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Newsletter of the Quantitative Methods Section of CPA

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QUANTITATIVE METHODS SECTION OF CPA

Website:

http://www.cpa.ca/aboutcpa/cpasections/quantitativemethods/

Listserv:

qmcpa@yorku.ca

Message from the Chair

Those of us who work as quantitative methodologists – whether as our primary identity (like me) or as a side interest (like many others who provide valuable contributions to quantitative methodology) – wear many hats. Our colleagues, peers, and students appreciate our critical teaching role (we even enjoy teaching statistics) and we are highly valued as research collaborators, statistical consultants, and members of thesis and dissertation committees.

Of course, we also publish our own work on quantitative methods. Didactic, tutorial papers on "best practices" in quantitative methods enjoy particular visibility. Along these lines, the 2017 volume of Canadian Journal of Behavioural Science features a special issue on best practices and other methodological and applied journals regularly publish tutorials and best-practice reviews.

These resources are usually more current and in-depth than what can be found in textbooks and they are extremely helpful to researchers who are aware of a particular procedure but are not sure how to implement it or interpret the results. What many colleagues and students do not realize, however, is that quantitative methodology is a research enterprise unto itself; how else can we know what to say when we write best-practice reviews and tutorials?

Original quantitative methods research involves the development of new methods for psychological data as well as evaluations (e.g., using Monte Carlo experiments) of how well new or previously developed methods perform in common psychological research scenarios. Similarly, quantitative methods research also involves demonstrating and evaluating the application of methods developed in other fields (e.g., education or economics) to psychological data.

Certain topics in methodological research have been prominent for decades and will remain prominent (e.g., methods for psychological measurement and longitudinal data), but there are also new (or newly prominent) frontiers. Examples of such frontiers include Bayesian methodology (e.g., MCMC estimation), which is the focus of the section's featured speaker Georges Monette at the 2017 convention, and methods for so-called "big data" (as detailed in a 2016 special issue of Psychological Methods).

Members of the Quantitative Methods section are actively engaged in all of these activities – teaching statistics, statistical consulting, research collaboration, and, crucially, publishing original methodological research as well as didactic papers and chapters. Although the Quantitative Methods section is small, our presentations at the CPA Convention also reflect this range of activities and draw sizable crowds given the essential role of quantitative methods in psychological research.

The 2017 convention in Toronto promises to continue this tradition. I am excited to see you there!

David Flora
York University
d*flora@yorku.ca*

Message from the Student Rep

"I have found the Quantitative Methods section to be a welcoming place where psychologists of all backgrounds can discuss and explore conceptual/theoretical and procedural issues pertaining to research methods."

For the past 5 years, the Quantitative Methods section of the Canadian Psychological Association has been an invaluable resource for learning and networking about statistics and methodology in psychology. My name is Donna Tafreshi and I am a PhD student studying psychological methods at Simon Fraser University. I am also the current student representative for the Quantitative Methods section.

Like many psychology students, my first exposure to methods and statistics was in the context of substantive psychological research. As such, I believe that having a solid understanding of statistical tools is, of course, highly valuable for research practice.

However, what really drew me to focus on studying statistics during my doctorate degree were the deeper philosophical and foundational issues that underlie psychology and the ways in which statistics are used to potentially answer some of those foundational questions. The reason that I am so passionate about statistics today is because of its narrative – I am fascinated by the ways in which statistics are used to narrate our understanding of psychological phenomena.

I encourage all psychology students to also explore these conceptual aspects of statistical practice. I have found the Quantitative Methods section to be a welcoming place where psychologists of all backgrounds can discuss and explore conceptual/theoretical and procedural issues pertaining to research methods.

Delving into the world of statistical tools and research methods can prove to be an invaluable learning experience as a psychological researcher. If you're quite new to this area of study, (or if you find statistics to be a bit intimidating), the Quantitative Methods section is a great place to begin. In fact, I was a new member to this section just last year; it is very easy to get involved!

We are currently gearing up for the Canadian Psychological Association annual convention to be held in Toronto, Ontario this June 2017. We welcome existing, new, and prospective members to join us at the variety of events (e.g., workshops, talks, posters, roundtables) that we have planned.

Finally, I want to thank all of the current members of the Quantitative Methods section, and, in particular, the executive committee for their hard work and commitment to building and maintaining this section. I hope to connect with many of you at the convention this year!

I always welcome feedback, questions, and comments from psychology students. I am happy to answer questions pertaining to methods, quant methods programs, or the Quantitative Methods section. Feel free to connect with me through email.

Donna Tafreshi, MA
Simon Fraser University
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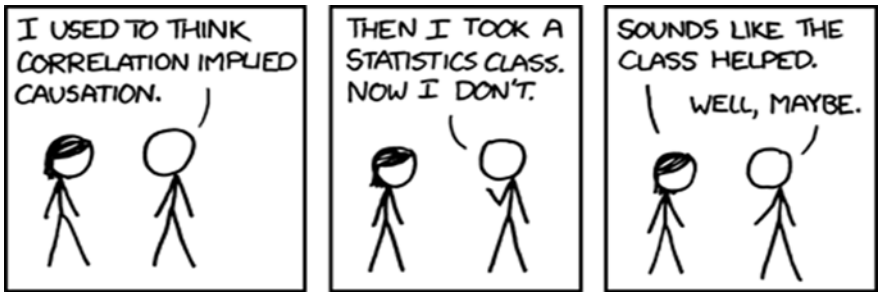
QM Laugh



Did You Know?
The QM Section currently has 46 student members, down by over 200 since we needed to start charging for memberships in order to meet CPA's new student member administrative fee.

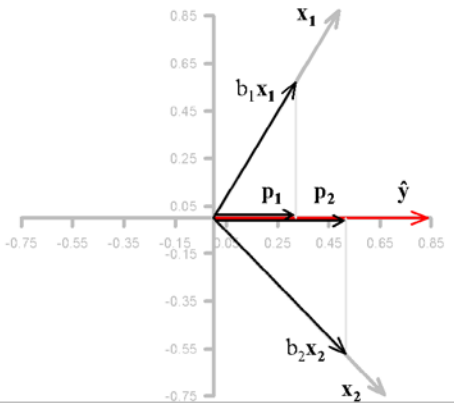
Visual Insights

Regression as Vectors in Subject Space – Ernest Kwan

Visualizations of least squares regression usually involve plots in *variable* space (e.g., scatterplot). Plots in *subject* space, however, can better show the relationship between variables. In such plots, axes represent subjects and line segments (vectors) represent variables.

For example, given n subjects and predictors X_1 and X_2, the centered predictors, x_1 and x_2, may be represented as two vectors in n-dimensional space (Figure 1 shows a slice from this space). The length of vector $\mathbf{x_i}$ (denoted $|\mathbf{x_i}|$) is related to the variability of x_i, and the cosine of the angle between $\mathbf{x_1}$ and $\mathbf{x_2}$ is the correlation between x_1 and x_2. In least squares regression of response Y on X_1 and X_2, we use x_1 and x_2 to reproduce the centered response, y. That is, create a vector $\hat{\mathbf{y}}$ that matches $\mathbf{y}$ as closely as possible, where $\hat{\mathbf{y}}$ resides in the space spanned by $\mathbf{x_1}$ and $\mathbf{x_2}$. In Figure 1, $\hat{\mathbf{y}}$ (red vector) is the result of adding the stretched versions of $\mathbf{x_1}$ and $\mathbf{x_2}$, namely, $\hat{\mathbf{y}} = b_1\mathbf{x_1} + b_2\mathbf{x_2}$, where b_1 and b_2 are the estimated slope coefficients.

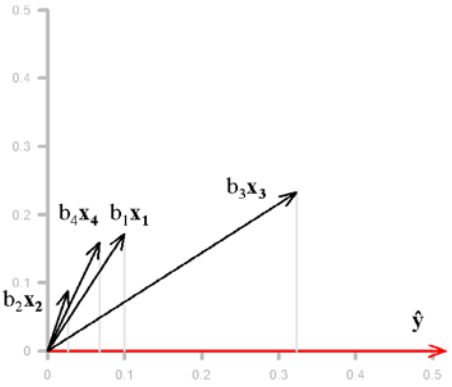
Figure 1. Multiple regression with two predictors



Note the vertical line that connects the tip of $b_i\mathbf{x_i}$ to $\hat{\mathbf{y}}$ in Figure 1. This line forms a right angle with $\hat{\mathbf{y}}$; the vector along $\hat{\mathbf{y}}$, from the origin to this vertical line, is the *projection* of $b_i\mathbf{x_i}$ on $\hat{\mathbf{y}}$ (denoted $\mathbf{p_i}$). By properties of vector algebra, $\hat{\mathbf{y}} = \mathbf{p_1} + \mathbf{p_2}$. If y is standardized (as it is in Figure 1), then $|\hat{\mathbf{y}}|$ is the square root of the R^2 from the regression, and as such, $|\mathbf{p_i}|$ indicates the contribution of X_i to R^2. In Figure 1, X_2 contributes more to R^2 than X_1; in this sense we regard X_2 as a more important predictor (see Thomas et al., 1998, for more discussion).

The above ideas extend to m > 2 predictors. The regression would entail $\hat{\mathbf{y}}$ in m-dimensional space. Though we cannot easily plot m dimensions, we can superimpose slices from this space. Consider the slice that contains only $b_i\mathbf{x_i}$ and $\hat{\mathbf{y}}$, there are m such slices. Figure 2 illustrates a regression with four predictors, where the four slices of $b_i\mathbf{x_i}$ and $\hat{\mathbf{y}}$ are superimposed so that the $b_i\mathbf{x_i}$'s appear in the same quadrant. Though this picture may not accurately depict the angle between $b_i\mathbf{x_i}$ and $b_j\mathbf{x_j}$ from the 4-dimensional space, the angle between $b_i\mathbf{x_i}$ and $\hat{\mathbf{y}}$ is accurately portrayed. Thus, as before, Figure 2 shows the contribution of each predictor to R^2 (in this case, X_3 is the most important).

Figure 2. Multiple regression with four predictors



Our paper (Thomas et al., in progress) explicates in detail how such plots show the contribution of predictors to the fit of a regression model. We also examine the implication of a predictor with *negative contribution* (i.e., obtuse angle between $b_i\mathbf{x_i}$ and $\hat{\mathbf{y}}$). We further describe the R code used to produce Figures 1 and 2. Data of both examples are from Hays (1994).

References

Hays, W. (1994). *Statistics* (5th ed.). Belmont, California: Wadsworth.

Thomas, D. R., Kwan, E., Schweitzer, L., & Zumbo, B. D. (In progress). Variable importance in regression: A geometric view.

Thomas, D. R., Hughes, E., & Zumbo, B. D. (1998). On variable importance in linear regression. *Social Indicators Research*, 45(1-3), 253-275.

Thank you to Ernest Kwan, assistant professor of psychology at Carleton University, for this issue's Visual Insight. Ernest's area of specialization is the development of statistical graphics for social science research. Send 'Visualization Insights' ideas to Heather Davidson (davi9640@yorku.ca), Communications Director of the QM Section

Consulting Corner

Dear QM Consultant,

I have a large number of variables and I would like to explore the relationships among these variables. More specifically, I would like to determine if there are meaningful psychological constructs that underlie this large set of variables. I have read that I can use either Principal Components Analysis or Factor Analysis, but I am not sure which one is most appropriate for my goal.

Thank you,
Charlie Spearman

Dear Mr. Spearman,

This is a very common issue that arises in psychology, where researchers often have a large number of items/scores and are interested in explaining the pattern of correlations among them. Since both Principal Components Analysis (PCA) and Factor Analysis (FA) reduce a larger set of scores into a smaller subset of variables, it is not a surprise that there is often confusion regarding which method to use in specific situations.

Very generally, PCA involves extracting linear composites of observed variables, whereas FA is based on a formal model predicting observed variables from theoretical latent variables. In other words, the aim of PCA is to represent total variance, while FA explains the covariances between the variables. From a practical standpoint, you would run PCA if you want to simply reduce your correlated observed variables to a smaller set of composite variables that retain a majority of the original variance, but you would run FA if you assume or wish to test a theoretical model of latent factors causing observed variables.

To provide a bit more statistical detail, PCA does not differentiate between common and unique variance. Instead, PCA attempts to account for the variance in the scores rather than explain the correlations among them. Thus, when communalities are low (i.e., the association between an observed variable and the set of factors), PCA and FA can result in quite different solutions. FA is more appropriate if the stated objective is to model the correlations of a set of scores using a smaller number of latent variables/factors, and thus models suggested by FA are also more likely to be replicated by a confirmatory factor analysis on a separate sample.

In short, since your goal is to uncover constructs represented by the factors underlying your set of variables, FA is more suited to the aims of your research than is PCA.

Sincerely,
Your Friendly Neighbourhood Stats Consultant

Have a Consulting Question?
Email Consulting Corner suggestions to Heather Davidson (davi9640@yorku.ca), Communications Director of the QM Section

"The best thing about being a statistician is that you get to play in everyone's backyard"
- John W. Tukey

QM Section Invited Speaker at CPA 2017

The QM Section's Invited Speaker at this year's CPA Convention is Dr. Georges Monette, Professor of Mathematics and Statistics at York University. The topic of Dr. Monette's presentation is *A Frequentist Travels to Bayesland: Field Notes on a Late Rumspringa.*

Georges Monette is an Associate Professor in Mathematics and Statistics at York University. He obtained his PhD in statistical inference at the University of Toronto in 1980. His main passion is using geometry and graphics as tools for statistical reasoning. Simple geometric diagrams can elucidate complex and otherwise elusive properties of statistical methods. His other passion is statistical consulting and collaboration -- mainly through York's Statistical Consulting Service -- with researchers in almost every discipline at his university. His most recent forays are in Bayesian inference for longitudinal data analysis using Hamiltonian Monte Carlo.

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2016 CPA Convention: Another Great Success for QM!

Section Invited Speakers

Why I Dislike the Null Hypothesis Significance Testing Procedure, David Trafimow, New Mexico State University

Integrative Longitudinal Lifespan Research and Within-Person Assessment of Cognition in the Age of Precision Medicine, Scott Hofer, University of Victoria

Preconvention Workshop

Workshops

Round Table

Small Sample and N = 1 Methodologies: Their Place or Absence in Psychology Research Curriculum and Its Implications, Rachel Fouladi, Simon Fraser University

Symposia

Teaching Statistics: Strategies for Improving Attitudes and Performance, Melissa Ferland, Alyssa Counsell, Heather Davidson, York University; Deanna Singhal, University of Alberta

Measurement and Probability Approaches to Optimize Replicability of Psychological Science, Michael Bradley, University of New Brunswick, D. Steven Lindsay, University of Victoria, Kaitlyn Werner, Carleton University, Lorne Campbell, University of Western Ontario

Posters

The EQ Ratio: A Robust Test Statistic for Applied Clinical Research, Teresa Allen, University of Ottawa

The Influence of High or Low Social Distance on Responding: A Comparison on Online, Social Media and Classroom-Based Survey Methods, Daniella Balascak-Besirovic, Concordia University of Edmonton

Distributional Characteristics of Quasi-Count CES-D Items: Poisson or Normal? Alexis Georgeson, Simon Fraser University

Test of Lack of Significant Interaction Between Continuous Predictors in Linear Models, Yasaman Jabbari, York University

Robust Correlations and Confidence Intervals for Non-Normal and Outlier Data, Johnson Li, University of Manitoba

Exploring Equivalence Tests for Analyzing Frequencies, Tanja Shishkina, York University

An Analysis of Quality Assessment Reporting Practices in Psychological Meta-Analyses, Donna Tafreshi, Simon Fraser University

Examining the Effect of Reverse-Worded Items on the factor Structure of the Need for Cognition Scale, Xijuan Zhang, University of British Columbia

Big Data, Big Analysis: A Collaborative Modelling Framework for Multi-Study Replication, Andriy Koval, University of Victoria

The program for this year's CPA Convention in Toronto can be found at *convention.cpa.ca/968/*

Quantitative Methods Student Presentation Award

Congratulations Alyssa Counsell, York University for winning the inaugural QM Student Presentation award for her symposium "Attitudes Towards Statistics and Statistical Software in Psychology: Implications for Teaching and Student Success"!

QM Graduate Programs in Canada

Numerous resources related to the study of quantitative methods for psychology can be found on the APA Website:

http://www.apa.org/research/tools/quantitative

There you will find, among other things, that relative to other areas of psychology there is a much greater chance of getting a job with a PhD in Quantitative Methods.

University of British Columbia

MA/PhD, Quantitative Methods
http://psych.ubc.ca/graduate/research-areas/quantitative-methods/
Contact: Jeremy Biesanz
Email: jbiesanz@psych.ubc.ca

University of Manitoba

MA/PhD Methodology
http://umanitoba.ca/faculties/arts/departments/psychology/graduate/programs/analysis.html
Contact: Johnson Li
Email: Johnson.Li@umanitoba.ca

McGill University

PhD, Quantitative Psychology and Modeling
http://www.psych.mcgill.ca/research.html#q
Contact:Yoshio Takane
Email: takane@psych.mcgill.ca

Simon Fraser University

MA/PhD, Quantitative Methods
http://www.psyc.sfu.ca/index.php?topic=theory
Contact: Rachel Fouladi
Email: rfouladi@sfu.ca

University of Western Ontario

MSc/PhD, Personality and Measurement Program
http://www.psychology.uwo.ca/research/personality_and_measurement/index.html
Contact: Don Saklofske
Email: dsaklofs@uwo.ca

York University

MA/PhD, Quantitative Methods
http://qm.info.yorku.ca/
Contact: David Flora
Email: dflora@yorku.ca

A list of available executive positions in the QM section can be found on pages 7 and 8

2017-2018 QM Section Elections

Elections for QM Section positions will occur at the QM Annual Meeting during the CPA Convention. If you interested in running for a position, or if you would like to nominate someone for a position, you can do so by emailing Rob Cribbie (cribbie@yorku.ca) or nominations will also be accepted during the Annual Meeting.

Meet Your 2016-2017 QM Section Executive Team

Chair:

Dave Flora
Quantitative Methods Program
Department of Psychology
York University
dflora@yorku.ca

Chair-Elect:

Donald Sharpe
Department of Psychology
University of Regina
sharped@uregina.ca

Past Chair:

Michael Bradley
Department of Psychology
University of New Brunswick
bradley@unb.ca

Special Points of Interest

QM Section of CPA was formed in 2013

Don Sharpe was the first chair of the section

CPA 2017 is in Toronto; CPA 2018 (in combination with the International Congress of Psychology) is in Montreal

Want to Get Involved?

Email any of the members of executive - we'd love to have you!

If you are not already a member of our listserv, please send an email to Rob Cribbie so you don't miss out on future newsletters, convention news, training opportunities and more!

Secretary/Treasurer:

Rob Cribbie
Quantitative Methods Section
Department of Psychology
York University
cribbie@yorku.ca

Communications Director:

Heather Davidson
Quantitative Methods Program
Department of Psychology
York University
davi9640@yorku.ca

Student Representative:

Donna Tafreshi
History, Quantitative & Theoretical Program
Department of Psychology
Simon Fraser University
nta18@sfu.ca

Classifieds

Position Information

Position Rank: Full Time Tenure Stream - Assistant Professor
Discipline/Field: Quantitative Methods
Home Faculty: Health
Home Department/Area/Division: Psychology
Affiliation/Union: YUFA
Position Start Date: January 1, 2018

Faculty of Health – Department of Psychology
Quantitative Methods

The Department of Psychology at York University (psyc.info.yorku.ca) invites applications for a full-time tenure track position in Quantitative Methods at the rank of Assistant Professor with an anticipated start date of January 1, 2018.

Candidates with a PhD in Psychology or a related field and a strong program of research in Quantitative Methods are encouraged to apply. Candidates must show excellence or promise of excellence in teaching and in scholarly research and publication. Candidates will be expected to teach both undergraduate and graduate level quantitative methods courses and supervise undergraduate and graduate student research in Quantitative Methods. Candidates with specializations in any area of Quantitative Methods for Psychology will be considered, for example structural equation modeling, multilevel modeling, Bayesian statistics, measurement, longitudinal analysis, robust statistics, data mining, etc. Pedagogical innovation in high priority areas such as experiential education and technology enhanced learning is an asset. The candidate must be eligible for prompt appointment to the Faculty of Graduate Studies.

York is Canada's third largest university with a rich diversity of perspectives and a strong sense of social responsibility. Our Psychology Department is ranked among the top 100 in the world according to the 2017 QS World Rankings.

York University is an Affirmative Action (AA) employer and strongly values diversity, including gender and sexual diversity, within its community. The AA program, which applies to Aboriginal people, visible minorities, people with disabilities, and women, can be found at www.yorku.ca/acadjobs or by calling the AA office at 416-736-5713. All qualified candidates are encouraged to apply; however, Canadian citizens and permanent residents will be given priority.

A cover letter of application an up-to-date curriculum vitae, a statement of research and teaching interests, three reprints or preprints, and teaching evaluations (if available) should be merged into a single pdf file and sent by June 30, 2017 to: psycjobs@yorku.ca. Arrangements should also be made for three confidential letters of reference to be submitted to the same email and addressed to Chair, Psychology Quantitative Methods Search Committee, 296 Behavioural Sciences Building, Department of Psychology, York University, Toronto, ON, Canada, M3J 1P3.

Send any classified ads to:
Rob Cribbie (cribbie@yorku.ca)
Secretary/Treasurer, QM Section