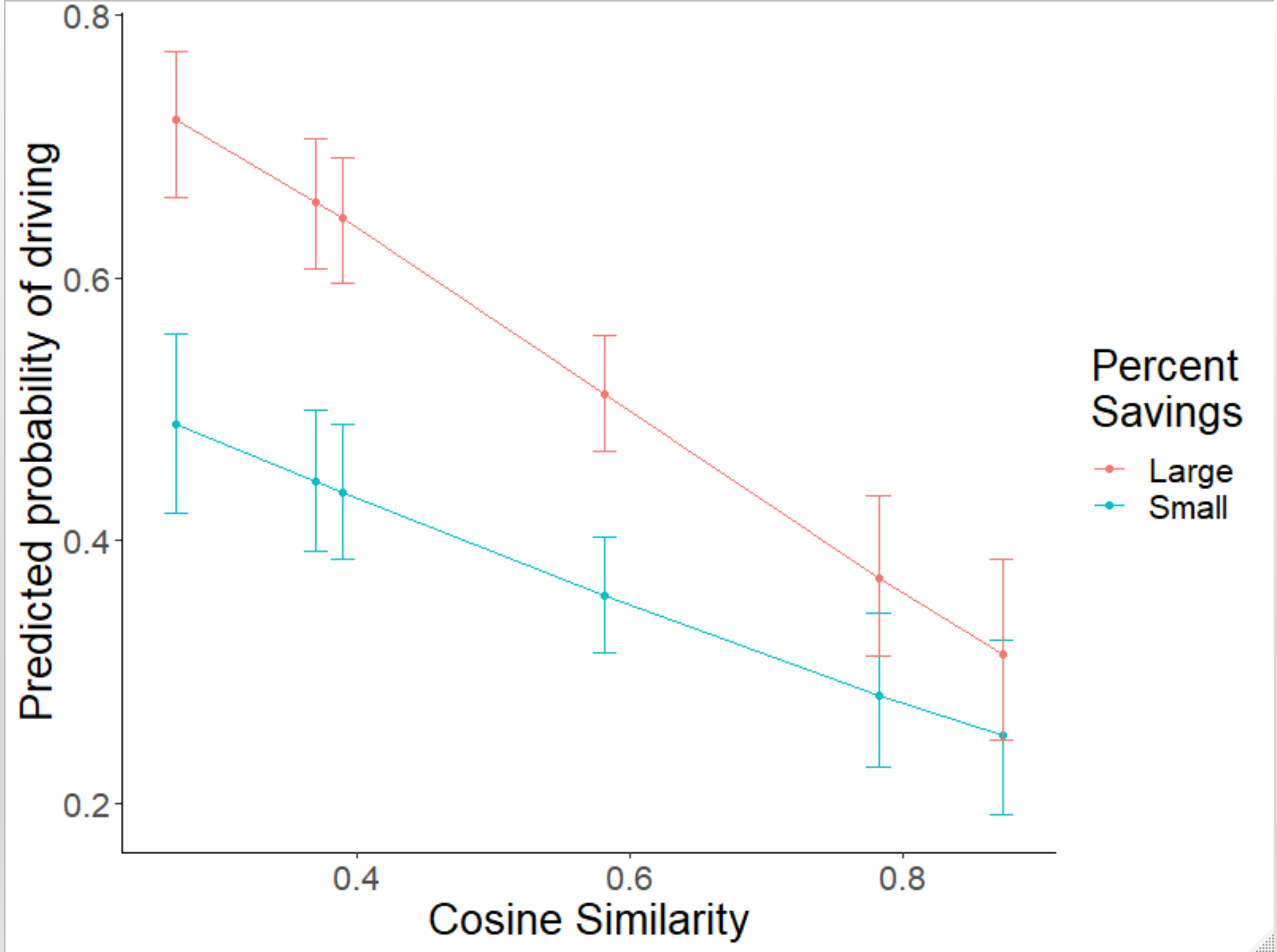
(Bonini & Rumiati 2002)


SNOWMAN
SNOWMAN


0.8
0.6
0.4
0.2
Predicted probability of driving
0.4
0.6
0.8
Cosine Similarity
Percent Savings
Large
Small


0.8
0.6
0.4
0.2
Predicted probability of driving
0.4
0.6
0.8
Cosine Similarity
Percent Savings
Large
Small


0.8
0.6
0.4
0.2
Predicted probability of driving
0.4
0.6
0.8
Cosine Similarity
Percent Savings
Large
Small


0.8
0.6
0.4
0.2
Predicted probability of driving
0.4
0.6
0.8
Cosine Similarity
Percent Savings
Large
Small

Vector Space Models

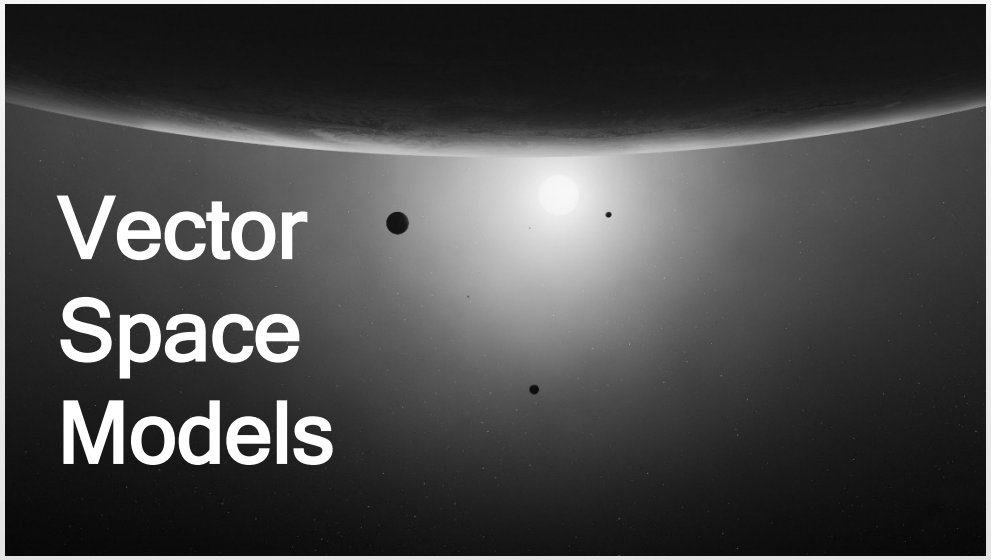
	AIC	Pseudo R^2
Participant Ratings	1434.8	.07
Cosine Similarity	**1395.7**	**.12**

Predict how expenses are budgeted

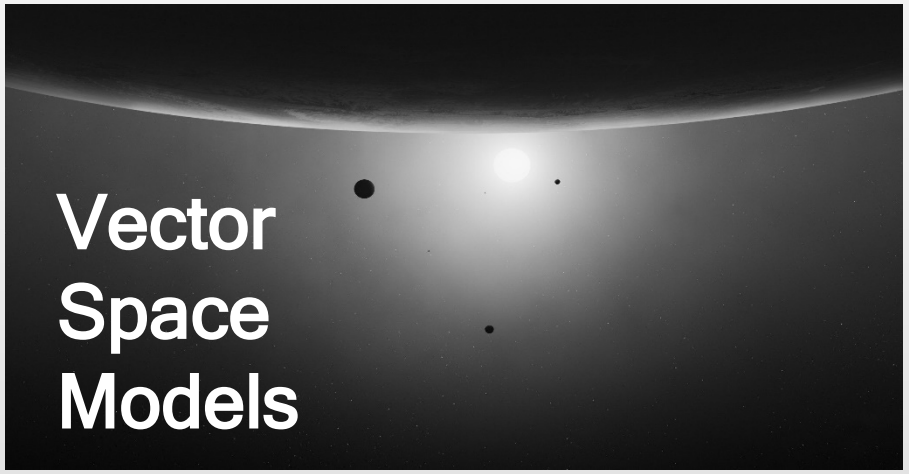
Predict why exceptional expenses are grouped into more categories than ordinary expenses

Predict when people flexibly categorize expenses

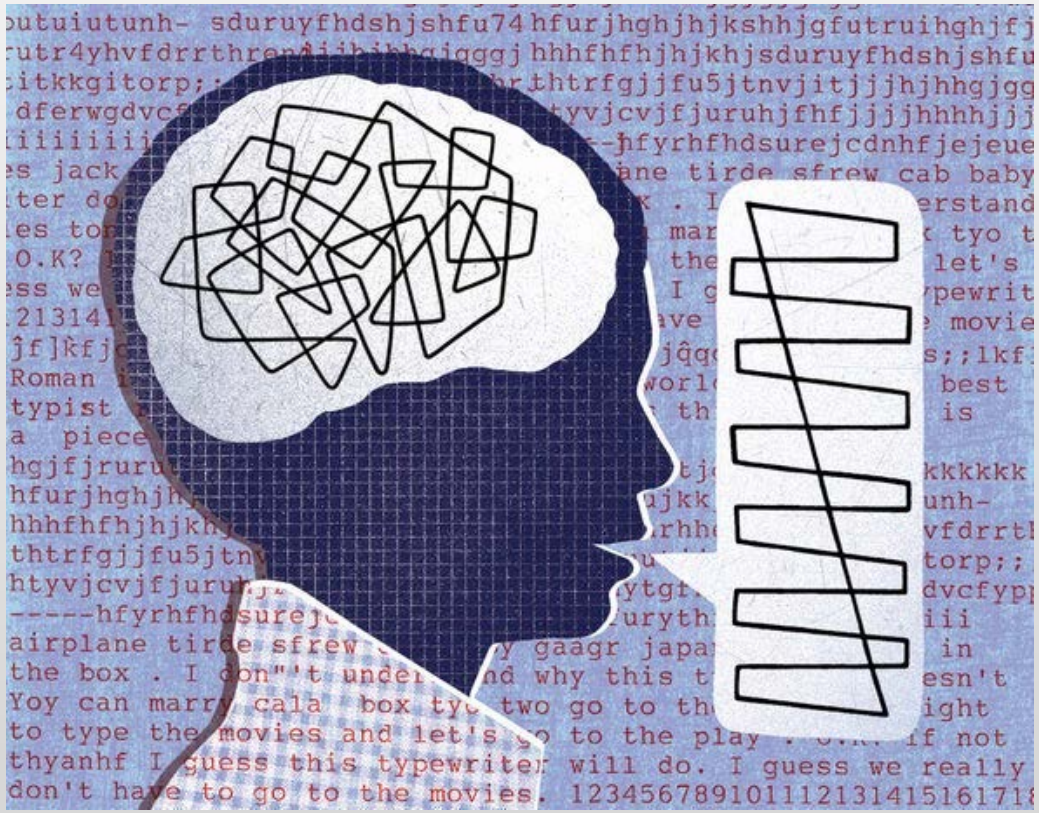
Predict creation of topical mental account better than participant ratings of similarity




Where do mental accounts come from?



(Jones & Mewhort, 2007; Bhatia, 2017)


sduruyfhdshjshfu74
hhhfhfhjhjkhjsduruyfhdshjshfu
thtrfgjjfu5jtnvjitjjjhjhhgjgg
hfyrhfhdsurejcdnhfjejeue
airplane tirde sfrew
the box . I don"'t
Yoy can marry cala box
to type the movies and let's go to the play
thyanhf I guess this typewriter will do. I guess we really
don't have to go to the movies.