

# The historical functional linear model: An approach to develop tests of significance

Nicole Malfait  
James O. Ramsay

Department of Psychology, McGill University,  
Montreal H3A 1B1, Quebec, Canada,  
[malfait@motion.psych.mcgill.ca](mailto:malfait@motion.psych.mcgill.ca)  
[ramsay@psych.mcgill.ca](mailto:ramsay@psych.mcgill.ca)

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## Abstract

We propose a functional linear model which can be used to explain the values of a sample of curves  $y_i(t)$  at a given point in time  $t$  by the behaviour of covariate time functions  $x_i(s)$  observed before and up to this time; that is for times  $s \leq t$ . We show how it is possible to determine the length of a delay,  $\delta$ , beyond which the feed-forward influence of the covariates  $x_i(s)$  can be neglected. To estimate the coefficient of regression, which is a bivariate function  $\beta(s,t)$  defined on a triangular domain ( $s \leq t$ ), we use the finite element method.

First, we provide simulation results to guide the calibration involved in the fitting process. Then, using data issued from a speech production experiment, we apply the model to the problem of predicting the acceleration of the lower lip during speech on the basis of electromyographical recording from a muscle depressing the lip. In this context, we estimate the standard error of the estimated regression function  $\beta(s,t)$ , and present preliminary work to develop tests of significance. Specifically, we propose an approach to formulate the calculation of F-values.

## References

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