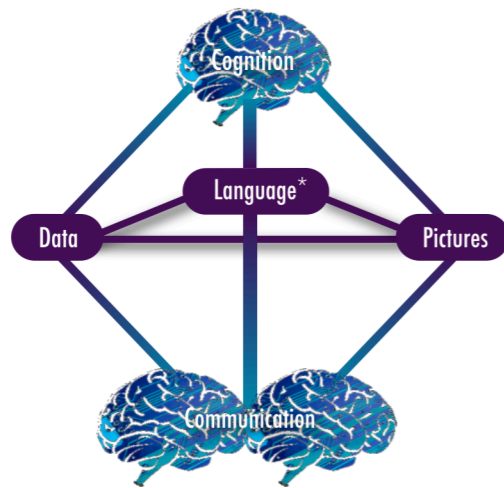


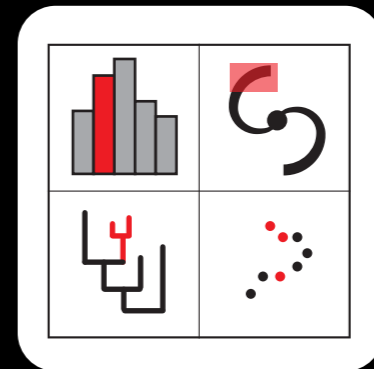
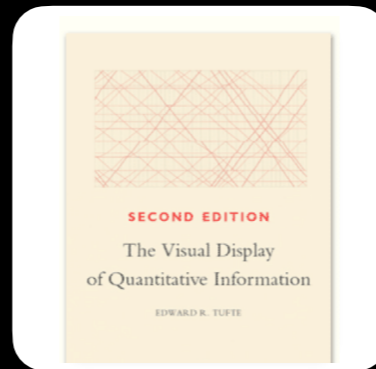
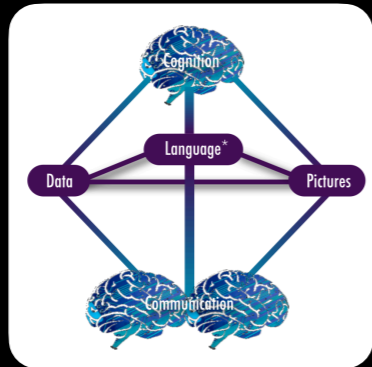
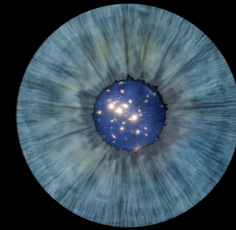
HOW TO PUBLISH 21ST SCIENCE IN A 21ST CENTURY WAY?



Alyssa A. Goodman

Harvard-Smithsonian Center for Astrophysics & Radcliffe Institute for Advanced Study

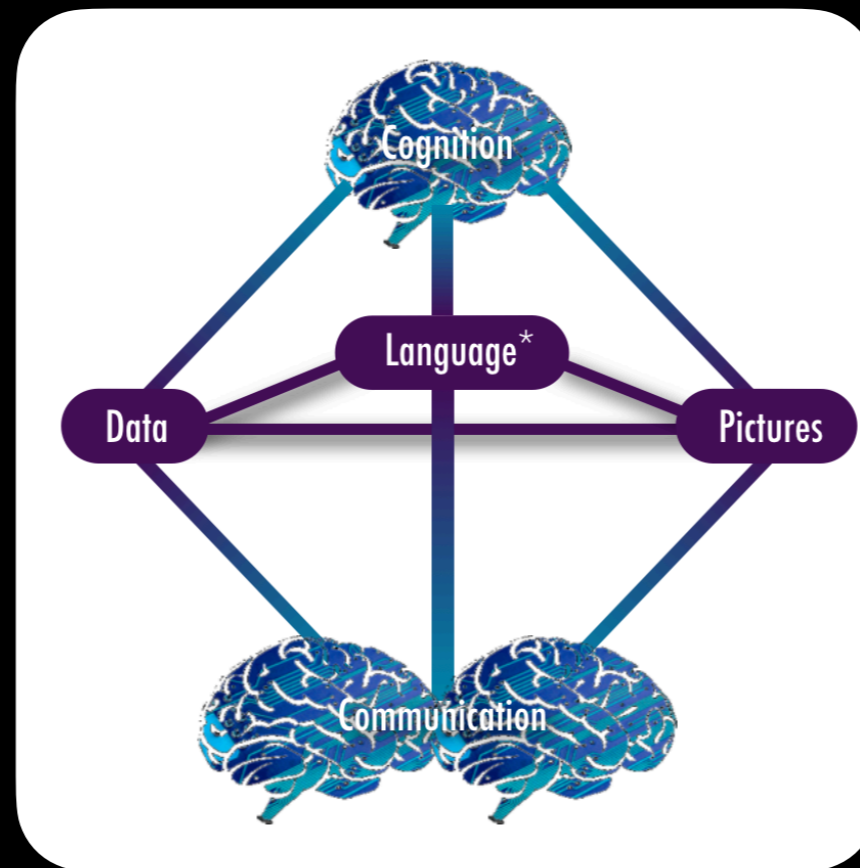
SEEING MORE OF THE UNIVERSE



Explore

Explain

“CONNECTING DATA, LANGUAGE AND PICTURES”



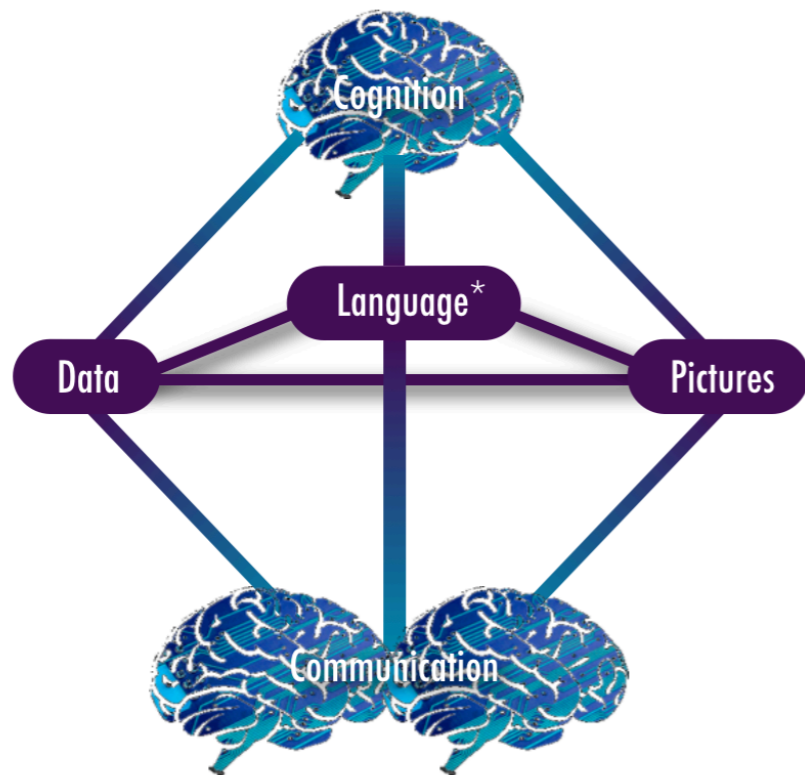
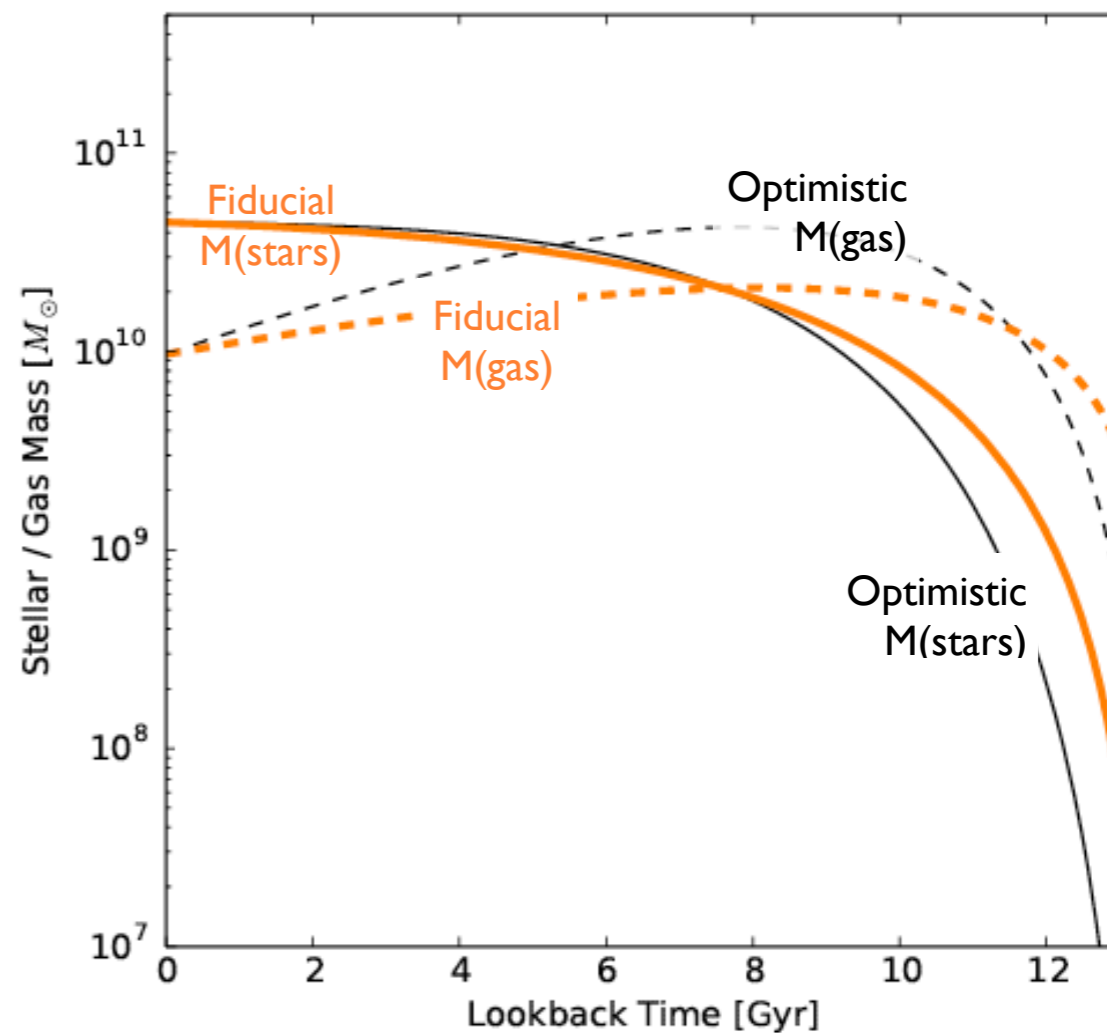
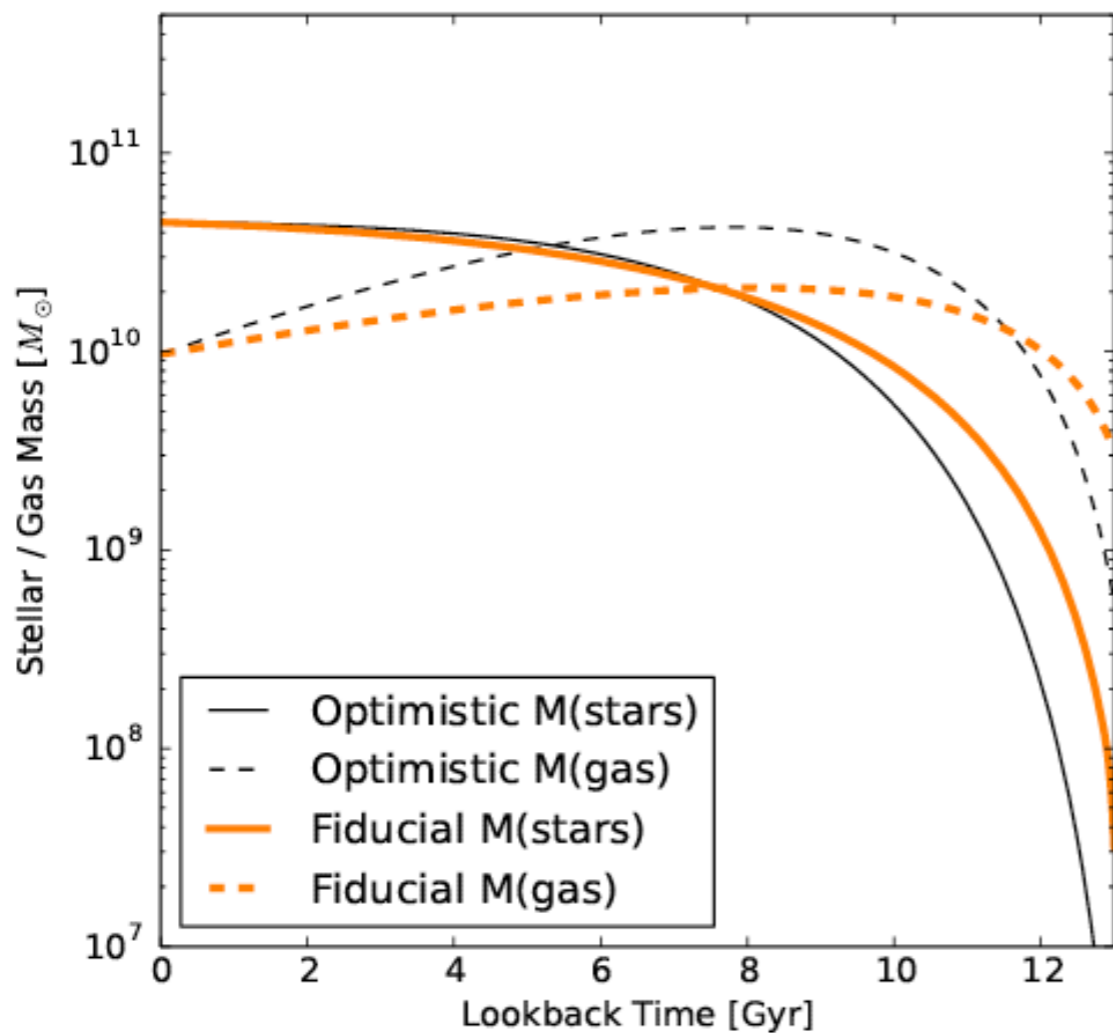
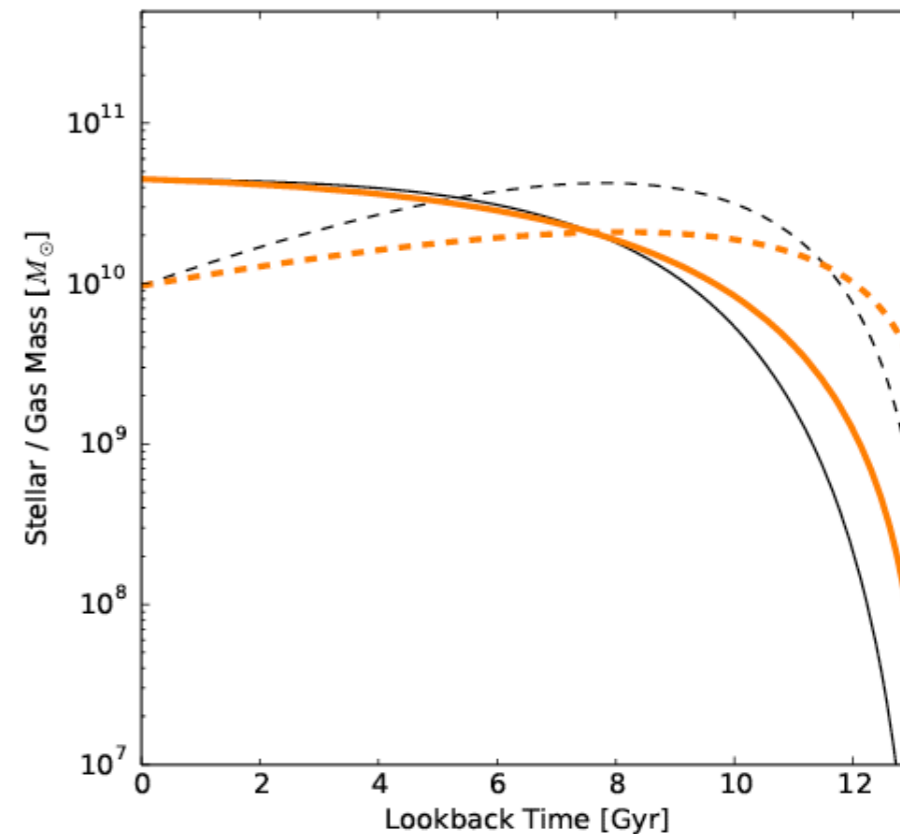
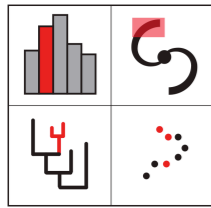


Figure Caption: The solid/solid black line shows the optimistic case for $M(\text{stars})/ M(\text{gas})$. The orange lines show the same quantities, for the fiducial case.





glue
multidimensional data exploration

 **plotly**

enabled by d3.js (javascript) outputs

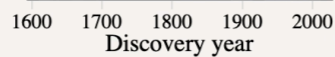
d3po

d3po is a project designed to allow an astronomer (or an interactive, publication-quality figure that has staged built can be previewed at d3po.org, and represents a figure from figure describes how metallicity affects color in cool stars, dragging in the scatter plots to understand the power of lin

Right now we are in search of alpha testers, who have figured their hands a little dirty (No javascript skills needed). In future figures interactively. We are also exploring [implementation](#) of version expected in January 2014.

Installing your own d3po server

```
git clone git@github.com:adnr/d3po.git
cd d3po
virtualenv --no-site-packages venv
source venv/bin/activate
pip install -r pip-requirements.txt
python run.py
```



- Four Centuries of Discovery
- A Chasm in Mass
- Little Siblings
- Close Cousins
- The Strangers

After Galileo discovered the first four moons of Jupiter, it took nearly three hundred years to discover the next one.

The "Paper" of the Future

Authorea preprint 02/21/2017 DOI: 10.22541/au.148769949.92783646

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Hope How-Huan Chen (Harvard University)
Merce Crosas (Harvard University)
Christopher Erdmann (North Carolina State University)

And 3 more...

A 5-minute video demonstration of this paper is available at [this YouTube link](#).

1 Preamble

A variety of research on human cognition demonstrates that humans learn and communicate best when more than one processing system (e.g. visual, auditory, touch) is used. And, related research also shows that, no matter how technical the material, most humans also retain and process information best when they can put a narrative "story" to it. So, when considering the future of scholarly communication, we should be careful not to do blithely away with the linear narrative format that articles and books have followed for centuries: instead, we should enrich it.

Much more than text is used to communicate in Science. Figures, which include images, diagrams, graphs, charts, and more, have enriched scholarly articles since the time of Galileo, and ever-growing volumes of data underpin most scientific papers. When scientists communicate face-to-face, as in talks or small discussions, these figures are often the focus of the conversation. In the best discussions, scientists have the ability to manipulate the figures, and to access underlying data, in real-time, so as to test out various what-if scenarios, and to explain findings more clearly. **This short article explains—and shows with demonstrations—how scholarly "papers" can morph into long-lasting rich records of scientific discourse**, enriched with deep data and code linkages, interactive figures, audio, video, and commenting.

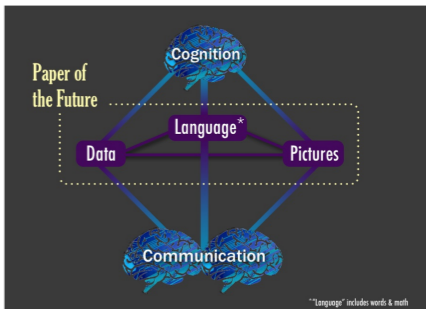


Fig. 1

The Paper of the Future should include seamless linkages amongst **data**, **pictures**, and **language**, where "language" includes both words and math. When an individual attempts to understand each of these kinds of information, different cognitive functions are utilized: communication is inefficient if the channel is restricted primarily to language, without easy interconnection to data and pictures.

WATCH a DEMO video, and find S/W links, on  **YouTube** at tinyurl.com/PotF-Demo

many thanks to Alberto Pepe, Josh Peek, Chris Beaumont, Tom Robitaille, Adrian Price-Whelan, Elizabeth Newton, Michelle Borkin & Matteo Cantiello for making the PotF possible.

PUBLISHING'S INTERACTIVE CUTTING-EDGE & (AUGMENTED) FUTURE



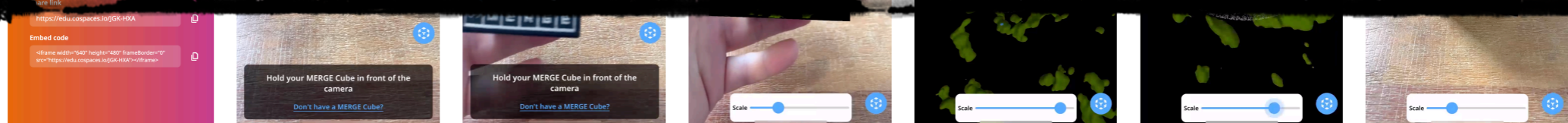
nature

PUBLISHED IN
NATURE
1-2020
ALVES ET AL.
(THE RADCLIFFE WAVE)



AUGMENTED REALITY
PROPOSED TO NSF
11-2020

This interactive 3D visualization of the Radcliffe Wave is available in the online version of the published *Nature* article. It was built using the plotly exporter plugin inside the glue visualization software. Click on any layer in the legend (at right) to turn it on and off, and see how the



a

b

c

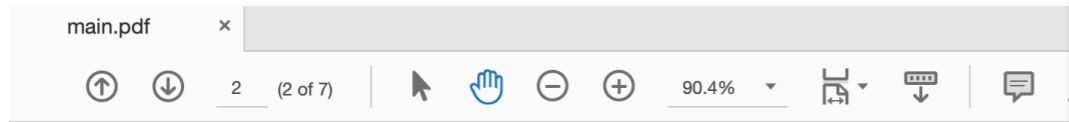
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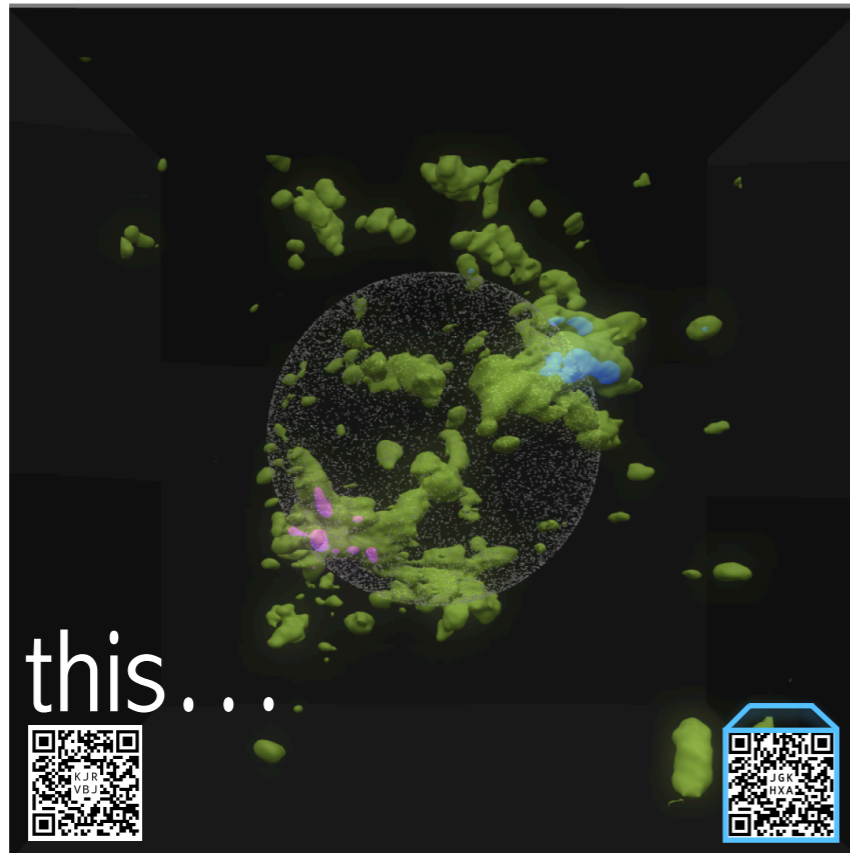
f

g

PUBLISHING'S INTERACTIVE CUT (AUGMENTED) FUTURE



2



scan this...

...see this

FIG. 1.— Density $n = 5 \text{ cm}^{-3}$ iso-surfaces in the Perseus-Taurus region as derived from 3D-dust extinction observations. The coordinates are the 3D galactic $x-y-z$ coordinates (see footnote 1). Overlaid is our spherical shell model (Eq. 5). The positions of Perseus and Taurus and the sun are indicated.

It is useful to express the results in terms of gas density. We first derive a conversion factor which we use to convert the reported dust opacity density s , into gas Hydrogen nuclei particle density n (units: cm^{-3}). The gas column density and dust extinction are related through the wavelength-dependent extinction curve, A_λ/N_H , where A_λ is the dust extinction at wavelength λ and N_H is the H nuclei column density. For the Gaia G-band, $\lambda = 673 \text{ nm}$ (central wavelength), $A_G/N_H = 4 \times 10^{22} \text{ mag cm}^2$ (reference XXX). In terms of the dust opacity $\tau_G/N_H = 3.7 \times 10^{-22} \text{ cm}^2$. Following the definition of s_x we get

$$\Delta N_H = s_x \left(\frac{\tau_G}{N_H} \right)^{-1} \frac{\Delta L}{\text{pc}}. \quad (2)$$

Dividing by ΔL we obtain the gas density (averaged over the 1 pc^3 resolution element):

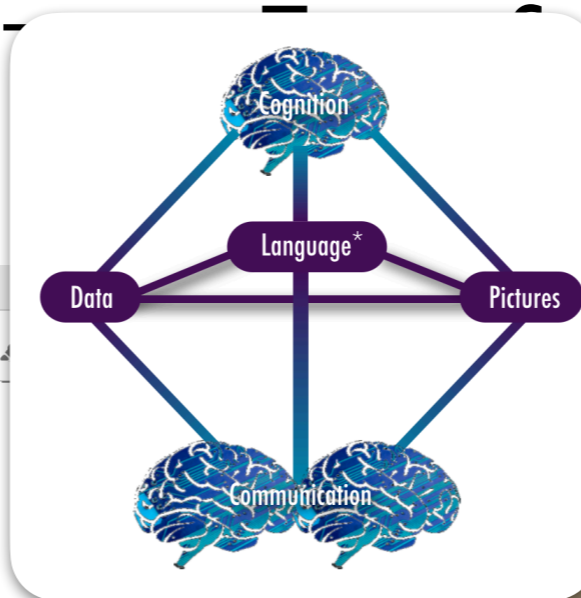
$$n = \frac{\Delta N_H}{\Delta L} = 880 s_x \text{ cm}^{-3}. \quad (3)$$

tion of the 3D position, (x, y, z) .

The gas density obtained via Eq. (3) is approximate as it includes several approximations. First, it assumes an extinction curve A_λ/N_H that is independent of position. In practice, there may be variations in the dust properties which result in deviation from the canonical extinction curve. Second, it includes uncertainties involved in the derivation of the original 3D dust map of ?, e.g., their assumptions on the priors, etc. (see ? for more details XXX). The derived densities are accurate probably to within a factor of 2-3. With these uncertainties in mind, we note that this is a unique opportunity to explore observationally the 3D density structure of the ISM in the solar neighborhood.

3.2. Characterizing the shell profile

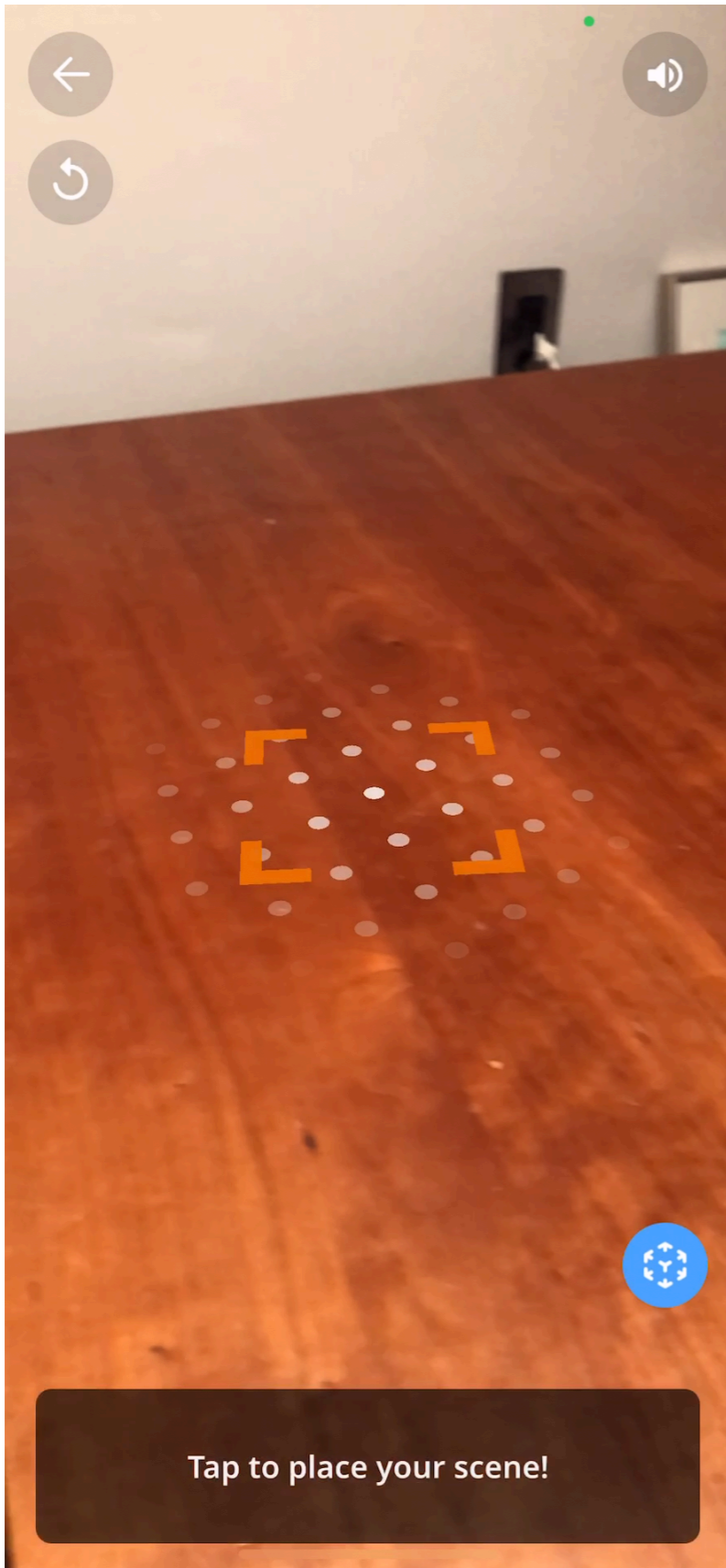
Radially-averaged mean density: In §4 we explore the 3D density structure in the Perseus-Taurus region, and discuss a large 3D-shell structure, extending from the Taurus



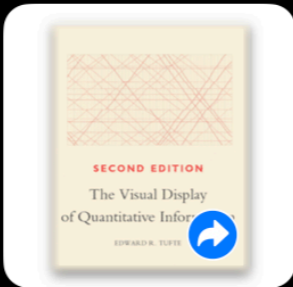
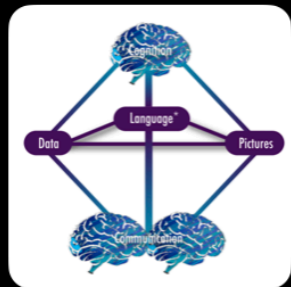
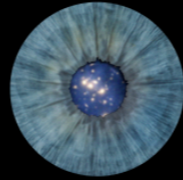
(AUGMENTED) FUTURE



PUBLISHING'S INTERACTIVE CUTTING-EDGE & (AUGMENTED) FUTURE



SEEING MORE OF THE UNIVERSE



Explore

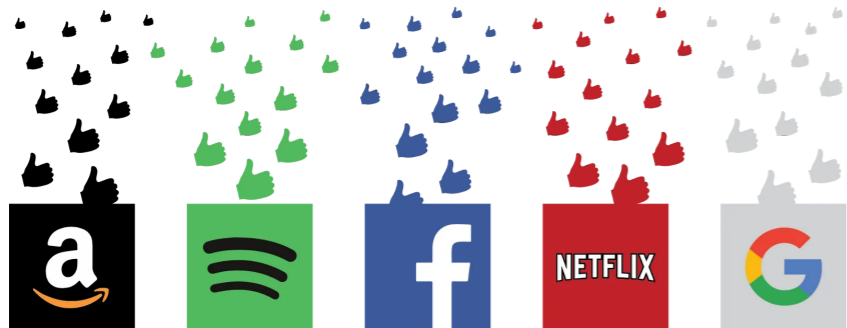
Explain

FIND THE FULL
SERIES ON

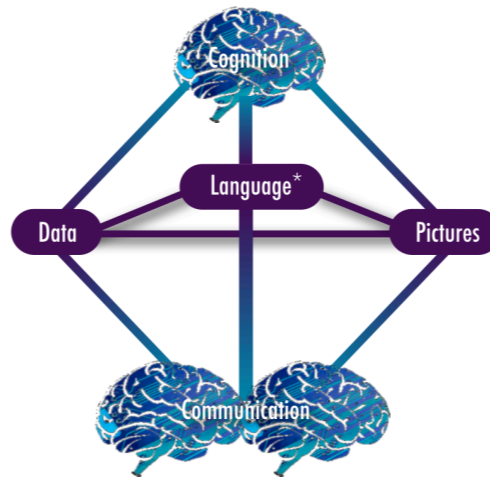


TINYURL.COM/
10QVIZVIDEOS

What's Next?



Recommender systems—what to do about sparsely-populated sub-fields?



use literature as data?



“Jupyter notebooks as papers”
— is that Authorea at some level?



more podcasts?

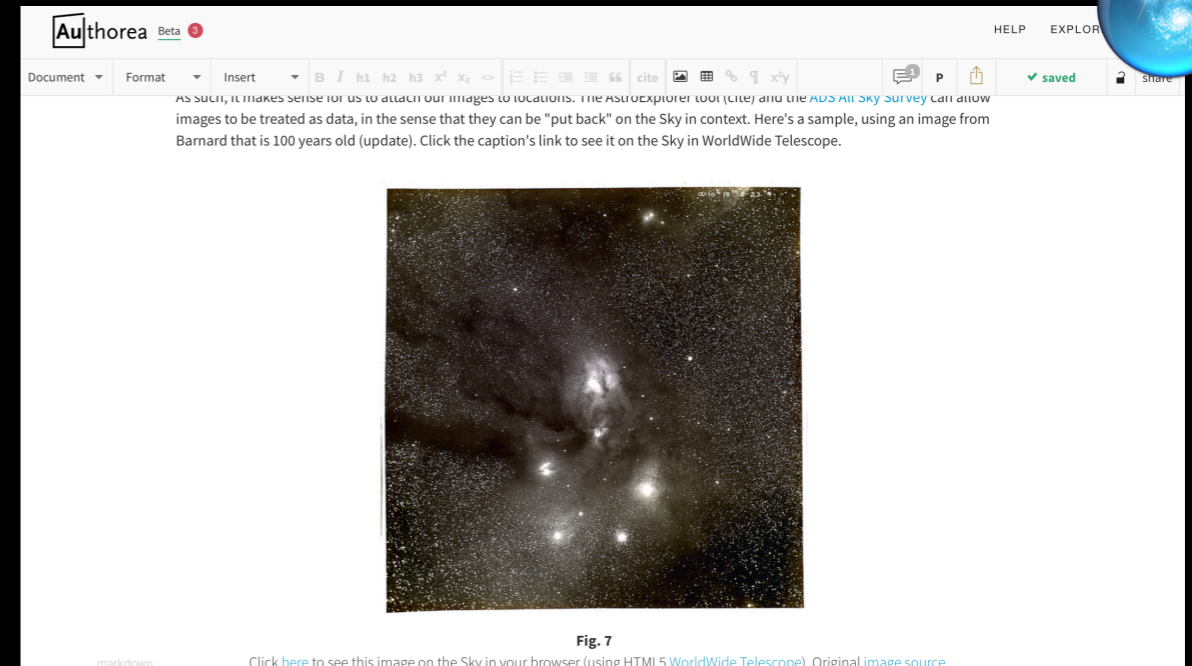
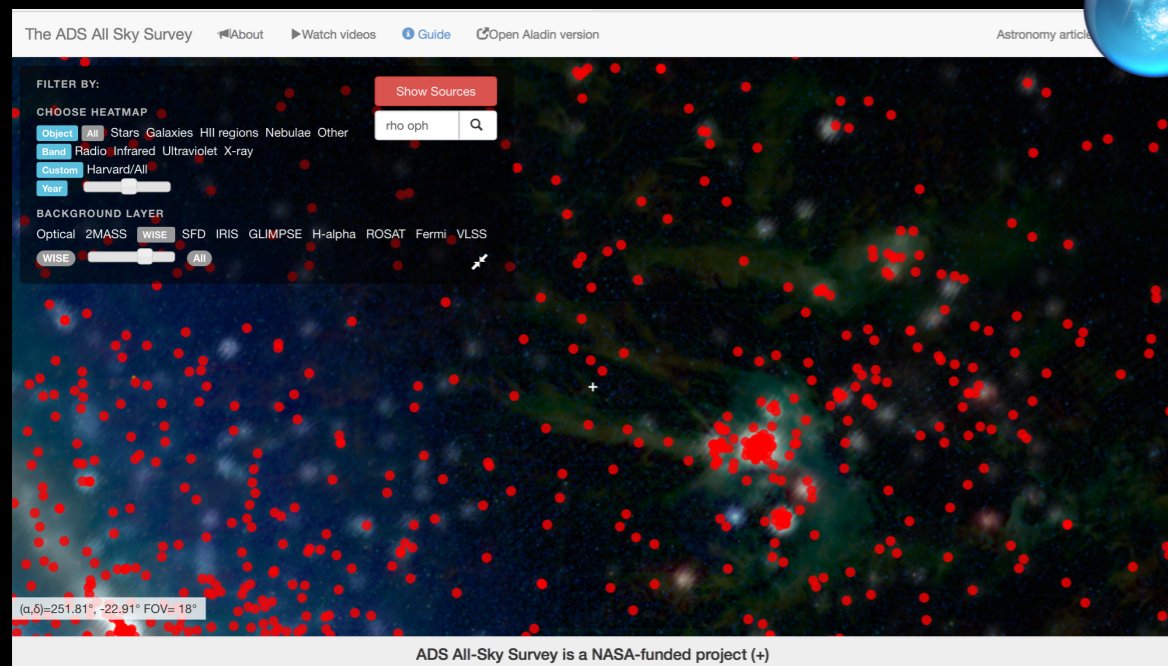


Video Abstracts?
Have not been popular (yet?)—
how about linking to talks instead?



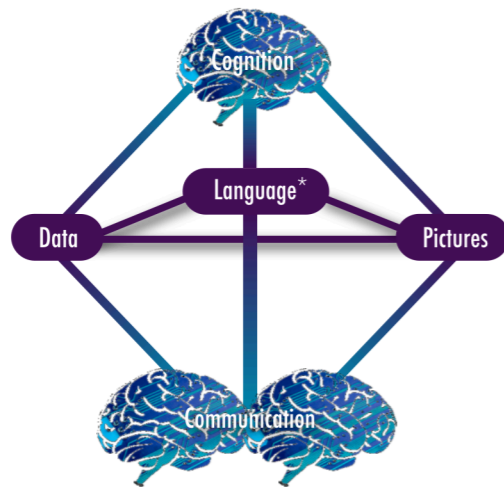
Data in papers is great
—but I really want
“talks in papers” too...

LITERATURE AS (A FILTER FOR) DATA



*Many thanks to Alberto Pepe, August Muench, Thomas Boch, Jonathan Fay, Michael Kurtz, Alberto Accomazzi, Julie Steffen, Laura Trouille, David Hogg, Dustin Lang, Christopher Stumm, Chris Beaumont & Phil Rosenfield for making this all work!
+ask me about 2021 update re:NASA ADAP Jill Naiman/Peter Williams/A. Goodman ML follow-on*

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