The Theory of Affordances

Gaurav Kaul and Richard Higgins

horizontal, flat,
wide, rigid

sittable

horizontal, flat,
wide, rigid

Affordances

Gibson argues:

- If perceiving light tells us an object is:
  - flat
  - rigid
  - horizontal
  - wide

- Then perceiving light also tells us an object is sittable.

- There is no separate, distinct, cognitive loop involved in parsing perceived physical properties and deciding whether or not something can be sat on.

Affordances

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Hippos weigh ~4,000 lbs

Overview

- To a bipedal person, a floor affords standing, walking, running, and more.

- When humans develop perception, we do not develop some “objective, general perception.” People generally think of their perception as describing solely physical properties that exist in an absolute. Gibson argues otherwise.

- We all develop an ecological perception that depends on our role as animals in the world. A floor is directly perceived as walkable.

- This ecology changes depending on the animal. For walking, a floor must be rigid enough.. this changes from a puppy to a hippo.

- Value and meaning are normally abstract, affordances let us make them concrete with respect to something.

Gibson wants to “upend” **Value** and **Meaning**

Value

- a generally intangible understanding of what some object is worth
- value depends on how something is used.. Gibson’s affordances suggest that this is perceivable and different depending on ecological niche

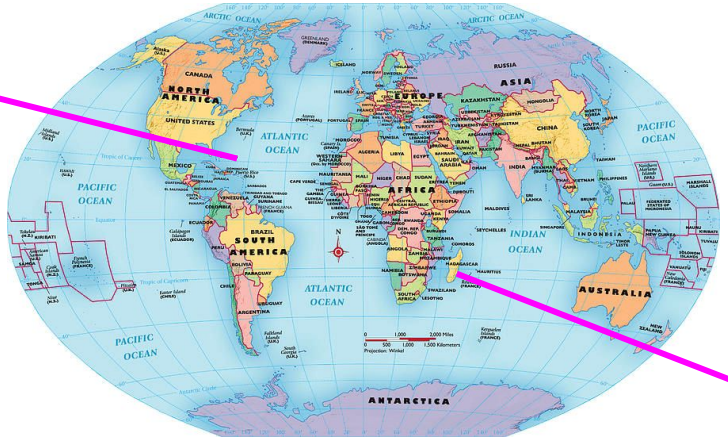
Meaning

- the inherent usable-ness of something
- using something also depends on who the user is, the meaning of a frying pan to a baby is different than to an adult

Niches | Architecture

Niches – Animals and Environments

Niches – Animals and Environments



Environment existed
BEFORE animals

Niches – Animals and Environments

Complementary process
through natural selection

Niches

- NOT the habitat
- Complementary because animals evolved
- Fits together

- “organism depends on its environment for its life, but the environment does not depend on the organism”
- sometimes there are “vacant niches”..... very controversial to ecologists*

The fundamentals of the environment

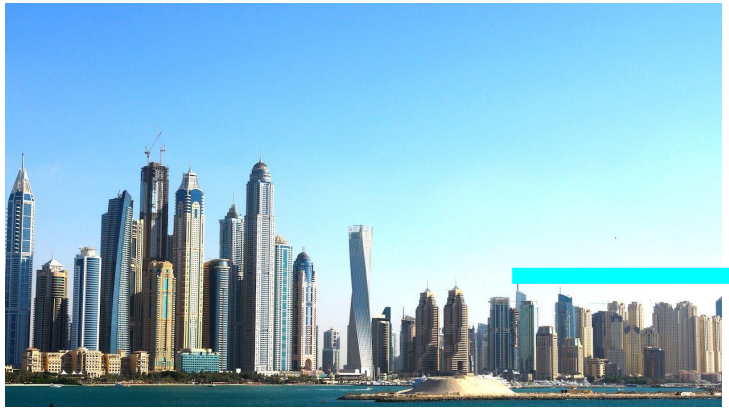
And Mankind's alterations

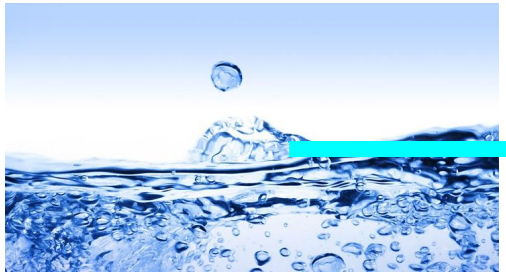
Media | What they afford

- Affords us breathing
- affords visual perception when illuminated and fog free
- can hear through it

- Affords Fish breathing
- Affords surface tension for the right kind of insect to navigate

Media | Mans Alteration





Substances | liquids and solids

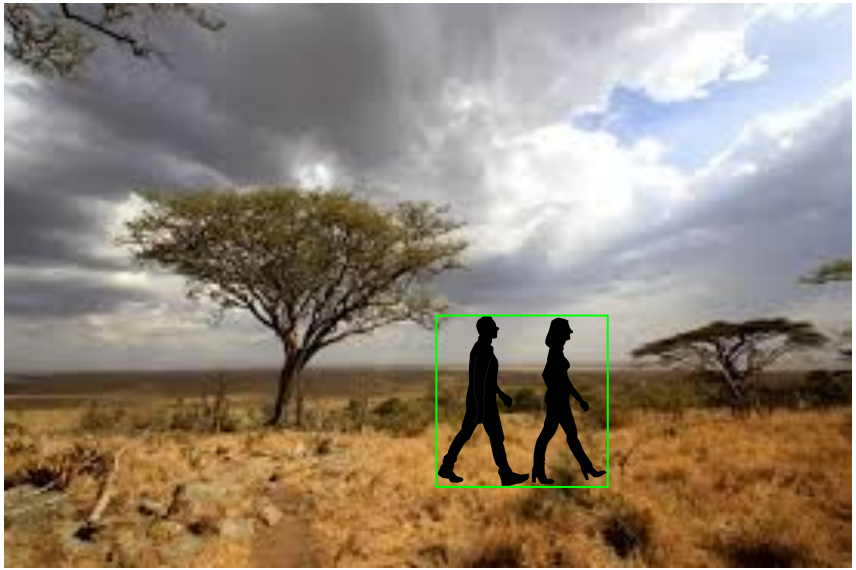
- Although a medium for fish, treated by us as mostly a substance
- Affords drinking and pouring

- Substances can afford nutrition
- Some can afford utility (ex: storage)

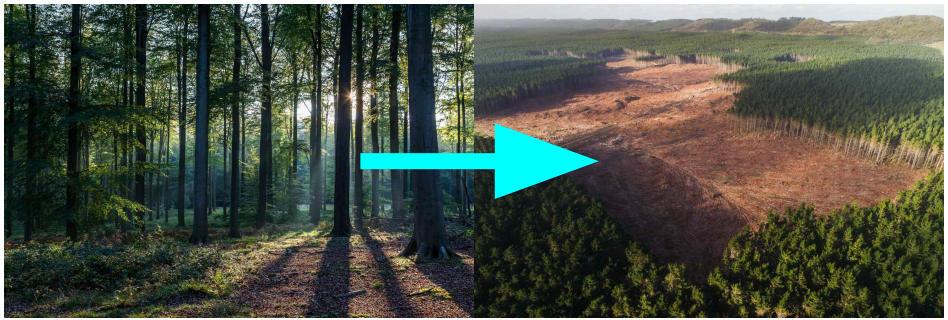
*Substances can be manipulated and manufactured

Surfaces and Layouts | Which affords locomotion?

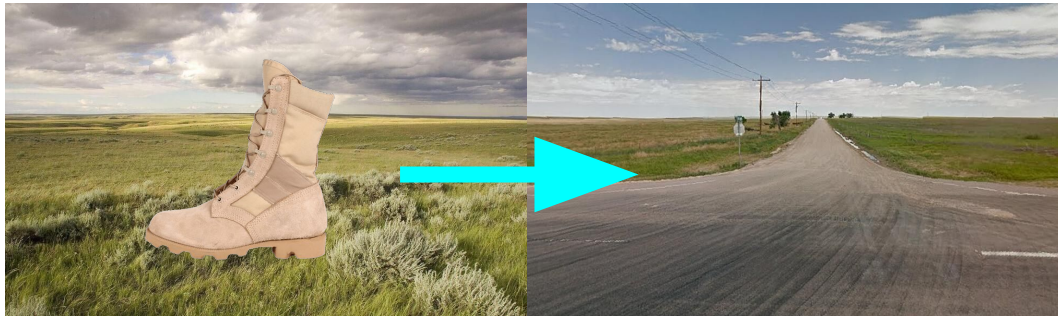
Surfaces and Layouts | It depends what animal you are!



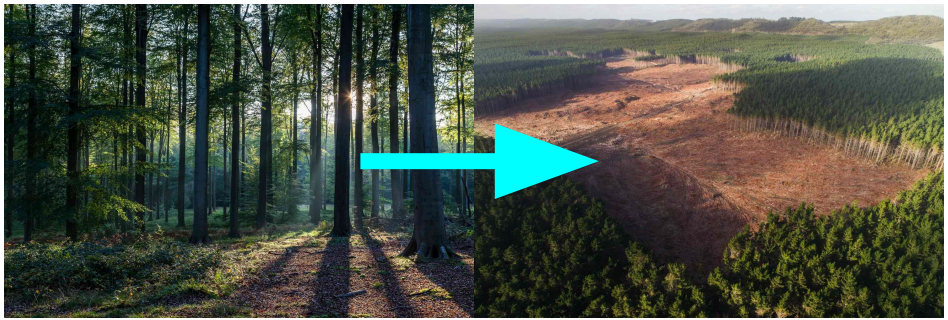
Surfaces and Layouts | Mans Alteration



“cutting, clearing, leveling, paving, building”



Surfaces and Layouts | Mans Alteration



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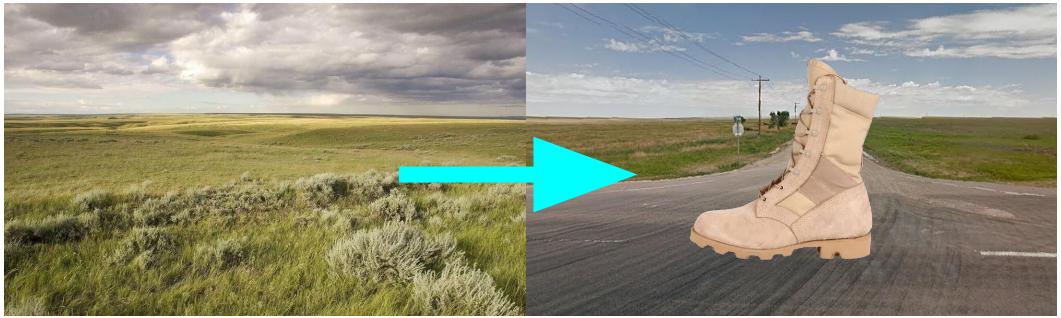


Objects | Detached objects

Affordances are not Classification

“a rock by any other name”

Affordances are not Classification

“a rock by any other name”

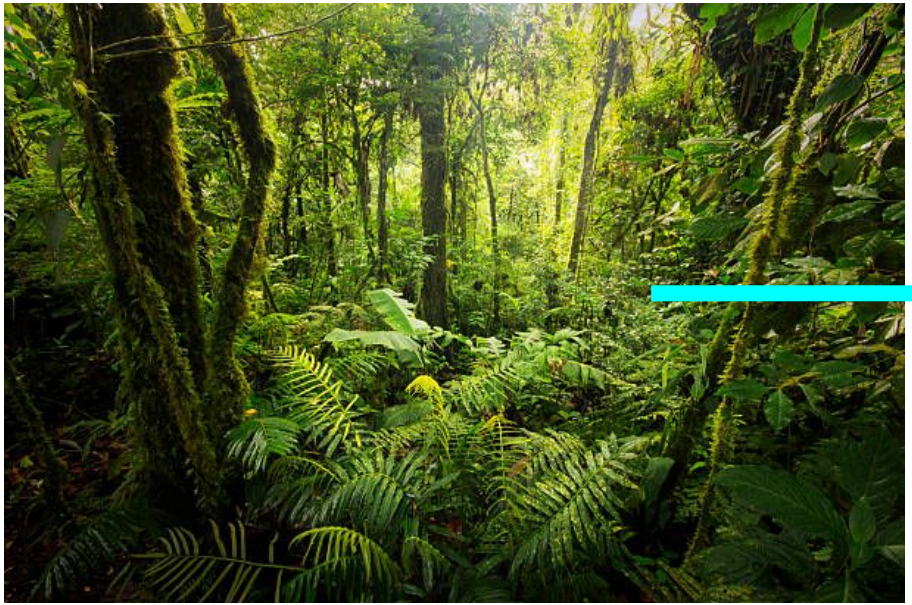
Animals and Other People

- For some, animals afford eating
- “Behavior affords behavior”
- If we squint just right, other people are objects and not humans.. they have affordances it to

Places and Hiding Places

- hiding places are concealed from others not yourself

Man’s Alteration to the World - One Jungle to Another

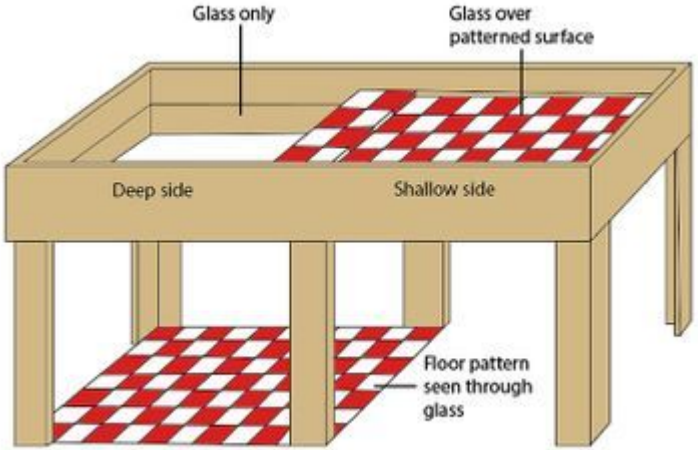


“This is not a new environment—an artificial environment distinct from the natural environment—but the same old environment modified by man”

Optics, Perception and Action

Avoiding injury | Looming and surface collisions

Avoiding dangers | Visual Cliff



Consuming plants | Fruit color

Although surface color a fruit may suggest it affords eating, We have to taste it to find out. And our **misperception** can cause injury

Interacting with the world | Opaqueness

Although opaque substances afford transparency they can also afford injury

Positive and Negative Affordances

Discussion

Gibson suggests we perceive objects' affordances and not their qualities.

Discussion

(@32_f4) Thor's hammer discussion on piazza - does the hammar afford nail driving or fighting? How can we perceive the affordances without thinking about the hammers qualities?

Discussion

(@32_f7) Are our algorithms thinking about objects affordances or qualities, How can object affordances be captured in training data? How might our system learn this? What would improve image understanding (what do we want to understand in an image)?

Further in class discussion points

- What does an observer see when perceiving an object without a goal (‘in a vacuum’), gibson would say affordances but some students suggested we would try to categorize it using qualities - which connected to the previous reading, this led to the discussion - How can this the affordance view of objects be compatible with the taxonomies? Structure we gain from taxonomies from object qualities seem like a more “digestible” world model for this task.
- qualities and affordances can be compatible - example from student, when she was younger her parents would tell he to avoid eating brightly colored mushrooms because they were dangerous, and this quality of colorforness is used to reason about how other mushrooms may afford injury - but this implies that we perceive objects qualities to reason about affordances

Further in class discussion points | cont..

- Affordances seem like an optimization on our system, because even though it may not be an ultimate tool for image understanding, it makes it easier to navigate and manipulate the world - which directly impacts the four Fs
- Kids often learn about the world through interaction, and when they see certain affordances that are possible for them (ex:table is walk-onable) they are told to stop by their parents, which makes it seem like
- What do our modern day networks perceive when looking at an object - the discussion was very interesting and led to how language gives us a common space for affordance and quality understanding, and students discussed how systems like chat gpt can see both - chatGPT prompt we discussed: “ generate 10 uses for a paper clip”