RUNNING HEAD: COGNITIVE PSYCH JOB MARKET

An analysis of the Canadian cognitive psychology job market (2006-2016)

Gordon Pennycook^{1*} & Valerie Thompson²

¹Department of Psychology, Yale University, ²Department of Psychology, University of Saskatchewan

*Corresponding author: gordon.pennycook@yale.edu

in press, Canadian Journal of Experimental Psychology

Keywords: Job market; hiring practices; academic success; Canadian cognitive psychology; Canadian psychology

Abstract

How accomplished does one need to be in order to be competitive on the Canadian cognitive psychology job market? We looked at the publication record of everyone who was hired as an Assistant Professor in Canadian cognitive psychology divisions with PhD programs between 2006 and 2016 ($N = 64$). Individuals who were hired from 2006-2011 averaged 10 journal article publications up to and including the year that they were hired. However, this increased by 57% to 18 publications by 2012-2016. Notably, this increase (a) occurred despite an *increase* in the number of positions since 2010, (b) was not restricted to top-ranked institutions, (c) did not come at the cost of decreasing quality in research (based on citations), and (d) was not driven by longer postdoctoral fellowships. To supply context, we obtained data on the publication records of 98 eminent and early career award winning cognitive psychologists when they obtained their first faculty position. The correlation between year of hire and publication number in the full sample was strongly positive ($r = .47$) and driven primarily by a substantial increase in recent years. This suggests that the increasingly competitive job market is not specific to Canada. Finally, we found that behavioural (as opposed to neuroscience) researchers and those who obtained their PhD from Canadian universities may be at particular risk in the job market. At a time when increasing numbers of PhDs are graduating from cognitive psychology programs, it has likely never been more difficult to obtain a faculty position.

Significance

We investigated the research record of every individual hired as a tenure track assistant professor in Canadian cognitive psychology from 2006 to 2016. We found that individuals who were hired from 2006-2011 averaged 10 journal article publications and that this increased by 57% to 18 publications by 2012-2016. We also found that individuals who focus on behavioural (as opposed to neuroscience) research and who obtain their PhD from Canadian universities may be at particular risk in the job market.

A common opinion among academic cognitive psychologists in Canada (and elsewhere) is that it is becoming increasingly difficult to be hired as a tenure-track Assistant Professor at a research institution. According to the Conference Board of Canada (Edge & Munro, 2015), Canadian universities granted 3,723 new PhD degrees in 2002. By 2011, this number increased by 67% to 6,219 – an increase that, anecdotally, applies to cognitive psychology programs. Despite this dramatic increase in the acquisition of PhDs, it does not appear that there has been a proportional increase in faculty positions in Canadian cognitive psychology; thus, the job market may be becoming increasingly competitive. Whatever anecdotal baselines cognitive psychologists are using to determine what (roughly speaking) is required for an early-career researcher to be competitive on the job market are likely outdated or even distorted.

The goal of the present analysis is to provide information about the academic records of those who have been hired into Canadian cognitive psychology positions. This will hopefully be of use to individuals who are deciding whether to pursue (or continue pursuing) a faculty position and will perhaps serve as a corrective for faculty and students who are unaware of the fundamental changes in the dynamics of the job market in recent years. In a more positive sense, the present analysis can be considered a representation of the strength of Canadian cognitive psychology: Highly productive researchers are filling faculty positions throughout the country.

Overview of the analysis

For this analysis, we will focus only on individuals who were hired as Assistant Professors at Canadian universities that have PhD programs in cognitive psychology or cognitive neuropsychology. Faculty hired into full neuroscience programs were not considered, nor were those who were hired into cognitive neuropsychology programs at institutions that have cognitive psychology programs (e.g., University of Waterloo).

There were two avenues through which we acquired the sample. First, an email was sent to the Department Heads/Chairs of all Canadian psychology programs. In this email, we requested a list of all individuals who were hired since 2006, along with the year that they were hired, and the division into which they were hired.¹ Second, since we did not receive return emails from a number of institutions, the lead author manually checked the faculty profiles for individuals who were hired since 2006. In these latter cases, year of hire and division was determined based on the individual's website or Curriculum Vitae (CV). However, in some cases, this information was not present, and as such, the lead author went through the individual's publication history to determine when their affiliation changed to their present institution. Thus, year of hire was inferred for a subset of the sample.² We had data for 24 cognitive psychology departments across Canada (14 via Department Head/Chair email and 10 via manual search).

In considering the most meaningful benchmarks for determining the relative success of academic psychologists, we chose to focus on the number of publications as our primary measure (although others were recorded; see below). This was recorded manually by the lead author. For individuals with CVs or publication lists on their website, the lead author simply counted all journal articles (and, rarely, books) that were published up until and including the year of hire. We included the year of hire in the count as it was assumed that the work that was published at that time was a part of the application package (and, potentially, the job talk). Some individuals did not have CVs or publication lists on their website (or they did not have a website)

¹ "Year of hire" refers to when the individual began their position – it is possible that some individuals deferred prior to starting.

² There was no difference on any measure that we recorded between individuals who were discovered manually ($N = 37$) versus via Department Head/Chair email ($N = 27$); t 's < 1 for total publications, publications per year, and Google Scholar citations.

– for these individuals, we used Google Scholar to locate publications (either via a Google Scholar profile page or, failing that, via an author search). However, since Google Scholar also documents numerous items that are not journal article publications (e.g., abstracts from the annual conference for the Canadian Society for Brain Behavior and Cognitive Science), it was sometimes necessary to make inferences about whether a given item was, in fact, a journal article publication. Thus, the present results should be interpreted assuming the potential for some errors in data collection, although we have no reason to believe that such errors would be systematic in any way. Given that some individuals treat published chapters and conference proceedings as publications, we also created a second variable including these in the publication count.

Through our search we found that the majority of the faculty members have Google Scholar profiles (72% of our final sample). This allowed us to record an additional measure of researcher eminence or impact: citations. For this, we chose to record the number of citations in the year the individual was hired as opposed to cumulative citations, since the latter measure is likely more strongly influenced than the former by the number of years that the individual has been publishing (and also happens to require more work to record).

Given the trend toward neuroscience hires (observed anecdotally), the lead author also separated individuals into two groups based on whether their research had a behavioural or neuroscience research focus. This was obvious based on publication record in most cases. However, in borderline cases ($N = 3$), individuals were classified as neuroscience researchers if they had published at least one first-author paper (leading up to and including the year of hire) either (a) in a neuroscience journal, and/or (b) employed a neuroscience methodology (based on

the title). The goal was to separate purely behavioural researchers from those who might fill a “neuroscience” need in a department (for which a first-author publication may be sufficient).

In an attempt to gain some information about the underlying source of changing trends in publication numbers over time, we also recorded (where possible) whether the individual completed a postdoctoral fellowship (and, if so how many).³ More directly, we recorded how many years had passed since each individual’s PhD (i.e., the difference between the year that the individual received their PhD and the year that they were hired).⁴

We also recorded additional information about the faculty members. First, we recorded their university of employ, and, from this, whether the university (a) was a top-ranked institution (based on Maclean’s 2017 Top 10 list of universities based on reputation of medical/doctoral programs; Dwyer, 2016) and (b) is located in Eastern or Western Canada. Second, we inferred the gender of the individual based on name and online profile pictures. Third, we recorded whether or not the individual obtained their PhD from a Canadian institution (note that this is not an indicator of Canadian citizenship, as non-Canadians graduate from Canadian institutions and Canadians graduate from international institutions).⁵

Data for this project can be found on the Open Science Framework: <https://osf.io/uwpjld/>.

Results

We identified 64 Assistant Professors who were hired into Canadian cognitive psychology positions from 2006-2016. As evidenced in Figure 1, the number of hires per year decreased precipitously from 2006 to 2010. Fortunately, there has been an equally precipitous

³ We could not find information about postdoctoral fellowships for 10 faculty members (15.6%).

⁴ We could not find the year during which 14 individuals (21.8%) obtained their PhD.

⁵ Based on the information available online, it was not possible to determine where 2 individuals (3%) received their PhDs.

increase in new hires since 2010 (and in fact, 2016 saw the most hires). Men accounted for 59.4% (38 out of 64) of the sample.⁶ This held relatively constant across the time period: men accounted for 53.3% of the hires between 2006-2011 and 64.7% of the hires between 2012-2016; these percentages are not significantly different using a chi-square test, $\chi^2(1, N = 64) = 0.86, p = .355$.

Figure 1. *The number of new Assistant Professors hired into Canadian cognitive psychology positions from 2006 to 2016.*

The grand mean in terms of published journal articles was 14.3 (95% CI: 11.8, 16.9), although this was quite variable ($SD = 10.1$) and the median was lower ($Median = 11$). The mean number of total publications (including chapters and conference proceedings) was only somewhat greater ($M = 16.6, SD = 10.4, Median = 14$). There was also a strong positive correlation between year of hire and number of publications, $r(64) = .48, p < .001$, indicating that the number of publications for new hires has been increasing. In fact, the mean number of

⁶ This discrepancy is driven primarily by neuroscience hires, who were more likely to be men (24 men and 13 women; 64.9% men). The proportion of men and women was relatively equal among behavioural hires (14 men and 13 women; 51.9% men).

journal article publications nearly doubled from 2006-2011 ($N = 30$, $M = 10$, $SD = 6.8$, 95% CI: 7.5, 12.5) to 2012-2016 ($N = 34$, $M = 18.1$, $SD = 11.1$, 95% CI: 14.3, 22), $t(62) = 3.5$, $p = .001$ (see Figure 2). This increase occurred despite an *increase* in the number of positions. In fact, there was no correlation between year of hire and number of publications between 2006-2011, $r(30) = .13$, $p = .510$, but the correlation was robust for the 2012-2016 time-period, $r(34) = .42$, $p = .014$. Hence, the increase in publications for new hires was largely driven by changes following 2012 (see Figure 3), which coincides with an increase in the number of new positions. Thus, the job market may have masked what would have presumably been an even larger increase in “CV length” for new faculty members.

Figure 2. Smoothed distribution of journal article publications for Assistant Professor hires in Canadian cognitive psychology as a function of cohort (2006-2011 v. 2012-2016). The mean number of journal article publications nearly doubled from 2006-2011 ($M = 10$, $SD = 6.8$, $N = 30$) to 2012-2016 ($M = 18.1$, $SD = 11.1$; $N = 34$).

Figure 3. Increase in number of total publications (left axis) and publications per year (right axis) as a function of year (grouped) for new Assistant Professors hires in Canadian cognitive psychology. Publications per year is an estimate based on an assumed 5-year PhD plus actual time between PhD completion and year of hire (and only for those for whom it was possible to determine how many years had passed since the completion of their PhDs, $N = 50$). Thus, if anything, publications per year is an underestimate. Note also that this includes the very first years of one's PhD.

Number of years since PhD

One possible source of the increase in publications in the last half of the previous decade is an increase in the number of years since new hires acquired their PhDs (i.e., longer postdoctoral fellowships), which is presumably one of the consequences of an increasingly competitive job market. Indeed, the number of years since PhD was (marginally) positively correlated with year hired, $r(50) = .27, p = .060$, and significantly positively correlated with number of publications, $r(50) = .43, p = .002$. To test the independent contribution of these factors, publication number was entered as a dependent variable in a multiple regression model with year of hire, number of years since PhD, and their interaction as independent variables ($df = 46$). Both year of hire, $\beta = .41, p = .002$, and number of years since PhD, $\beta = .33, p = .013$, were

significant independent predictors (there was no interaction, $\beta = .05$, $p = .685$). Thus, year of hire predicted publication number after taking the number of years since PhD into account. To represent this graphically, we added a constant of 5 years to the number of years since PhD to get a total estimate of the number of years active as a researcher (note that this is an estimate as some PhDs may be shorter than 5 years and some may be longer⁷). As evident in Figure 3, both total publications and publications per year increased markedly since 2012. Indeed, individuals hired in 2015-2016 published on average 21 papers when hired, which translates to 2.2 papers per year (from the beginning of their PhD and taking into account variable lengths of postdoctoral fellowships prior to landing a faculty position). The average number of publications for 2006-2008 was 9.9 (roughly 1.1 papers per year).

Reputation and location of hiring institution

The increase in publications for new hires as a function of year was not driven by a few top institutions. In fact, institutions that were *not* in Maclean's Top 10 in terms of reputation for medical/doctoral programs (Dwyer, 2016) had a (nominally) larger increase (mean publications went from 7.1 in 2006-2011 to 16.7 in 2012-2016) than did the Top 10 institutions (from 15.1 to 19 publications). The increase was also basically equivalent for institutions in Eastern Canada (from 10 to 18.7 publications) as it was for institutions in Western Canada (from 9.9 to 17 publications).

Neuroscience or behavioral research?

One reason why the number of publications has been increasing over time may be because of the rising popularity of neuroscience (in lieu of behavioural research). Anecdotally,

⁷ If anything, publications per year is an underestimate, as some engage in research prior to their PhD.

neuroscientists tend to co-author more papers and may therefore have more publications overall. Consistent with these anecdotal observations, the proportion of neuroscience hires has increased over time, $r(64) = .34, p = .006$ (from 43.3% in 2006-2011 to 70.6% in 2012-2016; see Figure 4), and neuroscience hires do indeed have more journal article publications on average (Behavioural: $M = 10.8, SD = 8.4$; Neuroscience: $M = 16.9, SD = 10.6$; $t(62) = 2.47, p = .016$). However, when both year of hire and proportion of neuroscience hires are entered into a multiple regression analysis predicting number of publications, year of hire remains a significant independent predictor, $\beta = .43, p = .001$, and proportion neuroscience hires does not, $\beta = .16, p = .194$. Thus, the number of publications increased over the years independent of the likewise increase in neuroscience hires.

Figure 4. The percentage of credible “neuroscience hires” (i.e., at least one first-author neuroscience journal article) for new Assistant Professors hires in Canadian cognitive psychology from 2006 to 2016. Note that 2010 represents a single individual.

Another factor that may be of interest to the Canadian cognitive psychology community is the percentage of individuals with PhDs from Canadian institutions who have been hired as Assistant Professors (see Figure 5). Overall, 54.8% of the individuals in our dataset received their PhD from a Canadian institution (excluding 2 individuals for whom it was not possible, based on the available information online, to determine the institution at which they completed their PhDs). This percentage held relatively constant throughout the time period (there was no correlation between year of hire and proportion Canadian PhD, $r(62) = .06$, $p = .619$). It should also be noted that the mean number of publications did not differ between Canadian PhDs ($M = 14.8$, $SD = 11.2$) and International PhDs ($M = 13.4$, $SD = 8.6$), $t(60) = 0.53$, $p = .597$.

Figure 5. *The percentage of new Assistant Professors hires in Canadian cognitive psychology who received their PhD from a Canadian institution from 2006 to 2016. Note that 2010 represents a single individual.*

Omnibus analysis

As a culmination of the preceding analyses, we entered the previously considered variables into a single multiple regression analysis. As is evident from Table 1, year of hire was

(nominally) the best predictor of publication number for new hires among all of the relevant variables that were recorded, which included years since PhD, gender, and whether or not: (a) the individual was hired into a Maclean's Top 10 institution, (b) the institution is in Western Canada, (c) the candidate obtained their PhD in Canada, and (d) the candidate was a credible neuroscience hire. The effect size for the independent correlation between number of publications and year of hire in the full model ($\beta = .36$) was more than double the effect size for the correlation between number of publications and being hired into a top ranked institution ($\beta = .14$). None of the other factors significantly predicted publication number.

Table 1. *Final step of hierarchical multiple regression analysis predicting number of journal article publications with year of hire (2006-2016), number of years since PhD, gender (inferred; 1 = male, 2 = female), and whether or not: a) the individual was hired into a Maclean's Top 10 institution (high score = yes), b) the institution is in Western Canada, c) the candidate obtained their PhD in Canada, and d) the candidate was a credible neuroscience hire (inferred). N = 50.*

	<i>r</i>	β	<i>t</i>	<i>p</i>	<i>Tolerance</i>	<i>VIF</i>
Intercept			2.72	.009		
Year Hired	.51	.36	2.73	.009	.82	1.22
Years Since PhD	.43	.30	2.23	.031	.83	1.21
Gender	-.12	-.13	0.98	.333	.87	1.15
Top Ranked Inst	.27	.14	0.90	.374	.63	1.59
Western Canadian Inst	-.06	.02	0.16	.872	.86	1.16
Canadian PhD	.11	.19	1.44	.157	.80	1.25
Neuroscience Hire	.28	.05	0.34	.735	.75	1.34

Increasing quantity, decreasing quality?

The final issue pertains to whether the increase in publications reflects a decrease in the quality of published work. This is not an easy issue to address, but we can form tentative conclusions based on citation data. Google Scholar citations in the year of hire was correlated with the year of hire (among those with a Google Scholar profile), $r(46) = .39$, $p = .008$. The mean number of citations increased from 2006-2011 ($M = 104.9$, $SD = 88.4$) to 2012-2016 ($M = 174.6$, $SD = 128.8$), $t(44) = 2.1$, $p = .042$. Crucially, however, the number of citations per paper

did not correlate with year of hire, $r(46) = -.06, p = .672$. Thus, the quality of the work – at least based on the number of citations – has not increased or decreased over time. New faculty are simply being hired with a longer track record in a shorter period of time (see Figure 3).

Reference classes

The preceding analyses demonstrated that the number of publications needed for an entry-level position has increased dramatically over the past 10 years. In this section, we make this point clearer by comparing our sample of new hires to four highly eminent references classes (Figure 6; see <https://osf.io/uwpjd/> for data). For the first, we curated a list of highly cited contemporary cognitive psychologists (all of whom have been cited over 40,000 times on Google Scholar). Whereas only 36% (23 out of 64) of the recent hires in Canadian cognitive psychology were hired with fewer than 10 publications, 80% (16 out of 20) of the most eminent cognitive psychologists had published fewer than 10 journal articles when they were hired for their first faculty position.⁸ Many eminent cognitive psychologists had fewer than 5 publications up to and including the first year of their first faculty position. Indeed, the average was 4.95 publications [95% CI: 2.7, 7.2] once one major outlier (who had 39 published papers when first hired, due to protracted role as a scientific staff member) was removed. Thus, the average is 189% greater for the full sample of Canadian cognitive psychology ($M = 14.3$) and 266% greater for those who were hired between 2012 and 2016 ($M = 18.1$). It is important to note that the Canadian cognitive psychologist group includes some individuals (10 out of 53) who had a faculty position prior to obtaining a position in Canada (it was not possible to find data on prior faculty positions for 11

⁸ Some of the new hires in our Canadian cognitive psychology data set had a prior faculty position (10 in total, although we could not find the requisite information for 11 additional candidates). Nonetheless, when constraining to only those individuals for which we know that we have recorded their first ever faculty position ($N = 43$), only 39.5% were hired with fewer than 10 publications.

individuals). Nonetheless, the mean number of publications for the 43 individuals who did not have a prior faculty position ($M = 14.2$, $SD = 10.5$, 95% CI: 11, 17.5) was similar to the grand mean for Canadian cognitive psychology ($M = 14.3$, $SD = 10.1$, 95% CI: 11.8, 16.9).

Figure 6. Number of journal article publications for Assistant Professor hires in Canadian cognitive psychology (red, $N = 64$), eminent cognitive psychologists (purple, $N = 20$), Canadian Society for Brain Behavior and Cognitive Science (CSBBCS) Donald O. Hebb Distinguished Contribution Award winners (orange; $N = 17$), American Psychological Association (APA) Early Career (EC) Award winners in cognitive psychology (blue; $N = 37$) and Psychonomic Society Early Career (EC) Award winners (green; $N = 24$). Data for latter four groups represent the number of publications when individuals obtained their first faculty position. Error bars represent standard error of the mean.

As a similar Canadian-based reference class, we recorded the number of publications upon first hire for the winners of the Canadian Society for Brain Behavior and Cognitive Science (CSBBCS) Donald O. Hebb Distinguished Contribution Award (Figure 6). Although 20 individuals have won this award, the date of first faculty position was not clear from information available on the internet for 3 of them (see: <https://osf.io/uwpjd/>). Similar to the other group of

eminent cognitive psychologists (who are contemporaries), 88% (15 of 17) of the CSBBCS awardees had fewer than 10 publications when first hired. Their average of 4.06 publications [95% CI: 2.5, 5.6] is 252% less than the full sample of Canadian cognitive psychology hires and 346% less than those who were hired between 2012 and 2016.

The majority of these two reference classes were hired prior to 1980 (see Figure 7). Moreover, their success as cognitive psychologists emerged from long careers and therefore, it is possible (however unlikely) that they do not represent individuals who had particular success early in their career. Thus, we obtained two contemporary and past samples of early career award winners in cognitive psychology. These individuals achieved distinction precisely because they accomplished a great deal *early* in their careers and therefore represent a highly selective group that is particularly likely to have published a lot prior to their first faculty position. First, we obtained data on publications for the American Psychological Association (APA) Early Career Award winners (from 1974-2017) in the three cognitive psychology areas: behavioral/cognitive neuroscience, perception/motor performance, and cognition/human learning. There were 51 such individuals. However, we excluded 5 who were in the eminent cognitive psychologist group and 3 who were in the smaller Psychonomics Society early career award group (see below). We could not find the requisite data (either date of first hire or past publications) for 6 individuals. One individual was excluded because her research was primarily in developmental psychology. The second early career award group was the winners of the Psychonomic Society Early Career Award (from 2012-2017). The mean number of publications for the APA award winners ($M = 10.5$, $SD = 6.7$, 95% CI: 8.2, 12.8) was *lower* than for Canadian cognitive psychology hires across the full 2006-2016 time period ($M = 14.3$, $SD = 10.1$, 95% CI: 11.8, 16.9), $t(99) = 2.07$, $SE = 1.87$, $p = .041$. The mean number of publications for the Psychonomics Society award

winners ($M = 12.2$, $SD = 9.2$, 95% CI: 8.3, 16.1) was similar to the grand mean for Canadian cognitive psychology hires, $t < 1$. A slight majority of APA award winners (51%) and a clear majority of Psychonomics Society award winners (63%) were hired with fewer than 10 publications (36% of Canadian psychologists were hired with fewer than 10 publications).

Figure 7. Correlation between number of publications (in the year of hire) and the year of hire for Assistant Professor hires in Canadian cognitive psychology (red), eminent cognitive psychologists (purple), Canadian Society for Brain Behavior and Cognitive Science (CSBBCS)

Donald O. Hebb Distinguished Contribution Award winners (orange), American Psychological Association (APA) Early Career Award winners in cognitive psychology (blue) and Psychonomic Society Early Career Award winners (green). Data for latter four groups represent the number of publications when individuals obtained their first faculty position. Regression line is a cubic function ($R^2 = .31$), which explains more variance than a linear function ($R^2 = .22$).

The previous analyses indicate that Assistant Professor hires in Canadian cognitive psychology have published at a rate greater than eminent cognitive psychologists, Canadian career award winners, and APA Early Career Award winners (and commensurate with Psychonomic Society Early Career Award winners). However, as is evident from Figure 7, this may be because the largest increase in publications came only recently (for which the Canadian hires are disproportionately represented). To investigate this issue, we analysed the combined data set with all four references classes and the Canadian cognitive psychology hires (which represents 162 individuals hired from 1962 to 2016). There was a strong correlation between year hired and number of publications in this full data set, $r(160) = .47, p < .001$ (removing the aforementioned outlier in the eminent cognitive psychologist group raises the correlation to $r(159) = .52$). Consistent with our previous analyses, this correlation appears to be driven more strongly by recent hires than earlier hires (see Figure 7). There was no correlation between year hired and publication number for individuals hired between 1962 and 1989, $r(45) = -.01, p = .922$ (with the outlier removed: $r(43) = .05, p = .741$). In contrast, the association was a strongly positive for those hired between 1990-2016, $r(113) = .40, p < .001$. This is plainly evident in Figure 8: The mean number of publications for new hires held relatively constant at ~5 from 1962-1989, but doubled to ~10 from 1990-2009, and then doubled again between 2010-2016. These data suggest that the increase in publications for new faculty members over time may not be unique to Canadian cognitive psychology – whether it is unique to cognitive psychology (or even psychology) is an open question.

Figure 8. Increase in the mean number of publications across the last 6 decades of cognitive psychology. Means were computed across five samples: Canadian cognitive psychology, eminent cognitive psychologists, CSBBCS Award winners (orange), APA Early Career Award winners, and Psychonomic Society Early Career Award winners. Error bars represent standard error of the mean. N 's = 12, 19, 14, 15, 51, 49 for the 6 decades, respectively. The outlier from the eminent cognitive psychologist group (hired in 1972) was removed.

Gender

Our data also provide an opportunity to investigate potential gender differences in hiring for Canadian cognitive psychology. A recent analysis of funding data from the Natural Sciences and Humanities Research Council of Canada (NSERC; the primary funding body for research in Canadian cognitive psychology) found that although a larger proportion of cognitive-psychology-relevant Canadian undergraduate and graduate awards in went to women between 2009-2016, this pattern flips for postdoctoral awards (42% went to women) (Titone, Tiv, & Pexman, 2018). Moreover, fewer NSERC Discovery grants were awarded to women and, among winners, women received \$3,737 less per grant on average than men (Titone, Tiv, & Pexman, 2018). Is a gender disparity also evident in our data? As is evident from Table 2, the answer is yes. Our sample consists of 59.4% men and this proportion was somewhat higher in 2012-2016

(64.7%) than it was in 2006-2011 (53.3%). Interestingly, there was a particularly large gender differences among those with an international PhD (67.9%). Hires with Canadian PhDs (50% men) were gender balanced. We do not report tests for statistical significance here as our data consists of the entire population of interest and these proportions may not generalize to other disciplines.

Table 2. *Breakdown of number (and, in brackets, proportion) of women v. men (inferred based on names) who were hired as Assistant Professors in Canadian cognitive psychology as a function of cohort (2006-2011 or 2012-2016), and location of PhD (Canadian or International).*

	Women	Men
All hires	26 (40.6%)	38 (59.4%)
2006-2011	14 (46.7%)	16 (53.3%)
2012-2016	12 (35.3%)	22 (64.7%)
Among neuroscience hires	13 (35.1%)	24 (64.9%)
Among behavioural hires	13 (48.1%)	14 (51.9%)
Among Canadian PhDs*	17 (50%)	17 (50%)
Among International PhDs*	9 (32.1%)	19 (67.9%)

* We were unable to find information about PhD location for two individuals.

To gain some insight into the potential source of this gender disparity, we also investigated differences based on type of research (behavioural v. neuroscience).⁹ As is evident from Table 3, there were a relatively equal number of behavioural researchers (both men and women) and women neuroscience researchers in the sample (each ~20% of the sample). The group that stands out is male neuroscientists (37.5% of the sample). There were some differences in the number of publications for men/women and behavioural/neuroscience researchers which suggests that the gender difference may be because there are more men in the applicant pool. It should be noted, however, that (as shown previously; see Table 1) gender and type of research do not predict publication number once other factors (most notable, year of hire) were taken into

⁹ We thank an anonymous reviewer for this suggestion.

account (and, in fact, there was no significant difference between men and women in terms of publication number at the zero-order level, $t(62) = 1.46, p = .149$).

Table 3. *Breakdown of mean publication count and number of Assistant Professor hires (N) based on type of research (behavioural or neuroscience) and gender.*

Research Experience	Women		Men	
	# of Publications	N	# of Publications	N
Neuroscience	16.1 (12.7)	13 (20.3%)	17.3 (9.5)	24 (37.5%)
Behavioural	8.2 (3.2)	13 (20.3%)	13.3 (10.8)	14 (21.9%)

Discussion

How accomplished does one need to be in order to be competitive on the Canadian cognitive psychology job market? Setting aside important factors such as (among other things) (a) the fit between the candidate's research program and the interests of the deciding faculty members, (b) quality of job interview and reference letters, and (c) fluctuations in the number of available positions, between 2006-2016, new faculty members were hired, on average, on the weight of around 14 journal articles [95% CI: 12, 17]. However, perhaps the most striking aspect of the current analysis was the marked increase in the number of publications for new hires over the time period considered. New hires averaged 10 publications from 2006 to 2011, but this increased by 57% to 18 publications from 2012 to 2016. Notably, this (a) was not restricted to top-ranked institutions (and, if anything, the increase was greater among lower-ranked institutions), (b) did not come at the cost of decreasing quality in research (based, at least, on citations), and (c) was not entirely (or even largely) driven by longer postdoctoral fellowships. It appears that some combination of changing publication norms and increased talent among PhD students (presumably as a result of increasing numbers of PhDs) may offer the best explanation for the increased competitiveness of the job market.

Although our data demonstrate a marked increase in the number of publications required to be competitive for an entry-level faculty position, our data do not mean that this trend will continue indefinitely. Given the rate of increase, the number of publications required to be competitive for individuals who are just now entering the job market may actually be greater than what is reported here. If the 57% increase in average publication count from 2006-2011 to 2012-2016 were to continue, the average number of publications for individuals hired from 2017-2022 will be ~33. However, this does not take into account the fact that the increase in the number of publications was more precipitous after 2012 (see Figures 3, 7, and 8). If we compare the baseline of 10 publications (which held relatively steady prior to 2012, see Figures 7 and 8) to the average for 2015-2016 (i.e., 21 publications), this 71% increase translates to an *average* of ~44 publications by 2019. This is, of course, speculative given the small underlying sample size and the uncertainty surrounding low frequency events.

It is hard to believe that this trend can continue. Unfortunately, there are reasons to believe that things will become even more competitive. For example, the possibility for a self-fulfilling cycle should also be considered: As the job market appears to become more competitive, supervisors and advisory committees may encourage students to publish earlier and more frequently. It is also possible that standards for who becomes an author on a given paper may become (or have become) loosened such that even those with the most minor of contributions are given authorship. Perhaps most importantly, the current incentive structure for research funding encourages the mass production of PhD students. For example, the Natural Sciences and Engineering Research Council of Canada weighs grants for scientific funding based on three factors: 1) Quality of the proposed research, 2) Quality of the researcher, and 3) Contributions to the training of Highly Qualified Personnel (HQP). Since HQP includes both the

quality and *number* of individuals trained, there is direct incentive for programs and researchers to train (and help graduate) as many students as possible, regardless of their probability of success on the job market.

Perhaps one of the clearest conclusions from this analysis is that present and future PhD students would benefit greatly from having a better sense of what the job market looks like. To this end, one relatively simple solution to the information deficit would be for future hiring committees to record a few key variables of interest for all individuals who are given the opportunity to interview for a new position (i.e., number of publications, number of first-author publications, gender, citations, location of PhD, and years since PhD). Naturally, this misses a lot of what goes into the decision to hire a new faculty member – such as fit with current faculty, quality of research (which is only loosely captured by citations), quality of job interview, teaching experience, etc. – but it would nonetheless offer some benchmarks for current and future PhD students.

Adding Context

One way to understand the scope of accomplishment that has become the norm for new hires in Canadian cognitive psychology is to compare them with reference classes. This was done in a few ways. First, consider the two groups of highly eminent cognitive psychologists: 1) A selection of individuals who have been cited more than 40,000 times on Google Scholar (e.g., Daniel Kahneman, John R. Anderson, Elisabeth Loftus, etc.) and 2) Career award winners for the primary cognitive science society in Canada (e.g., Fergus Craik, Melvyn Goodale). These individuals were hired as Assistant Professors (or, in the United Kingdom, Lecturers) primarily in the 60's, 70's, and early 80's (Figure 7). The majority of this group (73%) was hired into their first faculty position with 5 or fewer publications. This was true of only 7 out of 64 (10.9%)

Canadian hires – only 1 of whom was hired after 2011. Of course, many things have changed since the time when these eminent scholars were hired – technology, postdoctoral fellowships, expectations (to name a few) – but that is precisely the point. The median number of publications for the 11 individuals hired into Canadian cognitive psychology positions in 2016 is 24 publications. The median for some of the most eminent cognitive psychologists in the world when they were first hired is 4 publications (and the median for CSBBCS award winners is 3). The current norm in Canadian cognitive psychology was the exception for the first few generations of cognitive psychologists. The nature of graduate research for present PhD students in cognitive psychology is far different than it was for those who have shaped our field. What consequences (if any) this has for the quality and type of research that is being done is unknown.

Taking contemporary reference classes – the Early Career Award winners for the APA and the Psychonomic Society – provides some convergence. The average number of publications upon first hire for APA award winners (10.5) was more similar to (albeit still lower than) Canadian cognitive psychologists (14), and Psychonomics Society award winners (12.5) were not significantly different. Thus, the *average* new hire in Canadian cognitive psychology has been roughly near the level of individuals (upon first hire) who received recognition from international societies specifically for outstanding achievement in the *beginning* of their career. The combined analysis of the full set of individuals suggests that this is attributable to a significant increase in the competitiveness of the job market in recent years. For example, in the full data set, only a small minority (20.5%) of the individuals hired prior to 2005 had more than 10 publications when they were first hired and only 2.7% (two people) had more than 20 publications. From 2006-2016, the *majority* (57.3%) had more than 10 publications and 23.6% had more than 20 publications when they were first hired (or, among Canadian cognitive

psychologists, hired). It is striking that the current expectations for productivity amongst new faculty exceeds the early achievements of some of our most celebrated, respected, and impactful cognitive psychologists.

At risk: Canadian behavioural researchers

Another cause of concern for PhD students in Canadian cognitive psychology programs who focus on behavioural research is the apparent rise of neuroscience and apparent lack of selection for Canadian PhDs in hiring decisions. Whereas from 2006-2011, 57% of the positions were filled by behavioural researchers (i.e., those who did *not* have at least one first-author neuroscience publication up to and including the year of hire), this decreased to 29% from 2012-2016. Moreover, only 55% of the individuals who were hired obtained their PhD from a Canadian institution (this held relatively constant across the indexed time period). The low (in our view) proportion of Canadian PhD hires along with the high proportion of neuroscience hires does not bode well for those who most frequently graduate from Canadian cognitive psychology graduate programs. Only 10 behavioural researchers have been hired in the entire country since 2012 – only 6 of whom obtained their PhD from a Canadian institution (see Table 4). This group represents the majority of the students in Canadian cognitive psychology programs; many of which do not have access to the resources or infrastructure for neuroscience research. Moreover, given the funding structure and available funds from the Canadian Tri-Council, it is not feasible for the majority of cognitive psychology students to use expensive neuroscientific methods. Finally, it should be noted that, whereas those who specialize in neuroscience can often apply to both cognitive and neuroscience programs, those who focus on behavioural work cannot typically apply to neuroscience programs. Hiring committees naturally treat hiring decisions as encapsulated (although concerns about gender equity are often a factor) – perhaps it is time to

consider hiring from the group that represents the majority of the PhD students in Canadian cognitive psychology: behavioural researchers with Canadian PhDs (and if not the former, certainly the latter).

Table 4. *Breakdown of mean publication count and number of Assistant Professor hires (N) based on cohort (2006-2011 or 2012-2016), type of research (behavioural or neuroscience), and location of PhD (Canadian or International).*

Cohort	Research Experience	Canadian PhD		International PhD	
		# of Publications	N	# of Publications	N
2006-2011	Neuroscience	8.3 (2.1)	6	15.9 (8.4)	7
	Behavioural	6.9 (3.8)	9	9.6 (7.8)	8
2012-2016	Neuroscience	21.5 (12.6)	13	16.0 (9.5)	9
	Behavioural	18.3 (11.0)	6	10.8 (8.1)	4

Alternative career paths

The present analysis focuses on one very specific job that is open to cognitive psychology PhDs: Tenure-track assistant professor positions at primary research universities (i.e., with PhD programs) in Canadian cognitive psychology. There are, of course, many other faculty positions available in Canada and elsewhere which may not require such a great number of publications (and for primary teaching positions publications may not even influence hiring decisions). Moreover, it is possible for cognitive psychologists to apply for positions in other areas of psychology (depending on one's topic of study), such as quantitative psychology, social psychology, developmental psychology, neuroscience, or education. Researchers with expertise in judgment and decision making are also increasingly being hired in business schools.

There are also many non-academic careers that are open to cognitive psychology PhDs. Informally, the authors are aware of the following (some broad, some specific) positions that have been taken by cognitive psychology PhDs (this list is not intended to be exhaustive): Data scientist/analyst, general researcher (e.g., for non-profit agencies), marketing researcher, consumer or user experience researcher, product manager, science writer or communicator,

program evaluator, consultant. Technology companies such as Facebook, Google, Amazon, and Gorilla hire cognitive psychologists in a variety of roles. There are also jobs to be found in government as data scientists and researchers, but also program evaluators or even in “behavioural units” that nudge decision making (Curry, 2017). Internships are also available: For example, with the Ontario government

(<https://www.internship.gov.on.ca/mbs/sdb/intern.nsf/lkpwebcontent/epublishedhome>) or with

companies such as Mitacs in collaboration with the Canadian government

(<https://www.mitacs.ca/en/career-connect>). Information about non-academic career opportunities

can be found on websites operated by psychological associations and societies: E.g., the

Psychonomic Society (<https://featuredcontent.psychonomic.org/beyondacademia-digital-event-may-2017/>), the Association for Psychological Science

(<https://jobs.psychologicalscience.org/blog/>), the American Psychological Association

(<http://www.apa.org/careers/resources/profiles/non-academic.aspx>), and the Society for

Personality and Social Psychology (<http://www.spsp.org/CareerCenter/non-academic-internships>).

Limitations

We should note a few important limitations to the present analysis. First, as mentioned, we have focused on one very specific position in one field and in one country. We did not examine programs that do not offer a PhD degree, so the picture may not be quite as bleak as presented here – at the very least, far more faculty positions were filled than those we have reported on here. It is also unclear how generalizable our results are (although the correlation between publication number and year of hire was replicated among recent early career award winners). Second, we focused primarily on a journal article publication count as our measure of

success. This does not take into account the proportion of publications that are first-author. It also ignores other types of contributions, such as chapters, conference presentations, student mentorship, teaching, etc. We also had no information about the quality of reference letters or other factors such as whether the person worked with a notable individual. Third, and relatedly, we only assessed quality of work by recording citations (among those with a Google Scholar profile). However, citations may not be overly influential at the time of hire (often not enough time would have passed for work to be highly cited). Rather, quality might be determined by looking at which journals the individual published in and by actually reading some of the candidate's published work.¹⁰

Conclusion

The present analysis indicates that the job market for Canadian cognitive psychology has become extremely competitive. At a time when increasing numbers of PhDs are graduating from cognitive psychology programs, it is likely that it has never been more difficult to obtain a faculty position. Of course, doctoral training in science yields transferable skills for non-academic positions (Sinche et al., 2017) and we have no indication that the broader job market is any worse than it has been (and, anecdotally, it may be better). Nonetheless, graduate programs should increase their focus on developing skills and experience that appeal to employers outside of the academy. We also suggest that hiring committees start recording information about the publishing record of individuals who are given interviews for faculty positions – this will facilitate future explorations of the job market. Finally, individuals who focus on behavioural (as

¹⁰ Although we only looked into the 11 individuals who were hired in 2016, it is worth noting that each individual published at least one paper in *Trends in Cognitive Sciences* (2), *Nature Neuroscience* (2), *Proceedings of the Natural Academy of Sciences* (3), *Current Biology*, *Journal of Experimental Psychology: General*, *Cognition*, or *Neuroimage*. These are top journals.

opposed to neuroscience) research and who obtain their PhD from Canadian cognitive psychology programs may be at particular risk in the job market. A broader array of factors should enter into hiring decisions, including the interests of those who play perhaps the most important role in the strength of Canadian cognitive psychology: Our students.

Acknowledgements

We would like to thank Nathaniel Barr and Paul Seli for helpful comments on an earlier version of this manuscript.

References

- Curry, B. (2017). Canada studies Britain's "nudge unit" for ways to give the public a push. *The Globe and Mail*. Retrieved from <https://www.theglobeandmail.com/news/politics/canada-studies-britains-nudge-unit-for-lessons-in-public-persuasion/article13541716/>
- Dwyer, M. (2016). University rankings Canada 2017: Medical/Doctoral. Retrieved September 19, 2017, from <http://www.macleans.ca/education/unirankings/university-rankings-2017-medicaldoctoral/>
- Edge, J., & Munro, D. (2015). Inside and Outside the Academy: Valuing and Preparing PhDs for Careers. Retrieved September 19, 2017, from <http://www.conferenceboard.ca/e-library/abstract.aspx?did=7564>
- Sinche, M., Layton, R. L., Brandt, P. D., O'Connell, A. B., Hall, J. D., Freeman, A. M., ... Brennwald, P. J. (2017). An evidence-based evaluation of transferrable skills and job satisfaction for science PhDs. *PLOS ONE*, 12(9), e0185023. <https://doi.org/10.1371/journal.pone.0185023>
- Titone, D., Tiv, M., & Pexman, P. M. (2018). The status of women cognitive scientists in Canada: Insights from publicly available NSERC funding data. *Manuscript under review*.