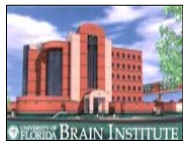


# UF Role of Dopamine in Influencing Masked Faces in Parkinson Disease: Timing is Key



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## Background & Aims

A flat, expressionless "masked" face is a common feature of Parkinson disease (PD) and is associated with negative misattributions about mood and personality characteristics by health care providers, family, and others.



In previous work, we used computer digitizing methods to quantify dynamic facial expressions and found, as expected, that facial movement changes were less robust in medicated PD patients compared to controls (Bowers et al., 2006).

## AIMS OF CURRENT STUDY

To test the hypothesis that dopaminergic depletion in PD will influence voluntary facial expressions by affecting temporal parameters of movement.

**AIM 1:** To determine whether overall facial movement (total entropy) will be decreased by dopa reduction.

**AIM 2:** To learn whether rate and timing parameters (entropy rate, time to initiate or reach peak entropy) will be slowed by dopa reduction.

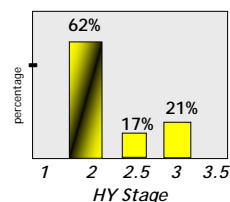
**AIM 3:** To examine clinical correlates of facial digitizing indices in PD (i.e., severity, duration, mood).

## Participants

40 idiopathic non-demented PD patients  
(enrolled in RCT for treatment of masked faces)

	Mean	SD
Age	69.0	6.9
Ed (yrs)	15.9	2.8
Sex: M-F	24:16	
UPDRS-motor	24.6	9.4
LED	761	443
Duration(yrs)	6.1	3.7
DRS-2	138.7	4.1
BDI-II	8.1	6.2
Antidepressants?	52%	

Percentage PD's at Hoehn-Yahr Stages



UPDRS: Unified Parkinson Disease Rating Scale, LED = levodopa equivalent dosage; DRS-2 = Dementia Rating Scale-2, BDI-II = Beck Depression Inventory II

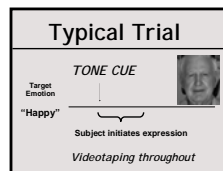
## Methods

### On & Off "Dopa" Design

- Each PD patient was tested twice: "on" and "off" dopa meds; 1 week apart
- Order of "on" & "off" dopa conditions was randomized across Ss
- Off dopa testing involved an overnight, 12 hour washout

### Face Expression Trials

- Ss made voluntary facial expressions
- Each trial began with presentation of target emotion & followed by an auditory tone.
- Auditory tone cued Ss to make the target emotion
- 5 Expressions: happy, sad, anger, fear, disgust
- 2 trials per expression
- Throughout, Ss were videotaped while seated with head stabilized in Vak-Lok system

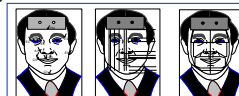


### Procedures for Analyzing Facial Movement\*



\*modified from Leonard et al. (1991)

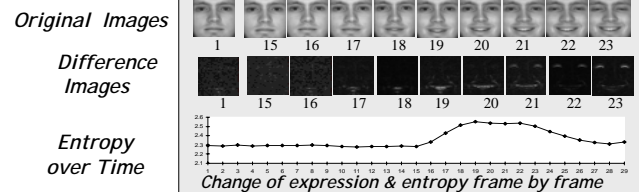
- For each expression, the initial 45 videoframes were captured, digitized, and saved on hard drive of computer. Each digitized frame was 30 ms in duration and represented 640 X 480 pixel array at 256 levels of grey scale
- Sixteen anatomic landmarks were manually placed on the first face of the expression sequence.
- Custom software in PV-Wave (Gokcay, 2003) used these landmarks to automatically compute geographic boundaries or regions of interest (ROI's) that were applied to all images of an expression sequence.



### COMPUTING MOVEMENT CHANGES: ENTROPY

For each expression, pixel intensities of adjacent frames were subtracted to obtain difference images (see Figure). These difference values were summed & divided by the # of pixels used. Custom software, developed by Gokcay (2003) was used to compute Entropy, a quantitative index of movement change (i.e., pixel intensity change) over the face during the course of movement

### Change of Expression and Entropy (movement) over Successive Video Frames



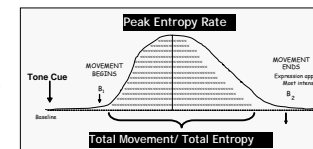
## Results

### DEPENDENT VARIABLES

1. Total Movement
2. Peak Entropy Rate
3. Time to Reach Peak Entropy

**Data Analyses:** Repeated measures ANOVA's; Within-S factors = dopa status (on/off) and Emotion category (Happy, Fear, Anger, Sadness, Disgust);

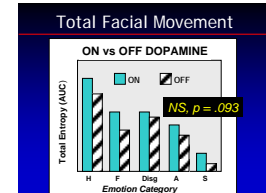
\_ NOTE: No specific hypothesis regarding emotion specific deficits in PD, though some literature suggests that PD's have difficulty with disgust.



### Aim 1 TOTAL MOVEMENT

• Total facial movement **was not significantly reduced** when PD patients tested OFF medication, though there was a trend ( $p < .09$ ) in this direction

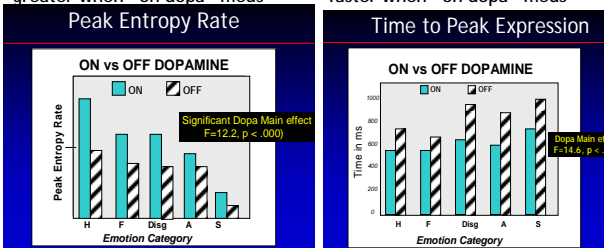
- Nonsignificant Dopa X Emotion interaction
- Significant Emotion effect: Sad involved less movement other emotions; Happy most movement



### Aim 2 MOVEMENT TIMING

Peak entropy rate significantly greater when "on dopa" meds

Time to peak entropy significantly faster when "on dopa" meds



Significant main effect of Dopa status for both temporal variables : rate and time to peak entropy; Non-significant Dopa status X Emotion interaction; Significant Emotion main effects

### Aim 3 CLINICAL CORRELATES

- No relationship among any of the experimental measures of entropy and the following: PD duration, UPDRS total motor, mood [BDI, STAI]
- Modest, though significant negative correlations between bradykinesia score of UPDRS and each temporal variable:
  - Peak Entropy Rate:  $r = -.391, p < .05$ ;
  - Time to Peak Entropy:  $r = .342, p < .05$

## Conclusions

• Dopaminergic medications had robust effects on temporal parameters of voluntary facial expression (entropy rate, initiation time), but not on the overall amount of facial movement in PD. Reduced dopa medications exerted the following:

1. Slowed time to reach peak entropy
2. Reduced rate of entropy change
3. Tended to reduce amount of overall movement

• These subtle rate and timing differences may be difficult to appreciate on gross screening measures, though they are correlated with overall bradykinesia rating on the UPDRS.

• Overall, these findings support the role of basal ganglia in modulating temporal aspects of facial (and other) movements. The precise mechanism remains unclear and could involve decreased activation of frontal cortical regions or movement-based suppression secondary to dopaminergic medication.