IN PRESS

CARMA 2026

8th Int. Conf. on Advanced Research Methods and Analytics
1-3 July 2026, Valencia, Spain

Functional Modeling of Subjective Time: Analyzing Inconsistent Decisions via Functional Time Distortion

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How to cite: Li Calzi, V.; Maturo, F.; Cruz Rambaud, S.; Mazzitelli, A.; Porreca, A. (2026). Functional Modeling of Subjective Time: Analyzing Inconsistent Decisions via Functional Time Distortion. In: 8th International Conference on Advanced Research Methods and Analytics (CARMA 2026). Valencia, 1–3 July 2026. https://doi.org/10.4995/CARMA2026.2026.21955

Abstract

This study develops a survey-based functional framework that connects intertemporal choice theory and Functional Data Analysis (FDA) to investigate subjective time deformation in intertemporal decision-making. Data are collected through a structured multilingual questionnaire combining equivalence judgments, explicit subjective time perception (STP) tasks, psychometric measures, and demographic information. Individual discount curves are elicited across 13 horizons, from 7 days to 5 years, smoothed under monotonicity constraints, and transformed into subjective-time functions $\tau_i(t)$. These functions are analyzed through derivatives, FPCA, clustering, and comparison with STP profiles. Preliminary empirical results indicate that subjective-time heterogeneity is mainly functional rather than scalar. FPCA shows that the first component explains more than 80% of variability, while clustering identifies three distinct temporal deformation profiles. The partial alignment between $\tau_i(t)$ and STP suggests that implicit and explicit representations of time capture different layers of subjective temporality.

Keywords: *intertemporal choice; subjective time; Functional Data Analysis; time distortion; discount curves; clustering.*

Article in Press

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Editorial Universitat Politècnica de València