Designing Academic Figures and Posters
http://guides.library.duke.edu/visualcomm

October 28, 2013

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Data Visualization Coordinator
Data & GIS Services, 226 Perkins Library

Many original materials by Bill Fick & Raquel Salvatella de Prada,
Dept. of Art, Art History & Visual Studies

Earlier version of this presentation prepared with Eric E Monson,
Visualization and Interactive Systems Group

Workshop Feedback Form

To give feedback on this workshop:

http://library.duke.edu/data/feedback.html

Data & GIS Services

- Data collections, LibGuides, etc.
  http://library.duke.edu/data/

- Blog (tutorials, announcements, etc.)
  http://blogs.library.duke.edu/data/

- Walk-in consultations
  http://library.duke.edu/data/about/schedule.html
  (or by appointment – askdata@duke.edu)

- Perkins 226 computing cluster
  http://library.duke.edu/data/about/lab.html
  (fast hardware, diverse software)

- Additional workshops
  http://library.duke.edu/data/news/
  (listserv – dgs-announce@duke.edu)

FIGURES

Common Issues

- Scientific software *can* produce figures, but they're not always pretty or legible

- Often very little help/training

- May have domain-specific expectations for how figures should look, what they should contain
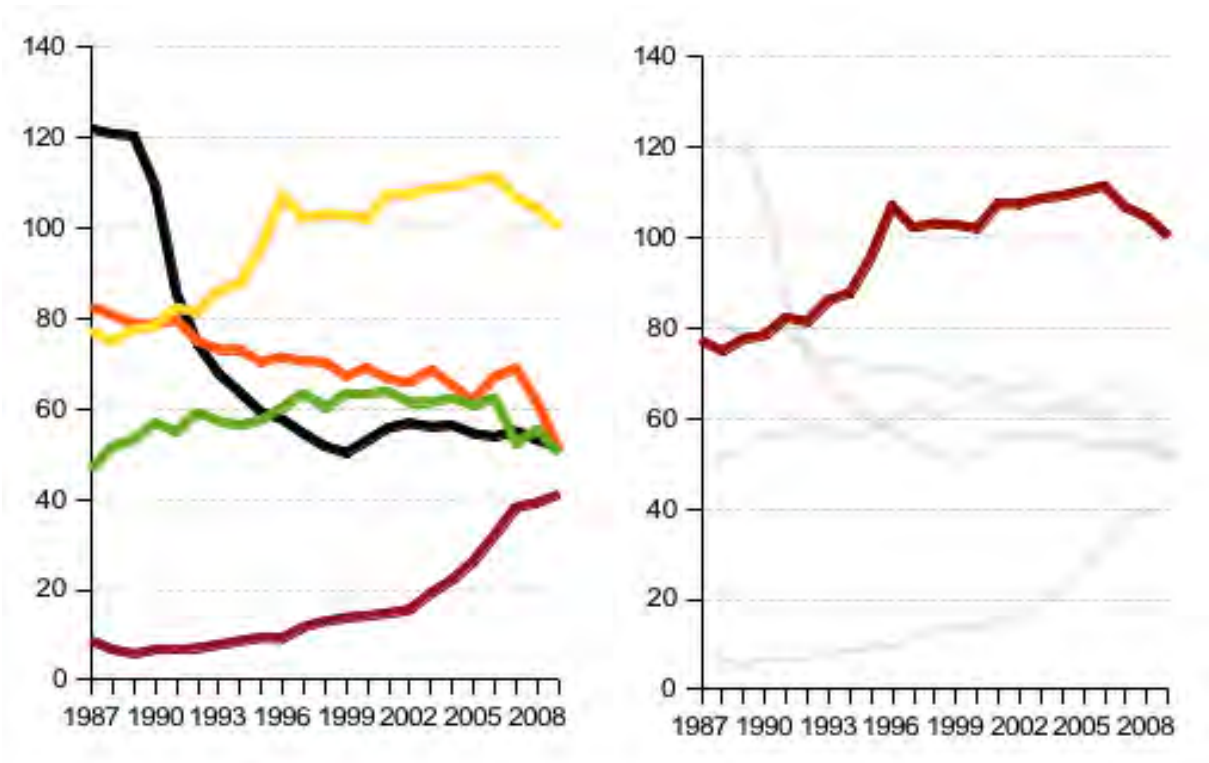
Basic Tips

Make it as easy to read as possible

- Edit (even data) for clarity of message
- Use color effectively (and minimally)
- Maximize contrast
- Follow conventions for orientation, alignment
- Don't add superficial effects

Editing

Direct attention to the important data/trends.

Use a reduced data set and color/contrast to help users find the important results.
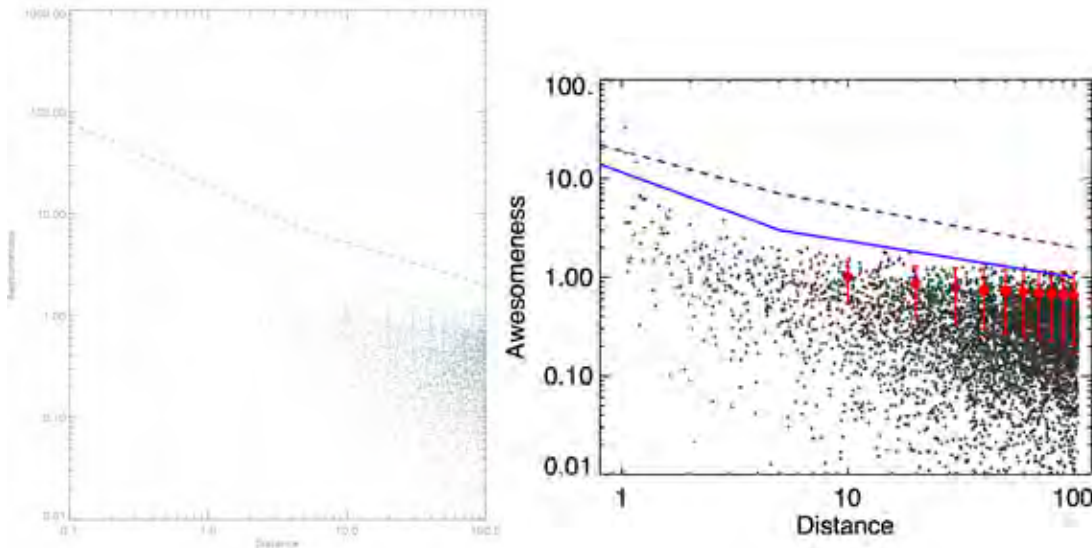
Contrast

- Which elements draw the most attention? What color pops out?

- Do the elements balance? Is there a clear organization?

- Do contrast, grouping, and alignment serve the function of the chart?

http://blog.xlcubed.com/2008/08/the-dashbord-squint-test/

Related:
Projectors often wash out figures. The squint test can simulate this. Try high contrast designs with clear trends.

http://shar.es/CWktB

Text

- Always label axes (somehow)
- Horizontal rotation is best, especially for category labels on bar charts, maybe even y-axis label
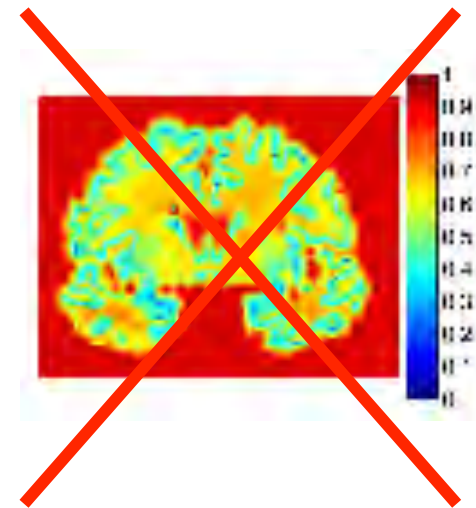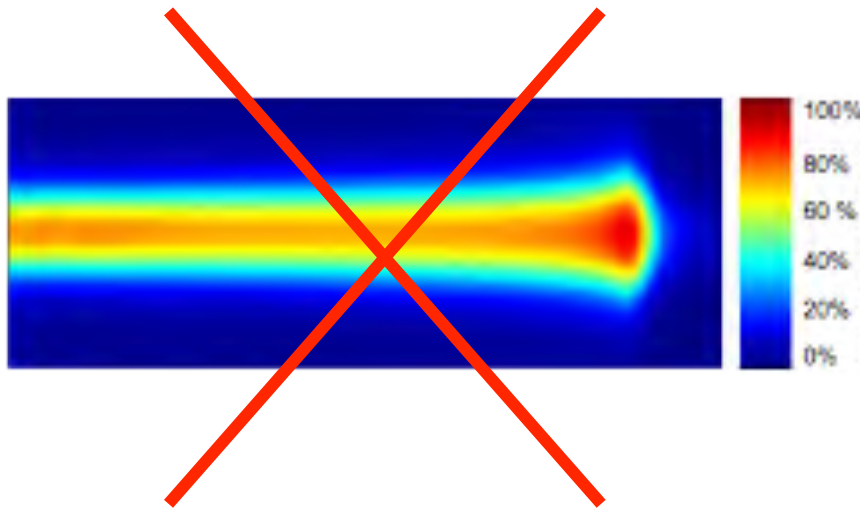

http://www.storytellingwithdata.com/2012/09/some-finer-points-of-data-visualization.html
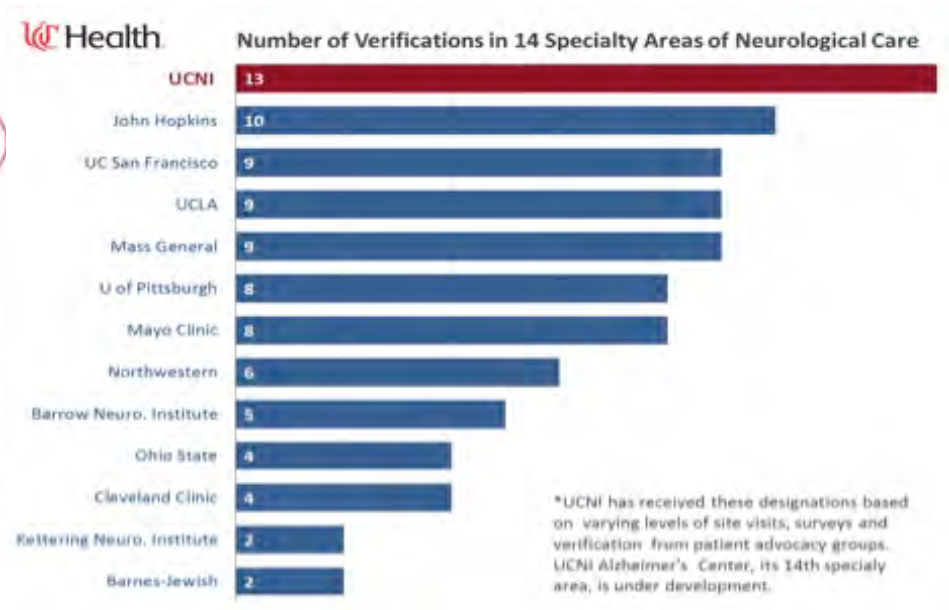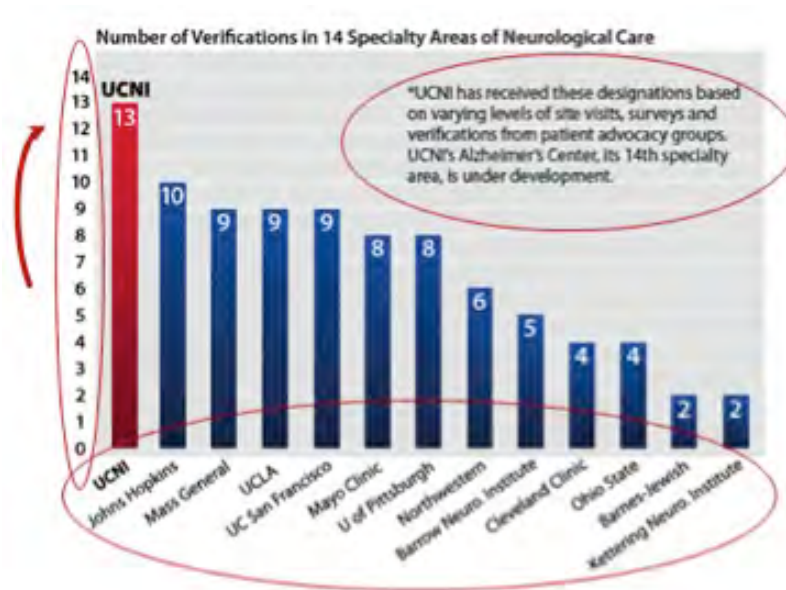
Color

Don't use rainbows for ordered, numerical variables.

We often think that the order of colors in our "rainbow" is easy for everyone to understand, but this order is not universal and will make figures harder to read.
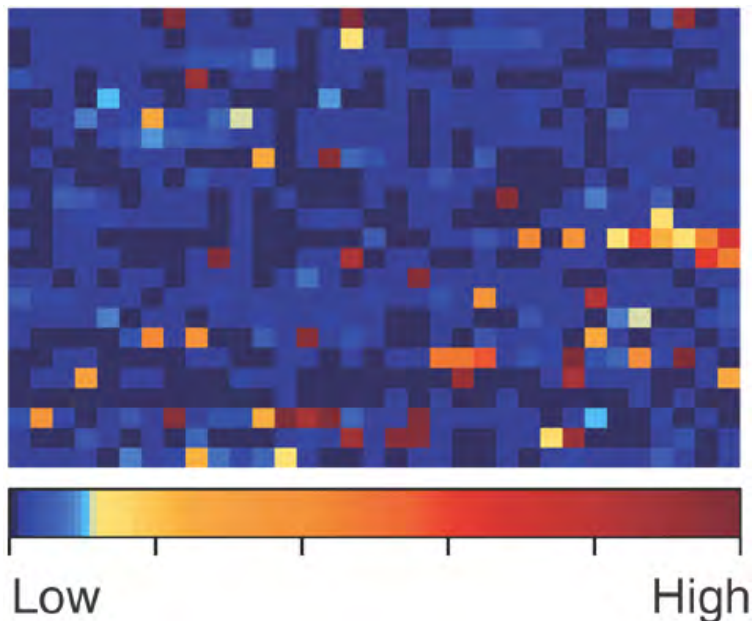

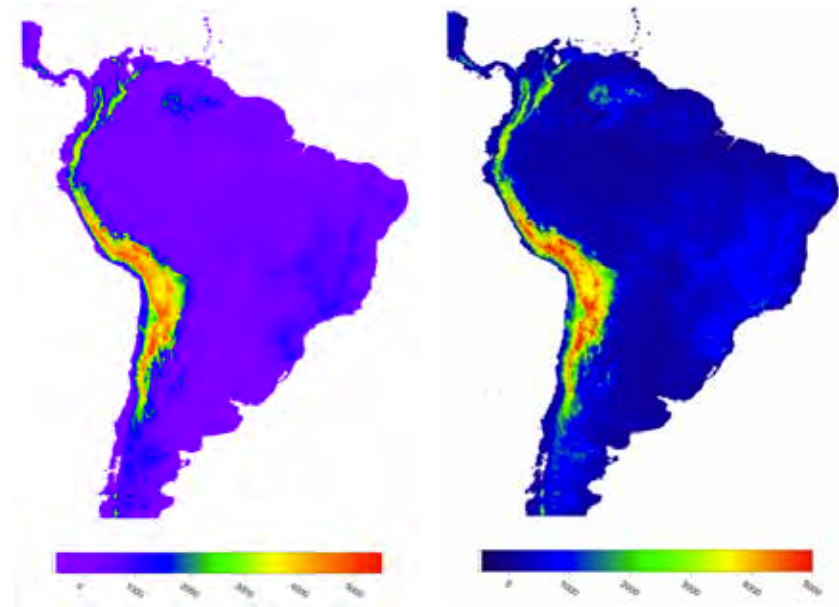**"Rainbow Color Map (Still) Considered Harmful"**
D Borland, RM Taylor, UNC-CH
IEEE Comp Graphics & Appl, 27:2 (2007)

Related: Salience

Rainbows also cause salience problems; some colors in the inner part of the rainbow "pop out" more than colors at the extremes.
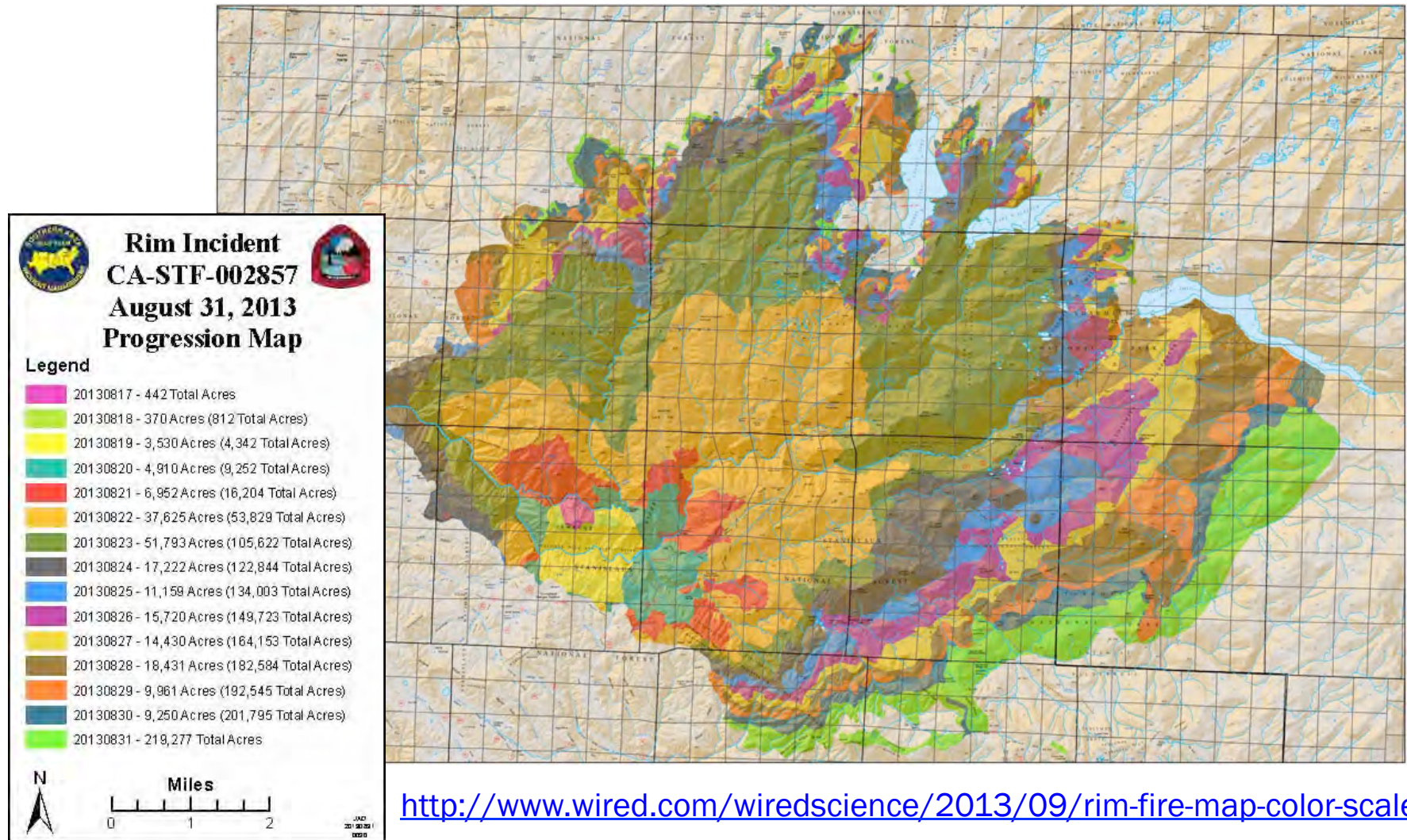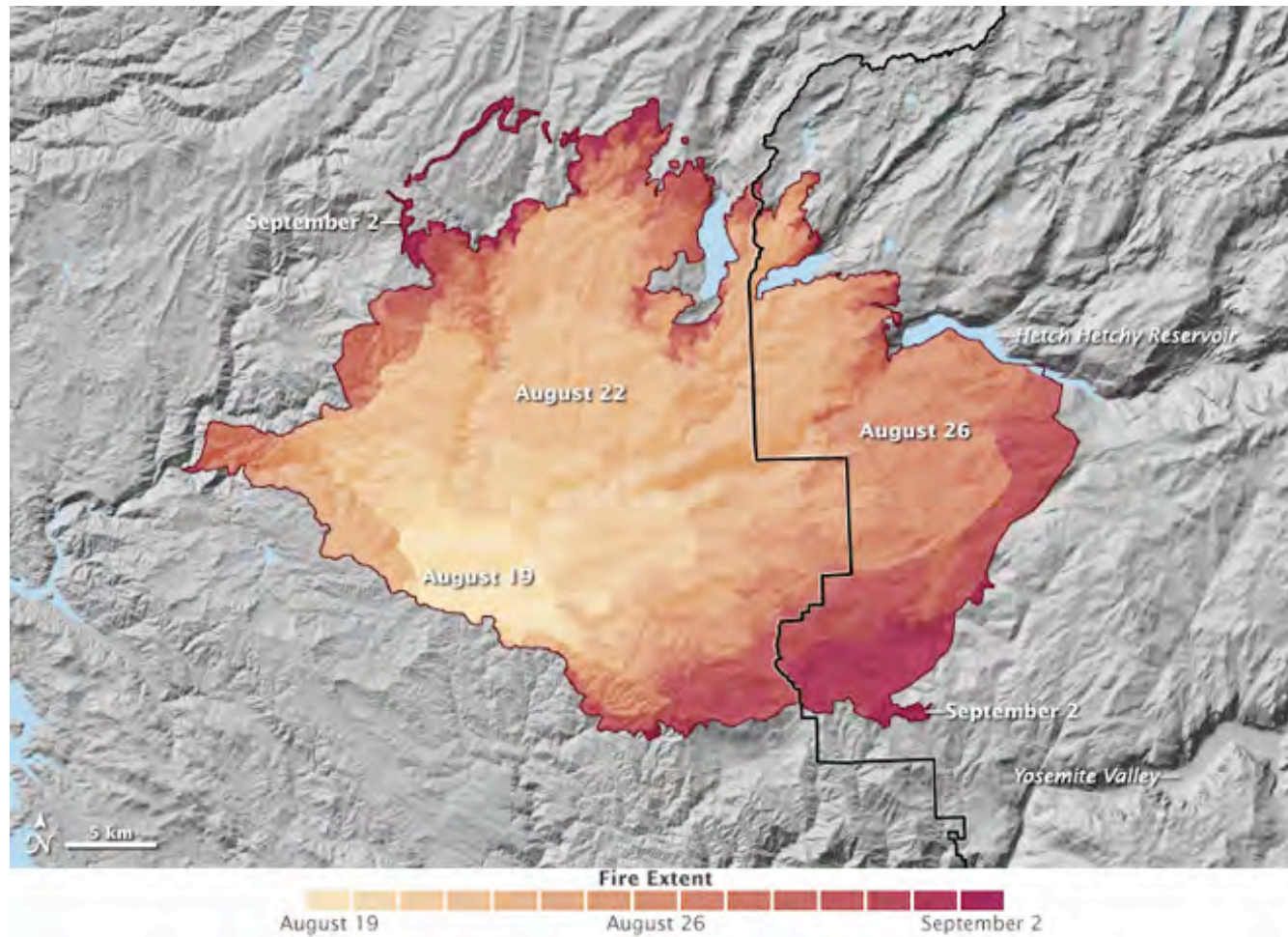

Low   High

An extreme case

Rim Incident
CA-STF-002857
August 31, 2013
Progression Map

Legend

- 20130817 - 442 Total Acres
- 20130818 - 370 Acres (812 Total Acres)
- 20130819 - 3,530 Acres (4,342 Total Acres)
- 20130820 - 4,910 Acres (9,252 Total Acres)
- 20130821 - 6,952 Acres (16,204 Total Acres)
- 20130822 - 37,625 Acres (53,829 Total Acres)
- 20130823 - 51,793 Acres (105,622 Total Acres)
- 20130824 - 17,222 Acres (122,844 Total Acres)
- 20130825 - 11,159 Acres (134,003 Total Acres)
- 20130826 - 15,720 Acres (149,723 Total Acres)
- 20130827 - 14,430 Acres (164,153 Total Acres)
- 20130828 - 18,431 Acres (182,584 Total Acres)
- 20130829 - 9,961 Acres (192,545 Total Acres)
- 20130830 - 9,250 Acres (201,795 Total Acres)
- 20130831 - 219,277 Total Acres
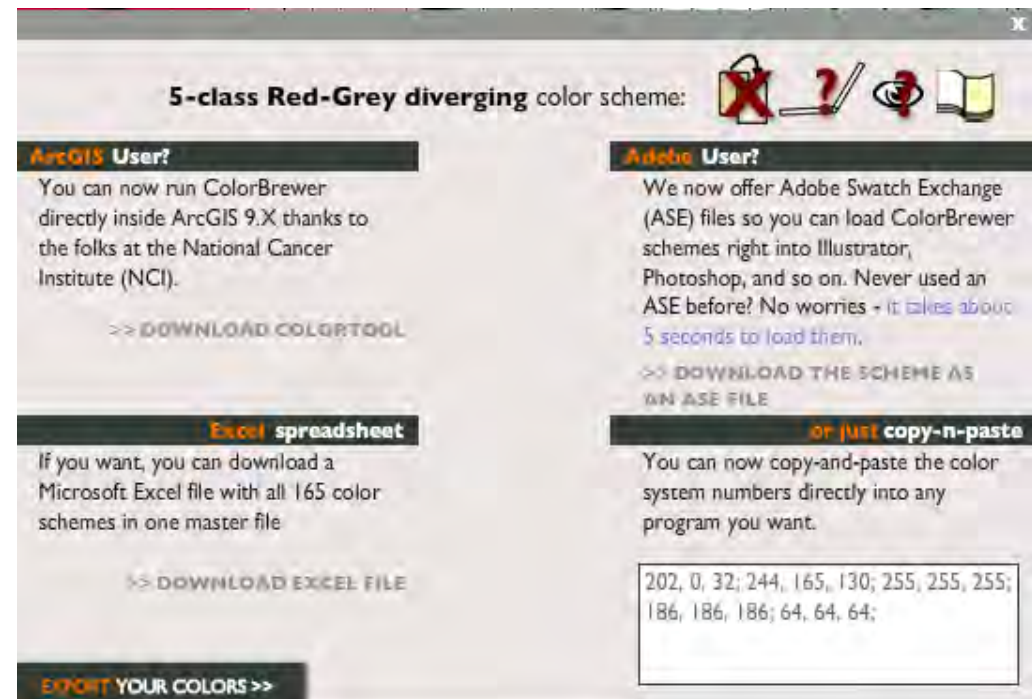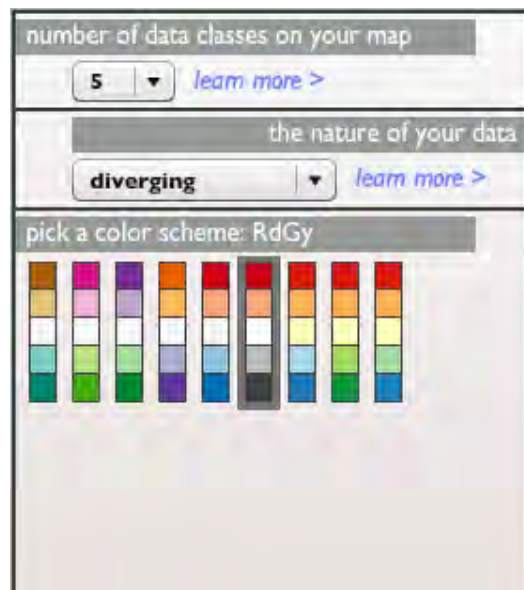
N

Miles
0   1   2

http://www.wired.com/wiredscience/2013/09/rim-fire-map-color-scale/

Instead, use a single hue

http://www.wired.com/wiredscience/2013/09/rim-fire-map-color-scale/

ColorBrewer

Cynthia Brewer, PhD – Penn State
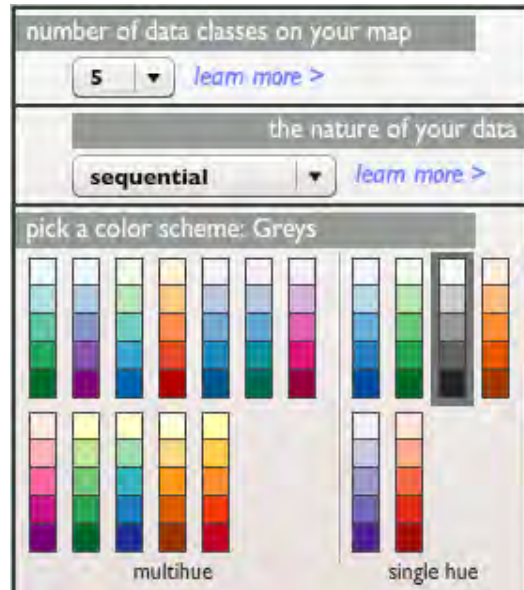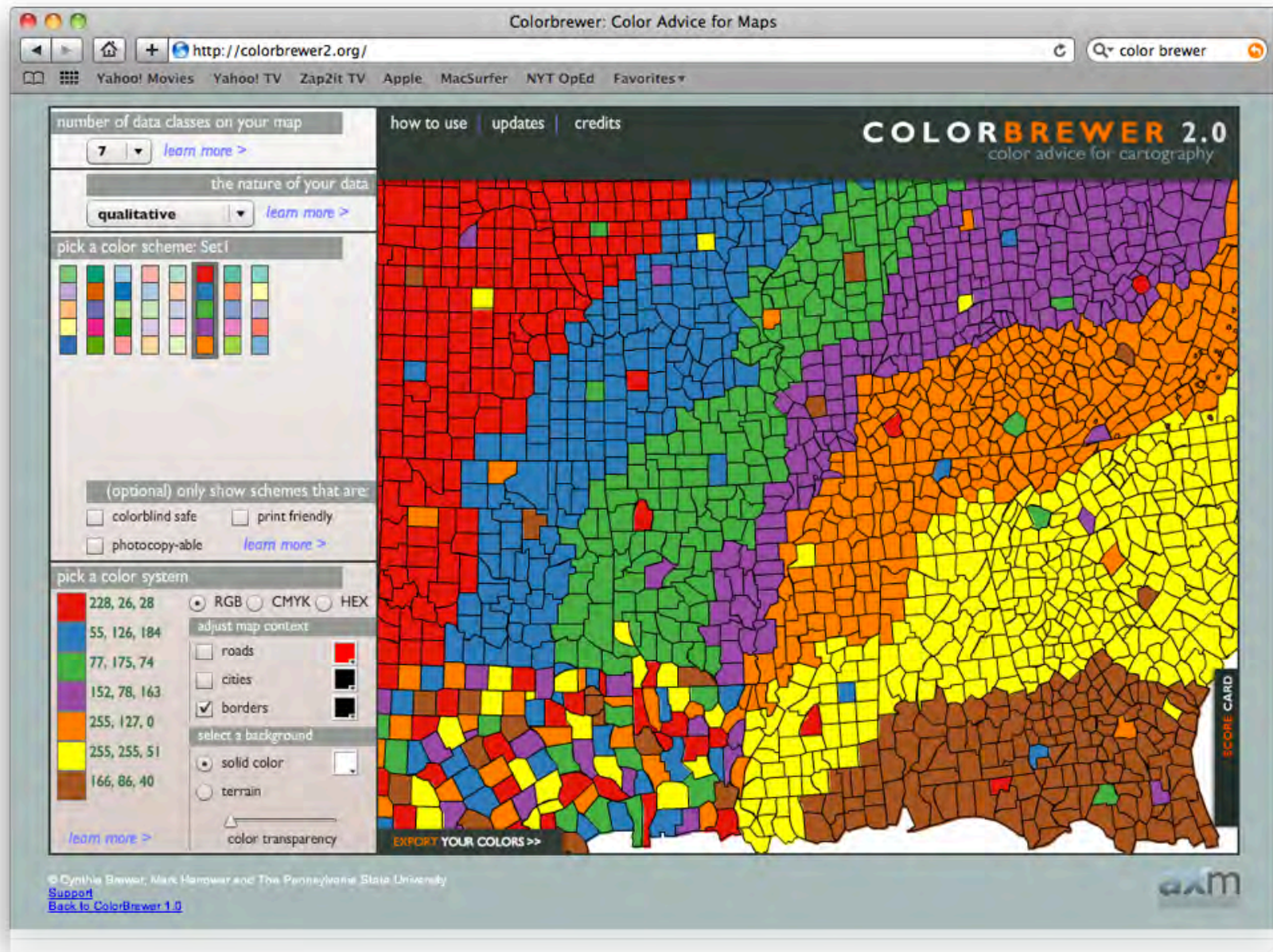
For categorical variables:
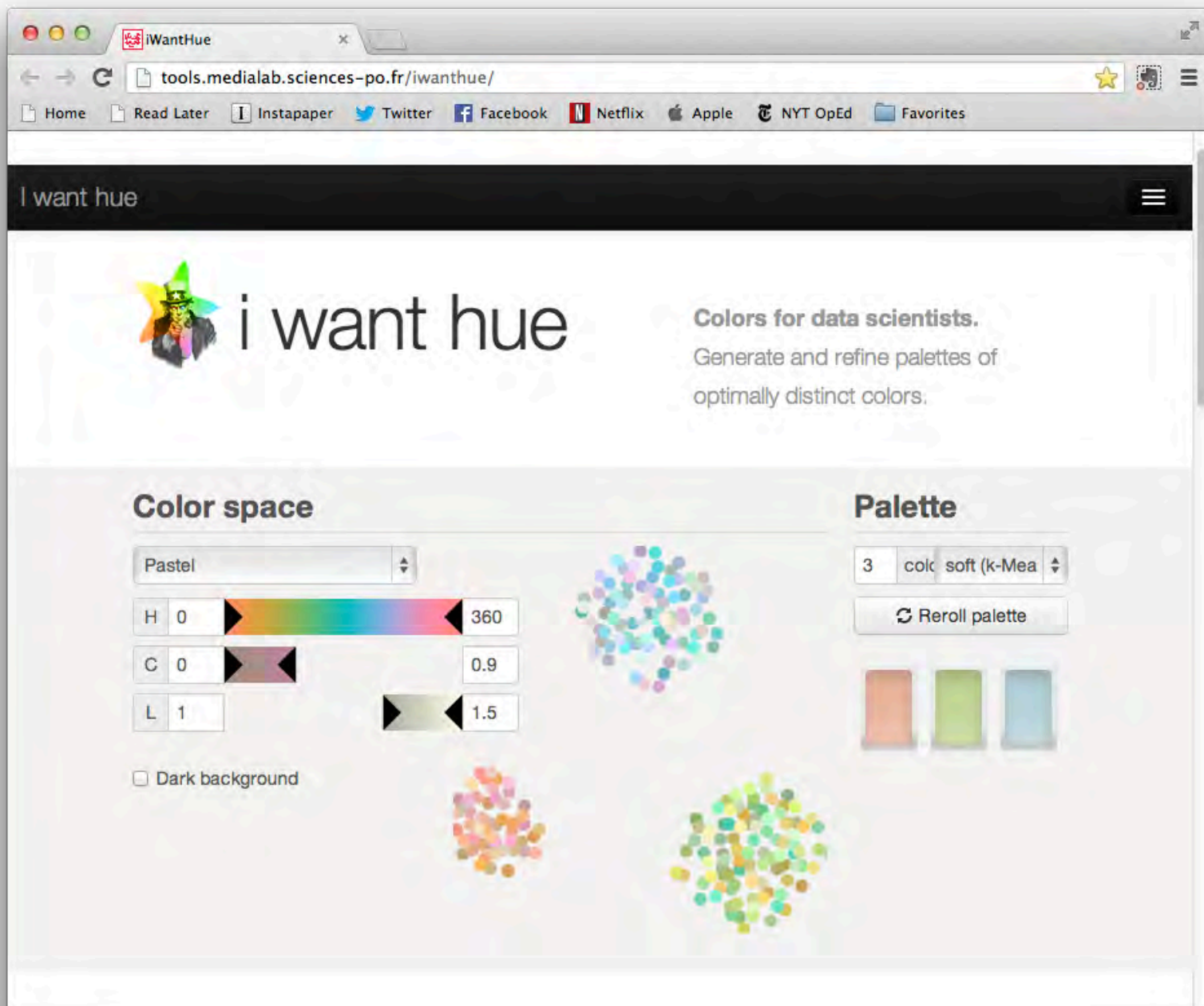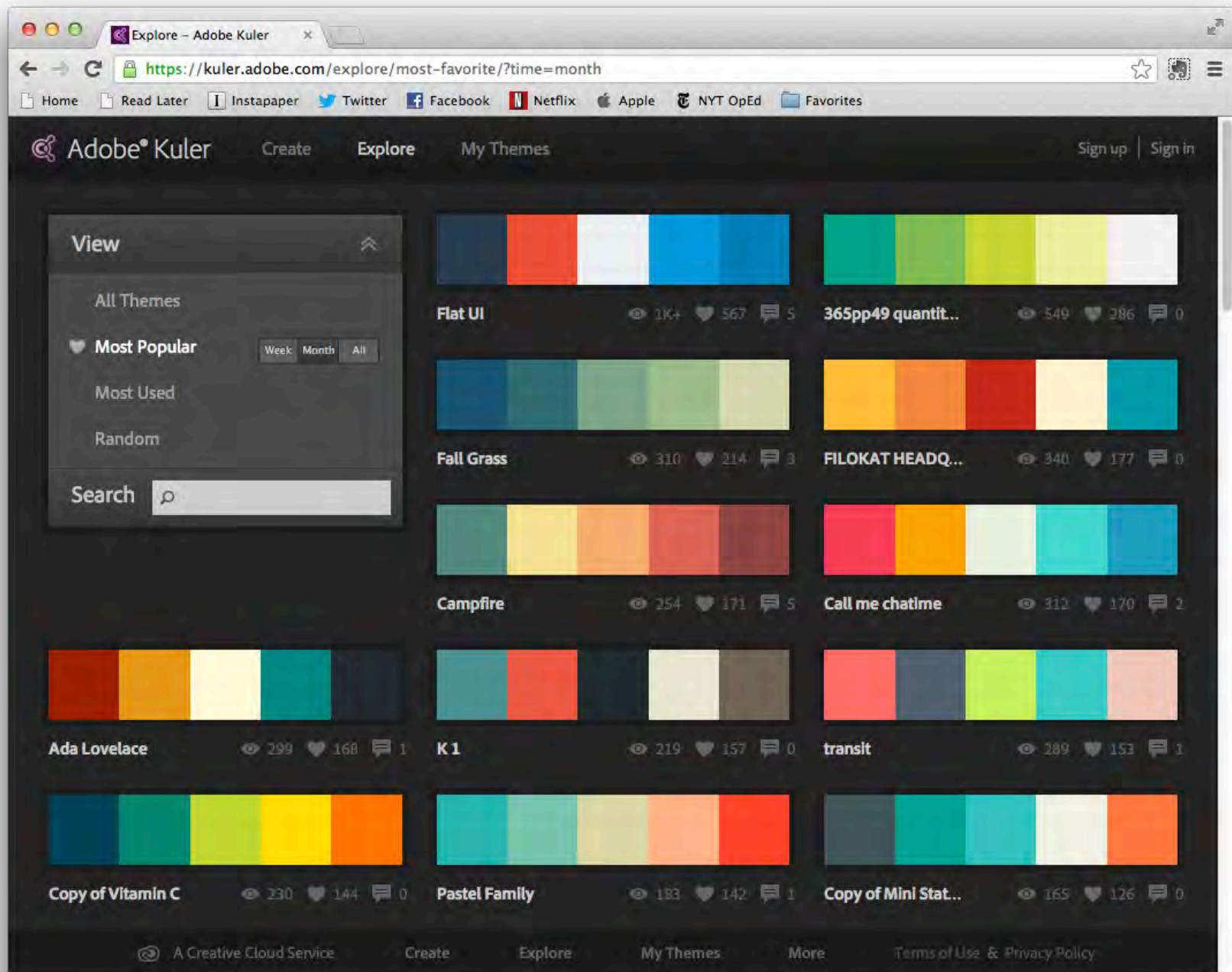
More on color

List of good color resources:

http://www.ifweassume.com/2012/12/colors-in-visualizations-rainbow-of.html

http://blog.visual.ly/web-based-color-tools/

Especially, Color Brewer 2:

http://colorbrewer2.org/

Subtleties of Color blog series by Robert Simmon:

http://blog.visual.ly/?s=%22subtleties+of+color%22

Avoid special effects
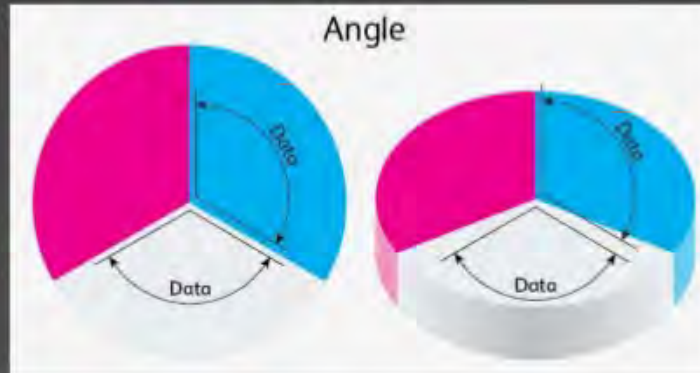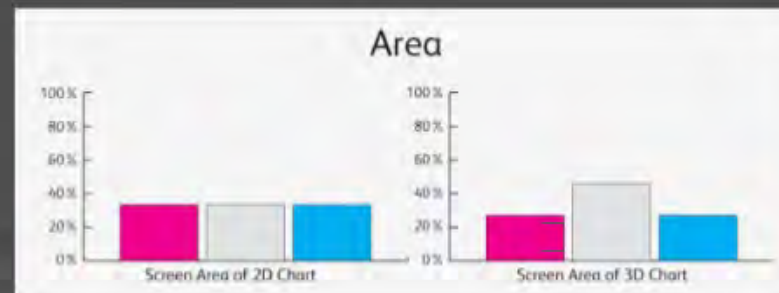
Avoid the z-axis, too

The third axis not only results in occlusion (hiding of background elements) but also makes it hard to compare bar heights across the perspective shift. Use small multiples instead.

http://onforb.es/MjG84K
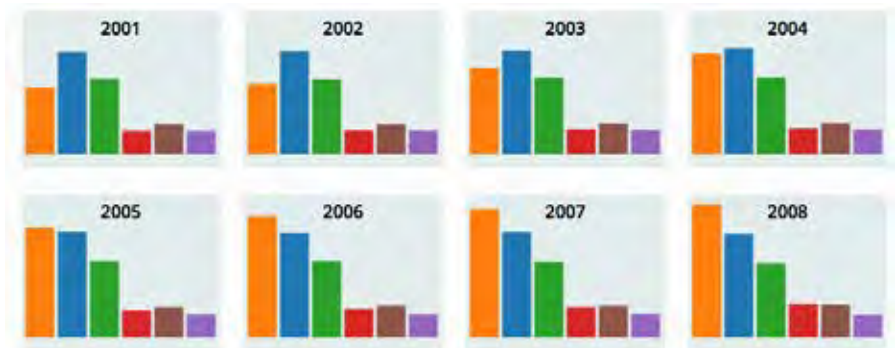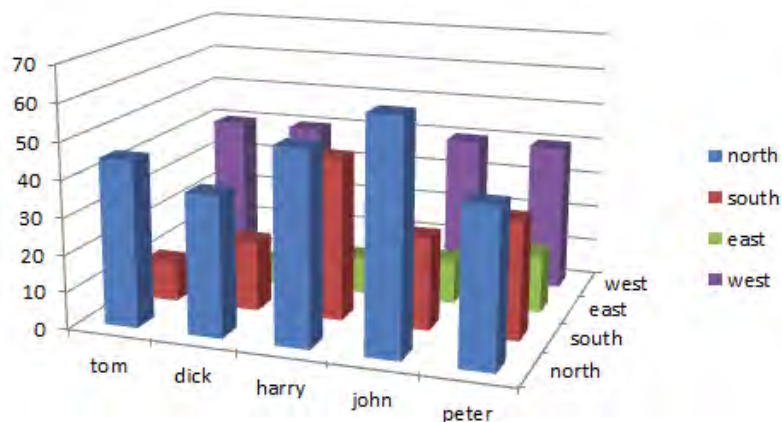
http://vallandingham.me/
small_multiples_with_details.html

POSTERS

PURPOSE

"Have one."

Michael Faber
Duke IT Innovation Program Manager

Purpose of a poster

Communicate your research

- It should attract attention (and be attractive)
- It should communicate effectively (comfortably and clearly)
- It should tell a story!

The design should support these three points.

Purpose of a poster (session)

- Develop verbal skills
- Network – Identify and establish academic contacts, collaborations & potential jobs
- Get feedback on your work

Design toward the session

- Standalone and/or Accompanied

- Level of the audience

- Size of the session

CONTENT

"Throwing away things is what it means
to be a grown-up."

Amanda Cox
Head, New York Times Graphics Department

Simpler is better

- Use active titles to summarize text blocks
  Instead of "Results," say "Accuracy Varies by Color, not Shape"
- Edit, edit, edit to reduce text
  Get down to ~500-800 words

A poster is different from an academic paper; you should change not just the amount of text, but also the style, the structure, maybe even the scope of what you cover.

In some poster sessions you may only have a few minutes to capture the attention of the passersby.

Figures

- See tips above!

- Don't be afraid to add visuals to convey even more of your research, to keep text blocks to a minimum

- Keep a consistent style and color palette across all figures; try to complement poster theme, but important to keep the figures legible

IMAGE RESOLUTION

Effect of Ovariectomy on Dopamine Neuron Number and Cocaine-Stimulated Locomotion in Rats and Mice

Amanda E. Day, Misha L. Johnson, Q. David Walker, Reynold Francis, and Cynthia M. Kuhn

Department of Pharmacology and Cancer Biology, Duke University, Durham, NC

Want 300 pixels/inch for printing

2" x 300 pixels/inch = 600 pixels

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264 x 319 - 25k - jpg
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Find similar images

LAYOUT

"Don't fear the white space.
It has magical powers."

Michael Faber
Duke IT Innovation Program Manager

SPACE

SPACE

SPACE

Development of Long-Lived, Hyperpolarized Contrast Agents for In Vivo MRI

[1]Elizabeth R. Jenista, [1]Rosa T. Branca, [2]Michael J. Jenista, [1]Xin Chen, [1]Warren S. Warren
[1]Department of Chemistry, Center for Molecular and Biomolecular Imaging, Duke University, Durham, NC 27708
[2]Department of Mathematics, Duke University, Durham, NC 27708

1. Why Increase the Hyperpolarized Lifetime?

- Hyperpolarization decays with T_1
- Limits choice of molecules to those with long T_1
- Limits applications to processes that happen faster than T_1
- Singlet state is a disconnected eigenstate - no available relaxation mechanisms.
- Offers the potential for MRI to advance as a molecular imaging modality
- Increases the general applicability of hyperpolarized contrast agents

2. What are Singlet States?

Consider a system with two spin 1/2 nuclei with identical resonance frequencies. The matrix representation of the spin Hamiltonian is not diagonal in the Zeeman product basis, indicating that the Zeeman product states $|\alpha\alpha>$, $|\alpha\beta>$, $|\beta\alpha>$ and $|\beta\beta>$ are not all eigenstates of the Hamiltonian, H. By selecting a different basis, called the singlet-triplet basis, the Hamiltonian is diagonalized. The triplet states are:

$$|T_{+1}> = |\alpha\alpha>$$
$$|T_0> = 1/\sqrt{2}(|\alpha\beta> + |\beta\alpha>)$$
$$|T_{-1}> = |\beta\beta>$$

And the singlet state is:

$$|S_0> = 1/\sqrt{2}(|\alpha\beta> - |\beta\alpha>)$$

The important feature of this system is that the singlet state is a completely disconnected eigenstate [3].

$$<S_0|H|T_0> = 1/2(<\alpha\beta| - |\beta\alpha>) H (<\alpha\beta| + |\beta\alpha>) = 0$$

Thus, populations in the singlet state are trapped and there are no allowed transitions in or out of the singlet state. The result is that hyperpolarized populations in the singlet state are stored and their lifetime increased.
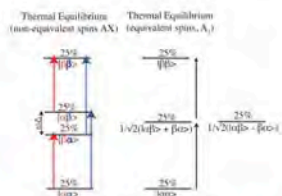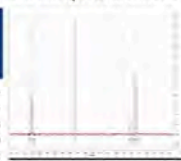
Figure 1: Energy levels of an AX (inequivalent spin) system and an A$_2$ (equivalent) spin system.

3. Diacetyl as a Test System

2,3-^{13}C-labeled diacetyl [CH$_3$(^{13}C=O)(^{13}C=O)CH$_3$] has a single line carbon spectrum, but the carbon spectrum in water has 5 lines (figure 2). The monohydrate [CH$_3$(^{13}C=O)(^{13}C(OH)$_2$CH$_3$] has two in equivalent carbons with a J$_{cc}$=45 Hz, and is the majority species in water (figure 2). Equilibrium between the hydrate and the diacetyl can be shifted with pH and solvent.

Figure 2: The structures above are diacetyl and the hydrate of diacetyl. When diacetyl is hydrated the carbonyl carbons are no longer equivalent, resulting in two doublets as seen in the spectrum to the right. The J coupling for the doublets is 45 Hz.

4. Evidence of a Disconnected Eigenstate

Figure 5 shows a comparison between experimental and simulated spectra demonstrating the presence of a disconnected eigenstate without magnetically equivalent spins. If J_{cc}=0 the experimental spectra for a singly labeled diacetyl molecule and the doubly labeled simulation are identical (3A and 3D), and the carbon singlet state is not an eigenstate. If J_{cc} is much larger than all the other couplings it collapses into a septet (3E), similar to the spectrum of acetone, EXCEPT that the splittings are not as expected - the splittings are 2.65 Hz, the average of the couplings to the near and far methyl groups. This spectrum comes entirely from transitions of the $\alpha\beta + \beta\alpha$ as a carbon state, and is delocalized over the two carbons and coupled equally to all the hydrogens [2].
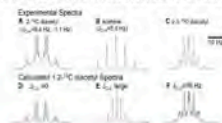
Figure 3: Comparison of experimental and simulated (using WindNMR) NMR spectra. Comparison of A and D shows that in the absence of any C-C coupling, the experimental spectra behaves as expected. When the C-C coupling is large compared to all other couplings, the spectrum collapses into a septet, but with unexpected splitting values, demonstrating a hidden eigenstate. The experimental spectrum for the doubly labeled diacetyl matches perfectly with the simulated spectrum.

5. Hyperpolarized Contrast On Demand via Singlet States

The figure below details the experiment to detect hyperpolarized signal. The singlet state is populated and the populations trapped for a chosen time period and then released through the injection of water.
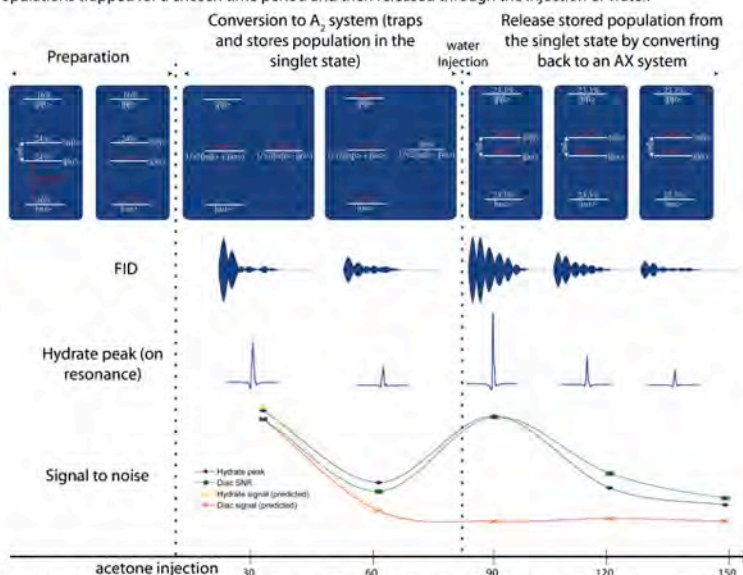
Preparation | Conversion to A$_2$ system (traps and stores population in the singlet state) | water Injection | Release stored population from the singlet state by converting back to an AX system

FID

Hydrate peak (on resonance)

Signal to noise

- Hydrate peak
- Diac SNR
- Hydrate signal (predicted)
- Diac signal (predicted)

acetone injection

Figure 4: A 15 µl sample of the 2,3 - 13C labeled and deuterated diacetyl was hyperpolarized by DNP using the Oxford Hypersense. The sample was dissolved into a pH 7 PBS solution and inserted into a 7T small animal imager with a home built carbon solenoid coil. The $|\alpha\beta>$ and $|\beta\alpha>$ populations were perturbed from equilibrium, and then 10 ml of acetone (37 ºC) was injected into the sample. 30 seconds passed to allow the dehydration of the diacetyl hydrate, and then a 45º pulse was applied, followed by another 30 s wait and a second 45º pulse. 10 ml of water (pH 7, 37 ºC) was injected, and 45º pulses were applied every 30 s to detect the populations flowing out of the singlet state.

6. Applications of Singlet States with Other Molecules and In Vivo

Precise numerical analysis of the eight spin system shows that the overlap of the singlet state with an eigenstate of diacetyl is more than 96%. This calculation is easily extended to other molecules to evaluate their potential for use with this technique. The criteria for selecting a molecule to use are:

1. The system of interest must have two nearby ^{1}H, ^{13}C, ^{15}N, ^{19}F or ^{31}P atoms.

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3. The system must have a precursor in which the two nuclei of interest are in equivalent, which can be converted into the contrast agent in a time short compared to T_1.

4. The system must have a mechanism by which the nuclei become inequivalent (a biological pathway for in vivo applications) permitting the detection of the trapped populations.

7. Simulations of the Singlet State

In the absence of relaxation, the time dependent diacetyl density matrix can be evaluated, and the transition dipole moment can be calculated.

- Allowed transitions are connected by $I_{x1} + I_{x2}$.
- Transition dipole moment (strength of transitions) is $\mu^2 = [\rho(t), I_{x1} + I_{x2}]$.

In the figure below (fig. 5) the transition dipole moment is plotted with respect to time for diacetyl (in the absence of relaxation, 5a). The same plot is below it for the transition dipole moment of the diacetyl hydrate (5b), and 5c is the first second of 5b.

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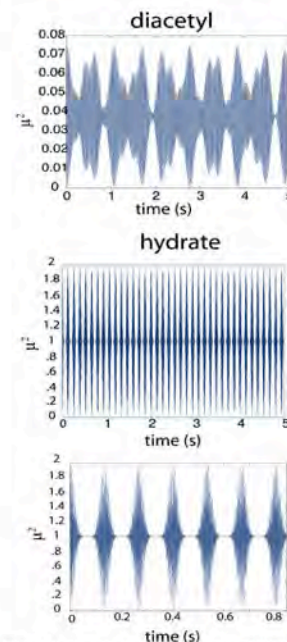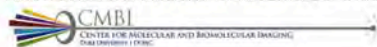
diacetyl

hydrate

Figure 5: Calculation of the transition dipole moment for diacetyl (5a) and diacetyl hydrate (5b), and a zoom on the hydrate spectrum (5c). The calculations reveal that the transition dipole moment from the singlet state oscillates as $1/[J^2 + \Delta\omega^2]^{1/2}$.

References
1. K. Golman, J. H. Ardenkjaer-Larsen, J. S. Petersson, S. Mansson, I. Leunbach, Proc. Natl. Acad. Sci. U.S.A 100, 10435 (2003).
2. R. J. Abraham, H. J. Bernstein, Can. J. Chem. 39, 216 (1961), and F. A. L. Anet, Can. J. Chem. 39, 2262 (1961).
3. M. Levitt, Spin Dynamics, 2nd ed. Wiley, 2008
4. M. Carravetta, O.G. Johannessen, and M.H. Levitt, Beyond the T-1 limit: Singlet nuclear spin states in low magnetic field.

CMBL CENTER FOR MOLECULAR AND BIOMOLECULAR IMAGING

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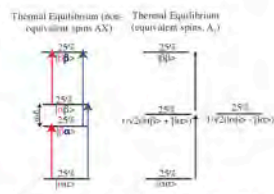

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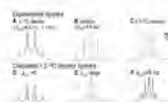

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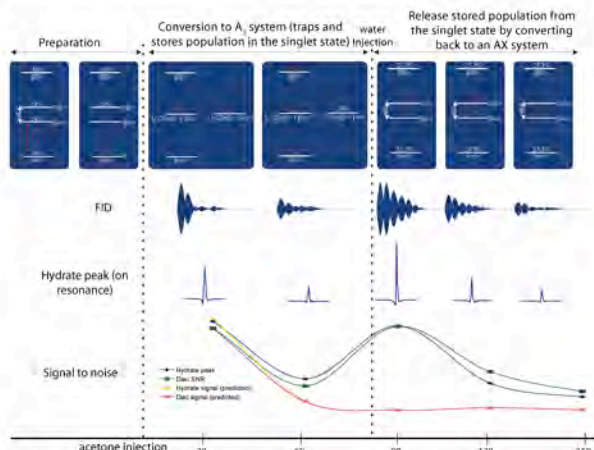

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The transition dipole moment for diacetyl is about 30 times smaller than that of the hydrate, which means that the lifetime of the singlet state can be up to 30 times longer.
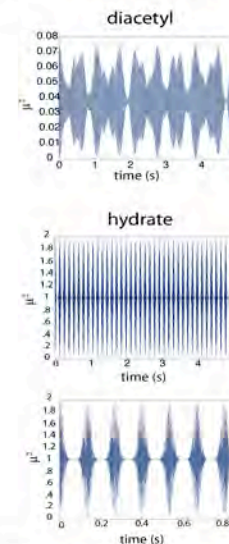

Figure 5: Calculation of the transition dipole moment for diacetyl (5a) and diacetyl hydrate (5b), and a zoom on the hydrate spectrum (5c). The calculations reveal that the transition dipole moment from the singlet state oscillates as $1/[J^2 + \Delta\omega^2]^{1/2}$.

References
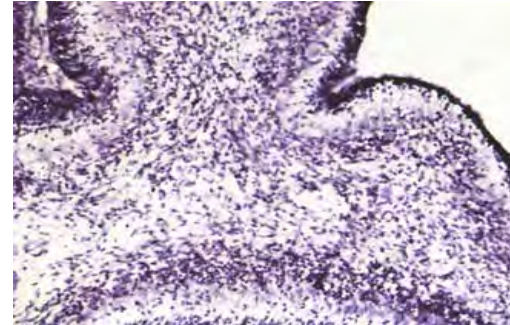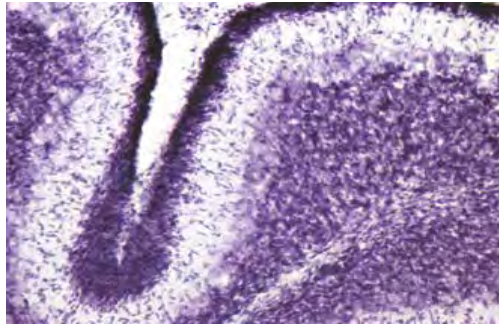
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4. M. Carravetta, O.G. Johannessen, and M.H. Levitt, Beyond the T-1 limit: Singlet nuclear spin states in low magnetic fields. Physical Review Letters 92 (2004)

CMBI
CENTER FOR MOLECULAR AND BIOMOLECULAR IMAGING
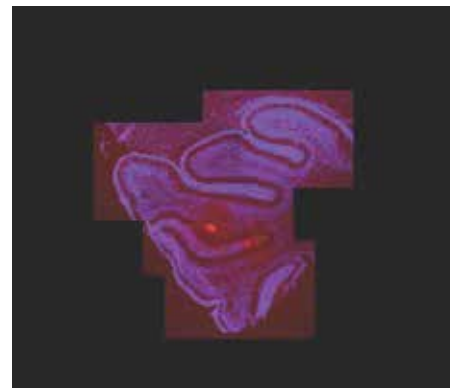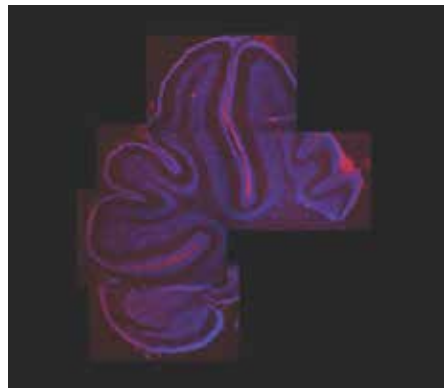
A

WT
(200 x)

siGen X
(200 x)

B

WT
(200 x)
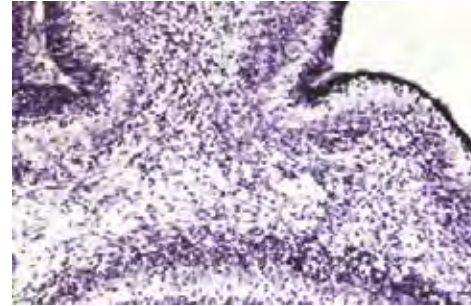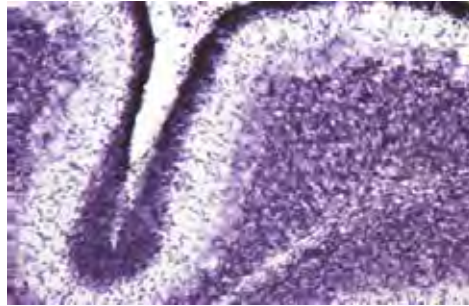
siGen X
(200 x)

C

WT
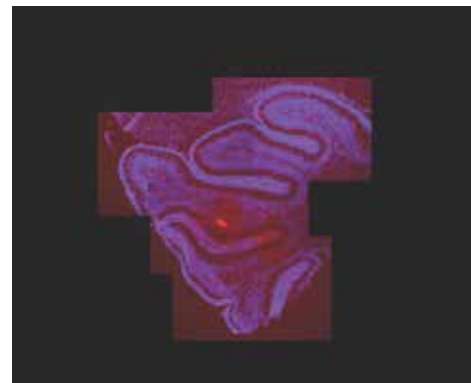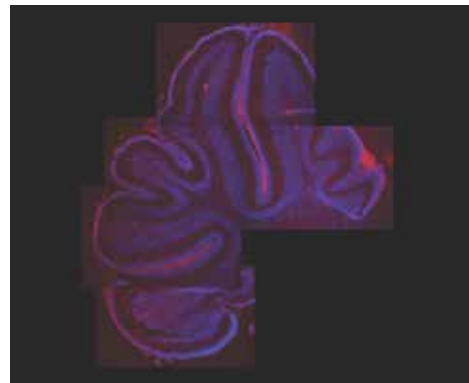(40 x)

siGen X
(40 x)

A WT (200 x)   siGen X (200 x)

B WT (200 x)   siGen X (200 x)

C WT (40 x)   siGen X (40 x)

Flow

Using the MYERS BRIGGS TYPE INDICATOR and TYPE THEORY to improve EDUCATIONAL OUTCOMES in a professional pharmacy program

David Caldwell, PharmD, AAHIVP and Jessica H. Brady, PharmD, BCPS

Objectives

To determine whether the application of type concepts will

1) Result in *improved academic performance*
2) Reduce *perceived levels of stress*
3) Improve *perceived levels of success*

in the professional pharmacy curriculum

Rationale

Comparison of student/faculty demographics, by type table quadrant

The typical undergraduate[1] (■) processes information differently than the typical faculty member[2] (■) in higher education. These differences appear to be more pronounced in pharmacy students (■).
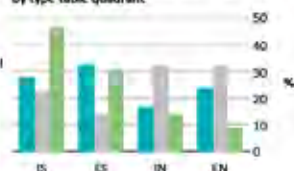
Methods

Ninety-five first year pharmacy students (P1s) were introduced to type theory and completed the Myers-Briggs Type Indicator (MBTI) process during a pre-semester boot camp. These students were randomly assigned to one of two groups. The intervention group participated in a learning styles activity that focused on the contributions of each psychological type to individuals' learning styles. This group also received five monthly emails *(at right)* outlining additional information related to type and learning and were encouraged to attend a mid-semester type-specific group session led by the investigators to discuss study habits and performance.

The control group participated in a type-based communication styles activity at boot camp and received no further follow-up.

Analysis included comparisons of grade point average (GPA) at the end of the P1 fall semester and a survey *(at for right)* administered at that time.

Summary characteristics and type table of the ULM COP class of 2015

Preference	#	%
Extrovert, E	35	36.8
Introvert, I	60	63.2
Sensing, S	70	73.7
Intuition, N	25	26.3
Thinking, T	39	41.0
Feeling, F	56	58.9
Judging, J	67	70.5
Perceiving, P	28	29.5

Example follow up information sent via email

Effects of whole type on learning style   Effects of individual dichotomies on learning

Pre-pharmacy vs. P1 fall semester GPAs

*Error bars denote 95% CI
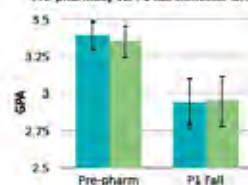
Covariates examined include

- Pre-pharmacy GPA (p<0.001)
- PCAT score (p=0.7)
- Self-reported application of type concepts to study habits (p=0.17)

Survey results, in which students rated the following scales from 0 (indicating a complete lack of the domain) to 10 (the opposite)

- Perceived level of success
- Perceived level of stress
- Efficacy of study habits
- Usefulness of type concepts in communication
- Usefulness of type concepts in learning
- Improvement of communication efficacy
- Improvement of learning efficacy

No statistically significant differences between groups' answers to survey items

- Intervention group
- Control group

Conclusions and discussion

After controlling for pre-pharmacy GPA, there were no statistically significant differences in the P1 fall semester GPA between the two groups. Nor were there differences found between any of the survey items (analyzed with the Wilcoxon Rank Sum test), including those related to stress or perceived success.

There was a low level of application of type concepts as reported on the survey (n=32) and participation in follow-up groups (n=1). For this reason, it may be inaccurate to accept the results as evidence of a true lack of effect.

To increase student follow-up and application next year, we plan to include an incentive plan, such as free lunch, to participants in the follow-up groups. We also plan to use a validated tool to measure perceived levels of student stress.

References
1. (Adapted from) Briggs, IM, et al. MBTI Manual. Palo Alto: Consulting Psychologists Press, Inc., 1984.
2. (Adapted from) Macdaid GP, McCauley MH, Kainz RI. Myers-Briggs Type Indicator Atlas of Type Tables. Gainesville: CAPT, 1987.
*IRB approval number 382-2011; 23 Jun 2011

HOW A COMMON SPECIES
WENT
EXTINCT

THE STORY OF THE **PASSENGER PIGEON**
(*ECTOPISTES MIGRATORIUS*)

JESSICA **STANTON**
STONY BROOK UNIVERSITY, New York

INTRODUCTION

Once the most abundant bird species in North America, the passenger pigeon (*Ectopistes migratorius*) was so numerous many observers did not believe they could ever be at risk of extinction. Over-harvest and habitat loss have each been proposed as the primary factor leading to the extinction of the passenger pigeon. I developed a temporally dynamic and spatially explicit modeling framework incorporating multiple lines of historical and biological evidence in order to quantitatively explore the likelihood of different extinction scenarios involving habitat loss and harvest.

THE MODELS:

POPULATION MODEL

I constructed a matrix-based model to simulate the effects of risk factors faced by the population during the 19th century including habitat loss and commercial hunting. I parameterized the model as much as possible from historic accounts (primarily Schorger 1955). When parameter data was not available for *E. migratorius*, data from similar extant relatives were used. I created a female-only model run using RAMAS GIS (Akçakaya 2005).

Maternity HY &
Survival to census

Survival HY

Maternity AHY &
Survival to census

Survival AHY

Hatch Year → After Hatch Year

$M_{HY} * S_a$	$M_{AHY} * S_a$	0.14	0.43
S_{HY}	S_{AHY}	0.68	0.68

Growth rate (lambda) = 1.014

DISTRIBUTION MODEL

Occurrence Locations

Nesting accounts
- Schorger 1955
- The Auk & Wilson Bulletin

Museum specimen collections
- GBIF
- Collected April-June

~

Environmental Covariates

Variable*	Rationale
Temperature seasonality	Beech distribution
Total precip. growing season	—
Max July temperature	—
Mean temp. coldest quarter	Mast preservation
Total precip. coldest quarter	—
Start growing season	—
April temperature range	Mast regulation
Potential Natural Veg.	Forest type
Slope variation	—

* Climate variables are based on data 1900-1950

Habitat Suitability

High
Low

Maxent (v. 3.3.1)
http://www.cs.princeton.edu/~schapire/maxent/

THE RISK FACTORS:

COMMERCIAL HARVEST

Although long prized by both native Americans and settlers, a commercial industry based on passenger pigeons was only made possible with the expans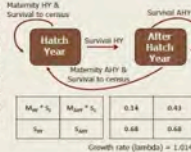ion of the railroad and telegram communication in the mid 1800's. I modeled commercial harvest at two levels based on witness and rail records:

Best estimate: average annual estimates
> 900,000 females

High: highest ever recorded estimates applied to all years
> 5 million females

NEST DISTURBANCE

Passenger pigeons nested in densely packed colonies which were the primary location where the commercial harvest took place. This also made the colonies susceptible to high incidence of nest failure due to this disturbance on the breeding grounds. Catastrophic nest disturbance was modeled as the probability of a loss of 70% of hatch year birds. In most scenarios the probability of this event was 5% before 1850 and 20% afterwards. Under a high nest disturbance scenario, the probability after 1850 was increased to 30%.

HABITAT LOSS

Baseline habitat suitability was proportionally reduced each year to simulate conversion of forest to cropland and pasture. Land conversion was based on the HYDE 3.1 historical land-cover inventory (Klein Goldewijk et al. 2010, 2011) which uses a spatial allocation algorithm based on population, available technology, suitability of land for agriculture (soil, slope, distance to water), and climate. Decadal maps were linearly interpolated to annual time-steps.

Available Habitat

1800
1840
1870
1900

HYDE 3.1 historical land-cover inventory
- 5 min resolution
- Fractional land use
- Decadal maps

SEE FLIP BOOK FOR
ANIMATION OF HABITAT LOSS
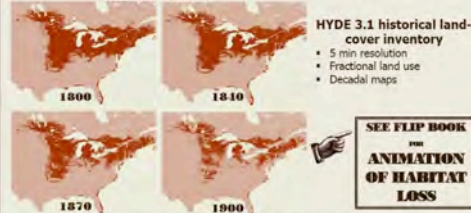
NOMADIC COLONIAL NESTING

A successful nesting colony depended on the birds' ability to locate forests with high productivity of mast. The massive colonies roved the landscape in search of masting deciduous forests and rarely nested in the same location two years in a row. I simulated this stochastic process by randomly assigning a mast location within the breeding range for each year and weighting the habitat within the mast area so that it contributed the majority to the overall carrying capacity for that year. This resulted in an increase in variability of reproductive success from year to year.

THE RESULTS:

Expected % Decline

- no commercial harvest
- 900k annual harvest
- 5m annual harvest

Probability of extinction

.007 .030 .064 .220

no habitat loss | habitat loss | habitat loss + nomadic habit | all risk factors
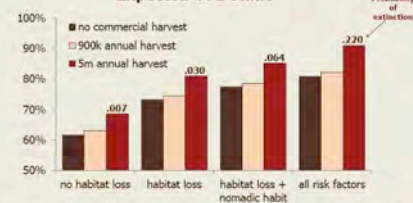
♦ Likely that **multiple factors** (commercial hunting, habitat loss and reliance on stochastic resources) contributed to the fate of this species.

♦ Better harvest management might not have **prevented** extinction, but perhaps it might not have been as rapid.

♦ Species facing multiple threats, even if **common** and **abundant**, may decline extremely rapidly; frequent evaluation of their status may be warranted.

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Klein Goldewijk, K., A. Beusen, G. van Drecht, and M. de Vos. 2011. The HYDE 3.1 spatially explicit database of human-induced global land-use change over the past 12,000 years. Global Ecology and Biogeography 20:73-86.
Schorger, A. W. 1955. The Passenger Pigeon: Its natural history and extinction. University of Wisconsin, Madison.

Evaluation of internal communication within a large academic medical center department of pharmacy

Adam Wolfe, PharmD, BCPS[1], Kayla Hansen, PharmD, MS, BCPS[2], Elizabeth Forshay, RPh, MBA[3], Stephen Eckel, PharmD, MHA, BCPS[4]

[1] Graduate Student at University of North Carolina (UNC) Eshelman School of Pharmacy (ESOP); Senior Pharmacy Administration Resident at UNC Health Care; [2] Research Advisor at UNC ESOP, Clinical Manager , Department of Pharmacy, UNC Health Care; [3] Experiential Advisor, UNC ESOP, Assistant Director, Department of Pharmacy, UNC Health Care; [4] Faculty Advisor and Vice Chair of Practice Advancement and Clinical Education, UNC ESOP; Associate Director of Pharmacy, Department of Pharmacy, UNC Health Care

Introduction

- Organization-wide annual employee opinion surveys have highlighted that communication within the department of pharmacy can be improved.
- The UNCH department of pharmacy is nationally recognized as a center for excellence within the profession of pharmacy.
- Employee communication is a major focus for the University of North Carolina Hospitals (UNCH) department of pharmacy.
- The department of pharmacy employs over 300 employees, over 100 pharmacists, and 200 technicians and administrative staff.
- Because this is the largest group within the department a specific, targeted actionable insights for this group are needed for improved employee engagement.

Objective

- The purpose of this research was to conduct focus groups with non-pharmacist employee-participants to develop a more complete understanding of staff perceptions regarding internal communication and how it relates to employee engagement.
- An additional purpose was to identify best practices and to validate current understanding of internal communication

Methods

Non-pharmacist perceptions on internal communication were evaluated through focus group methodology.

- Each focus group was designed as a structured meeting of 6 to 9 participants, 1 facilitator, and 1 recorder.

Employees were selected for participation through a two-step process.

- The first step was to have focus groups with employees representing different work locations, shifts, and years of work experience.
  - Employees having a pharmacist license or supervisory capacity were excluded.
- The second step was to ensure, due to the sensitive nature of employment, that the participants were not coerced into participating.

The focus group agenda was structured around four domains:

- defining internal communication,
- current methods of internal communication
- new methods of internal communication
- assessing communication skills of leadership and self

Focus groups were audio-recorded with acknowledgement from the participants.

None of the authors of this presentation have any discloses concerning possible financial or personal relationships with commercial entities that may have a direct or indirect interest in the subject matter of this presentation.

Results

Twenty eight employees participated in 4 focus group sessions. Transcripts and notes were analyzed through iterative sorting and manual sentiment analysis to identify a number of emergent themes relating to:

- Email, huddles, and one-on-one meetings
- Differentiation between information and communication
- The role of innovation in communication methods
- Insights for the manager's communication toolkit

Table 1. Baseline characteristics (N = 28)

Focus groups	N (%)
Acute care day & evening shifts	6 (21)
Acute care evening & night shifts	9 (32)
Specialty roles	6 (21)
Offsite professional staff	7 (25)
Work experience (N=28, Years)	**Average, SD**
Total work experience	14.7, 9.0
Total UNCH experience	5.4, 5.1
Total current position experience	3.9, 3.4
Ethnicity	**N (%)**
African-American	12 (43)
Non-Hispanic White	13 (46)
Other: Mixed	3 (12)
Generational affiliation (years)	**N (%)**
Boomer (46-64)	4 (14)
Gen-X (30-45)	14 (50)
Millennial (18-29)	9 (32)
Position	**N (%)**
Administrative	4 (14)
Specialty	1 (4)
Supportive	6 (21)
Technician	17 (61)

Figure 1. Top ranked methods of communication
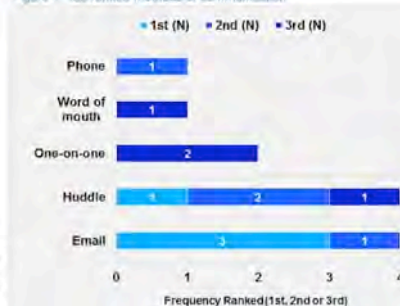
Figure 2. Communication grades for each level of supervision
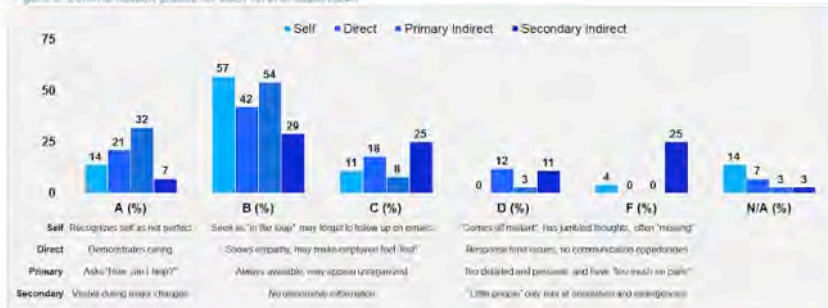
Figure 3. Sentiment analysis of top methods
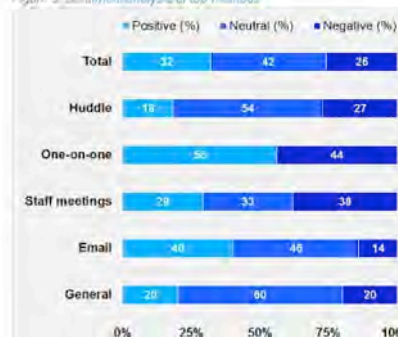
Table 2. New communication methods

Employee-centric (N=6, 50%)

Instant messaging, social networks, blogs, automated voicemails, mounted TVs, and electronic pharmacy systems

Procedural (N=4, 33%)

Communication board, cross training, community agreements

Archival (N=3, 25%)

Video recordings, blogs, and communication binder

Recreational (N=3, 25%)

Internet-based social networks, social events, and free food

Conclusions

Throughout these focus group sessions, staff explored their perceptions on the purpose of internal communication, current methods, new methods, and their assessments of leaders and selves. These groups identified many methods of communication used within the UNCH department of pharmacy as well as others that could be incorporated into the future.

The current modalities that department of pharmacy non-pharmacist employees perceive as most prominent are:
- email, huddles, and one-on-one meetings

Innovative methods that were described during the focus group sessions were related to:
- employee-centric technology
- development of communication procedures including archiving
- recreational activities

Finally, current managers were assessed by the focus group participants on their communication skills. The responses can provide managers actionable insight into determining their own communication performance.

While there are a number of challenges to conducting focus group research within a department of pharmacy, this project demonstrated that this method can provide valuable insights for both leadership and staff alike.

These responses will be shared with the participants of the focus groups and the departmental leadership with the overall aim to improve departmental communication and employee satisfaction scores.

MIRIAM L SHARPE, KURT L KRAUSE AND PETER K DEARDEN, DEPARTMENT OF BIOCHEMISTRY, UNIVERSITY OF OTAGO

TRANSCRIPTOME OF THE NEW ZEALAND GLOW-WORM, *ARACHNOCAMPA LUMINOSA*

454 SEQUENCING

Non-normalised total RNA samples were prepared from glow-worm light organs and remaining bodies separately, using TRIzol® reagent (Invitrogen) and a Qiagen RNeasy Mini Kit. Total RNA was shippe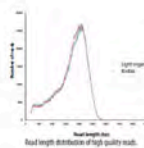d to 454 Life Sciences (USA) for mRNA enrichment, cDNA library construction, and subsequent 454 sequencing on a Roche GS FLX Titanium Genome Sequencer. Each sample was sequenced on one-half of a pico-titer plate. A total of about 1.12 million high quality reads were obtained, amounting to almost 400 Mb of high quality sequence.

Read length distribution of high quality reads.

Summary of sequencing run metrics. HQ = high quality % filtered = percentage of reads filtered out the mixed filter, where a mixed read is the result of simultaneously sequencing a mixture of different DNA molecules. % Dots = percentage of reads filtered by the dots filter, where a dot is an instance of three successive nucleotide flows that record no incorporation.

CONTIG ASSEMBLY

Since there is no *A. luminosa* reference genome available for mapping, 454 reads from the light organ and body samples were de novo assembled using the Roche-454 contig assembly software GS De Novo Assembler (light organs and bodies separately) or CLC Genomics Workbench Version 5.1 (light organs and bodies combined).

Contig length distribution of assemblies.
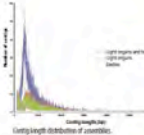
Assembly metrics. N50 size = the length such that 50% of the assembled genome lies in N50 size or greater. Q40+ = number of bases in the assembled contig that carry a phred-equivalent quality score of 40 and above (a score of 40 is equivalent to an error ratio of 10^-4 or an accuracy of 99.99%). NA

ARACHNOCAMPA LUMINOSA
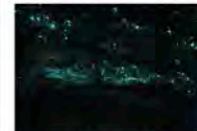
Bioluminescence of *A. luminosa* in a cave.

The New Zealand glow-worm has fascinated people for centuries with its star-like display of lights in caves and sheltered gorges throughout the country. The nocturnal and carnivorous larva of the glow-worm, a type of fungus gnat, attracts its prey using a bioluminescent light organ on the end of its tail. Revealing the molecular mechanisms behind this light show will extend our understanding of the biochemistry and evolution of bioluminescence, and may provide new tools for biomedical research. We aim to study the gene expression and function of the light organ of the glow-worm by sequencing the transcriptomes of both the light organ and the rest of the glow-worm body using Next Generation Sequencing.

The larva (1), pupa (2) and adult fly (3) of *A. luminosa*, drawn by F. A. A. Skuse (Hudson, GV. 1890. Trans NZ Inst. 23: 43).

This is the first study to investigate the genetic makeup of the New Zealand glow-worm. The 454 pyrosequencing of this transcriptome will provide clues to the identification of genes involved in the bioluminescence of the glow-worm and lay the foundation for future biochemical and genomics studies.

INTERPRETATION

Comparing the difference in type and abundance of transcripts from the light organ and the bodies of *A. luminosa* may reveal transcripts involved in bioluminescence. Although the lack of both a reference genome and sequencing depth in this transcriptome prevent a full differential analysis with statistical confidence from being completed, we have carried out a limited comparison between the transcript assemblies.

We used the CLC Genomics Workbench to calculate gene expression levels based on a reference dataset (the contig assembly of 454 reads from the light organ and body samples combined) and transcript sequencing reads from the light organ and from the body separately. We then compared these values between the two samples.

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Te Whare Wānanga o Otāgo
NEW ZEALAND

FOUNDATION FOR RESEARCH SCIENCE & TECHNOLOGY

Expression of transcripts in Light Organs vs Bodies (Normalisation method = Scaling to median; Reference value = Median of medians). Trimming = 5% hyp = hypothetical protein

BLASTX assignment overview.

E-value distribution

Sequence similarity distribution

Species distribution
BLASTview

Annotation of the combined light organ and body assembly was initiated using Blast2GO. Automated assignment of BLASTX identities has been completed, with about 66% of contigs assigned a BLASTX identity. Assignment of BLASTX identities for the separate light organ and body assemblies, and annotation and mapping in terms of Gene Ontology (GO) terms for all three assemblies are underway.
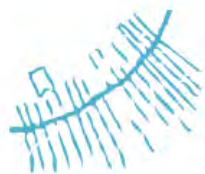
PALAEOPATHOLOGY AND URBAN DECLINE AT IMPERIAL GABII (ITALY)

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Research Labs of Archaeology, University of North Carolina, Chapel Hill NC 27599

BACKGROUND: URBANISM IN LATIUM

The ancient city of Gabii emerged in the late first millennium BC during a wave of urban explosion that also saw the rise of Rome just 12 miles away.[1] Gabii grew to one of the largest cities in the area by virtue of its geographic location at the intersection of several important roadways. Rumored to be the place where Romulus and Remus were educated, Gabii was a cultural icon for centuries. By the late Republican period (1st century BC), literary references to Gabii concerned its depopulation and insignificance in civic life.

Little archaeological investigation was undertaken at Gabii until 2007. One of the surprising finds was a makeshift Imperial-era necropolis. Since Roman cemeteries were traditionally located outside the walls of a city,[2] one of the salient features of the collapse of Gabii as an urban center is the reuse of the city as a necropolis. The question remains: *Who was buried at Gabii?*

GABII CEMETERY

Area B at Gabii corresponds to a domestic structure dating to the mid-Republican period, followed in the early Imperial period by burials that were likely purposefully made within the abandoned structure. The sequence of burials in Area B has not been fully refined, but carbon dating of bones from three graves suggests the burial program began in the late 1st/early 2nd century AD and continued through at least the 3rd century AD.[3]

Most of the burials in Area B are aligned roughly east-west, but others, like Tomb 8 (the "lead burrito"), are more north-south in orientation. Skeletons were interred in simple pits, in amphorae, and in *cappuccina*-style graves, consistent with burial forms found in other Rome-area necropoleis.[4] However, three burials contained lead sheeting, a practice not well-attested in Roman graves. The lead burials are not included in this presentation, as they will be studied further this summer.

The total number of Imperial-period skeletons from Area B is 23 – 5 subadults under the age of two, 7 females, 8 males, and 3 adults of indeterminate sex.
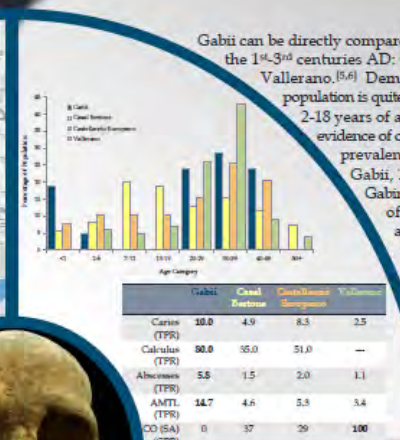
PATHOLOGICAL CONDITIONS

Gabii can be directly compared with three other cemeteries in use during the 1st–3rd centuries AD: Casal Bertone, Castellaccio Europarco, and Vallerano.[5,6] Demographic data show that the Gabine burial population is quite different, however, with no subadults between 2-18 years of age. None of the five children examined had evidence of cribra orbitalia, compared to much higher crude prevalence rates at the other sites. Of the adults from Gabii, 14 presented teeth or jaws for analysis. The Gabine population had worse dental health in terms of true prevalence rates of caries, calculus, abscesses, and antemortem tooth loss than did the other three populations. In comparing these frequencies using Fisher's exact test, Gabii is statistically different ($p \leq .01$) than Casal Bertone and Vallerano in caries, abscesses, and AMTL, and different than Castellaccio Europarco in the latter two conditions. Gabii is similar to Casal Bertone and Castellaccio Europarco in frequency of degenerative joint disease: 67%, 76%, and 63% CPR, respectively.

	Gabii	Casal Bertone	Castellaccio Europarco	Vallerano
Caries (TPR)	10.0	4.9	8.5	2.5
Calculus (TPR)	80.0	55.0	51.0	–
Abscesses (TPR)	5.5	1.5	2.0	1.1
AMTL (TPR)	14.7	4.6	5.5	3.4
CO (SA) (CPR)	0	37	29	100

INTERPRETATION

The urban area of Rome boasted a very heterogeneous population during the Imperial period owing particularly to the importation of slaves from other areas of the Empire. Attempts to characterize the skeletal health of this disparate population, however, are only just beginning, and most reports do not list methods or individual-level data. Based on the information available to date, the Gabii skeletal series is different than those from other cemeteries near Rome in terms of demographics and frequencies of dental disease. Osteological investigation of the Gabine population suggests a burial program biased towards adults and young children, and palaeopathological investigation suggests consumption of different foodstuffs and/or more physical stress compared with other groups from the same area and time period. It is currently unclear whether these differences can be directly related to the collapse of the city of Gabii. Analysis of this site and the skeletons is ongoing. Future research will involve biochemical testing to investigate the diet and the geographical and biological backgrounds of the Gabines.

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Southward propagation of the Marlborough Fault System: Fault linkage and blind faults in North Canterbury

Previous interpretation:

New hypothesis:

Contrary to previous research the southernmost propagation of the Marlborough Fault System lies not in the PPAFZ, but a new incipient fault system stretching from the Porters Pass Fault to the Hope Fault over a length of 140 km.

The fault system is at an early stage where it shows various stages of overlapping and fault linkage. Furthermore, not every fault in the system ruptures the surface.

Hanmer Springs

Hope Fault

unnamed fault

Possible blind faulting

Mt Culverden Fault

Lake Sumner

Blind faulting:
This is one of few spots where the Esk Fault has ruptured to the surface. Other faults might be hidden completely.

Diagnostic hook shape of advanced linkage

Waichi Downs Fault

northern Esk Fault

Mt White Fault

Bullock Hills Fault

western Esk Fault

southern Esk Fault

Hawdon Fault

Lake Coleridge

Torlesse Fault

Overlapping faults advanced linkage

Porters Pass Fault

Very active:
140 m and 110 m of post-glacial displacement on the Hawdon and Bullock Hills faults result into a slip rate of 9.3±2.8 mm/year.

Redcliffe Fault

dilational stress

contractional stress

0   5   10   15   20   25 km

Christchurch

Jana Mittelstädt
Department of Geology, University of Canterbury
jana.mittelstaedt@googlemail.com

{ NEXT GEN SEQUENCING }
millions of reads
hard to completely assemble

{ FRAGMENTED ASSEMBLIES }
repeat regions difficult to bridge
unenven read coverage

{ REQUIRE FINISHING }
join contigs together
trim nucleotide sequences
add PCR sequences

{ FINISHING ERRORS }

[human-error]
manually joining contigs and
trimming sequences can introduce
errors

[unreproducible]
manually editting a sequence
can't be repeated by anyone else

[hard to change]
large blocks of nucleotide sequence
are hard to update and determine
the source contig

scaffolder
microbial genome scaffolding software
http//next.gs

michael d barton*, hazel a barton
northern kentucky university
*mail@michaelbarton.me.uk

scaffold file

① sequence
   source sequence1

② unresolved
   length 20

③ sequence
   source sequence2
   start 30
   stop 1000
   reverse true
   inserts

④ source insert1
   start 8
   stop 160
   reverse true
   open 200
   close 250

⑤ source insert2
   open 400

putative scaffold
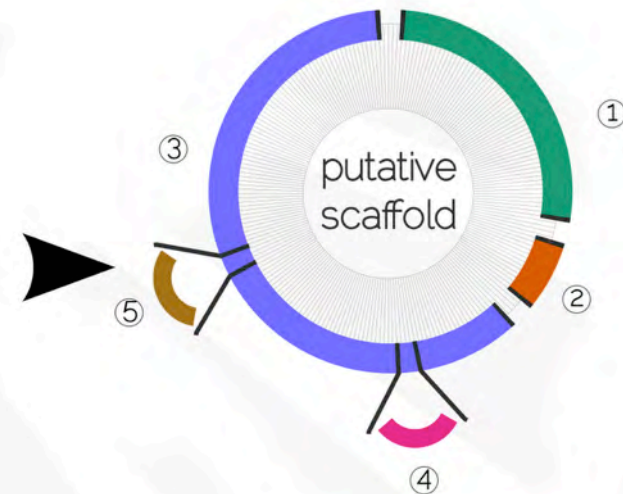
reproduce
remove human-error and
scaffolds can be reliably
reproduced from the
same data

separate
separate sequence from
the scaffold organisation
and preserve the original
assembly data

edit
easier to edit the
scaffold file compared
with raw nucleotide
sequence

visualise
privdes an overview
of the genome
construction and allows
easier comparions of
differences in scaffolds

TYPOGRAPHY

"Or [the typographer] may work in what I call transparent or
invisible typography. I have a book at home, of which I have
no visual recollection whatever as far as its typography goes;
when I think of it, all I see is the Three Musketeers and their
comrades swaggering up and down the streets of Paris."

Beatrice Warde
The Crystal Goblet, or Printing Should Be Invisible (1955)

Type rules

- Don't use more than two font families
- Use fonts with the right "feel"
- All caps are hard to read
- Limit line lengths
- Left alignment might be easier to read

Times New Roman

Optima

Baskerville

Garamond

Cambria

Helvetica

Verdana

Calibri

Gill Sans

Corbel

Type family

CONDENSED

REGULAR

ITALIC

SEMIBOLD

BOLD

BOLD ITALIC

Myriad Pro

1. WHY INCREASE THE HYPERPOLARIZED LIFETIME?

- Hyperpolarization decays with T_1
- Limits choice of molecules to those with long T_1
- Limits applications to processes that happen faster than T_1
- Singlet state is a disconnected eigenstate - no available relaxation mechanisms.
- Offers the potential for MRI to advance as a molecular imaging modality
- Increases the general applicability of hyperpolarized contrast agents

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Line length and height

- Lines should have 45-75 characters
(wider columns get bigger text, not more words per line)

- Longer lines need more space in between
(good starting point for line height is "1.25" spacing in PPT)

Size guidelines

Title: 85 pt

Authors: 56 pt

Subheading: 36 pt

Body text: 24 pt

Caption: 18 pt

text in 24 pt,
line spacing at default,
character count ~95

Text in 24 pt, line spacing at default, character count ~95:

Left alignment is often assumed to be easier to read, but it produces a "ragged" right edge and thus looks less polished. Justified text (text that is aligned both on the left and right sides of the paragraph) may be harder to read and is likely to produce strange spacing and hyphenation issues in narrow columns. With either alignment, it may also be necessary to be creative about word placement to prevent "orphaned" words at the end of the paragraph (i.e., lines that only have a single word).

text in 28 pt,
line spacing at 1.25,
character count ~80

Text in 28pt, line spacing at 1.25, character count ~80:

Left alignment is often assumed to be easier to read, but it produces a "ragged" right edge and thus looks less polished. Justified text (text that is aligned both on the left and right sides of the paragraph) may be harder to read and is likely to produce strange spacing and hyphenation issues in narrow columns. With either alignment, it may also be necessary to be creative about word placement to prevent "orphaned" words at the end of the paragraph (i.e., lines that only have a single word).

text in 42 pt,
line spacing at 1.2,
character count ~53

Text in 42pt, line spacing at 1.2, character count ~53:

Left alignment is often assumed to be easier to read, but it produces a "ragged" right edge and thus looks less polished. Justified text (text that is aligned both on the left and right sides of the paragraph) may be harder to read and is likely to produce strange spacing and hyphenation issues in narrow columns. With either alignment, it may also be necessary to be creative about word placement to prevent "orphaned" words at the end of the paragraph (i.e.,

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Consider a system with two spin 1/2 nuclei with identical resonance frequencies. The matrix representation of the spin Hamiltonian is not diagonal in the Zeeman product basis, indicating that the Zeeman product states $|\alpha\alpha>$, $|\alpha\beta>$, $|\beta\alpha>$ and $|\beta\beta>$ are not all eigenstates of the Hamiltonian, H. By selecting a different basis, called the singlet-triplet basis, the Hamiltonian is diagonalized. The triplet states are:

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$$|T_{-1}> = |\beta\beta>$$

And the singlet state is:

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The important feature of this system is that the singlet state is a completely disconnected eigenstate [3].

$$<S_0|H|T_0> = 1/2(<\alpha\beta| - |\beta\alpha>) H (<\alpha\beta| + |\beta\alpha>) = 0$$

Thus, populations in the singlet state are trapped and there are no allowed transitions in or out of the singlet state. The result is that hyperpolarized populations in the singlet state are stored and their lifetime increased.

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COLOR

Theme

- Pick two or three main colors that complement each other to add visual interest

- Maintain high visual contrast throughout

- Do not use a background image
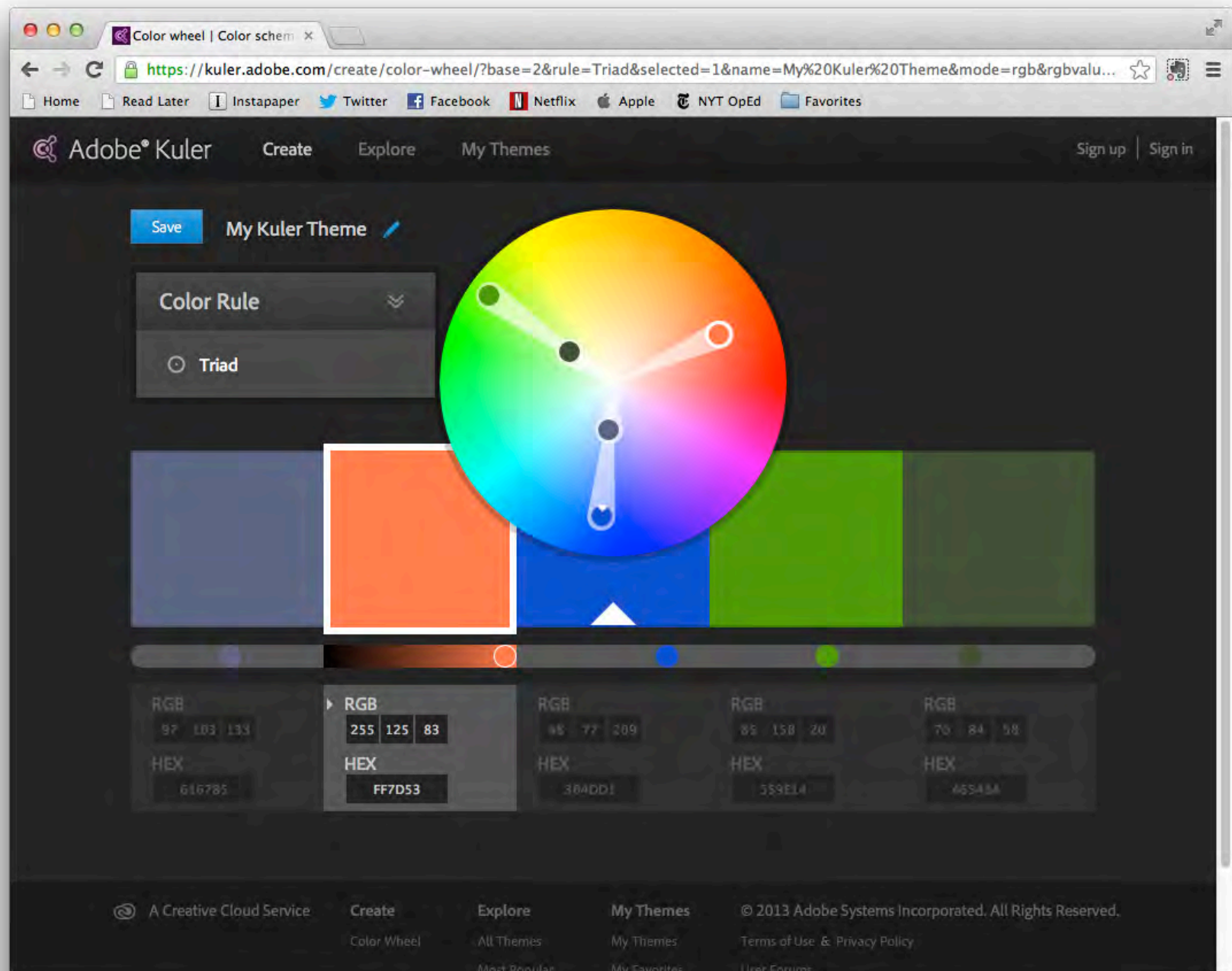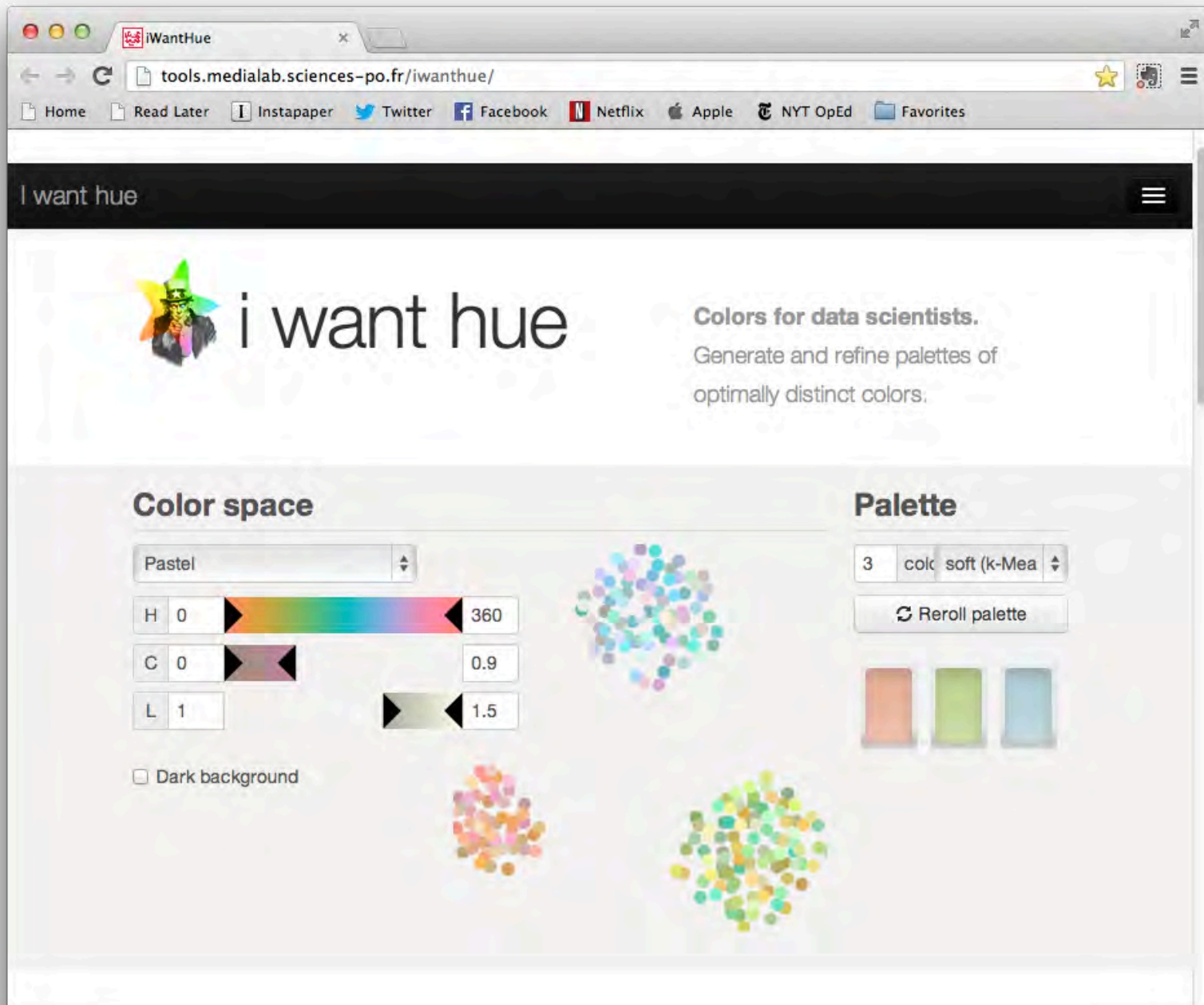
visual contrast

Blue on black
doesn't work well

Yellow on white
is even worse

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- Limits choice of molecules to those with long T_1
- Limits applications to processes that happen faster than T_1
- Singlet state is a disconnected eigenstate - no available relaxation mechanisms.
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Development of Long-Lived, Hyperpolarized Contrast Agents for In Vivo MRI

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Figure 1: Energy levels of an AX (inequivalent spin) system and an A_2 (equivalent) spin system.

3. Diacetyl as a Test System

2,3-^{13}C-labeled diacetyl [$CH_3(^{13}C=O)(^{13}C=O)CH_3$] has a single line carbon spectrum, but the carbon spectrum in water has 5 lines (figure 2). The monohydrate [$CH_3(^{13}C=O)(^{13}C(OH)_2)CH_3$] has two inequivalent carbons with a $J_{CC}=45$ Hz, and is the majority species in water (figure 2). Equilibrium between the hydrate and the diacetyl can be shifted with pH and solvent.

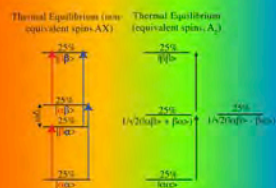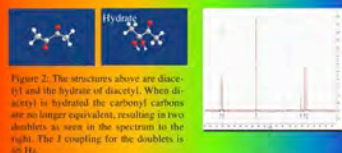Figure 2: The structures above are diacetyl and the hydrate of diacetyl. When diacetyl is hydrated the carbonyl carbons are no longer equivalent, resulting in two doublets as seen in the spectrum to the right. The J coupling for the doublets is 45 Hz.

4. Evidence of a Disconnected Eigenstate

Figure 5 shows a comparison between experimental and simulated spectra demonstrating the presence of a disconnected eigenstate without magnetically equivalent spins. If $J_{cc}=0$ the experimental spectra for a singly labeled diacetyl molecule and the doubly labeled simulation are identical (3A and 3D), and the carbon singlet state is not an eigenstate. If J_{cc} is much larger than all the other couplings it collapses into a septet (3E), similar to the spectrum of acetone, EXCEPT that the splittings are not as expected - the splittings are 2.65 Hz, the average of the couplings to the near and far methyl groups. This spectrum comes entirely from transitions of the $\alpha\beta + \beta\alpha$ as a carbon state, and is delocalized over the two carbons and coupled equally to all the hydrogens [2].
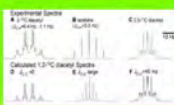
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5. Hyperpolarized Contrast On Demand via Singlet States

The figure below details the experiment to detect hyperpolarized signal. The singlet state is populated and the populations trapped for a chosen time period and then released through the injection of water.

Preparation | Conversion to A_2 system (traps and stores population in the singlet state) | water injection | Release stored population from the singlet state by converting back to an AX system

FID

Hydrate peak (on resonance)

Signal to noise

acetone injection

Figure 4: A 15 µl sample of the 2,3 - [13]C labeled and deuterated diacetyl was hyperpolarized by DNP using the Oxford Hypersense. The sample was dissolved into a pH 7 PBS solution and inserted into a 7T small animal imager with a home built carbon solenoid coil. The $|\alpha\beta> + |\beta\alpha>$ po er (pH 7, 37 °C) was injected, and 45° pulses were applied every 30 s to detect the populations flowing out of the singlet state.

6. Applications of Singlet States with Other Molecules and In Vivo

Precise numerical analysis of the eight spin system shows that the overlap of the singlet state with an eigenstate of diacetyl is more than 96%. This calculation is easily extended to other molecules to evaluate their potential for use with this technique. The criteria for selecting a molecule to use are:

1. The system of interest must have two nearby ^{1}H, ^{13}C, ^{15}N, ^{19}F or ^{31}P atoms.
2. The coupling between the two spins must exceed (substantially) any couplings to other spins as well as the resonance frequency difference.
3. The system must have a precursor in which the two nuclei of interest are in equivalent, which can be converted into the contrast agent in a time short compared to T_1.
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In the absence of relaxation, the time dependent diacetyl density matrix can be evaluated, and the transition dipole moment can be calculated.
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diacetyl

hydrate

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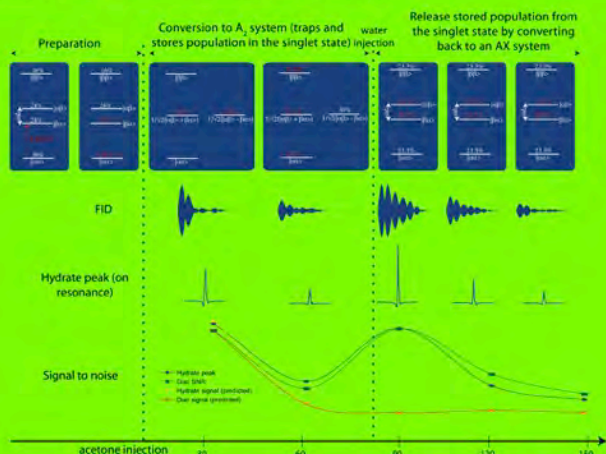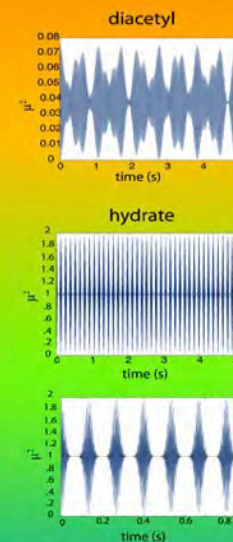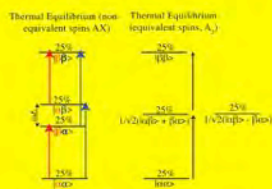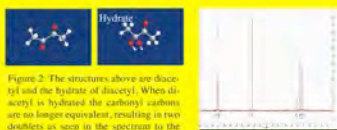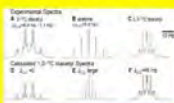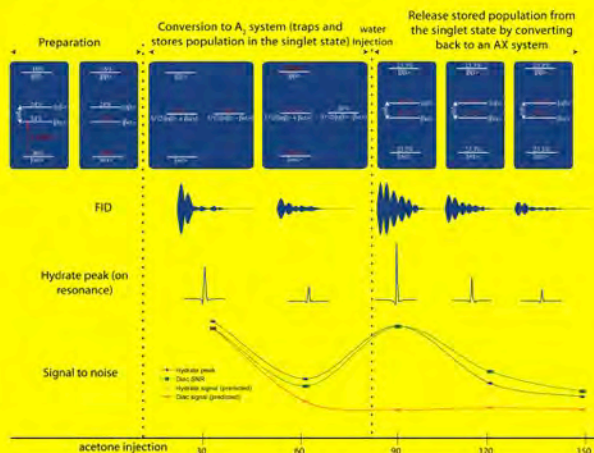
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3. M. Levitt, SpinDynamics 2nd ed. Wiley, 2008
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CMBI
CENTER FOR MOLECULAR AND BIOMOLECULAR IMAGING

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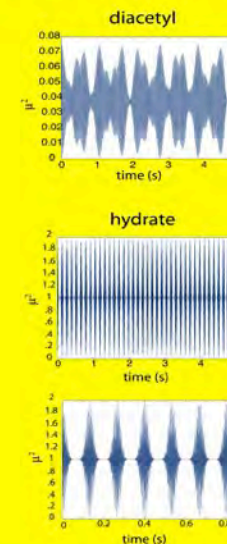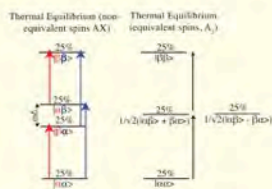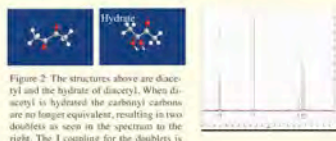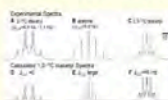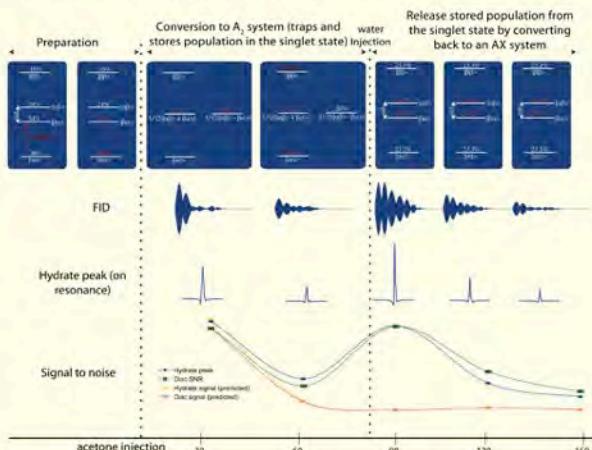

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1. Why Increase the Hyperpolarized Lifetime?

-Hyperpolarization decays with T_1

-Limits choice of molecules to those with long T_1

-Limits applications to processes that happen faster than T_1

-Singlet state is a disconnected eigenstate - no available relaxation mechanisms.

-Offers the potential for MRI to advance as a molecular imaging modality

-Increases the general applicability of hyperpolarized contrast agents

2. What are Singlet States?

Consider a system with two spin 1/2 nuclei with identical resonance frequencies. The matrix representation of the spin Hamiltonian is not diagonal in the Zeeman product basis, indicating that the Zeeman product states $|\alpha\alpha>$, $|\alpha\beta>$, $|\beta\alpha>$ and $|\beta\beta>$ are not all eigenstates of the Hamiltonian, H. By selecting a different basis, called the singlet-triplet basis, the Hamiltonian is diagonalized. The triplet states are:

$$|T_{+1}> = |\alpha\alpha>$$
$$|T_0> = 1/\sqrt{2}(|\alpha\beta> + |\beta\alpha>)$$
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The figure below details the experiment to detect hyperpolarized signal. The singlet state is populated and the populations trapped for a chosen time period and then released through the injection of water.

Preparation — Conversion to A_2 system (traps and stores population in the singlet state) — water Injection — Release stored population from the singlet state by converting back to an AX system

FID

Hydrate peak (on resonance)

Signal to noise
- Hydrate peak
- Diac SNR
- Hydrate signal (predicted)
- Diac signal (predicted)

acetone injection

Figure 4: A 15 µl sample of the 2,3 - 13C labeled and deuterated diacetyl was hyperpolarized by DNP using the Oxford Hypersense. The sample was dissolved into a pH 7 PBS solution and inserted into a 7T small animal imager with a home built carbon solenoid coil. The $|\alpha\beta>$ and $|\beta\alpha>$ populations were perturbed from equilibrium, and then 10 ml of acetone (37 °C) was injected into the sample. 30 seconds passed to allow the dehydration of the diacetyl hydrate, and then a 45° pulse was applied, followed by another 30 s wait and a second 45° pulse. 10 ml of water (pH 7, 37 °C) was injected, and 45° pulses were applied every 30 s to detect the populations flowing out of the singlet state.

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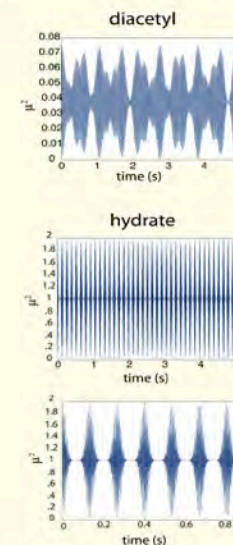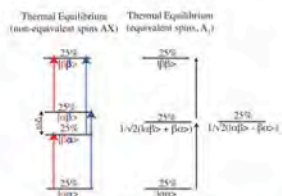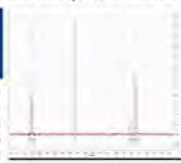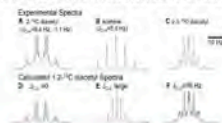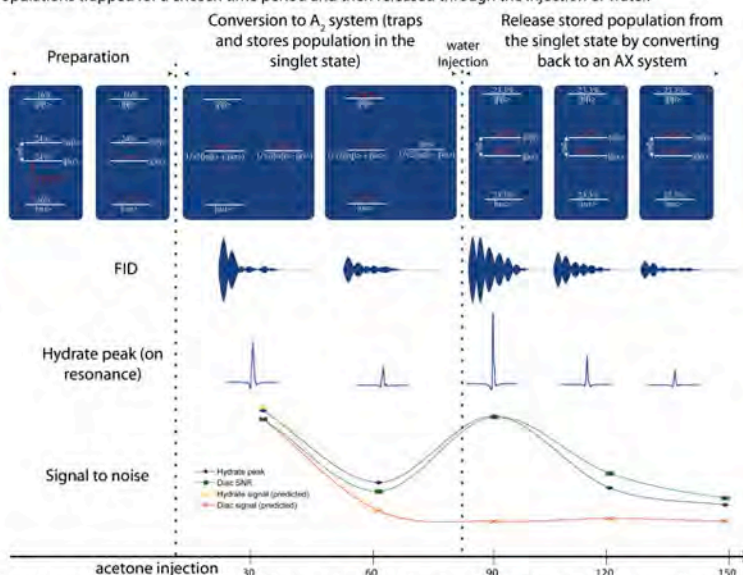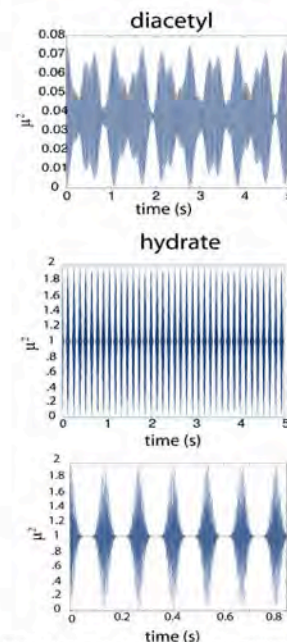
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hydrate

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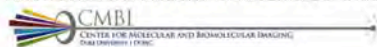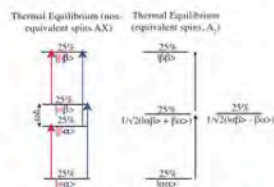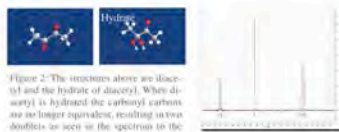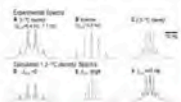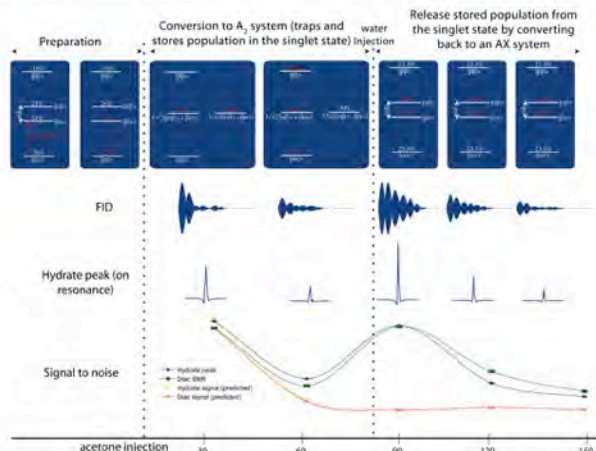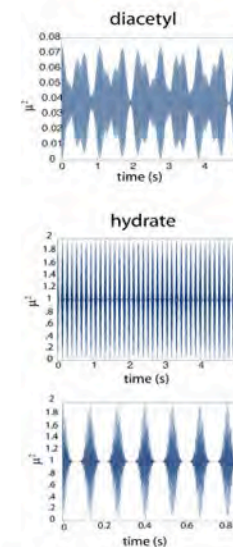
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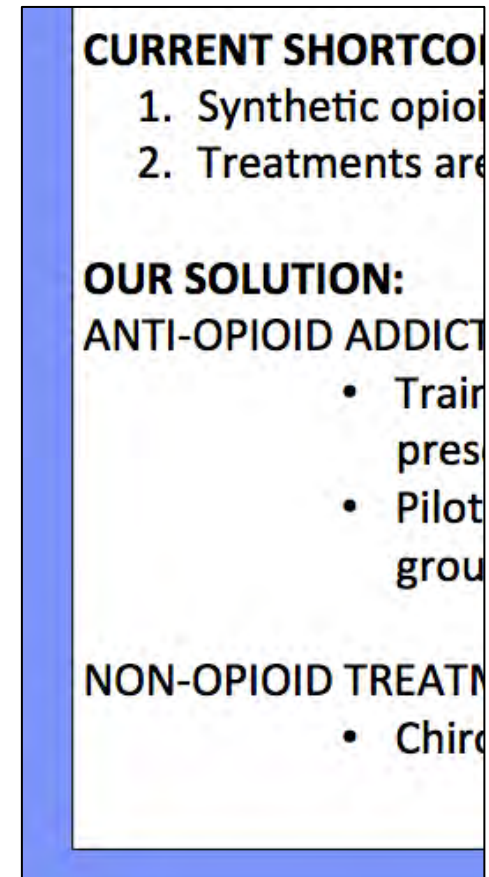
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