

An Analysis of the Canadian Cognitive Psychology Job Market (2006–2016)

Gordon Pennycook
Yale University

Valerie A. Thompson
University of Saskatchewan

How accomplished does one need to be to compete in 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 to 2011 averaged 10 journal-article publications up to and including the year they were hired. However, this number increased by 57% to 18 publications between 2012 and 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 positions. 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, which suggests that the increasingly competitive job market is not specific to Canada. Finally, we found that behaviour (as opposed to neuroscience) researchers and those who obtained their PhDs 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.

Public Significance Statement

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 to 2011 averaged 10 journal-article publications, which increased by 57% to 18 publications between 2012 and 2016. We also found that individuals who focus on research in behaviour (as opposed to neuroscience) and who obtain their PhDs from Canadian universities may be at particular risk in the job market.

Keywords: job market, hiring practices, academic success, Canadian cognitive psychology, Canadian psychology

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 psychol-

ogy 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 (EC) researcher to be competitive on the job market are likely outdated or even distorted.

The goal of the present analysis was to provide information about the academic records of those who have been hired into Canadian cognitive psychology positions. We hope this information will 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

Gordon Pennycook, Department of Psychology, Yale University; Valerie A. Thompson, Department of Psychology, University of Saskatchewan.

We thank Nathaniel Barr and Paul Seli for helpful comments on an earlier version of this article.

Correspondence concerning this article should be addressed to Gordon Pennycook, Department of Psychology, Yale University, 2 Hillhouse Avenue, New Haven, CT 06520. E-mail: gordon.pennycook@yale.edu

psychology: Highly productive researchers are filling faculty positions throughout the country.

Overview of the Analysis

For this analysis, we focused 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 e-mail was sent to the department heads/chairs of all Canadian psychology programs. In this e-mail, we requested a list of all individuals who had been hired since 2006, the year they were hired, and the division into which they were hired.¹ Second, because 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 were determined based on individuals' websites or curriculum vitae (CV). However, in some cases, this information was not present, and as such, the lead author went through individuals' publication histories to determine when their affiliations changed to their present institutions. 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 e-mail 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), which was recorded manually by the lead author. For individuals with CVs or publication lists on their websites, 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 published at that time was a part of the application packages (and, potentially, the job talk). Some individuals did not have CVs or publication lists on their websites (or they did not have websites). For these individuals, we used Google Scholar to locate publications (either via Google Scholar profile pages or, failing that, via author searches). 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 Behaviour 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 those in the publication count.

Through our search, we found that the majority of the faculty members had Google Scholar profiles (72% of our final sample), which 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, because the latter measure is likely more strongly influenced than the former by the number of years the individual had 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 neuroscientific 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 need in a neuroscience 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 the individual received his or her PhD and the year that he or she was hired).⁴

We also recorded additional information about the faculty members. First, we recorded their university of employ, and, from this, whether the university was (a) 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) 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 his or her 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/uwpjd/>).

Results

We identified 64 assistant professors who were hired into Canadian cognitive psychology positions from 2006 to 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 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, which held relatively constant across the time period: Men accounted for 53.3% of the hires between 2006 and

¹ "Year of hire" refers to the date individuals began their positions—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.

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 PhDs.

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

2011 and 64.7% of the hires between 2012 and 2016; these percentages were not significantly different using a chi-square test, $\chi^2(1, 64) = 0.86, p = .355$.

The grand mean in terms of published journal articles was 14.3 (95% CI [11.8, 16.9]), but which varied considerably ($SD = 10.1$); the median was lower ($Mdn = 11$). The mean number of total publications (including chapters and conference proceedings) was only somewhat greater ($M = 16.6, SD = 10.4, Mdn = 14$). 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 journal-article publications per person nearly doubled between 2006–2011 ($n = 30, M = 10, SD = 6.8, 95\% CI [7.5, 12.5]$) and 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 and 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.

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, $\beta =$

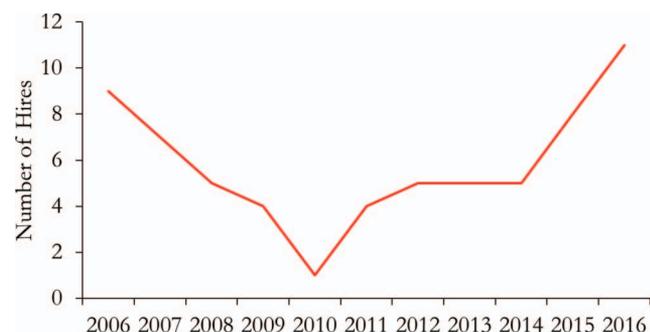


Figure 1. The number of new assistant professors hired into Canadian cognitive psychology positions from 2006 to 2016. See the online article for the color version of this figure.

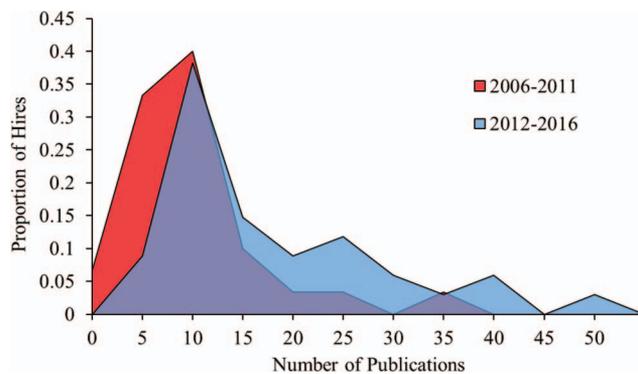


Figure 2. Smoothed distribution of journal-article publications for assistant-professor hires in Canadian cognitive psychology as a function of cohort (2006–2011 vs. 2012–2016). The mean number of journal-article publications nearly doubled from 2006 to 2011 ($M = 10, SD = 6.8, n = 30$) to 2012–2016 ($M = 18.1, SD = 11.1, n = 34$). See the online article for the color version of this figure.

.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 longer⁶). 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 Behavioural 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, neuroscientists tend to coauthor 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),

⁶ If anything, the number of publications per year is an underestimate, as some engage in research prior to their PhD.

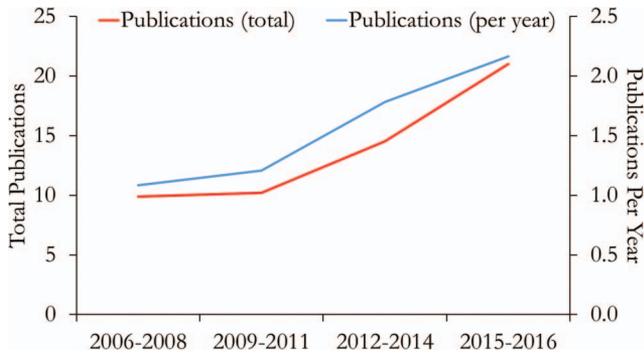


Figure 3. Increase in number of total publications (left axis) and publications per year (right axis) as a function of year (grouped) for newly hired assistant professors in Canadian cognitive psychology. Publications per year is an estimate based on an assumed 5-year PhD plus actual time between PhD 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. See the online article for the color version of this figure.

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 of 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.

Canadian or International PhD?

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 two individuals for whom it was not possible, based on the

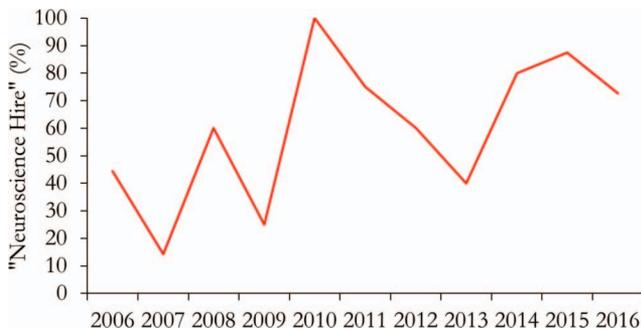


Figure 4. The percentage of credible neuroscience hires (i.e., at least one first-author neuroscience journal article) for new assistant-professor hires in Canadian cognitive psychology from 2006 to 2016. Note that 2010 represents a single individual. See the online article for the color version of this figure.

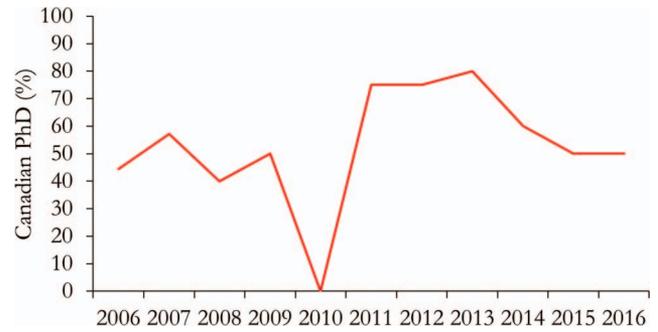


Figure 5. The percentage of new assistant-professor hires in Canadian cognitive psychology who received their PhDs from Canadian institutions from 2006 to 2016. Note that 2010 represents a single individual. See the online article for the color version of this figure.

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 of Canadian PhDs, $r(62) = .06$, $p = .619$. 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 ($M = 13.4$, $SD = 8.6$), $t(60) = 0.53$, $p = .597$.

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 was in western Canada, (c) the candidate obtained his or her 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 ($\beta =$

Table 1
Final Step of Hierarchical Multiple Regression Analysis

Variable	r	β	t	p	Tolerance	VIF
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	.98	.333	.87	1.15
Top-ranked institution	.27	.14	.90	.374	.63	1.59
Western Canadian inst	-.06	.02	.16	.872	.86	1.16
Canadian PhD	.11	.19	1.44	.157	.80	1.25
Neuroscience hire	.28	.05	.34	.735	.75	1.34

Note. Analysis predicted 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 his or her PhD in Canada, and (d) the candidate was a credible neuroscience hire (inferred); $N = 50$.

.14). None of the other factors, apart from the number of years since PhD, significantly predicted publication number.

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 Google Scholar profiles), $r(46) = .39, p = .008$. 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/uwpij/> 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 positions. Many eminent cognitive psychologists had fewer than five publications up to and including the first year of their first faculty position.

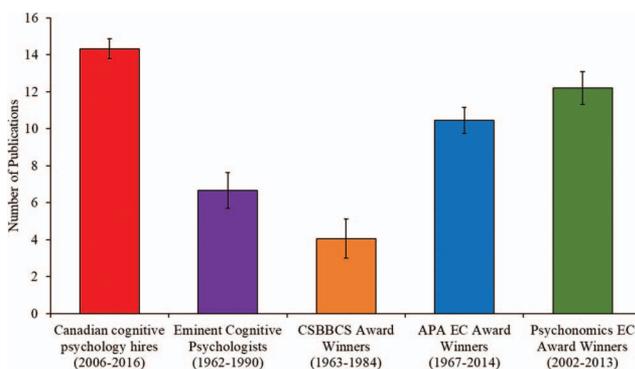


Figure 6. Number of journal-article publications for assistant-professor hires in Canadian cognitive psychology (red, $n = 64$), eminent cognitive psychologists (purple, $n = 20$), CSBBCS Donald O. Hebb Distinguished Contribution Award winners (orange, $n = 17$), APA EC Award winners in cognitive psychology (blue, $n = 37$), and Psychonomic Society EC Award winners (green, $n = 24$). Data for the latter four groups represent the number of publications when individuals obtained their first faculty positions. Error bars represent *SEM*. See the online article for the color version of this figure.

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 because of a protracted role as a scientific staff member) was removed. Thus, the average was 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 included some individuals (10 out of 53) who had faculty positions prior to obtaining their positions in Canada (it was not possible to find data on prior faculty positions for 11 individuals). Nonetheless, the mean number of publications for the 43 individuals who did not have prior faculty positions ($M = 14.2, SD = 10.5, 95\% \text{ CI [11, 17.5]}$) was similar to the grand mean for Canadian cognitive psychology ($M = 14.3, SD = 10.1, 95\% \text{ CI [11.8, 16.9]}$).

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 Behaviour and Cognitive Science (CSBBCS) Donald O. Hebb Distinguished Contribution Award (see 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 three of them (see <https://osf.io/uwpij/>). 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 EC 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) EC Award winners (from 1974–2017) in the three cognitive psychology areas: behavioural/cognitive neuroscience, perception/motor performance, and cognition/human learning. There were 51 such individuals. However, we excluded five who were in the eminent cognitive psychologist group and three who were in the smaller Psychonomic Society EC Award group (see below). We could not find the requisite data (either date of first hire or past publications) for six individuals. One individual was excluded because her research was primarily in developmental psychology. The second EC award group comprised the winners of the Psychonomic Society EC Award (2012–2017). The mean number of publications for the APA award winners ($M = 10.5, SD = 6.7, 95\% \text{ CI [8.2, 12.8]}$) was *lower* than for Canadian cognitive psychology hires across the full 2006–2016 time period ($M = 14.3, SD = 10.1, 95\% \text{ CI [11.8, 16.9]}$), $t(99) = 2.07, SE = 1.87, p = .041$. The mean number of publications for the Psychonomic Society award winners ($M = 12.2, SD = 9.2, 95\% \text{ CI [8.3, 16.1]}$) 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 Psychonomic Society award winners

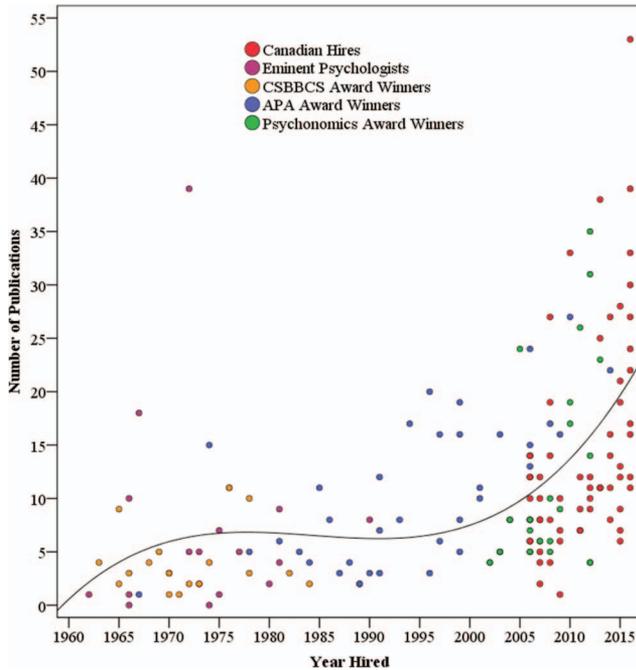


Figure 7. Correlation between number of publications (in the year of hire) and the year of hire for assistant professors in Canadian cognitive psychology (red), eminent cognitive psychologists (purple), CSBBCS Donald O. Hebb Distinguished Contribution Award winners (orange), APA EC Award winners in cognitive psychology (blue) and Psychonomic Society EC Award winners (green). Data for the latter four groups represent the number of publications when individuals obtained their first faculty positions. Regression line is a cubic function ($R^2 = .31$), which explains more variance than a linear function ($R^2 = .22$). See the online article for the color version of this figure.

(63%) were hired with fewer than 10 publications (36% of Canadian psychologists were hired with fewer than 10 publications).

The previous analyses indicate that newly hired assistant professors in Canadian cognitive psychology have published at a rate greater than eminent cognitive psychologists, Canadian career-award winners, and APA EC Award winners (and commensurate with Psychonomic Society EC 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 reference 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 raised 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 strongly positive for those hired between 1990 and 2016, $r(113) = .40$, $p < .001$, which is plainly evident in Figure 8: The mean number of publications for

new hires held relatively constant at approximately five from 1962 to 1989, but doubled to around 10 from 1990 to 2009, and then doubled again between 2010 and 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.

Gender

Our data also provided 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) revealed that, although a larger proportion of cognitive-psychology-relevant Canadian undergraduate and graduate awards went to women between 2009 and 2016, this pattern flipped 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 et al., 2018). Is a gender disparity also evident in our data? As is evident from Table 2, the answer is yes. Our sample consisted of 59.4% men; this proportion was somewhat higher in 2012–2016 (64.7%) than it was in 2006–2011 (53.3%). We find it interesting that there were particularly large gender differences among those with international PhDs (67.9%). Hires with Canadian PhDs (50% men) were gender-balanced. We do not report tests for statistical significance here as our data comprised the entire population of interest, and these proportions may not generalise to other disciplines.

To gain some insight into the potential source of this gender disparity, we also investigated differences based on type of re-

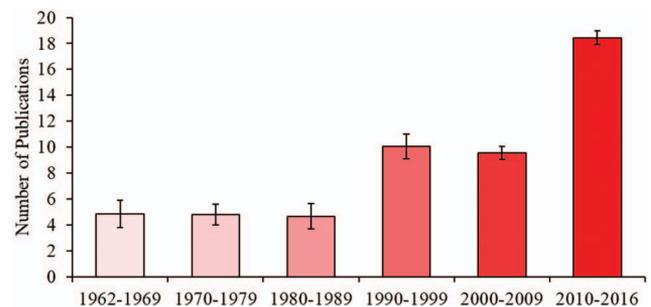


Figure 8. Increase in the mean number of publications across the last 6 decades of cognitive psychology. Means were computed across five samples: Canadian cognitive psychology, eminent cognitive psychologists, CSBBCS Award winners, APA EC Award winners, and Psychonomic Society EC Award winners. Error bars represent SEM; $ns = 12, 19, 14, 15, 51, 49$ for the 6 decades, respectively. The outlier from the eminent cognitive psychologist group (hired in 1972) was removed. See the online article for the color version of this figure.

search (behavioural vs. neuroscientific).⁷ As is evident from Table 3, there was 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 stood out comprised men in neuroscience (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 a result of more men in the applicant pool. It should be noted, however, that (as shown previously; see Table 1), gender and type of research did not predict publication number after other factors (most notable, year of hire) were taken into account. In fact, there was no significant difference between men and women in terms of publication number at the zero-order level, $t(62) = 1.46, p = .149$.

Discussion

How accomplished does one need to be to be competitive on the Canadian cognitive psychology job market? Setting aside important factors such as (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 (among other things) between 2006 and 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, which, notably, (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 post-doctoral fellowships. It appears that some combination of changing publication norms and increased talent among doctoral 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 fac-

Table 2
Breakdown of Number of Women Versus Men Hired as Assistant Professors in Canadian Cognitive Psychology

Variable	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%)

Note. Data include proportion of women versus men in brackets (inferred based on names) and reflect hires as a function of cohort (2006–2011 or 2012–2016), and location of PhD (Canadian or international).

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

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	
	No. of publications	n	No. 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%)

ulty 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 between 2017 and 2022 would be ~33. However, this predicted rate 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, which 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 doctoral students. For example, NSERC weighs grants for scientific funding based on three factors: (a) quality of the proposed research, (b) quality of the researcher, and (c) contributions to the training of highly qualified personnel (HQP). Because 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 doctoral 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), which, naturally, misses a lot of what goes into

⁷ We thank an anonymous reviewer for this suggestion.

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; and so forth) but it would nonetheless offer some benchmarks for current and future doctoral 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, which we did in a few ways. First, consider the two groups of highly eminent cognitive psychologists: (a) 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) and (b) 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 60s, 70s, and early 80s (see Figure 7). Most members of this group (73%) were hired into their first faculty positions with five or fewer publications. This was true of only seven out of 64 (10.9%) Canadian hires—only one 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 four publications (and the CSBBBCS Award winners *Mdn* = 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 current doctoral students in cognitive psychology is far different than it was for those who shaped our field. What consequences (if any) this has for the quality and type of research being done is unknown.

Taking contemporary reference classes—the EC 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 Psychonomic 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 careers. 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 doctoral 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 doctoral students in Canadian cognitive psychology: behavioural researchers with Canadian PhDs (and if not the former, certainly the latter).

Alternative Career Paths

In the present analysis, we focused on one very specific job open to cognitive psychology PhDs: tenure-track assistant professor positions at primary research universities (specifically, those 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

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	
		No. of publications	<i>n</i>	No. of publications	<i>n</i>
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

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 nonacademic careers 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/analysts, general researchers (e.g., for nonprofit agencies), marketing researchers, consumer- or user-experience researchers, product managers, science writers or communicators, program evaluators, consultants. 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 as 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 nonacademic career opportunities can be found on websites operated by psychological associations and societies: for example, 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/nonacademic.aspx>), and the Society for Personality and Social Psychology (<http://www.spsp.org/CareerCenter/nonacademic-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 EC 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, and so forth. 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.⁸

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 nonacademic 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, which will facilitate future explorations of the job market. Finally, individuals who focus on behavioural (as opposed to neuroscience) research and who obtain their PhDs 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.

⁸ 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 National Academy of Sciences* (3), *Current Biology*, and *Journal of Experimental Psychology: General, Cognition, or Neuroimage*, which are top journals.

Résumé

À quel point faut-il être accompli pour être concurrentiel sur le marché de l'emploi canadien en psychologie cognitive? Nous avons examiné les dossiers de publication de toutes les personnes qui ont été embauchées en tant que professeurs adjoints dans les divisions offrant des programmes de doctorat en psychologie cognitive au Canada entre 2006 et 2016 (N = 64). Les personnes qui ont été engagées entre 2006 et 2011 avaient en moyenne 10 publications d'articles de journaux jusqu'à, et y compris, l'année de leur embauche. Toutefois, ce nombre a grimpé de 57 % s'élevant à 18 publications entre 2012 et 2016. Notamment, cette augmentation (a) a eu lieu en dépit de l'augmentation du nombre de postes depuis 2010, (b) n'était pas limitée aux établissements scolaires de haut niveau, (c) ne s'est pas faite au détriment d'une baisse de qualité de la recherche (basé sur les citations), et (d) n'était pas due à des bourses postdoctorales prolongées. Pour fournir un peu plus de contexte, nous avons obtenu des données sur les dossiers de publication de 98 psychologues cognitifs éminents et primés au début de leur carrière au moment où ces derniers ont obtenu leurs premiers postes de professeurs. La corrélation entre l'année d'embauche et le nombre de publications dans l'échantillon complet était fortement positive ($r = 0,47$) et principalement due à une hausse substantielle au cours des dernières années, donnant à penser que le marché de l'emploi de plus en plus concurrentiel n'est pas spécifique au Canada. Enfin, nous avons constaté que les chercheurs en sciences du comportement (par opposition aux neurosciences) et ceux qui ont obtenu leur doctorat auprès d'une université canadienne peuvent être particulièrement à

risque sur le marché du travail. À l'heure où de plus en plus de détenteurs de doctorats obtiennent leurs diplômes de programmes de psychologie cognitive, il devient plus difficile que jamais de décrocher un poste de professeur.

Mots-clés : marché de l'emploi, pratiques d'embauche, réussite scolaire, psychologie cognitive canadienne, psychologie canadienne.

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Received October 4, 2017

Accepted March 17, 2018 ■

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