

Determinants of category-based induction: the role of conceptual structure

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Induction using categories

- People use categories to make inductive inferences
- Object_A \rightarrow Bird
 - can fly, have feathers
- Person_B \rightarrow Linguist/Psychologist
 - poor,

- **Example:**
- Compassionate conservative
 - → tax breaks for the rich

Previous studies

- Syntactic categories, such as verbs, nouns, and adjectives, guide category-based induction.
- Count nouns
- When an object is characterized with a count noun,
 - → activate the prototype of the category.

Previous studies

- Count noun → activates the dominant features of a category and
- Use the dominant features (e.g., prototypes, family resemblance information) for category-based induction
 - Gelman & E. Markman (1986)
 - Rips (1975)
 - Murphy & Ross (1995)
 - Yamauchi & A. Markman (2000a, 2000b, 2002)

Family resemblance-based account

- A categorical statement (category label --- **Japanese**) activates
 - the dominant features of that category.
 - Because these features are **contained** in that category.
 - *Takashi likes sushi.*

Traditional Account

- Count noun
- → activates an abstract summary of a category
 - (Prototype, Family resemblance)
- → make inductions based on the prototype

My point:

- Show that this Count Noun Prototype-based account does **NOT** explain everything.
- There is something more in category-based induction.
- What's more?
 - Not a syntactic group **but conceptual structure** of a category influences category-based induction

To investigate category-based induction,

- Examine “labeling effect”
 - Overestimation of attributes due to labeling.

Labeling effect

- **John is a liberal.**
- John is liberal.

- **Linda is a feminist.**
- Linda believes in and supports feminism.

- Linda is a feminist.
 - categorical statement
- Linda believes in and supports feminism.
 - – descriptive statement
- Categorical statements
 - → people tend to overestimate/overemphasize a dominant characteristic of the category.
 - E.g., Linda is interested in politics.

Labeling effect

- “Labeling effect”
 - Overestimation of features due to labeling.
- My goal:
 - Examines the source of the labeling effect.
 - What causes the labeling effect?
 - Count noun → Prototype?

An account for the labeling effect

- Family resemblance
 - A categorical statement (category label) activates
 - the dominant features /exemplars of that category.
 - Because these features/exemplars are **contained** in that category.
 - these features/exemplars become particularly salient given a categorical statement.
 - Rips (1975); Gelman & Heyman (1999); Yamauchi & Markman (2000a, 2000b, 2001).
 -

Is this correct?

Goal of my talk

- Show that this family resemblance-based account does **NOT** explain everything.
 - There is more in category-based induction
- What's more?
 - Category-based induction derives from the specific **conceptual structure** associated with categorical representation.

Outline

- Exp. 1.
 - Demonstrate the labeling effect using adult subjects.
- Exp. 2.
 - Describe some cases when the family resemblance-based account is difficult.
- Exp. 3
 - Provide an new account for the labeling effect.

Exp. 1

- Design:
 - 2 conditions
 - Descriptive condition & Categorical condition
 - (between-subjects manipulation)
- Task:
 - Ss read statements about people and estimated the attributes of the people described in each statement.

– **Descriptive condition**

- **Linda believes in and supports feminist philosophy at heart.** She is concerned with issues of discrimination and social justice.
 - **Task:**
 - Estimate the likelihood of A & B with a 1-100% scale.
 - » A. Linda likes to watch presidential debates.
 - » B. Linda works as a bank teller.

– **Categorical condition**

- **Linda is a feminist.** She is concerned with issues of discrimination and social justice.
 - **Task:**
 - Estimate the likelihood of A & B with a 1-100% scale.
 - » A. Linda likes to watch presidential debates.
 - » B. Linda works as a bank teller.

Dependent measure

- Subjects' estimation scores given to A & B in the two conditions.

Major & minor attributes

- **Linda is a feminist.** She is concerned with issues of discrimination and social justice.
 - A. Linda likes to watch presidential debates. (**Major attributes**)
 - B. Linda works as a bank teller. (**Minor attributes**)
- Question is
 - What happens to minor attributes? The labeling effect in minor attributes?

- 15 stimulus statements

feminist

truck driver

art collector

fierce competitor

stamp collector

aerobics instructor

amateur poet

Korean

New Yorker

outspoken liberal

over-achiever

high-school drop-out

party animal

millionaire

drug addict

Major attributes (attributes consistent with the category norm)

Feminist

watch presidential debates.

truck driver

play softball on Sundays.

avid art collector

has a vacation house in Florida.

fierce competitor

likes action movies.

aerobics instructor

loves rock-climbing.

Amateur poet

writes short stories for a hobby.

Minor attributes (attributes inconsistent with the category norm)

Feminist

works as a bank teller.

truck driver

Jack's hobby is watching birds.

avid art collector

loves to watch professional wrestling.

fierce competitor

Ted's hobby is writing poems.

aerobics instructor

smokes at least one pack of cigarettes a day.

Amateur poet

trades stocks using the Internet.

The two types of statements were roughly equivalent

- 186 students read the 15 statements in the Descriptive condition, and answered category questions.
 - Linda believes in and supports feminist philosophy at heart. She is concerned with issues of discrimination and social justice.
 - » Is Linda a feminist?
 - Average estimate → 95%

Feminist: 93%

truck driver: 95%

avid art collector: 97%

fierce competitor: 97%

avid stamp collector: 97%

aerobics instructor: 98%

amateur poet: 92%

Korean : 98%

New Yorker: 97%

outspoken liberal: 93%

typical over-achiever: 92%

high-school drop-out: 97%

party animal: 96%

Millionaire: 97%

drug addict: 98%

Average: 95.3%

Results:

Categorical vs. Descriptive (Major attributes)

	Categorical	Descriptive
feminist	72.2	67.2
truck driver	57.3	52.3
avid art collector	39.6	29
fierce competitor	72.2	68
avid stamp collector	39.7	35.9
aerobics instructor	63.5	59.6
amateur poet	59.4	48.8
Korean	78.2	72.2
New Yorker	53.8	49.1
outspoken liberal	80.9	81.2
typical over-achiever	55.6	48.9
high-school drop-out	45.2	41.9
party animal	61.9	51.3
millionaire	69.8	63.7
drug addict	77.4	74.7
average	61.8	56.3
Cell count	14	1
Binomial test	p=0.0005	
signed-rank test	p=0.001	
paired t-test	p<0.001	

e.g., Linda likes to watch presidential debates.

N=113 (Descriptive)
N=116 (Categorical)

Categorical vs. Descriptive (Minor attributes)

	Categorical	Descriptive
feminist	36.8	30.8
truck driver	17.6	13.7
avid art collector	12.6	12.6
fierce competitor	18.9	17.3
avid stamp collector	20.8	18.1
aerobics instructor	12	8.6
amateur poet	25.6	23.5
Korean	22.7	19.8
New Yorker	16.7	12.9
outspoken liberal	26	21.4
typical over-achiever	14.1	16.2
high-school drop-out	13.1	13.4
party animal	20.7	21.2
millionaire	6.1	6.8
drug addict	10.9	10.7
average	18.3	16.5
Cell count	11	4
Binomial test	p=0.06	
signed-rank test	p=0.02	
paired t-test	p=0.008	

e.g., Linda works as a bank teller.

N=113 (Descriptive)

N=116 (Categorical)

Interpretations

- A labeling effect on
 - major attributes
 - minor attributes
- Inconsistent with the family resemblance-based account
 - Does the prototype of “feminist” contains the feature “bank teller”?

Minor attributes (attributes inconsistent with the category norm)

Feminist

Linda works as a bank teller.

truck driver

Jack's hobby is watching birds.

art collector

Hazel loves to watch professional wrestling.

fierce competitor

Ted's hobby is writing poems.

aerobics instructor

Julie smokes at least one pack of cigarettes a day.

Amateur poet

Laura trades stocks using the Internet.

Exp. 2

- Introduce manipulations that make the family resemblance-based account difficult.
 - Manipulations:
 - Use ad hoc categories (Barsalou, 1983, 1985)
 - Asked entirely irrelevant attribute questions
 - very difficult to make associations

Prediction

- Ad hoc categories do not have a family resemblance structure. They are organized with goals and ideals.
 - → If family resemblance is only the source of the labeling effect, then it should disappear in this Exp.
 - → If the labeling effect comes from another source, then it should be still present.

15 ad hoc categories

birthday gift

diet food

winter clothing

holiday activity

vacation site

suburban car

children's game

honeymoon site

health food

winter sport

Asian food

tabloid journal

healthy exercise

summer food

ethnic restaurant

Notes: 3 ontological categories: places, events, & things (Jackendoff, 1983)

Categorical vs. Descriptive conditions

Categorical statements

“KINATE” is a diet food. It is rich in protein but has no fat.

Descriptive statements

Many people who are dieting eat “KINATE” to reduce their weight. It is rich in protein but has no fat.

Irrelevant questions

Many people who are dieting eat “KINATE” to reduce their weight. It is rich in protein but has no fat.

A. People who like KINATE love baseball but not basketball.

B. KINATE sells well in mid-size cities.

C. KINATE is a diet food.

(C. Is included only in the Descriptive condition.)

Results:

	Categorical	Descriptive
birthday gift	44.4	36
diet food	45.4	33
winter clothes	30.9	22.1
popular holiday activity	43.6	26.1
popular vacation site	34.2	18.6
suburban car	50.2	34.4
children's play	43.5	33.9
honeymoon site	34.8	26.4
health food	46.3	28.8
summer food	39.1	21.6
popular winter sport	33.8	22.1
Asian food	25.8	14.9
tabloid journal	39.1	23.6
healthy exercise	41.3	29
ethnic restaurant	48.9	34.9
Average	40.1	27
Cell count	15	0
binomial test	p<0.0001	
signed rank test	p=0.001	
Paired-ttest	p<0.0001	

The data in the Descriptive condition were taken from those who responded with 100% for the categorical questions -- C.

of responses = 161 (Categorical)

of responses = 62 (Descriptive)

Summary

- The labeling effect was present
 - even for ad hoc categories.
 - even when irrelevant questions were asked.
- Interpretation
 - It is difficult to account for these results with the family resemblance explanation.

So, what's going on?

- Where does the labeling effect come from?

Hypothesis

- Category-based induction derives from “conceptual structure” pertinent to categorical knowledge.
- Categories are structurally characterized as “type/region” and are distinguished from “token/instance.”
- “type/region” and “token/instance” have different conceptual structures.
 - Jackendoff, 1983; Langacker, 1987; 1991

Type vs. token

- “Dog” → type/token, region/instance
 - I love dogs → dogs in general. → **type, region**
 - I love my uncle’s dog → a single specific dog (instance) → **token, instance**

Type vs. Token

Region vs. Instance

- “Type” and “token” are conceptually distinguished.
 - Jackendoff, 1983; Langacker, 1987; 1991
- If the labeling effect stems from a conceptual structure associated with “type/region”
 - Modifying a categorical statement **from a type to a token** should eliminate the labeling effect.

Exp. 3

- 3 conditions
- Descriptive = Exp. 2
 - Many people who are dieting eat “KINATE” to reduce their weight.
- Categorical (type) = Exp. 2
 - “KINATE” is a diet food.
- Instance (token)
 - “KINATE” is **the** diet food **that Susan eats every morning.**

– **Descriptive**

- Many people who are dieting eat “KINATE” to reduce their weight. It is rich in protein but has no fat.
 - A. People who like KINATE love baseball but not basketball.
 - B. KINATE sells well in mid-size cities.
 - C. KINATE is a diet food.

– **Categorical**

- “KINATE” is a diet food. It is rich in protein but has no fat.
 - A. People who like KINATE love baseball but not basketball.
 - B. KINATEE sells well in mid-size cities.
 - C. Many people who are dieting eat “KINATE” to reduce their weight.

– **Instance (token)**

- “KINATE” is the diet food that Susan eats every morning. It is rich in protein but has no fat.
 - A. People who like KINATE love baseball but not basketball.
 - B. KINATEE sells well in mid-size cities.
 - C. Many people who are dieting eat “KINATE” to reduce their weight.

Categorical vs. Descriptive

	Categorical	Descriptive
birthday gift	35.5	35.8
diet food	38.3	32.2
winter clothes	22.7	21
popular holiday activity	39.6	32.7
popular vacation site	25.5	20.1
suburban car	43	43.1
children's play	36.1	34.1
honeymoon site	27.7	23
health food	37.3	30.7
summer food	32.9	24.6
popular winter sport	21	17.3
Asian food	17.5	18.9
tabloid journal	23.5	21.9
healthy exercise	39.1	28.3
ethnic restaurant	41.6	33.5
Average	32.1	27.8
Cell count	12	3
binomial test	p=0.02	
signed rank test	p=0.002	
Paired-ttest	p=0.001	

Categorical:

“KINATE” is a diet food.

Descriptive:

Many people who are dieting eat “KINATE” to reduce their weight.

of responses =46.2
(categorical condition)

of responses =60.1
(descriptive condition)

Categorical (type) vs. Instance (token)

	Categorical	Token
birthday gift	35.5	32.5
diet food	38.3	27.7
winter clothes	22.7	21
popular holiday activity	39.6	32.5
popular vacation site	25.5	20.1
suburban car	43	35.6
children's play	36.1	31.5
honeymoon site	27.7	19.8
health food	37.3	26.6
summer food	32.9	25.1
popular winter sport	21	23
Asian food	17.5	17
tabloid journal	23.5	18.4
healthy exercise	39.1	25.5
ethnic restaurant	41.6	33

Average	32.1	26
Cell count	14	1
binomial test	p=0.0005	
signed rank test	p=0.001	
Paired-ttest	p<0.0001	

Categorical:

“KINATE” is a diet food.

Token:

“KINATE” is the diet food that that Susan eats every morning.

of responses =46.2
(categorical condition)

of responses =40.6
(specific categorical condition)

Descriptive vs. Instance (token)

	Descriptive	Token
birthday gift	35.8	32.5
diet food	32.2	27.7
winter clothes	21	21
popular holiday activity	32.7	32.5
popular vacation site	20.1	20.1
suburban car	43.1	35.6
children's play	34.1	31.5
honeymoon site	23	19.8
health food	30.7	26.6
summer food	24.6	25.1
popular winter sport	17.3	23
Asian food	18.9	17
tabloid journal	21.9	18.4
healthy exercise	28.3	25.5
ethnic restaurant	33.5	33
Average	27.8	26
Cell count	11	4
binomial test	0.06	
signed rank test	0.04	
Paired-ttest	0.03	

Descriptive:

Many people who are dieting eat “KINATE” to reduce their weight.

Token categorical:

“KINATE” is the diet food that that Susan eats every morning.

Summary

- The labeling effect was present
 - even for ad hoc categories.
 - even when irrelevant questions were asked.
- The labeling effect disappeared when
 - The label pointed to a specific instance(token).

Interpretation and implications

- It is difficult to account for these results with the association between the syntactic category (count noun) and underlying features.
- The labeling effect has something to do with the conceptual structure associated with a “category” in general – “type” as distinguished from “token/instance.”

