A Perceptual Space for Describing Human Bodies

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Problem

- people commonly describe bodies using descriptors (e.g. skinny, curvy, heavyset, stocky, fit, muscular, built, petite) – Can descriptions be used to reverse engineer a representational space to describe body similarities?

Goals

- create multidimensional representation of human body shapes based on *perceptual* judgments
- map shape variation across *individual bodies* using *body feature descriptors*
- represent both bodies and body descriptor terms in a common multidimensional space

Long Term Goals

- relate perceptual body spaces to physical body spaces
  - (e.g., from laser scans of bodies, Freifeld & Black, 2012)
- map body descriptions onto perceptual and physical body spaces

Background

- **Adaptation and Norm-based Coding Studies of Body Perception**
  - identity aftereffects within two bodies (Rhodes, Jeffery, Boeing, & Calder, 2013)
  - weight & gender adaptation invariant for viewpoint and pose
    - virtual bodies from space of 2000 laser scans (Sekunova, et al., 2013)
  - silhouettes of bodies yield gender adaptation aftereffects (Palumbo, Laeng, & Tommasi, 2013)
  - rectangle width adaptation does not explain weight adaptation (Hummel, et al., 2012)

Approach

- participants rate the applicability of body descriptor terms to a large number of bodies
- correspondence analysis (Greenacre, 2010) separately to male and female body descriptions
  - shared perceptual *body* and *feature descriptor* space: male and female bodies
  - enables visualization of feature terms and bodies in common space

Method

Participants
- 60 undergraduate students (30 male)

Stimuli
- 224 identities: 164 female, 60 male (O'Toole, Harms, Snow, Hurst, Pappas, & Abdi, 2005)
- 2 images per identity: one standing, one walking (448 images total)
- blurred to obscure facial identity

Procedure
- each participant rated 75 identities on 27 feature descriptors
- total 2,025 judgments

Body Feature Descriptors

body size terms
- big, small, short, tall, heavyset, stocky, skinny, petite

global shape terms
- round (apple), rectangular, long, pear-shaped, curvy

fitness terms
- lean, fit, muscular, built, sturdy

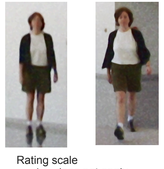
local feature terms
- long legs, short legs, long torso, short torso, broad shoulders

averageness terms
- average, proportioned

gender terms
- masculine, feminine

Correspondence Analysis

- multivariate technique similar to principal component analysis
- used for categorical rather than continuous variables
- visualization of cross-tabular data
- *simultaneous visualization of observations and variables*



Rating scale
1. does not apply
2. applies somewhat
3. applies perfectly

Results

Interpretation

Axis	Female		Male
1	weight	⟷	weight
2	height	⟷	height
3	female shapes vs. "other"	⟷	male shapes vs. "other"
4	masculine vs. curvy	⤡	waist height
5	waist height	⤢	toned vs. average

Contributing descriptor terms

Female Bodies: Axes 1-4		
←	AXIS	→
big, heavyset, round (apple), stocky	**axis 1**	skinny, lean, proportioned
short, short legs, small, petite, pear-shaped	**axis 2**	tall, long, long legs
skinny, round (apple), lean, petite, small, fit	**axis 3**	pear-shaped, curvy
masculine, rectangular, average, broad shoulders, muscular, long torso, short legs	**axis 4**	curvy
long torso, pear-shaped, short legs	**axis 5**	short torso, long legs

Male Bodies: Axes 1-4		
←	AXIS	→
heavyset, round (apple), big, stocky	**axis 1**	skinny, lean, fit
short, average, short legs, small, feminine, short torso	**axis 2**	tall, big, fit, muscular
skinny, long, small, long legs	**axis 3**	muscular, built, fit
long torso, short legs, skinny, average	**axis 4**	short torso, long legs
fit, muscular, small, built, lean, skinny, short torso	**axis 5**	average, tall, long

Feature Term Pilot Study

Method

Participants
- 12 undergraduate students (6 female)

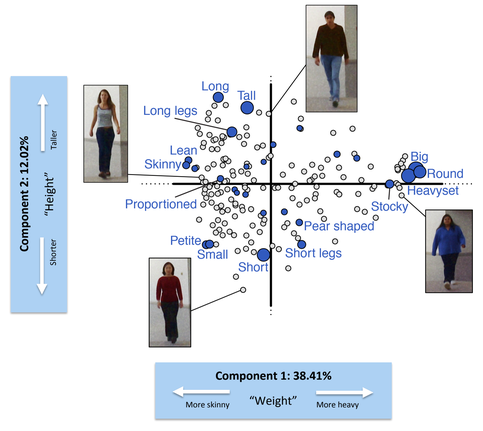
Procedure
- each participant gave open ended ratings of bodies used in main experiment

Feature selection

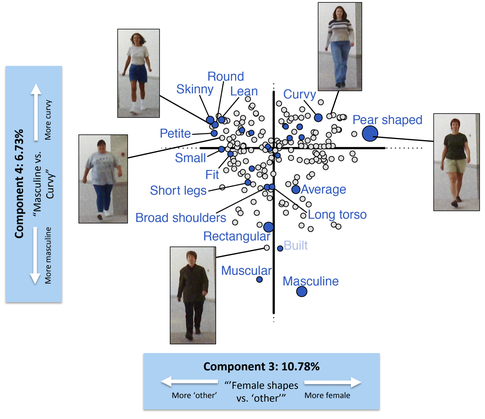
Exploratory Analysis
- categories:
  - size, global shape, fitness, local feature, averageness, gender
- descriptor terms chosen based on:
  - frequency of use within each category

females

Female Bodies: Axes 1 & 2

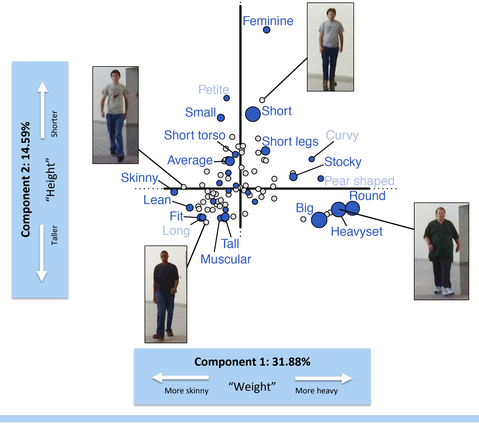


Female Bodies: Axes 3 & 4

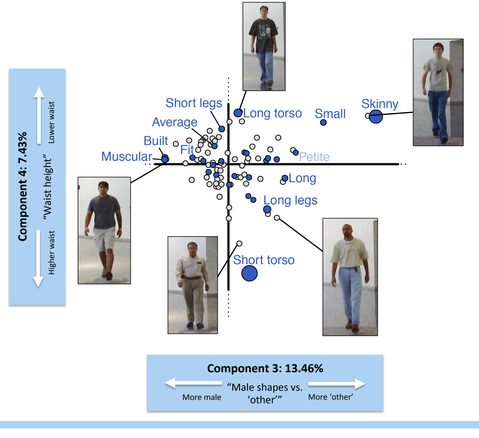


males

Male Bodies: Axes 1 & 2



Male Bodies: Axes 3 & 4

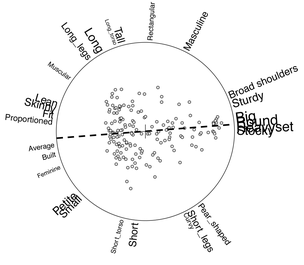


Conclusions

- possible to reverse engineer a body similarity space from body feature descriptors
- resulting spaces interpretable in the context of the feature terms
- common and gender-specific components for male and female body spaces
- space can be applied to generate similarity measures from verbal descriptions of bodies
- rating data can be used to generate verbal descriptions when physical measurements are known

Future

- test perceptual validity of body space using adaptation paradigm
- use space to find real "opposite" bodies (in progress)



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