Patterns in Crew-Initiated Photography of Earth from ISS

Is Earth Observation a Salutogenic Experience?

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Positive (salutogenic) experiences in space...

- May promote psychological well-being by enhancing personal growth and offset the challenges of living and working in a confined and isolated environment (Suedfeld and Weiszbeck, 2004, *Aviation Space Env. Med.*)

"Perceptions of Earth"...

- Positive changes in the "Perceptions of Earth" most-identified change cited in a survey of flown astronauts (Ihle et al., 2006, *Aviation Space Env. Med.*)
- If viewing Earth is an important component of positive experience in spaceflight, then "Earth out-of-view" may be an important challenge for crews going to Mars, increasing the sense of isolation (Kanas and Manzey, 2003, *Space Psychology and Psychiatry*)

Astronaut Photography of Earth and "Crew Earth Observations" on ISS

- Crewmembers on ISS both watch the Earth and take photographs of the Earth to share with the world
- "Crew Earth Observations" provides daily requests of targets of scientific or public interest
- Crewmembers take photos of areas of interest on a time available basis
- All images are distributed to the public via the Web "Gateway to Astronaut Photography of Earth" http://eol.jsc.nasa.gov

The Gateway to Astronaut Photography of Earth - Microsoft Internet Explorer

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Crew Earth Observations

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The Gateway to Astronaut Photography of Earth hosts the best and most complete online collection of astronaut photographs of the Earth.

Beginning with the Mercury missions in the early 1960s, astronauts have taken photographs of the Earth. Our database tracks the locations, supporting data, and digital images for these photographs. We process images coming down from the International Space Station on a daily basis and add them to the more than 699,481 views of the Earth already made accessible on our website. These images include 255,882 from the International Space Station (updated 9/1/2006; see database content summary).

National Aeronautics & Space Administration

Image of the Week

Crater Lake, Oregon

Date Posted:
September 17, 2006

Photo ID:
ISS013-E-54243

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British astronomer Sir Fred Hoyle stated, "Once a photograph of the Earth, taken from outside, is available - once the sheer isolation of the Earth becomes known - a new idea as powerful as any in history will be let loose."

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14,532,650 web hits & **507,228** database

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Objectives

- Mine the dataset of Earth Observation photography—What can it tell us about the importance of viewing the Earth as a positive experience for the crewmembers?
- Quantify extent to which photography was self-initiated (not requested by scientists)
- Identify patterns photography activities

- Used the data on the date and time images were taken from the digital camera files
- Lists of areas of known geographic interest to crews (public biographical information)
- Orbital track parameters
- Records of on orbit activities (EVAs, dockings, holidays)
- Records of scientific requests sent to crewmembers (distinguish requested and self-initiated images)

Hypotheses

1. Fewer self-initiated images during extraordinary activities (EVA, vehicle dockings, visiting spacecraft)
2. More self-initiated images taken on weekends
3. More self-initiated images of areas of geographic interest
4. Changes in numbers of self-initiated images over the course of a mission
   - Third quarter effect

Results: Self-initiated Photography

- December 2001 (Expedition 4) to October 2005 (Expedition 11)
  - Almost 4 years
- 144, 180 images of Earth taken
  - Average 100 per day
- 84.5% self-initiated

- Significant correlations between
  - self-initiated images and requested images
  - self-initiated images and 800mm lens images
  - availability in crew schedule

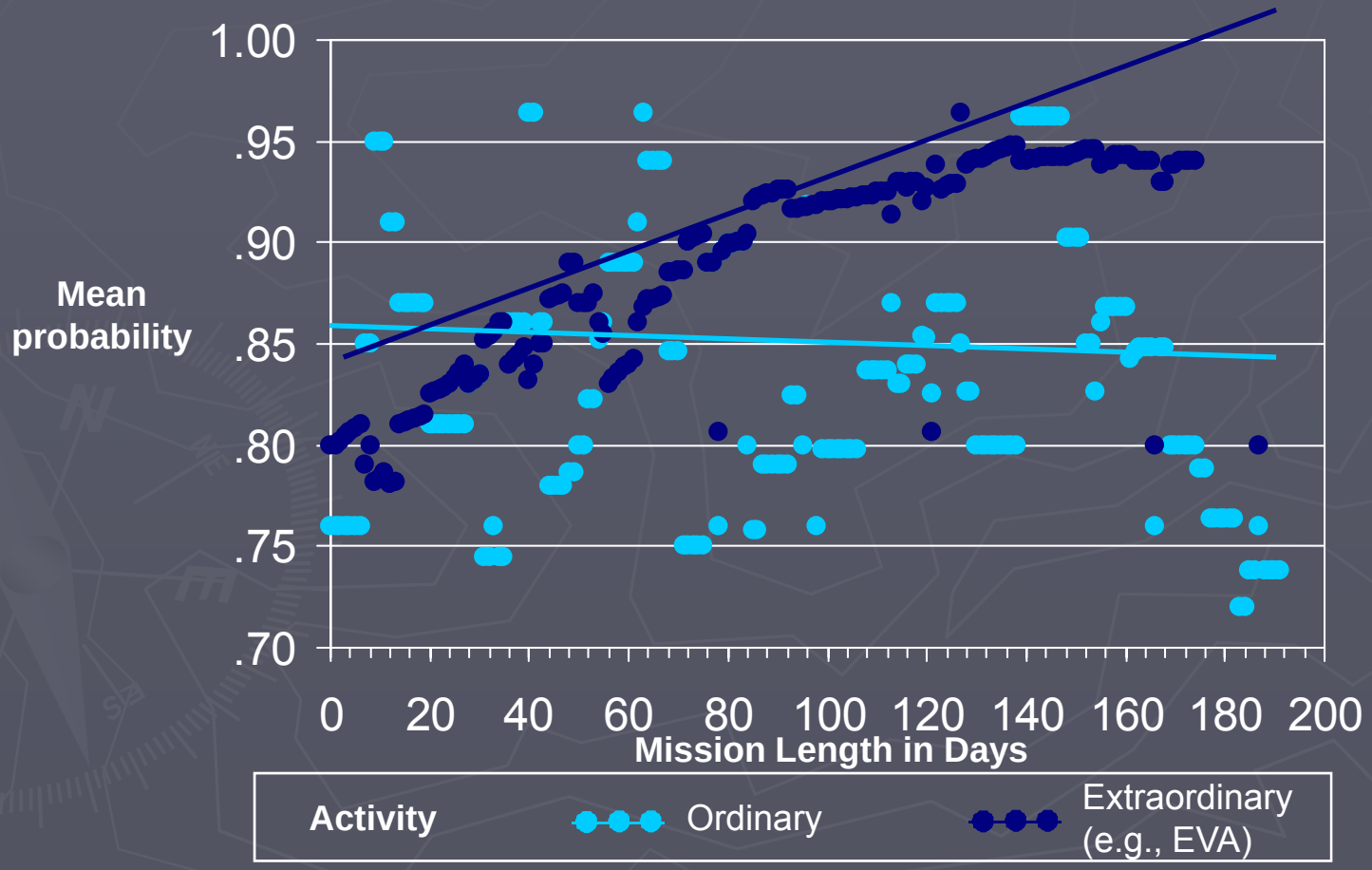
	Mean	Std Dev	1	2	3	4	5	6
Daily number of:								
1 Total images taken	102.3	119.1	--					
2 Self-initiated images taken	86.4	107.5	.98**	--				
3 Images of geographic interest	1.6	5.1	.25**	.25**	--			
4 Requested images taken	15.9	25.3	.54**	.36**	.10**	--		
5 Images taken with 800mm	17.8	34.4	.41**	.41**	.15**	.19**	--	
Proportion of days with:								
6 Higher availability to take images	.3	.4	.06*	.07**	-.01	-.03	.07**	--

Each parameter is measured on a daily basis across all expeditions combined.
** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

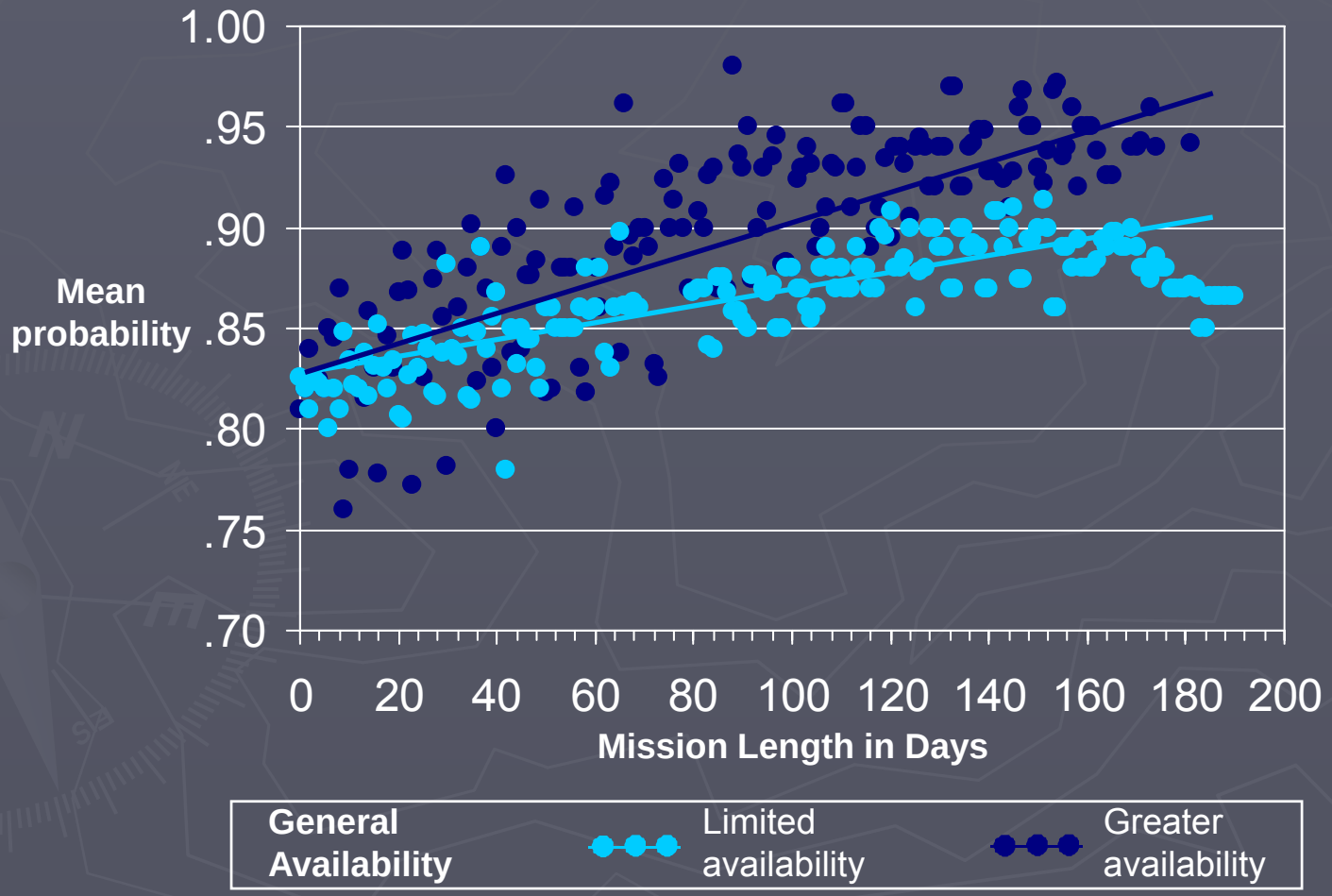
800 mm lens

- Requires practice up to 6 weeks to master motion tracking
- Allows crewmembers to take photographs with up to 5-6 m pixels
- Can view streets, ships, other detailed features

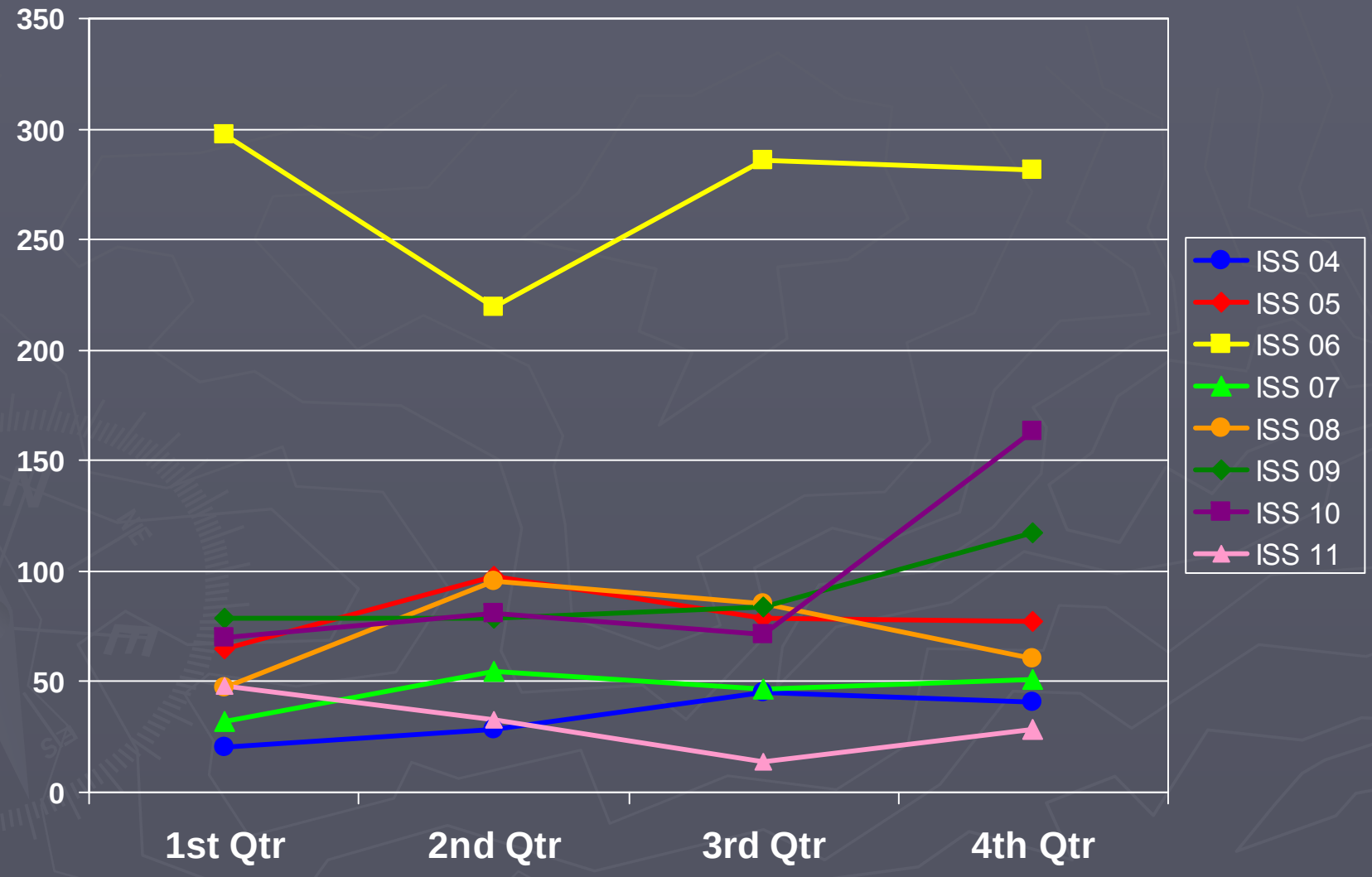
- Activity as a Predictor of photographic activity (General linear mixed model)
  - Less likely to take photos while preparing for and during mission events (t=-2.50, p>.01)
  - More likely to take images on normal days as the mission progressed (t=-4.65, p<.01)



- Weekends as a Predictor of photographic activity (General linear mixed model)
  - More images were not taken on weekends (t=0.65, ns) weekends aren't always off...
  - *Post hoc*—General availability was associated with whether self-initiated images were taken (t=4.37, p<.01)



- Time effects
  - Time on ISS a predictor of whether self-initiated images would be taken (t=3.16, p<.01, not shown)
  - No third quarter effect



Discussion & Observations

- Astronaut photography is a significant leisure activity for some (but not all) crewmembers

Over 250,000 images from ISS to date

Discussion & Observations

- Crewmembers use photography to connect to significant events on Earth

New York, Sept 12, 2001

New Orleans after Hurricane Katrina, 2005

- Photography of Earth provides opportunities for self-challenge and personal achievement

Mt. Everest, Expedition 4

Mt. McKinley (Denali), Alaska

Sao Paulo Brazil at Night, Expedition 6

Scientific requests and self-initiated photography

- Continue to photograph Earth once a camera is in hand
- Suggests the importance of the scientific base and public use of photographs in making the activity worthwhile for the crewmembers
- Could be confirmed in a structured survey

Future research and applications

- Importance of behavioral health and performance for mission success
  - But, only 2 ISS studies to date (one in progress)
- Data mining from ISS operations can provide insight and influence future behavioral studies on ISS
- Correlative support for the importance of Earth observation to crewmembers
  - Quantitative assessment should be included in future studies
- Considerations for interplanetary missions
  - Positive effects from scientific observations and astronomical imaging?
  - Importance of self-initiated work and personal challenges

Cleveland Volcano, Aleutian Islands, May 23, 2006
Eruption first observed by Jeff Williams

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