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Evaluation of a Novel Non Model Driven Assessment of Cardiac Autonomic Activity: Response to Initiation and Termination of Head-Up Tilt

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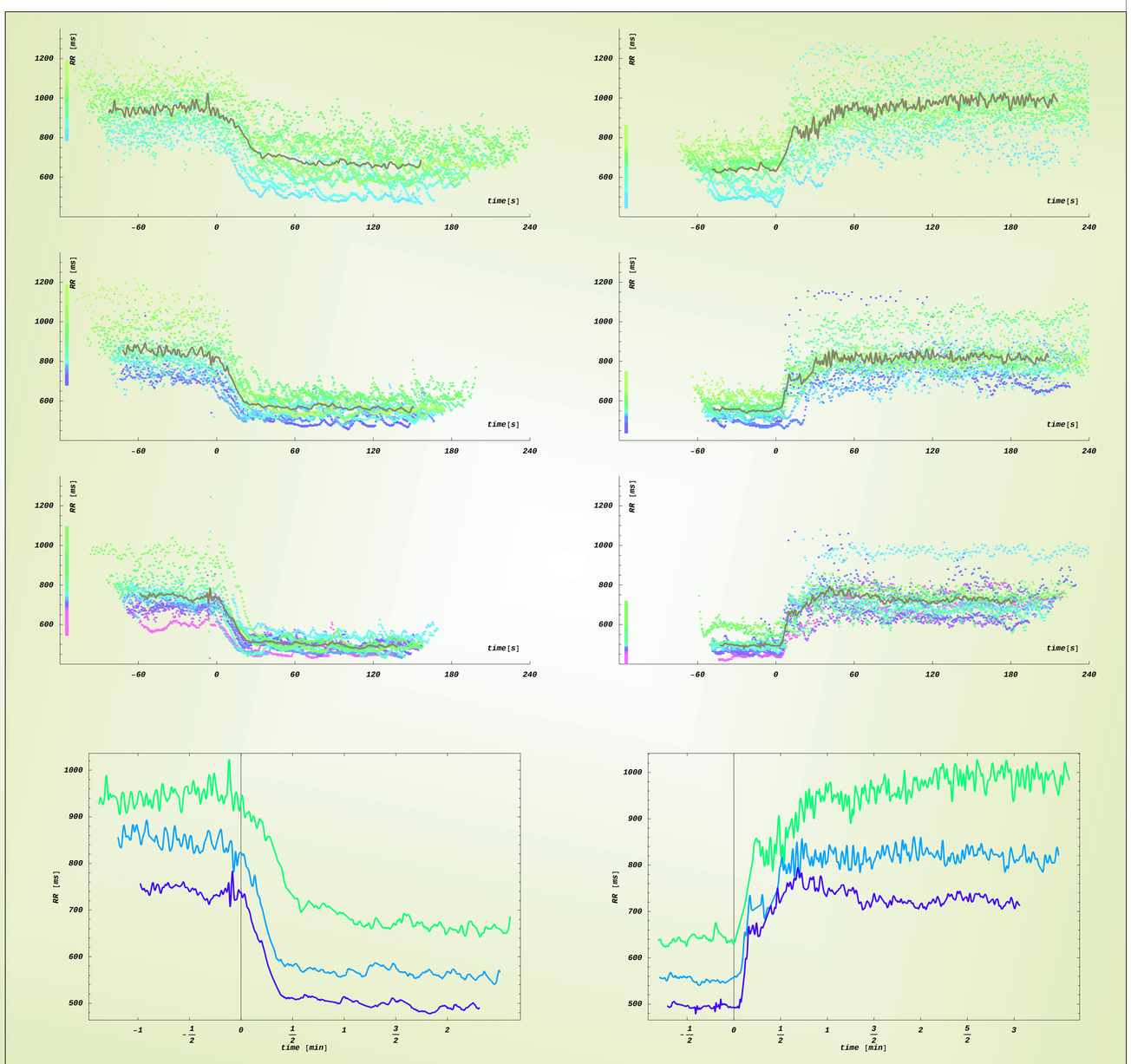
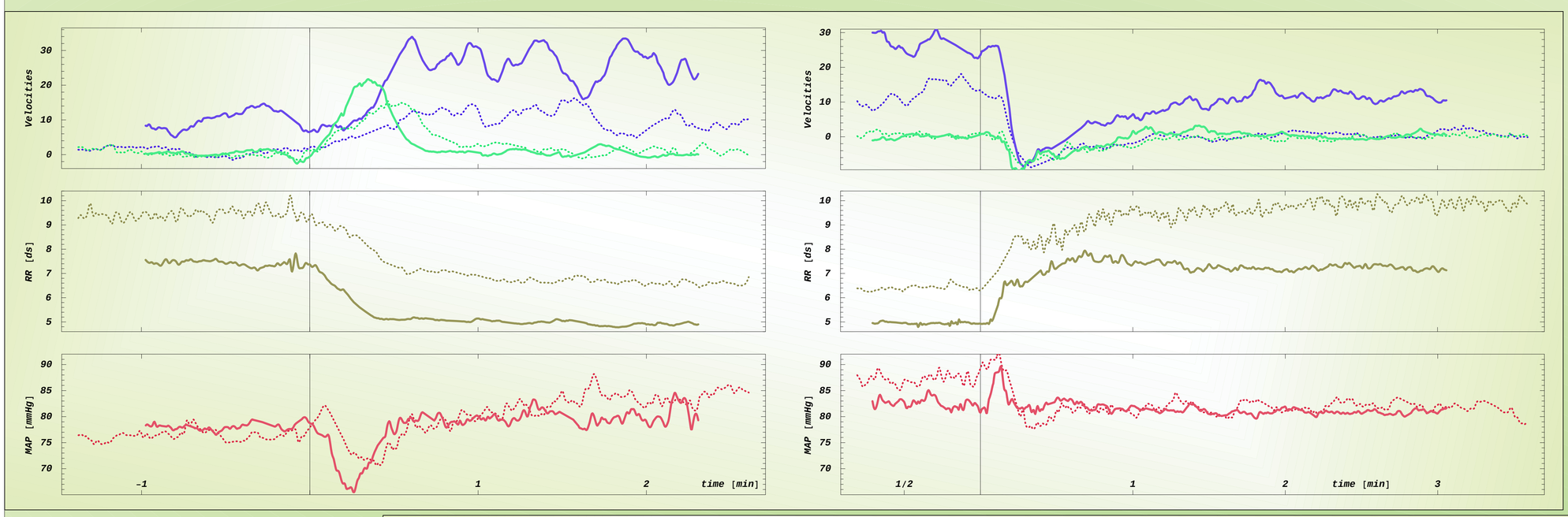
Introduction: We have previously described the kinematics of the steady state response to combined head-up tilt (HUT) and graded heat stress in 13 subjects using a novel time domain method that decomposes beat-to-beat changes in R-R intervals (RRI) into components that reflect parasympathetic and sympathetic cardiac autonomic activity. Steady state cardiac sympathetic velocity increased incrementally and predictably as orthostatic stress increased (HUT and heat stress), whereas changes in cardiac parasympathetic velocity were less evident. Our method's ability to track beat-to-beat changes in velocities also allows us to observe the interactions of these two components of cardiac autonomic activity during the transition to and from HUT as orthostatic stress increases.

Results: During the onset of HUT at the lowest level of orthostatic stress, the average decrease in RRI reached steady state by 35 seconds accompanied by a slow rise in parasympathetic velocity that reached a peak at 28 seconds and returned to baseline by 53 seconds. Sympathetic velocity gradually increased to reach steady state by 37 seconds. During highest orthostatic stress, the time to steady state RRI (23 seconds) and the rise time in parasympathetic velocity (21 seconds) were brisker. The rise in sympathetic velocity reached steady state at 37 seconds by which time parasympathetic velocity had declined to baseline. At the termination of HUT in both cases there was a rapid decline in parasympathetic and sympathetic velocities to below baseline negative values that reached a global minimum by 17 seconds after termination and returned to baseline by 42 seconds.

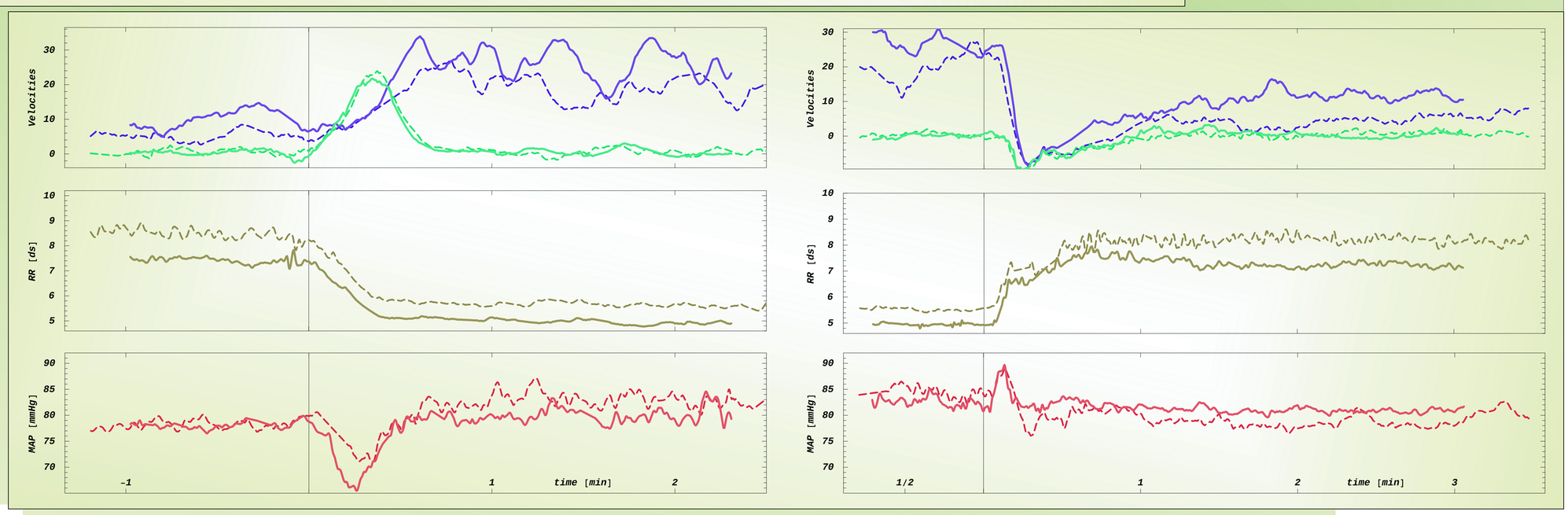


1. Composite averages of changes in RR interval during initial and end head up tilt as heat stress progresses.

Conclusions: The rise in parasympathetic velocity during initial HUT stabilizes the transition to sympathetic predominance during steady state orthostatic stress and is more evident as orthostatic stress increases. We speculate that the negative trajectory during tilt back is indicative of "recoil" within the system as cardiovagal braking is again briefly applied in concert with the rapid transient reduction in sympathetic velocity.



2. *(left)* Composite averages comparing changes in RR intervals, blood pressure, sympathetic and parasympathetic velocities during no heat (dotted line) and maximal heat stress (full line).



3. *(right)* Composite averages comparing changes in RR intervals, blood pressure, sympathetic and parasympathetic velocities during moderate (dashed line) and maximal heat stress (full line).

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