Systematic fundamentals, paleontological questions.

GEO 391/371C 27740/27970

Rm 3.218, 2-3:30 Mondays and Wednesdays

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Course Description: This reading-intensive course will focus on 1) the philosophical/historical underpinnings of, and 2) practical approaches to, the study of morphological evolution using discrete cladistic characters. Active participation in class discussion is expected.


Grading: Assignments 1- 4 (see due dates below) and the abstract of your proposed research (due March 19) are each worth 10% of your grade for a total of 50%. Participation is 20%. Final written assignment: 30% of your grade.

Final Assignment: See description at the end of this syllabus. You will be expected to have an abstract of your proposed research just after spring break (March 19) so a topic should be chosen early in the semester. Ideally this research will be a short paper modifiable for submittal to a journal and a viable part of one of the chapters of your thesis.

Date and time of Final Exam: There is no final exam.

Materials: Papers and assignments are distributed via Blackboard. You must regularly check for new posting and download all readings to have them available in each class. In each class, students will choose one of the assigned papers and be responsible for co-presenting its main points. We can cover more of the relevant literature in this way.
Course plan: NOTE reading assignments and topics will shift as the course progress necessitates – it is your responsibility to follow changes announced to the course plan. These changes will be announced in class or via email so please make sure I have your preferred email contact. Note based on the interest and experience of the class primary and suggested readings may be swapped.

Week 1. Introduction: Phylogenetic dataset properties

Jan. 18. Course overview and discussion. Questions: what are properties of a dataset? How do datasets differ? What is a character? What are properties of a character?

Week 2. The character, Part I.

Jan. 23. No Class. Prepare for Assignment 1. Spend appropriate course prep and course time: 1. Finding and installing a data editor (Mesquite, MacClade, WinClada) on your computer or locate one you will use throughout the class or establishing an account: Morphobank), and 2) locating, uploading into this data editor, formatting your target dataset and 3) prepare (copy with citation) the corresponding character list into an editable word document.

Jan. 25. Due: Discussion of your character sets: Be prepared in just 3 well organized powerpoint slides (in-class component of Assignment 1) to 1) introduce your dataset, 2) state your target question(s) and 3) briefly introduce your target taxonomic group.

Written Assignment 1 Due. Bring (on one printed page): a 1) one line statement of a proposed target question, 2) relevant formatted citation(s) and 3) attach a print out of your working character list.

Week 3. Philosophy of “the character”: Question to be discussed in class: How would your perspective on the nature of the character directly impact establishing decisions about your dataset and analytical approach?

Jan. 30. Readings:


Feb. 1. Reading:

Other suggested readings:
Week 4: Relationship between philosophies of the character and systematic practice.

Feb. 6: Lecture/discussion: Character construction: Morphoclines, Multistate/single state, Ordering. Post analysis character exploration. Primary/Secondary Homology

Readings: 67


Feb. 8. Readings


Other suggested readings on ordering and multistate characters: N.B. available hardcopy only (no UT online access).


Week 5. Character writing workshop


Character writing workshop I. Character wording, construction, issues, state discrimination. Problems of the composite state and non-equivalence of the “0” state. Due:
bring examples of characters for discussions and workshop- suitable for the overhead projector, as handouts or as powerpoint slides.

**Instructions for assignment:**

1. Bring 3 characters for discussion: at least one ordered multistate, unordered multistate, and one binary. If there are no multistates in your analysis bring 2 examples of sets of additive binary characters that could arguably be made into multistates. Be ready to explain the features addressed –bring along visuals or draw on the board…

2. Be prepared to discuss: What kinds of features are multistates are in your dataset? Where are they in the skeleton/organism? Is there any pattern? Why did you (or the authors) choose an ordered multistate in one example, and why did you choose an unordered in another case? Is redundancy introduced? Composite 0 states? Where “O” compasses a variety of disparate conditions?

Feb. 15. **Workshop continued and discussion** concerning the relationships between philosophies of the character and systematic practice.

**Reading:**


Feb.20. **Readings**


Feb 22. **Readings**


**Week 7. Missing data**

**Feb 27. Readings:**


**Feb. 29. Readings:**


**Week 8. Character analysis, missing data & taxon sampling – discussion and workshop**

**Mar. 5. Assignment 3 Due: Choose 2 of the below: 1 well written page single spaced. One figure.**

1. **Ordering:** Chose a minimum of 2 multistate characters (preferably some we discussed), run an appropriate analysis or use a tree from the literature and bring Macclade or Mesquite output screen shots (or similar) to show character optimizations (use the “show states changing option”) when the characters are ordered and unordered. Be prepared to present and discuss these results (ordered vs. unordered, implications for character evolution in trait).

2. **Terminal taxa:** Go from species or other exemplar scoring to composite (e.g.) supraspecific for one set of taxa or specimens (minimum 2!) or Go from supraspecific/composite to a species based exemplar approach (from higher taxa to species or species to specimen).

3. **Missing data:** Explore your dataset for example iteratively deleting the most incomplete taxa by percent missing data. What is the effect on the recovered topology? If there are apparent wild card taxa in your dataset is lack of resolution driven by operational taxonomic equivalents or by homoplasy? How would you investigate this?

**Mar. 7. Continued.**

*Mar. 12-18 Spring Break*
Week 9. Morphological evolution, models and methods for considering rate heterogeneity

Mar. 19. Abstract Due. Readings:


Dececchi and Larsson, H. 2009. Patristic evolutionary rates suggest a punctuated pattern in forelimb evolution before and after the origin of birds. Paleobiology 35:1-12


Mar. 21. Readings:


Other suggested readings:


Mar. 26. Readings:


Mar.28: Readings:

Week 11. Discussion/workshop of methods for dataset exploration

Apr. 2. Assignment 4 Due – hard copy in class:
Exercise – Sensitivity analyses and post-analysis data exploration: Choose 2 of the below: 1 well written page single spaced. One figure.

1. **Implement a minimum of 2 rounds of reverse successive weighting on CI (or CI and RI if you want).**
   Present results:
   a. What characters were removed in the first round? What is their distribution over the skeleton? What are their properties: Ordered? Unordered? Multistate?
   b. Summarize resultant tree topologies minimally as strict consensus cladogram after each round. Present these. What other signal is/maybe present in your dataset? Are other topologies recovered inconsistent with the primary topology based on all of the data?

2. **Partition your dataset into at least 2 anatomical subregions or hypothesized “data types” based on evolutionary hypotheses of your group.** Run separate analyses iteratively including characters from one subregion and then the other. Compare resulting trees to each other and to the primary analysis of all data: topological differences? L? CI and other metrics? Present these trees and metrics.

3. **Take another approach to exploration of your dataset.** For example, the effect of iterative taxonomic deletion or enforcement of a backbone constraint tree on the distribution of characters of interest? You may choose any methods. Please include the relevant cite either from this syllabus or other.

Apr. 4. Continued.

Week 12. Incongruence, Combined analyses, the place of morphology in phylogenetic analyses

Apr. 9. Readings:


Weins. JH. 2004 The role of morphological data in phylogeny reconstruction. Systematic
Biology, 53: 653-661.


Apr. 11. **Readings:**


**Other suggested readings:**


**Week 13. Introduction to debates over the comparative method & and the nature of hypothesis testing in the historical sciences.**

Apr. 16 Hypotheses and the Historical Sciences

**Readings:**


Apr. 18. The comparative method: fundamentals and critiques

**Readings:**


**Other suggested reading:**

**Week 14. Diversification**

Apr. 23. Rates of character evolution: molecules and morphology.

**Readings:**


Apr. 25. Diversification: rate or age?

**Readings:**


**Week 15. Comparative method- Biogeography**

Apr. 30. **Readings:**


May 2. **In class workshop: examples of biogeographical inference from paleontological data.**

**Readings:**


**Other suggested readings:**


May. 9 Final paper due. (see next page).

Final paper:

1. Chose a topic covered in one of our 4 modules – e.g. the character, taxon sampling, homoplasy, patterns of morphological evolution, comparative methods and hypothesis testing. N.B. since independent research is expected- there will be no way to complete all relevant work at the very end of the semester.

2. Critically evaluate the prior literature on your topic and/or method. (e.g., an aspect of character philosophy). Please remember that you are expected to explore the literature on one of these subjects not to primarily cite papers from class. No more than 30% of the references can be from class.

3. Empirically investigate an aspect of this topic with your dataset or through simulation (see "character philosophy" example below). You are also expected to present something new- not something from a prior assignment - although you may include results from a prior assignment as a limited part of the data discussed in the paper or presentation.

4. All papers will take the general form of manuscripts for submittal to a journal (e.g., Systematic Biology, Evolution, Paleobiology, Biology Letters) (Maybe you will submit them?!).
   a. All have a well crafted abstract, introduction, methods, results, discussion, conclusions and formal reference section. They also have figures.
   b. Length is not the primary concern but papers are anticipated to be 15+ double spaced pages not including references. The emphasis is up to you: you may focus primarily on a novel critical evaluation of the literature and only have a brief empirical portion or vice versa.

I have included an example sketch for the outline of a final project (below). Please discuss your project concept with me well prior to the end of the semester.

-Critically review the prior literature regarding aspects of a debate, for example, concerning character identity/ontology, transformational vs. taxic homology etc., issues with choice of terminals implications for your understanding of the relationships in your group and the evolutionary history of that group.

Through your concise and thoughtful discussion of the relevant literature, your unique perspective (e.g., on the character, taxon sampling/taxon choice, hypothesis testing and comparative method, homoplasy) as the author of the paper will be come clear. This discussion would generally comprise the introduction (may be lengthy) and contextualize your empirical exercise.

-Methods and Results would present how you investigated, for example, the impact of enforcing your philosophy/ methodological approach (e.g., on character concept, taxon choice etc.) in the revision of the characters in your data matrix (or if you are building a data matrix - in your interpretation and 'translation' of the prior literature to make your dataset).

-Results: explore the implications of, for example, your revised characters etc. on the outcomes of your analysis. How may have your "dataset properties" have changed?

-Discussion and Conclusions: synthesize your results and present your recommendations for other workers based on your critical evaluation of the literature and your analytical results.
-References: Formatting matters.

Grading of final project: Approximate breakdown: 20% Originality of question, articulation of topic/hypothesis, 15% fit of methods/approach to chosen question, 20% relevant literature cited, 20% thorough discussion of implications, 25% quality of the written document, figures and citations.
Policies and other information:

University of Texas Honor Code
The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the university is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and community. We maintain a zero-tolerance policy on cheating. Scholastic dishonesty includes, but is not limited to, cheating, plagiarism, collusion, using, buying, stealing, and/or divulging the contents of an examination, removing a test from the examination room, substituting for another person, having someone take a test for you, misplacing or damaging property of the University or destroying information so another student may not have materials, falsifying research data, misrepresenting facts including providing false grades or resumes, presenting someone else’s work as one’s own academic work, and falsifying academic records. A full and comprehensive statement about what constitutes academic dishonesty can be found in Appendix C, section 11-802 in the General Information bulletin. The Student Judicial Services office in the Office of the Dean of Students has the responsibility for following up and making the final determination.

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Use of E-Mail for Official Correspondence to Students
E-mail is recognized as an official mode of university correspondence; therefore, you are responsible for reading your e-mail for university and course-related information and announcements. You are responsible to keep the university informed about changes to your e-mail address. You should check your e-mail regularly and frequently—I recommend daily, but at minimum twice a week—to stay current with university-related communications, some of which may be time-critical. You can find UT Austin’s policies and instructions for updating your e-mail address at http://www.utexas.edu/its/policies/emailnotify.php

Religious Holy Days
By UT Austin policy, you must notify me of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, I will give you an opportunity to complete the missed work within a reasonable time after the absence.

Behavior Concerns Advice Line (BCAL)
If you are worried about someone who is acting differently, you may use the Behavior Concerns Advice Line to discuss by phone your concerns about another individual’s behavior. This service is provided through a partnership among the Office of the Dean of Students, the Counseling and Mental Health Center (CMHC), the Employee Assistance Program (EAP), and The University of Texas Police Department (UTPD). Call 512-232-5050 or visit http://www.utexas.edu/safety/bcal