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Application Credentials
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Apr 27, 2012

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1	Recommendation from Professor Brown	Confidential Letter of Recommendation	3 pages	CONFIDENTIAL
2	Recommendation from Professor Sporns	Confidential Letter of Recommendation	3 pages	CONFIDENTIAL
3	Recommendation from Professor Goldstone	Confidential Letter of Recommendation	2 pages	CONFIDENTIAL

---END OF DOCUMENTS---

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DEPARTMENT OF
PSYCHOLOGICAL AND
BRAIN SCIENCES

INDIANA UNIVERSITY
Bloomington

Aug. 7, 2011

Dear Colleague,

I write to support **Dr. William Alexander**'s application for the position of Assistant Professor at your institution. I have been Will's postdoctoral advisor for four years. In short, Will is an absolutely excellent candidate. What makes him stand out from the rest is his uniquely strong interdisciplinary expertise in combined functional neuroimaging and computational modeling. In terms of computational modeling, Will is second to none: he has the distinction of being one of a select few to publish a pure computational modeling paper in *Nature Neuroscience*, besides a rapidly growing list of other computational modeling and neuroimaging papers. Beyond that, he has all the usual qualities needed to excel, along with a solid and rapidly growing publication record. Overall, he promises to be a tremendous asset to whichever department is fortunate enough to recruit him.

Will joined my lab in order to gain experience in neuroimaging techniques and further develop his skill in neurocomputational modeling. He quickly mastered fMRI data collection and analysis, resulting in one article already published (Alexander & Brown, 2010, *NeuroImage*), and several more which are currently in preparation. Will even went on to make use of advanced fMRI analysis techniques such as dynamic causal modeling (DCM), which speaks to his initiative and technical prowess. In addition to acquiring important skills in this area, Will has used his experience to assist in training graduate students, both within my lab and in the department, in fMRI analysis.

Besides mastering and then mentoring others in fMRI, a second component of Will's activities in my lab has been the development of a new computational model of medial prefrontal cortex (mPFC). mPFC has been the subject of intense interest among researchers studying cognitive control and executive function for almost two decades. Despite years of study and stacks of *Science* and *Nature* papers on the subject, there is still no consensus on the function of mPFC. Drawing on his background in reinforcement learning and computational modeling, Will developed essentially a unified theory of mPFC function. The theory, which suggests that mPFC learns predictions of behavioral responses and their associated outcomes, accounts for a vast range of effects in mPFC. Notably, the theory suggests a resolution of ongoing debate in the literature between human imaging studies and single-unit neurophysiology data from monkeys. Will then developed the theory into a concrete computational model and compared it directly with fMRI data, as well as with other data from human behavior, monkey single-unit neurophysiology, human event-related potentials, and human individual difference measures. This may be an unparalleled *tour de force* of interdisciplinary integration in a single

computational model! Will's efforts in this area have already resulted in three articles in press, and several more studies underway designed to test predictions of the model. The impact of Will's modeling work is already being felt as it strongly informs our ongoing fMRI studies and analysis in the lab. Not only has Will mastered and published in multiple fields, but he has also gone on to integrate them and develop his own research agenda in combined computational modeling and functional neuroimaging. Entirely on his own initiative, Will used insights gained from developing the model of mPFC to formulate a novel reinforcement learning algorithm which is an exact recursive definition of the well-known hyperbolic model of temporal discounting. This formulation is notable in that it was previously believed that no such definition was possible! The discovery of this recursive definition has already resulted one published article (Alexander & Brown, 2010, Neural Computation), with several more in preparation. Will is currently developing his ideas further to account for combined temporal and probability discounting in decision-making, and he already has presentable results from that effort. With that, Will has begun developing his own focused and independent research agenda.

Besides his own research questions, Will is currently working as the lead member of my research group on the Intelligence Advanced Research Projects Agency (IARPA) Sensemaking program, a collaboration with other researchers at MIT, Brandeis, and Raytheon/BBN based in Boston. This project aims to build a computational model of how defense intelligence analysts piece together raw intelligence data, in a way that captures the neurobiological detail of how specific brain regions interact and subserve cognitive function. The project uses Will's model of mPFC as one of the main starting points, giving further testament to the impact of his work.

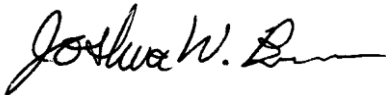
Will is an effective teacher/mentor as well as an excellent researcher. Grad students have sought him out for help on their own fMRI projects, and Will has been helpful and congenial. I am confident that he will be an effective undergraduate instructor once given the opportunity.

Will is also a good citizen in the department here and in the larger community. Will has presented at numerous conferences, is an active member of departmental colloquia, and has presented his work on three occasions to the Indiana University Neuroimaging Group and the Cognitive Psychology colloquium. Additionally, he represented my lab at a recent meeting for the Air Force Office of Scientific Research. He has been an active participant in our weekly lab meetings, presenting difficult, often technical material in a clear and lucid manner, and offering novel insights from his own work. As part of his service to the larger academic community, he has reviewed articles for five different journals.

On the personal level, Will is very easy to get along with and is a pleasant colleague. He has good insight and regularly stimulates my thinking. He is relatively quiet and hard-working, with a witty sense of humor. In the three years I have known him, I have never had an unpleasant interaction with him, and I find him to be considerate and well-adjusted as he interacts with his lab-mates. He is consistently focused, hard-working, and produces consistent high-quality research.

Well, there you have it – my loss is your gain. If Will had applied to my department, I would have no hesitations about hiring him. Will has the unique interdisciplinary expertise, the fMRI, the computational modeling, the teaching ability, the good citizenship, the pleasant demeanor, the sharp intellect, the very strong motivation, the focused independent research program -- essentially everything needed to succeed and make a department proud in the process. So it is my privilege to recommend him in the strongest possible terms. Please don't hesitate to contact me by email or phone if you have any further questions about Will.

Yours Truly,

A handwritten signature in black ink that reads "Joshua W. Brown". The signature is fluid and cursive, with the first name "Joshua" being the most prominent part.

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DEPARTMENT OF
PSYCHOLOGICAL AND
BRAIN SCIENCES

INDIANA UNIVERSITY
Bloomington

Bloomington, August 5, 2011

Letter of Support for William Alexander

Dear Members of the Search Committee:

It is a great pleasure to write this letter of recommendation in support of William Alexander's application for a position in your department. I wish to express my strongest possible support for Will's application – he is a smart and creative scientist, an energetic and diligent researcher, and highly knowledgeable in his field. His research productivity over the past few years has been very strong and he has clearly succeeded in establishing himself as one of the young leaders in computational studies of reinforcement learning and decision making. As you know from his CV, Will was my graduate student from 2001-2006, and I am delighted to have seen his career blossom in the years since he received his degree. I think that Will's background, previous research and current interests make him an ideal candidate for the open position in your department, and I enthusiastically support his application.

In his time at IU, Will was a tremendously successful graduate student. Shortly after he arrived, in the summer of 2001, he started to work with me on models of values systems (related to the midbrain dopamine system) and their role in behavior, using both computer simulations and robotic platforms. Will was independent from the start, generating simulations and robot experiments that led, in rapid succession, to a series of papers, all of which were well received in the larger community. Will's paper presented at an international conference (ICDL 2002) won the "Best Paper Award", and when I could not travel to SAB 2002 in Edinburgh, I did not hesitate to send Will in my place – from what I heard Will gave a great talk and I was not missed. Will's early performance in the lab won him a faculty commendation (rarely given after only one year) in 2002. This was about as good a start of any graduate student I have ever seen.

Next, Will went on to design increasingly sophisticated robot experiments that highlighted the role of the environment and of robot-environment interactions on developmental/learning time courses. This line of work sparked a whole series of related projects in the lab, carried out by several undergraduate researchers, keeping

some of us busy to this day. Because of his own creativity and drive, Will ended up with a whole series of publications and presentations, building a track record for himself and getting noted by people in the field. Passing through graduate exams in 2003 posed no problem, and Will then moved on to design his dissertation research. Will set out to do a very original and independent research project, in which I deliberately took only an occasional advisory role. He was interested in a more formal understanding of the connection between TD learning and attention and came up with a beautifully designed model that unified these two previously disconnected problem domains. This project formed the core of his dissertation work, which was then published in a single-author paper in the journal “Adaptive Behavior” which appeared in 2007.

After moving on to the lab of Kenji Doya for a postdoctoral position, he returned to IU to pursue a new set of studies under the direction of my colleague Dr. Josh Brown. These studies have been quite successful and resulted (so far) in two first-author publications in the highly respected journals “Neuroimage” and “Neural Computation”. While I no longer work with Will, I took the opportunity to attend a couple of seminars where he presented work in progress. I was impressed by the ingenuity of the computational approaches he had taken, and the clever blend of empirical (neural, behavioral) data and modeling. The topics Will has pursued so far all have great potential for future development and elaboration – he is well on his way to define his own research program.

Looking back over the past 10 years, I have known Will to be an innovative and productive investigator, and I think he has demonstrated excellent skill as a modeler and computational scientist. What has always struck me is that Will is an exceptionally careful researcher, always questioning the assumptions that go into the design of the models themselves and their interpretation. He has an inclination towards wanting to understand model performance at a more formal level, which is a very useful trait in this line of work. He strives to broaden his horizon beyond modeling and is fruitfully engaged in related experimental work. In the future, I expect to see him move into more and more interdisciplinary settings, driven by his strong desire to expand his intellectual and scientific horizons.

Personally, Will is a very mature individual, very responsible, helpful to others – in short, a good person to have around. His calm and reasonable manner of approaching and solving problems contributed greatly to “keeping the peace” in the lab and moving us all forward in our research. Will and I have never had a crisis, or even a misunderstanding, over the entire 5 years he was working with me. It was really a pleasure having Will in the lab. Since then, nothing has changed in my positive feelings for Will as a person and colleague here in the department.

As his record abundantly shows, Will is already an accomplished researcher who has made several independent contributions in his field. On top of that he is great person to

work with. In summary, I give Will my highest level of enthusiastic support. Please feel free to contact me (855-2772, osporns@indiana.edu) if you need further information.

Sincerely,

A handwritten signature in black ink, appearing to read 'Olaf Sporns'. The signature is fluid and cursive, with the first name 'Olaf' written in a large, looped script, and the last name 'Sporns' written in a more compact, cursive style.

Olaf Sporns, PhD
Provost Professor
Department of Psychological and Brain Sciences

INDIANA UNIVERSITY



COGNITIVE SCIENCE PROGRAM

August 5, 2011

To Whom it may concern:

It is my great pleasure to recommend William Alexander to you as an excellent candidate for the position for which he has applied. I have been very impressed with Will as a scientist, scholar, and researcher. I was a member of Will's dissertation committee and I have continued to stay in contact with him over the years. Will has a rare blend of excellent computational and mathematical skills, PLUS a deep knowledge of neuroscience and cognition in general. This has enabled him to execute very sophisticated mathematical modeling of neurological data. He has exactly the tool set that is going to be needed to conduct the next generation of research in computational neuroscience. This is obviously an area poised for rapid growth in the near future.

Will is a true cognitive scientist, with excellent training in neuroscience, but also very strong abilities in conducting experiments, mathematics, computer science, and psychology. His combination of fundamental skills and theoretical savvy make his prospects extremely bright. Given his technical skills and general intelligence, Will could pursue any number of research areas very effectively.

Will's dissertation work developed a computational model of the dopaminergic system's role in reinforcement learning. It was notable because it did not make the simplifying assumption of most previous work in the area – that learning occurred over discrete episodes. Instead, in Will's model, time passes continuously and the difficult problem of disentangling what events predict what other events in a real-time stream is not finessed by hand-coded representations. Will presents a neurologically plausible model of how internal reinforcement leads to the creation of associations between cues. His model neatly explained and organized a wide array of data from animal and human learning paradigms.

Since his dissertation, Will has been very productively working with Josh Brown on models of temporal difference learning under various discounting functions. This work beautifully combines formally grounded models from computer science with experimental work on the effects of timing on people's learning. It is a pleasure to see work that is explicit enough to generate testable predictions from experiments.

Overall, Will has been highly productive. He publishes in prestigious outlets in his field: Neural Computation, Adaptive Behavior, Topics in Cognitive Science, and Neural Networks. His productivity in scholarly writings is impressive, especially given the typically slow rate with which computational modelers publish. Nothing is harder in psychology or neuroscience than creating rigorous, formal models of mental function that are carefully fit to empirical results. Will believes in instantiating theories in working computational models, and this is an arduous process that is worth the hard work because the theories can be quantitatively tested, and are articulated enough to provide complete and coherent explanations.

I have seen Will teach several classes, and I can vouch for the very high quality of his teaching. He is very engaging, exciting, and respectful. His lectures are always clear and well structured. He comes across as a studious and dedicated teacher who is intrinsically interested in the ideas he teaches, and gets the students to be intrinsically interested as well.

Will is an excellent scientist. I have enjoyed interacting with him, and learning from him. His credentials are strong already, and his best work is just getting out now. In short, I most highly recommend him to you without any reservations at all.

Sincerely,

A handwritten signature in purple ink that reads "Rob Goldstone".

Dr. Robert Goldstone Chancellor's Professor of Psychological and Brain Science, and Director of the Cognitive Science Program, Indiana University, rgoldsto@indiana.edu, 812-855-4853

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