

July 9, 2015

PROFESSOR MARTA KUTAS, Chair
Cognitive Science

SUBJECT: Undergraduate Program Review for the Department of Cognitive Science

Dear Professor Kutas,

The Undergraduate Council has discussed the Cognitive Science 2015 Undergraduate Program Review. The Council supports the findings and recommendations of the review subcommittee and appreciates the thoughtful and proactive response from the Department. The Council's comments centered on the following:

- **Faculty, Staff and Student Morale.** The Council was pleased to hear that the morale in the Department was high, and that there was a genuine level of excitement about the department across faculty, staff and the student population.
- **Staffing.** The Council appreciates the efforts made by the Department to address issues of staff overload; specifically in creating a peer advising group to help funnel the flow of traffic into the advising office. The report showed glowing reviews for the sole undergraduate advisor in the department and, in order to maintain this excellent level of service, the Council would like to see more staff hired as the department continues to grow.

The Council will conduct its follow-up review of the Department in Spring Quarter 2016. At that time, our goal is to learn about the Department's progress in implementing the recommendations of the program review subcommittee and the Undergraduate Council. The Council extends its thanks to the Department for its engagement in this process and we look forward to the continued discussion.

Sincerely,

Leslie Carver, Chair
Undergraduate Council

cc: G. Boss
R. Continetti
G. Cook
C. Padden
R. Rodriguez
B. Sawrey
M. Sidney

Department of Cognitive Science

Undergraduate Program Review Report

Committee Members:

Professor and Program Review Chair Tara Javidi, Electrical and Computing Engineering, UC San Diego

Professor Nick Spitzer, Division of Biological Sciences, UC San Diego

Professor Donald Hoffman, Department of Cognitive Science, UC Irvine

Procedures:

The review committee was provided with the previous Department of Cognitive Science Undergraduate Program Review from 2008, the department's extremely comprehensive current Self-Study Report, and various data collected by the Office of the Associate Vice Chancellor of Undergraduate Education—including courses taught, enrollments, and grade distribution; catalog copy, degree requirements, major vs minor statistics, student demographics, etc.

On the day of the interview (March 3, 2015), the committee met with the department chair, faculty director of UG affairs, two groups of faculty members, three lecturers, graduate teaching assistants, two undergraduate majors and minors, and the MSO and undergraduate coordinator.

Executive Summary:

After a day long of interviews, the committee was extremely impressed by the strength of the undergraduate educational efforts of the department. The committee was tremendously impressed by the very high morale among all members of the department; the faculty, staff,

and students were all uniformly excited about the program. The committee was also pleased to see the growth in student enrollment, faculty hiring despite faculty separations, and the academic visibility of the program. The committee found the self-study conducted by the director of UG affairs very helpful and an excellent exercise. The committee felt that the program has a healthy emphasis on outreach and recruitment of a diverse student population, more reflective of California's general population, and identified and suggested areas of improvements in terms of the diversity of the current undergraduate population in the program.

The committee also felt that Cognitive Science with its broad, unconventional, and forward outlook on cross-disciplinary research and education provides a model and living laboratory for the campus as we move forward towards an academic world with an increased emphasis on interdisciplinary instruction and interdisciplinarity. In this light, the committee saw itself best positioned not only to help the department to remove obstacles they are facing in their growth and expansion, but also to help the administration to think through questions of resource management in a way to adapt to new models of education that address a variety of issues at hand: cross-departmental teaching, cross-listing of courses, resource accounting for cross-departmental activities, and rewarding of the programs for their interdisciplinary educational efforts.

The Cognitive Science Undergraduate Program:

Borrowing from the department catalogue (emphasis added by the committee), "Cognitive science is a diverse field that is unified and motivated by a single basic inquiry: What is cognition? How do people, animals, or computers "think," act, and learn? In order to understand the mind/brain, cognitive science brings together methods and discoveries from

neuroscience, psychology, linguistics, philosophy, and computer science. UC San Diego has been at the forefront of this exciting field and the Department of Cognitive Science was the first of its kind in the world. It is part of an exceptional scientific community and remains a dominant influence in the field it helped create. In addition to preparing undergraduates for careers in a variety of sciences, the major also provides an excellent background for many professional fields, including medicine, clinical psychology, and information technology." The undergraduate program is closely tied into three main areas of research in cognitive science: brain (neuroscience), behavior (sociocultural interactions), and computation (cognitive tools and representations).

The department offers both a BA and a BS degree. The BS requires completion of more lower-division courses in rigorous mathematics as well as three additional courses at the upper-division level. The BS degree is often taken with a specified area of specialization:

- Clinical Aspects of Cognition
- Computation
- Human Cognition
- Human Computer Interaction
- Neuroscience

There is also an honors program for both BS and BA students.

In addition, the Cognitive Science department offers a minor. When the minor was first proposed, the target enrollment was 100 students. The department has surpassed their target with current enrollment of 155 undergraduate students from all across the larger campus. The minor is both a source of resources (TA support, etc) and a challenge to serve.

Recently, the department charged its Curriculum Committee to address various issues within the context of existing programs. In response, the Committee provided revisions that address the questions of integration, redundancy, balancing depth and breadth, and the distinction between MA and MS programs.

While the specifics of the programs, course offerings, and prerequisites are fairly involved, the undergraduate program coordinator, Ms Thanh Maxwell, provides exemplary service in terms of advising students, both those enrolled in the major and those in the minor. However, it seems that given the growth in both the major and the minor programs, there are some resource issues at the staffing level.

The morale among the graduate student TAs seems quite high. The main unique challenge the students in the Cognitive Science department face is the multi-disciplinary teaching needs of the department. In particular, many graduate students are recruited from more conventional and disciplinary departments of biology, computer science, etc, and as such are not familiar with all subjects where TA allocations are mostly needed. Given the fact that the department's graduate student population, by and large, is supported through TAs, this creates a significant complication for the TAs. Despite this, the students seemed quite content with the overall program and the breadth of the field. They were interested to have access to their teaching evaluations as well as representation on the curriculum committee.

The faculty overall are very active in their areas of research. The morale among the faculty is extremely high with many running visible and successful research programs. Undergraduate research and interdisciplinary course offerings seem to be a hallmark of the cognitive science undergraduate program at UCSD.

Most faculty expressed that conveying a "cognitive science identity" to the undergraduate population might be one of the biggest challenges the program faces.

- The multidisciplinary nature of the field means that the students are required to be exposed to a wide set of topics, fields, approaches. The perceived redundancy in the course work and curriculum becomes a challenge for the students.
- Lower division courses are constantly revised to provide the students with the “cognitive science big picture”.
- There is an ever increasing need for additional space in the department both in terms of teaching lab spaces that would allow the students to have a stronger connection to the program but also a more student centric space (the undergraduate lounge has been somewhat helpful).

Due to its broader definition and appeal, however, there is a lot of agility in the program to adapt to the advances in the field and technological breakthroughs.

- There is a feeling among faculty that they *“are addressing the future needs”*. Another faculty said, “The field is rapidly changing: We are positively impacted by the students’ interest and increased enrollment.”
- In cognitive science, there are plenty of opportunities for truly innovative models of teaching (from humanities to engineering). This is strongly encouraged and allows for the faculty to be ahead of the curve in terms of integration in research.
- Innovative models of teaching often give faculty a heads up in establishing/participating in interdisciplinary research efforts and organized research units (ORUs) across campus. The model example that came up was the Temporal Dynamics of Learning Center (an NSF funded ORU).
- In other words, many faculty felt that “the advances in the field have made it very easy to make a distinction between cognitive science and other fields despite the apparent

overlap". The example that was brought up over and over was the complimentary nature of knowledge produced in cognitive science versus that in computer science and engineering.

While the faculty express a lot of enthusiasm for the kinds of unconventional educational activities they all, more or less, seem to be involved in, they also expressed some degree of frustration with many challenges they face on campus.

- There is a critical need for real models available on campus for "multi-faceted" teaching roles and objectives. There are also no working models for co-teaching courses across departments or, even more challenging, across divisions. Even more disheartening is that a course being officially identified as cross-disciplinary and cross-departmental (jointly offered), negatively impacts the TA as well as other teaching resources for each department involved."
- There are really no real models of equitable resource sharing amongst the departments, in terms of faculty efforts, teaching credits, and TA support. There is also no formal form of recognition or resource allocation for faculty with sizable undergraduate research advising.
- The inclusion of Cognitive Science in the Division of Social Sciences (instead of Engineering or Biological Science) adds another layer of problems. In particular, the macro inequity across divisions manifests itself in form unequal allocation of teaching resources.
 - One example is the vastly different TA resources available to one faculty member with joint appointments in CSE and CogSci for similar courses taught in each department.

- While it is true that each department is given some control over the TA assignments to individual courses, the problem mostly is caused by the calculation of Penner Ratios across the two Divisions of Social Sciences and Engineering.
- Finally, the faculty, at large, were extremely concerned with the issue of space. There seem to be two issues regarding the space needs of the department.
 - As discussed earlier, the faculty felt that the scarcity of space adds to the challenge of conveying the big picture to the students.
 - The lack of space has had severe implication for the type of courses taught by the faculty. There is a significant interest among faculty to increase the lab component of their work and also to link the material directly to the data science and design initiatives across campus.

In terms of diversity, the demographic of the cognitive science undergraduate student population reflects a mixed result. In terms of gender breakout, the department has consistently done better than the statistics of the Division of Social Sciences as well as over all campus numbers. In particular, about 60% of the cognitive science undergraduates are women, well above the gender breakout of the Division of Social Sciences. This is particularly encouraging when one notes the incredibly worrying statistics in computer science, mathematics, and other programs with heavy emphasis on computing. While the Cognitive Science undergraduate program has a significant overlap with Computer Science and Engineering, in terms of gender, it educates a much broader group of students.

Regarding racial and ethnic diversity, unfortunately, the numbers fall; the ethnic demographic of the department is comparable to the (unfortunately alarming) statistics of the general UCSD campus population with URM racial groups (African Americans, Native

Americans, Latinos, and Pacific Islander groups) hovering at 1%-15%. While the program has a strong outreach to the community and high school programs, no specific recruitment and retention efforts regarding URM undergraduate populations is in place: no formal partnership with campus programs with a diversity mandate, including OASIS, Summer PreP, Academic Enrichment, McNaire, etc, seems to be available. Given the noticeably large undergraduate/summer research experience in place, the committee hopes that this might just be an issue of accounting and reporting.

Challenges Faced by the Department:

The challenges faced by the department fall into the following broad categories:

- Educating the students about the nature of cognitive science as a discipline
 - What is the overarching and unifying frameworks for seemingly desperate intellectual inquiry that fall in the realm of cognitive science?
 - Beyond basic scientific questions, why should a student be interested in pursuing cognitive science? Who are future employers?
 - What would professional development for a cognitive science undergraduate student look like?
- Institutional support for the mission of the department
 - Inter-disciplinarity is the hallmark of cognitive science as a major scientific field of study. Given the current structure of allocation of TA support, the department is at a disadvantage. Some of the TA allocations and Penner Ratios need to be reassessed to be at the higher level to account for the lab-like nature of the courses.

- Multiple cross-campus degree programs seem to impact the enrollment and resources available to the Department. These include the cross-divisional discussions around Data Science and Contextualized Robotics as well as the behavioral and cognitive neuroscience degree proposed by Psychology in the Division of Social Sciences. If not carefully approached, these programs have “the potential to siphon student enrollment, hence teaching resources, from cognitive science” as the department chair put it.
- Advising and professional development are important components of the undergraduate education. These are of particular relevance to the undergraduate program in Cognitive Sciences.
 - The program is inter-disciplinary, extremely dynamic, and particularly broad. The advising office is essential in ensuring the students are on the right path to graduation and success. The current advising staff is based on previous (much smaller) enrollment and does not adequately address the increased enrollment and/or establishment of the minor.
 - The program is unique and at the forefront of basic scientific training. However, the students often are somewhat at a loss how to imagine and/or prepare themselves for their post graduation professional life and growth. Some efforts to bring alumni onto the campus have been made. Further resources to address professional development will be critical.

Recommendations to the Department and the Administration

The committee would like to commend the department on its impressive record in undergraduate education. In particular, the committee was encouraged by the following strong indicators of quality and success:

- Growth in student enrollment: both doubling the major enrollment and going above the target with the minor. The department has developed the intellectual content of the field in an authoritative way while addressing the educational needs of the undergraduate students as they move through the program and also beyond into the work place.
- Hiring world class faculty and creating incentives and excitement to have them involved in novel forward-looking undergraduate teaching, even despite losing 6 faculty; the visibility of the research conducted by the faculty becomes a true asset for the undergraduate student searching for job and graduate school opportunities.
- Conducting an impressive rigorous and thorough self-study issues. We also commend them on their alumni initiative and survey. The collected data are very informative; we support the departmental effort to capitalize on their alumni in increasing the effectiveness of their program, increasing industry resources, and professional development.
- The departmental morale is quite high. The faculty, staff, and students we met were all uniformly excited about the program.

The committee would like to recommend that the department consider the following questions:

- Effective curriculum: The committee identified a few minor issues that are likely to be easily addressed:
 - How can the undergraduate students be exposed to an integrated view of the field earlier on?
 - Is it possible to further integrate of the content of the 101, 102, 107 series?

- Temporal scheduling of courses (there was some feeling that hard (HCI) courses are concentrated in winter)?
 - Ongoing evaluation and sustaining of the curriculum:
 - Re-assess the relative utility of the subfields
 - Is there a trade-off between depth and breadth?
 - A unique and specific identity maintained as "cognitive science"
 - Can the department increase the current TA structure to include area-specific "TA-at-large" support?
 - There seems to be a gap in programming language requirements which is caused by a possible mismatch between the programming language taught in CSE7 versus the requirements in the upper-division HCI courses.
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- Resources for Professional Development: Can the department lead the charge on increasing effective professional development?
 - Introduction to various aspects of the field
 - Internship program
 - Alumni relationship
 - Industry connections
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- Diversity Efforts: While the department has an active outreach program to local high schools and community college, the department must also think about recruitment and retention of the URM undergraduate students:
 - Summer Prep program: Can the department partner with Academic Enrichment and Office of Academic Support & Instructional Services (OASIS) to identify best practices regarding recruiting a more diverse undergraduate cohort?

- Targeted Summer Research programs: Given the abundance of undergraduate research in the department, can the department target diversity-related research resources such as McNair and Star summer programs in improving the retention of the URM students within the program?
- Miscellaneous discussions:
 - Can the department investigate and address the main reasons for the undergraduate lounge to remain underutilized?
 - What processes can be put in place to provide a thorough teaching evaluation (from the department) to the non-senate faculty
 - Compared to sister disciplines such as engineering and biological sciences, the number of available fellowships and graduate student research assistantships is too low. This additionally stresses the TA needs and at times might result in suboptimal TA allocations. What are the best ways to encourage faculty to pursue a broader set of funding sources (gift funds; industry sponsor grants, etc)?
 - What are the best mechanisms to ensure that the curriculum committee includes advice, suggestions, and involvement from TAs as well as non-senate faculty?
 - A potential work-around various course count limitations such as 198/9 limit, credit caps, etc, seems to be the introduction of a 5 year MS program

The committee would like to also recommend that the administration in collaboration with the Department try to address the following immediate and long term needs of the undergraduate program.

- The committee recommends the administration to look at possible ways that Cognitive Science is recognized for its unique attributes beyond a more conventional social science department. The main areas that such a recognition would impact are as follows:
 - TA support: Currently the Penner Ratio used to allocate teaching resources in general and TA allocations in particular does not fit the (laboratory) nature of the courses offered by the department.
 - Can this be addressed by reevaluating the Penner Ratio computation across the division?
 - Can the Division reevaluate the PRC formula to create more consistency with the Biological Sciences and School of Engineering?
 - Is there a mechanism to achieve consistency in terms of TA support for the same class being taken by students from different departments/divisions?
 - Space Needs: Currently the department faces a dire space crunch.
 - EEG lab space
 - Studio/design Lab space

- Interdisciplinary Undergraduate Education: With the ever-increasing interest in interdisciplinary knowledge and research, the campus has to must innovate with more flexible models of teaching. A set of suggestions follow:
 - Reward co-teaching: interdisciplinary courses co-taught by two or more faculty from two or more divisions should be given additional resources.
 - Enable cross-departmental and cross-divisional program developments: Remove administrative impediment for more cross-departmental and cross-divisional undergraduate program development.
 - Nurture and sustain innovation in education; because of its interdisciplinary nature, the Cognitive Science department has an advantage in securing funds and innovation

grants to establish research centers in the area of interdisciplinary teaching. However, there must be a method to address sustainability in the long term.