![mindCORE — Center for Outreach, Research, and Education]

SAS Center Annual Report 2020

Penn's hub for the integrative study of the mind, connecting researchers across our campus and with our community.

June 1, 2020

This is a report on the activities of the Mind Center for Outreach, Research, and Education (MindCORE) for academic year 2019-2020. MindCORE was officially created in the fall of 2017 as one of the School's key endeavors under the "Mapping the Mind" initiative identified in the School's strategic plan, *Foundations and Frontiers*. Sharon Thompson-Schill, Christopher H. Browne Distinguished Professor of Psychology and then Chair of the Psychology Department, served the inaugural two-year term as faculty director. Joe Kable, Baird Term Professor of Psychology and Marketing, assumed the role of Director for a four-year term beginning on July 1, 2019, the start of the current reporting year.

Mission

MindCORE is an interdisciplinary effort to understand human intelligence and behavior. Research programs in MindCORE bring together faculty with diverse approaches to the study of the mind, from disciplines in the Arts & Sciences ranging from Psychology, Biology, Cognitive Science, Neuroscience, and Physics to Economics, Linguistics, Political Science, Sociology, and Philosophy; and they bridge to centers and departments in Medicine, Wharton, Engineering, and Annenberg. MindCORE is the home of several undergraduate and graduate programs that are educating the next generation of students of the mind. MindCORE promotes cutting-edge research, increases the broader societal impact of new knowledge about human behavior and decision making gained from current research, and influences public policy and education through coordinated outreach programs.

Most Significant Accomplishments & Developments This Year

In the third year of center operations, MindCORE launched several new innovative programs, grew initiatives launched in the first operating year of 2018, and continued some of the legacy programs inherited from the Institute for Research in Cognitive Science (IRCS). Significant accomplishments include:

Launched New Programs

- Launched Pop-up Labs (https://mindcore.sas.upenn.edu/outreach/pop-up-labs/) based on the Living Labs program that involves scientists recruiting participants and conducting experiments in a public setting in order to collect data for and educate the public about on-going studies. Piloted the program for Penn at the Academy of Natural Sciences during the summer of 2019. The Pop-Up Lab met regularly on Saturdays and Sunday throughout the

![Penn Arts & Sciences logo]

summer in the Academy's Outside In exhibit space.[1] The program continued for 16 dates during the fall and spring semesters. The Academy has agreed to support an ongoing MindCORE presence in that space for a fee of $1500 per semester.

- Ran regular sessions of the MindCORE Writing Room. First launched during the summer of 2019, MindCORE Writing Room is a space dedicated to productive work with a structured schedule, guidelines, and commitment devices based on behavioral research. The room is open to all MindCORE faculty, staff, postdocs, grad students, and undergrads. The summer pilot program featured 48 writers from 15 departments, logging 976 writing hours and reporting a 96% increase in productivity. Information on how to run a MindCORE-based writing room was shared with some other Penn departments and centers in the fall of 2020. The MindCORE Writing Room continued through fall and early spring and moved to a virtual writing partner program following the close of campus. The program has since been duplicated within Linguistics[2].

- MindCORE is launching a new mentoring program for undergraduates, graduate students, and postdoctoral fellows inspired by the cognitive science of mentoring. The new MindCORE Step-Ahead Mentorship Program (STAMP) matches undergraduate students with a mentor who is "a step ahead" of them as graduate students or postdoctoral fellows. The Summer STAMP session will run June 15-August 15, 2020 and will occur virtually. There were 42 mentee applications received within the first 24 hours of advertising this program on May 28. More information is available here: http://mindcore.sas.upenn.edu/mindcore-step-ahead-mentorship-program/

- Preparing to launch a podcast "PhDemystified" based on the recordings from the Behind the CV: Stories from Faculty Series during the summer of 2020.

- Launched a dinner series for the nine MindCORE-supported postdoctoral scholars so that they can go to dinner together and build camaraderie and help ignite interdisciplinary collaborations.

- Implemented a snack and wine closet to help lower event catering costs. This is a small innovation, but given that events have been a core element of MindCORE programming, and food at campus events is the norm and a draw for attendees—yet ordering event catering can be expensive in both time and money—having a ready and inexpensive stash of healthy (and not so healthy) snacks has been an odd but helpful innovation. Shelf-stable snacks are purchased in bulk from Costco for use in writing room, weekly coffee and other ad hoc MindCORE-affiliated and student club events. MindCORE also has a small supply of bottled wine on hand for faculty to be able to take visiting seminar speakers to some of Philadelphia's excellent BYOB restaurants and save on overall entertainment meal costs.

Growth of Current Programming

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[1] Penn Today article: https://penntoday.upenn.edu/news/MindCORE-living-lab-community-outreach

[2] Pleng Chanchaochai launched a Writing Room program stating "Since I benefited greatly from the MindCORE Writing Room when I was writing my dissertation, I am planning to hold virtual writing rooms[2]"
https://docs.google.com/spreadsheets/d/15vpMm_iEbbBIYlh1dIsPsarnF0TR4eyOqE0_m2BYIaE/htmlview?fbclid=IwAR1DcDtrMCcqkGrrd5FWnaXcWUp0Sbh6T_2sYgBwY-LbWfNeCH1vbi6AiV4#

- Continued to provide support to three interdisciplinary research initiatives. Details on each of these initiatives can be read about in their appended reports. Each initiative receives total funding of $500,000 spread over 3 years. All initiative funds are eligible for carry over each year to incentivize careful spending. The funded initiatives include:
    - Social and Behavioral Science Initiative – SBSI (Coren Apicella & Geoff Goodwin): An understanding of the human mind, both its intelligent capacities and limitations or biases, is becoming increasingly important to explaining how human social, political and economic institutions work. Social and decision sciences use contemporary theories of behavioral decision-making, neuroeconomics, networks, and social evolution to understand how individuals and groups make decisions. It considers how to address a real-life problems in an array of fields, such as social and public policy, law, education, business, and medicine. (In year 2 of 3 of funding.)
    - Integrated Language Science and Technology – ILST (John Trueswell & Charles Yang): Human capacity for complex language is unique within the animal kingdom, and psychologists have long appreciated how the languages we learn can shape our patterns of thought in subtle ways. Language science fosters collaboration between researchers in cognitive science, computer linguistics, psycholinguistics, and phonetics to drive research in language acquisition and use. This research aims to develop and improve language and speech technologies (e.g., automatic speech recognition, translation, and transcription). In addition, this research can develop computational tools to learn more about how the human brain works and how sciences understands social groups. (In year 2 of 3 of funding.)
    - Social and Cultural Evolution Working Group – SCEW (Erol Akcay & Gareth Roberts) - Since humans are fundamentally a social species, a full understanding of human cognition ultimately has to take into account the interaction of different individuals' minds with each other (Hasson et al., 2012). Cultural evolution is a crucial element in this enterprise of broadening the reach of cognitive science beyond the confines of single minds. The evolutionary feedback between culture and social structure is crucial in determining the social landscape individuals find themselves in. The grand challenge in cultural evolution is to elucidate and integrate cognitive, social, and population-level mechanisms into a coherent evolutionary theory designed for culture from the ground up. SCEW is working on this. (In year 1 of 3 of funding.)
- Supported four MindCORE Fellows in FY20: Colin Twomey (started 7/1/18), Julia Leonard (started 9/1/18), Andrea Beltrama (started 8/15/19) and Rista Plate (started 1/15/20). Designed for individuals who have recently obtained a PhD degree in psychology, linguistics, neuroscience, philosophy or other cognitive science discipline, the MindCORE Fellowship is intended as a springboard for young researchers to help them build and establish their own research. Fellows pursue collaborative research with faculty working across disciplines at Penn and receive a competitive salary and health insurance plus a modest research budget. Fellows are invited to join regular working group meetings within their field plus career development workshops aimed at young researchers, and are provided with a mentoring committee, and an opportunity to present during the MindCORE Seminar Series. Funding is provided in one year terms renewable for up to three years. As a good sign of the impact of the fellowship program, Julia Leonard, one of our inaugural fellows, has already been

offered and accepted a position as an Assistant Professor at Yale, starting in the summer of 2021.

- o Received 214 applications in 2020 (up from 100 in 2019 and 72 in 2018) for the MindCORE Research Fellowships. These were reviewed by a Postdoc Selection Committee of five faculty chaired by Coren Apicella (Psychology), that also included Gary Hatfield (Philosophy), Alan Stocker (Psychology), Jay Gottfried (PSOM & Psychology), and Anna Pappafragou (Linguistics). One additional faculty member and a previous committee chair, Russell Epstein, was asked to attend the final interview day on March 6 and the final decision meeting the following week in order to act as a stand-in where there was a conflict of interest with the committee members.
- Grew the "Behind the CV: Stories from Faculty" series (formerly called the Growing Up in Science[3] series and renamed in early 2020) in partnership with the Center for Undergraduate Research & Fellowships (CURF). Behind the CV is a conversation series that is not about science or specific fields, but about the paths that faculty take to where they are now and the set-backs they encounter along the way. This is designed for undergraduate and graduate students but open to the whole community. This year's speakers included Dave Meaney (9/19/19), Liz Brannon (10/17/19), Weiji Ma (series founder from NYU on 11/21/19), Michael Platt (12/12/19), Katie Schuler (1/23/20), and Dawn Mechanic Hamilton (2/20/20); and would have included Rinad Beidas (March) and Emily Falk (April) except for COVID-19 closing campus events. The sessions are filmed and available for viewing online: http://mindcore.sas.upenn.edu/behind-the-cv/
- Lent the first science kit from the MindCORE Outreach Library (https://mindcore.sas.upenn.edu/outreach/outreach-library/) for use by a Penn graduate student group to conduct science outreach as part of an afterschool program at the Walnut West Library. Obtained 3D-printed animal brain samples from the Biomedical Library to fulfill a faculty request from Allyson Mackey for use in a future community outreach activity (formerly planned for this summer but now postponed).
- Grew the Interview with Scientists series library to 36 interviews (up from 22) with weekly seminar speakers about their work in plain language to appeal to young scientists and the greater public. The interviews are available here: http://mindcore.sas.upenn.edu/outreach/interviews-with-scientists/)
- Organized and promoted 108+ MindCORE-affiliated events including the weekly Seminar Series, yoga, coffee & tea meet-up, plus professional development talks and special events. Some highlights include:
  - o Hosted a welcome back reception for the MindCORE community in September 2019 with 100+ attendees
  - o Continued the success of the MindCORE Interdisciplinary Mind and Brain Seminar by hosting 22 speakers at the invitation of the IMB Planning committee (Ted Satterthwaite, Assistant Professor, Department of Psychiatry, PSOM; and Anna Jenkins, Assistant Professor of Psychology, SAS and John McCoy, Assistant Professor Marketing, Wharton). The weekly seminars regularly attracted 75+ attendees for standing-room only crowds. Big-draw speakers included Timothy Lillicrap, Simon

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[3] http://www.cns.nyu.edu/events/growingupinscience/

Eickhoff, and Todd Rogers. Canceled spring speakers from COVID included Hyowon Gweon (March 20), Avram Holmes (March 27), Marina Bedny (April 10), and Michael Lee (April 17). The final planned speaker of the series, Dani Bassett, originally scheduled for April 24, presented her talk to a virtual audience on May 8 of 161 live attendees plus 50 additional people who watched the recording of the talk afterwards. Virtual attendees included people from Wellington, NZ, Hyderabad, India, and Utrecht, the Netherlands and other international locations. The video broadcast of the event can be seen here: https://www.crowdcast.io/e/mindcore-seminar.

- o Held talks by three new MindCORE faculty hired to MindCORE-affiliated departments to introduce new researchers to the Penn community and seed interdisciplinary collaborations. The speakers included assistant professors Anna Schapiro (Psychology), John McCoy (Wharton Marketing), and Greg Corder (PSOM).
- o Staffed 20 weekly Computational Neuroscience Initiative talks held Tuesdays at 11:30-1:00 and 11 bi-weekly Vision Science Seminar talks held Mondays from 12:15-1:30 in Barchi Library.
- o Hosted the 22nd Annual Pinkel Lecture on March 6, 2020 featuring Matthew Botvinick, Director of Neuroscience Research at DeepMind presenting on "Deep reinforcement learning and its neuroscientific implications."
- o Co-sponsored the Penn Neuroscience Public Lecture in Winter 2019, "Ouch! The Neuroscience of Pain" (12/2/19) that featured three 15-minute TED style talks from Penn neuroscience and MindCORE faculty members Drs. Nicholas Betley, Gregory Corder, and Ishmail Adbus-Saboor in the Rubenstein Auditorium with 240+ attendees.
- o Sponsored 6 MIRA (Mind-like Intelligence, Research, and Analysis) Group open talks.
- o Launched a regular yoga series initially located in the Levin lobby, but later moved to the 2nd Floor Atrium of McNeil. This public event regularly had 16+ attendees and introduced a broader SAS audience to the work of MindCORE.
- o Held the 2nd MindCORE Faculty Reception, the evening of January 15, 2020 in the Penn Museum Main Entrance/Sphinx Gallery and featured a lecture by Patrick McGovern on the cultural evolution of wine-making and an accompanying wine tasting of ancient wines.
- Grew MindCORE community to unite and promote Penn's work in Mind & Brain to include:
  - o Added 19 new faculty members to the faculty affiliate list for a total of 114 faculty and associates across the University working in areas related to mind and brain. MindCORE closes the year with 153 grad student and postdoc affiliates.
  - o Expanded social media presence to 1174 @PennMindCORE Twitter followers (up from 692 last year) with a focus on 1) building the community for mind and brain across the University and 2) promoting the work taking place within Penn to the greater academic and scientific community and the public.
  - o Maintained a Facebook page dedicated to outreach and sharing information on the science of mind and brain to a lay audience with 105 followers.

Adapting to Change Brought by COVID-19

The first inkling that something was coming was during recruitment for the Fellowship program with campus interviews scheduled for March 6. One international candidate located in Turkey chose not to travel over concern that she would be unable to return home. Before the selection committee could meet the following Tuesday, one committee member from the Perelman School of Medicine requested a larger meeting room to allow social distancing between attendees, that surfaces be wiped, and doors remain open during the discussion. These changes were made. The committee ranked the candidates and submitted a final report to the MindCORE Executive Committee, who recommended two fellowship offers be made. Both finalists received other offers and during the time of negotiation, the university moved to remote operations for all non-essential personnel. One candidate, Jessie Sun, was eager to accept the MindCORE offer, but wanted the assurance of a signed offer letter as she had a signed competing offer from Columbia. Though it took time to get this letter approved with the all of the disruptions due to the pandemic, everything worked out and Jessie will join MindCORE—working remotely—as a new Fellow beginning July 1, 2020. Jessie has previously spent time working on Penn's campus and her research is primarily conducted online so she seemed a particularly good candidate for successful postdoctoral start during this time. The second offer to Chris Bates was declined in lieu of an offer to work with Sam Gershman at Harvard. The MindCORE Executive Committee made a decision to not extend a second offer for this year and retain the option to make three offers in 2021 rather than try and navigate the difficulties of hiring a second Fellow during this time.

MindCORE made a quick decision following the cessation of on campus activities to offer a small grants program to Penn undergraduate students to support a pivot to remote data collection so students could successfully complete research requirements for independent study and other Penn classes in Spring 2020. Each undergraduate student was eligible to receive up to $300 for subject payments, software expenses, or other unexpected research costs. These expenses could be reimbursed or charged directly to a MindCORE Procard. Applications were reviewed on a rolling basis until April 24, and awards were made to 15 undergraduate students enrolled in COGS, PPE, BIBB, PSYC, LING, SOCI and BCHE courses. Awards were made to undergraduate students Yubin Huh, Jordyn Schor, Alexandra Breckenridge, Simon Chen, Yumeka Hirayama, Margaret Badding, Zeyu Chen, Alexander Basescu, Cody Dong, Yu-Ting Liu, Simay Ipek, Christina Steele, Ebony Goldman, Lucia Pallotta, Shivanki Juneja, and Jennifer Richards. An example of the types of study funded includes this one: "This study is investigating how certain sociocultural aspects can affect a listener's pragmatic understanding of an utterance. Fairchild & Papafragou (2018) found that under informative sentences are interpreted differently by listeners for native vs non-native speakers. This study will investigate whether speaker gender will affect participants' pragmatic decisions. This study will investigate how under-informativeness ties in with politeness theory, and gender based expectations of discourse for men vs women."

During the initial shut down period, MindCORE staff outlined three back-up scenarios for the continuance of summer programming: late start, later summer start with part-time fall experience, and remote experience. Faculty were surveyed on their preferences. All but the

remote internship experience were eliminated by the COVID threat in time. This program starts June 1 and is described in more detail later in this report. While this program normally only places ten interns, 13 student were placed this summer in response to demand and in recognition that students' other summer opportunities are severely curtailed this summer.

One significant set-back to the summer plan is this year MindCORE had planned for the first time to offer placements to non-Penn undergraduate students alongside Penn students in the summer Fellowship program as part of the goal to increase diversity and access to first generation, low-income, and underrepresented students. MindCORE applied for REU funding in August of 2019 to support this program and while the grant was not awarded, it was decided that a few students would be accepted this summer as part of a pilot program to demonstrate feasibility for future grant applications. The program received 187 applications for three spots in what would have been the inaugural year. However, one core element of the non-Penn student internship experience was to be able to house students near campus and place them with research faculty committed to closely supervising and mentoring student research interns who were not already familiar with Penn. Given that much of the summer research experience this year will be new for both faculty and student fellows, and the quality of the learning experience of a remote research internship has not been measured, it seemed a poor choice to launch a new program and experiment with a population of students potentially already at risk. MindCORE will reapply for REU funding this summer and plans to offer rich research experiences to this important population of students next year if there is confidence that this can be done safely and well enough to provide a significant research opportunity to this group.

MindCORE collaborated with CURF on a remote poster session this spring. Originally designed to be an-person poster session at Houston Hall with two prep lectures on poster design and communication planned for late March, the poster session was moved entirely online while retaining the original poster date of April 24, 2020. Using the pre-existing CURF poster registration system, there were 41 student posters in the expo, including MindCORE-affiliated students. Though the format was not as interactive as we hoped, it was still a useful lesson. MindCORE staff will use this information to make improvements to an online poster session for the Lila Gleitman Fellowship program the first week of August.

During the rapid transition to online teaching and learning and in the glut of new online programming, MindCORE staff decided to not move regular programming (e.g., yoga, seminar, professional development talks, weekly coffee) online given that a significant part of our community was busy adjusting to the new work and study environment while juggling personal and family needs. It seemed there was little demand, and the community was initially overwhelmed as everything shifted to online. As the academic community adapted to these new conditions, MindCORE held one final semester seminar to share the important work from Dani Bassett that is ripe for replication and can be done remotely. This was also an opportunity to test the audience for and utility of a virtual seminar platform (Crowdcast) that can be used for the seminar in the fall. That event was well attended by a world-wide audience and presents a good—perhaps even bigger opportunity—for the continuation of the MindCORE Seminar this fall.

Despite the personal and professional difficulties of living and working during this time, there was a silver lining of having time away from the MindCORE busy event schedule to focus on developing new initiatives: MindCORE is in the process of piloting a new mentor-matching program for undergraduate students and will launch a podcast in the coming weeks.

Most Promising Areas of Research
MindCORE is excited about the new cluster hire proposal around the theme of "The Interconnected Mind." This theme was agreed upon following discussions with faculty groups that included faculty from psychology, linguistics, biology, and philosophy, and then further discussion by the MindCORE Faculty Advisory Board. There was broad excitement among discussants. A full proposal describing the cluster theme was given to the Dean's office in early May. The core challenge of "the interconnected mind" cluster theme is mapping the relationship between individual minds and group behavior. How is the behavior of individuals shaped by phenomena at the social level, such as group differences and group structure? What aspects of the behavior of groups can be traced back to cognitive and neural processes acting within individuals and what aspects are only emergent at the group level? Tackling these twin questions, about how individual minds influence group behavior and vice versa, is central to understanding social behavior, social communication, and social decision-making.

MindCORE Fellows—of whom there will be five in FY21—are also working at the forefront of several areas related to brains and behavior and represent some of the most promising areas of research. The current Fellows' research accomplishments since becoming MindCORE Fellows include the following:

Julia Leonard of Psychology is working to understand the various factors that impact children's decisions to persist in the face of challenges, with applications to real-world learning.
   Job offers:
   - Assistant professor of psychology at Yale starting summer 2021
   Publications:
   - Leonard, J.A., Martinez, D.N., Dashineau, S., & Mackey, A.P. (revise and resubmit at Child Development). Children persist less when adults take over.
   Leonard, J.A.*, Romeo, R.R.*, Robinson, S.T., Mackey, A.P., West, M.R., & Gabrieli, J.D.E. (submitted). Replication and extension of a family-based training program to improve cognitive abilities in young children.
   - Leonard, J.A., Schulz, L & Mackey, A. P. (2020). Children are sensitive to their rate of learning. Proceedings of the 42nd Annual Conference of the Cognitive Science Society.
   - Leonard, J.A., Garcia, A., & Schulz, L.E. (2019). How adults' actions, outcomes, and testimony affect preschoolers' persistence. Child Development. https://doi.org/10.1111/cdev.13305
   - Leonard, J.A., Bennet-Pierre, G., & Gweon, H. (2019). Who is better? Preschoolers infer relative competence based on efficiency of process and quality of outcome. Proceedings of the 41st Annual Conference of the Cognitive Science Society.

- Leonard, J.A., Romeo, R.R., Park, A.T., Takada, M.E., Robinson, S.T., Grotzinger, H., Last, B.S., Finn, A.S., Gabrieli, J.D.E., & Mackey, A.P. (2019). Associations between cortical thickness and reasoning vary by socioeconomic status in early childhood and adolescence. Developmental Cognitive Neuroscience, 36(100641). https://doi.org/10.1016/j.dcn.2019.100641

Presentations:
- Leonard, J.A., Thomas, O., Pelz, M., Braham, E. (2020). Children and challenge: Using research to inform museum experiences. InterActivity: Association of Children's Museums Conference, St. Louis, MO. ***canceled due to COVID
- Romeo, R.R., Leonard, J.A., Grotzinger, H., Robinson, S.T., Takada, M., Segaran, J., Mackey, A.P., Rowe, M.L., Gabrieli, J.D.E. (2019). Cortical plasticity associated with a parent-implemented language intervention. FLUX Congress, New York, NY.
- Romeo, R.R., Leonard, J.A., Grotzinger, H., Robinson, S.T., Takada, M., Segaran, J., Mackey, A.P., Rowe, M.L., Gabrieli, J.D.E. (2019). Cortical plasticity associated with a parent-implemented language intervention. Society for the Neurobiology of Language, Helsinki, Finland.
- Leonard, J.A., Bennet-Pierre, G., & Gweon, H. (2019). Who is better? Preschoolers infer relative competence based on efficiency of process and quality of outcome. The Annual Meeting of the Cognitive Science Society, Montreal, CAN.

Posters:
- Leonard, J.A., Martinez, D.N., Dashineau, S., & Mackey, A.P. (2019). Let me do it myself: The relationship between intrusive behavior in adults and young children's persistence. Child Development Society, Louisville, KT.
- Martinez, D.N., Leonard, J.A., & Mackey, A.P. (2019). Children's persistence is related to how much they attend to their parent's effortful actions. Child Development Society, Louisville, KT.
Leonard, J.A., Sorcher, L., Forde, J., Fergler, S., Tooley, U.A., Park, A.T., Hart, Y., & Mackey, A.P. (2019). Associations between brain development and creativity in early childhood. FLUX Congress, New York, NY.
- Park, A.T., Leonard, J.A., Tooley, U.A., Boroshok, A.L., & Mackey, A.P. (2019). Stress exposure in early childhood relates to altered midbrain functional connectivity. FLUX Congress, New York, NY.
- Tooley, U.A., Park, A.T., Leonard, J.A., Bassett, D.S., & Mackey, A.P. (2019). Functional network development in early childhood. FLUX Congress, New York, NY.

Invited talks:
- Department of Psychology Colloquium, University of Chicago, 2020
- Department of Psychology Colloquium, University of Southern California, 2020
- iSearch Research Retreat, Max Planck Institute for Human Development, 2020
- Concepts and Categories Seminar, New York University, 2019
- Department of Psychology Colloquium, Yale University, 2019
- Department of Psychology Colloquium, Stanford University, 2019

Colin Twomey in biology explores information theory to understand the social dynamics that cause natural languages to form efficient descriptions of sensory information (https://www.sas.upenn.edu/~crtwomey/).

Publications:

- Twomey, C.R., Hartnett, A.T., Sosna, M.M.G., and Romanczuk, P. (2020) Searching for structure in collective systems. Theory Biosci. https://doi.org/10.1007/s12064-020-00311-9
- Sosna, M.M.G., Twomey, C.R., Bak-Coleman, J., Poel, W., Daniels, B.C., Romanczuk, P., and Couzin, I.D. (2019) Individual and collective encoding of risk in animal groups. PNAS, 116(41):20556-20561. https://doi.org/10.1073/pnas.1905585116
- Hein, A.M., Gil, M.A., Twomey, C.R., Couzin, I.D., and Levin, S.A. (2018) Conserved behavioral circuits govern high-speed decision-making in wild fish shoals. PNAS 115(48):12224-12228. https://doi.org/10.1073/pnas.1809140115

Presentation:

Twomey, C. (2019, May 16-17) Talking about color: inferring world-wide patterns of color communication frequency. Contributed presentation to the Penn Symposium on Cultural Evolution and Global Social Dynamics, University of Pennsylvania, Philadelphia, PA. Event page: https://web.sas.upenn.edu/scew/symposium/ and listing of abstracts: https://www.dropbox.com/s/2s179gujaxapuos/SCEW2019Schedule.pdf?dl=0

Posters:

- Twomey, C.R., Roberts, G., Brainard, D., and Plotkin, J.B. Efficient descriptions based on communicative need explain color categories in language. Poster presented at: The language of evolution and the evolution of language conference; Feb. 23-24, 2020; Weizmann Institute, Rehovot, Israel.

Colin's co-authors are a mix of physicists, biologists (field, lab, and theory), psychologists (David Brainard), and linguists (Gareth Roberts). The conference he presented his poster at was about bringing together folks in evolutionary biology and linguistics. The first paper listed at the top was as part of a special issue on quantifying collectivity put together by some people at the Santa Fe institute following a workshop there to bring together folks from biology, physics, and neuroscience to come up with some useful cross-disciplinary language and tools for understanding collective behavior in all these different systems.

Andrea Beltrama is a linguist who combines the study of the formal properties of the meaning of words and morphemes with the study of what humans *do* when using these expressions in everyday language (https://andreabeltrama.com/).

Publications:

- Beltrama, A. Social meanings in semantics and pragmatics. Accepted pending minor revisions at Language and Linguistics Compass. 2020
- Beltrama, A., E. Meertens and M. Romero. Alternative Questions: Distinguishing between Negated and Complementary Disjuncts. Accepted pending minor revisions at Semantics & Pragmatics. 2020
- Rudin, D. and A. Beltrama. Whither Default Agreement? The case of subjective assertions. Semantics and Linguistic Theory 29. 2019

Presentations:
- Beltrama, A. and Florian Schwarz. Imprecision and speaker identity: How social cues affect meaning resolution. CUNY 2020. Amherst, MA, March 19-21, 2020.
- Beltrama, A., H. Burnett, and S. Solt. How pragmatic precision affects social perception: a socio-pragmatic study. NWAV 48. Eugene, OR, Oct 10-12, 2019.

Invited Talks:
- Beltrama, A. Navigating imprecision: From semantic composition to social identity. Colloquium at University of Delaware. Linguistics Department. February 28, 2020.
- Beltrama, A. Composing meanings, interpreting meanings. Between the grammar and social identity. Colloquium at the University of California, Davis. Linguistics Department. February 5, 2020.
- Beltrama, A. Exclusion, alternatives and social stereotypes. Meanings in interaction. Invited talk at Western Washington University. Linguistics Department. January 28, 2020.
- Beltrama, A. Describing reality, perceiving identity. Pragmatic precision at the crossroads of meanings. Speaker Series at Georgetown University, Linguistics Department. November 15, 2019

Reviewing service as a MindCORE Fellow:
- Language (Linguistics, General)
- Semantics & Pragmatics (Linguistics/Philosophy)
- Language in Society (Linguistics/Anthropology)
- Mind (Philosophy)
- Thought (Philosophy)

Rista Plate is a developmental psychologist who studies how children make sense of complex social environments (https://www.ristaplate.com/). Rista just started in January so does not have much to report yet but gave the following talk at Temple:
- Plate, R.C. (2020). How children make choices when information sources diverge. Invited talk at Temple Infant and Child Laboratory. Temple University. 2020

Fundraising

MindCORE, founded in response to the SAS strategic plan, was made part of the Power of Penn campaign goals for SAS. We have had several communications with Advancement staff around the design of a new campaign brochure featuring MindCORE. That publication has not yet been printed but is in progress. MindCORE has already been the recipient of a few anonymous gifts, including the $1M gift to support for the Penn Undergraduate Summer Research Fellowship program, named now with permission from the anonymous donor in honor of Lila Gleitman in January 2020.

██████████████ MindCORE provided quotes for an official forthcoming announcement for this significant gift in April.

The SAS Dean's office agreed to provide $1.25M per year to MindCORE for the duration of Joe Kable's four-year term as Director (FY20 – FY23).

MindCORE applied for an REU grant from the NSF in August of 2019 based on an expansion of the Summer Fellowship program to non-Penn students. Executive Committee member Florian Schwarz was listed as the PI with Joe Kable as co-PI. This grant was not awarded, but MindCORE will reapply for it this summer.

MindCORE continues to seek foundation grants that might be applicable and welcomes information and support from SAS Advancement in this effort.

Alignment with Emerging Academic Opportunity Themes of the School's Strategic Plan
MindCORE was created in response to the "Advancing Integrated Knowledge: Mapping the Mind" section of the SAS Strategic Plan (http://www.sas.upenn.edu/strategic-plan/emerging-academic-opportunities), and as such, many of the MindCORE initiatives were specified in that plan including:

- *"These contiguous facilities will now be used to promote intellectual synergies and serve as a dedicated home for shared instrumentation and collaborative laboratory facilities."*
  - The MindCORE-funded SBSI and ILST research initiatives both have shared instrumentation and laboratory facilities.
  - Planning is underway for a new Brain Imaging Center administered by MindCORE that includes an MRI scanner to be built on the Pennovation complex to support research in human brain function.
- *"The School will establish a Neuroscience Council composed of faculty across the disciplines to propose additional targeted faculty hiring particularly where it will foster meaningful connections between the humanities, social sciences, cognitive science, and neuroscience. Recruitment strategies will include cluster hiring and the appointment of senior faculty who build bridges across schools, including through the Penn Integrates Knowledge program."*
  - MindCORE submitted a proposal for a cluster hire in FY20 ("Minds in the World") and was asked to resubmit. This year, after a participatory process involving dozens of faculty, a new theme ("The Interconnected Mind") was developed. A cluster hire proposal around the theme of "The Interconnected Mind" was submitted in May 2020.
- *"SAS will also support post-doctoral "junior fellows" who will be recruited for their ability to work across disciples and with multiple faculty mentors."*
  - The MindCORE Fellowship program was started in response to this specific aim. This year MindCORE had four MindCORE Fellows (Julia Leonard, Colin Twomey, Andrea Beltrama and Rista Plate whose research accomplishments were detailed above), plus provided funding for an additional five through the three funded research

initiatives. The breadth and interdisciplinary of the MindCORE Fellows' work is detailed above.

- *"This initiative will also fund new opportunities for undergraduate research, especially in the summer."*
  - Nine Penn undergraduates participated in the MindCORE Undergraduate Summer Fellows program in 2019 following the 11 participants from the summer of 2018. Thirteen participants have been selected for the summer of 2020 and will start June 1. A $1M gift was secured in 2018 to endow this program for future years.
- MindCORE is also working to *"strengthen relationships among departments, programs, schools, and disciplines"* and *"have a significant impact on undergraduate and graduate education"* and to that end has begun to partner with other centers and departments on campus to provide collaborative and coordinated programming which thus far includes:
  - Collaborating with CURF to co-present the Growing Up in Science/Behind the CV Series.
  - Co-sponsoring all NGG (Neuroscience Graduate Group) Outreach events including the two popular public lectures that regularly have more than 300 attendees.
  - Participating in the monthly PSTEMA outreach group, comprised of faculty and staff from across Penn working on community science outreach.
  - Partnering with CURF and REU programs on campus to provide coordinated professional development and other educational events to the 300+ collected summer research students. That partnership began in 2019 with four coordinated events, and will continue this summer.
  - Promoting events from other centers and programs on campus with similar missions and constituencies including the Warren Center, Wharton Neuro, CURF, Neuro Graduate Group & GLIA, Biomedical Graduate Studies, Biomedical Postdoc Programs, Center for Neuroaesthetics, the Penn Memory Center. MindCORE staff also maintains relationships with other center directors with unrelated missions to compare best center management practices and share resources, including the Water Center, Sachs Arts Initiative, Institute for Contemporary Art, the Herbert D. Katz Center for Advanced Judaic Studies, Penn Museum, and Morris Arboretum.
  - MindCORE events on campus are always open to the entire Penn community. Professional development events and the seminar series are regularly attended by BGS, NGG and graduate and undergraduate students from other schools and programs across campus.

Education: Links to Undergraduate Education, Graduate Education & Liberal and Professional Studies

MindCORE is the home of the large Cognitive Sciences Major, and hosts a summer research experience for Penn undergraduate students. The Center also supports professional development sessions for graduate students and postdocs and is working to create links to other interdisciplinary programs at Penn. The primary undergraduate education programs to date include:

- Provides all staff support to the Cognitive Sciences Program and as such supports 155 students in the major and 40 in the minor with declarations, enrolling students in courses, year-round support for student registration issues, and social events. There has been a five-fold increase in students in the major since 2010.
- Offers an Undergraduate Summer Fellowship Program for Penn students working with MindCORE faculty. The program is a full-time, 10-week Fellowship where admitted students are awarded a $4500 stipend for research work with a faculty mentor. The program offers weekly journal club-style meetings and seminars, ethics and communications training, ongoing mentoring and professional development throughout the summer, and a final research presentation. The summer 2020 program received 77 applications (44 in 2019, 60 in 2018) for the ten 10-week Undergraduate Summer Fellowship spots. The summer 2019 fellows gave final presentations based on their research and included:
  - Aishwarya Balaji – *Developing simultaneous recording and TMS in primates*
  - Daniel Cohen – *Identifying problems and inconsistencies in the measurement of depression*
  - Christina DiCindio – *Transcranial Magnetic Stimulation to Promote Brain Plasticity Indexed by fMRI in Major and Persistent Depressive Disorder*
  - Sophia Kim – *The neuroscience behind negotiations*
  - Derek Nuamah – *Becoming Certain About Uncertainty*
  - Emma O'Neil – *Opinions and Predictions*
  - Sonia Reardon – *Are Psychopathic Traits Related to Emotion Recognition Deficits?*
  - Alexander Silva – *Modeling Seizure Propagation with Diffusion Weighted Imaging and Intracranial EEG*
  - Jialin Wang – *Temporal Orientation in Chinese Social Media Posts*

Long-term Leadership & Succession Planning

MindCORE is committed to leadership development at all levels and provides the following opportunities to members of our community:

- MindCORE-funded Postdocs are the leaders on the Professional Development Committee that also include graduate student and guide programming decisions for MindCORE professional development events.
- Junior faculty are offered positions on low-work, high-visibility committees, such-as the MindCORE seminar committee, that provides a valuable leadership opportunity and contact with visiting speakers but only requires a few hours of work per year. The Seminar Committee will retain its two continuing members in the coming year but the committee will be temporarily grown to six members for FY21 to include some associate and full professors, under the leadership of Nicole Rust, MindCORE's Associate Director for Research, to transition the popular campus seminar event to a virtual and worldwide format in the times of COVID-19.
- Mid-career faculty are invited to join committees to review and recommend MindCORE Fellowship selection. As the recognition of the Fellowship program has grown and in response to greater marketing efforts, there are more applications to review each year. In

the coming year, a new review mechanism will be employed to help disburse the reading load more widely across a larger faculty group.

- The MindCORE subcommittees for Outreach, Research, and Education are comprised of junior and senior faculty and in the case of the education committee, also includes a grad student.
- There were nine Executive Committee meetings throughout the academic year, plus 1 Faculty Advisory Board meeting in December 2019.
- New executive committee members are invited to join based on their interest in the area of concentration (outreach, research, and education) and MindCORE involvement. Typically only tenured senior faculty are invited to this time-intensive leadership role. This year will see the addition of Meredith Tamminga of Linguistics who will assume the role of Associate Director for Outreach from Michael Weisberg.
- Secession planning is handled by the Dean's Office who selects the faculty director.

Outreach: Enhancing Faculty and Student Diversity

- This year MindCORE made a decision to discontinue the Undergraduate Summer Workshop that was inherited from IRCS in its current configuration of inviting students to attend a fully funded two-week intensive residential program. This decision was made because the workshop audience was failing to significantly meet our diversity goals. In 2019, 144 complete applications were received, 48 (33%) of which were from URMs; and yet of the 19 students who enrolled in the program only 3 (16%) were from underrepresented groups. The decision was made to instead offer a more substantive REU type experience for non-Penn students to help improve diversity in the graduate student and faculty pipeline and supplement that with an abbreviated one-week workshop experience. Both the REU program, and the one week intensive workshop were tabled in response to COVID-19. We plan to offer both programs in 2021.
- MindCORE is a cosponsor for the Neuromatch Academy 2020, an online school for Computational Neuroscience (https://neuromatch.io/academy/). Cosponsorship is specifically aimed to keep participant registration costs low while allowing for a significantly larger enrollment than typical in-person summer schools. Early registration numbers anticipate a very large worldwide audience of undergraduate, graduate, postdocs and professors (all tutorials will have beginners, intermediate and advanced components) and run online from July 13 - 31, 2020, across multiple timezones, and available worldwide. There is a small fee for full-time students/academics, with fee waivers available.
- The new MindCORE Step-Ahead Mentorship Program (STAMP) matches undergraduate students with a mentor who is "a step ahead" of them and also at Penn as a graduate student or postdoctoral fellow. Based on the behavioral science of mentorship, the goal is to create a safe space for mutually beneficial relationships and honest discussions about issues students face entering grad school and the workforce. MindCORE is particularly interested in mentor-matching both students and trainees, providing information on mentoring best-practices to affiliated faculty, and teaching student supervisors about some of the unique needs of FGLI Students.

- MindCORE started the Behind the CV speaker series in collaboration with CURF where invited Penn faculty talk about their path to academia. This year's selected speakers were all either first-generation low-income (FIGLI) college students, women in science, or both. The new spin-off podcast from this series, "PhDmystified," is focused particularly for first-generation and underrepresented minority students to provide advice and inspiration to successfully navigate their own academic path.

Entering the fourth year of operation, MindCORE is well positioned with strong faculty leadership, experienced and innovative staff, talented postdoctoral researchers, and an enthusiastic and appreciative constituent base. MindCORE looks in the coming year to build on a growing reputation and presence to position Penn as a leader in the pursuit of understanding human intelligence and behavior in the greater academic community.

Respectfully submitted by,
Heather Calvert, Executive Director

Attachments:
Social and Behavioral Science Initiative (SBSI) Report
Integrated Language Science and Technology (ILST) Report
Social and Cultural Evolution Working Group (SCEW) Report

MindCORE Directors 2019-2020
Joseph Kable, Professor of Psychology, Director
Heather Calvert, Executive Director
Michael Weisberg, Professor of Philosophy, Associate Director of Outreach
Nicole Rust, Associate Professor of Psychology, Associate Director of Research
Florian Schwarz, Associate Professor of Linguistics, Associate Director of Education
Sharon Thompson-Schill, Professor of Psychology, Immediate Past Director

Faculty Advisory Board 2019-2020
Vijay Balasubramanian, Physics (FY 2017-2020)
Danielle Bassett, SEAS (FY 2017-2020)
Liz Brannon, Psychology (FY 2020-2022)
John Detre, PSOM (FY 2017-2020)
Russell Epstein, Psychology (FY 2020-2022)
Emily Falk, Annenberg (FY 2017-2020)
Martha Farah, Psychology (FY 2017-2020)
Maria Geffen, PSOM (FY 2020-2022)
Joshua Gold, PSOM (FY 2017-2019) (FY 2020-2022)
Jay Gottfried, Psychology and PSOM (FY 2020-2022)
Konrad Kording, SEAS and PSOM (FY 2017-2019) (FY 2020-2022)
Barbara Mellers, Psychology and Wharton (FY 2017-2019) (FY 2020-2022)
Michael Platt, Psychology, PSOM and Wharton (FY 2017-2019) (FY 2020-2022)
Adrian Raine, Criminology and PSOM (FY 2018-2020)
Marc Schmidt, Biology (FY 2017-2019) (FY 2020-2022)
Dan Swingley, Psychology (FY 2020-2022)
Lyle Ungar, SEAS (FY 2017-2020)

Ex-officio
David Brainard, SAS Associate Dean for the Natural Sciences

Ex-officio (Directors of MindCORE-funded research initiatives)
Coren Apicella, Psychology, SBSI
Geoff Goodwin, Psychology, SBSI
John Trueswell, Psychology, ILST
Charles Yang, Linguistics, ILST
Gareth Roberts, Linguistics, SCEW
Erol Akcay, Biology, SCEW