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Effects of Graphical Weather Information versus Textual Weather Information on Situation Awareness in Meteorology

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EFFECTS OF GRAPHICAL WEATHER INFORMATION VERSUS TEXTUAL WEATHER INFORMATION ON SITUATION AWARENESS IN METEOROLOGY

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Introduction

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- Before a flight, pilots gather weather information
  - Self-briefing and/or professional weather briefer (Casner, Murphy, Neville, & Neville, 2012)
- Aviationweather.gov provides weather products in graphical and text form
  - Pilots need to interpret symbols and abbreviations
  - Would one type be better than the other?
- Kharb, Samanta, Jindal, and Singh (2013)found that people prefer visual to verbal learning
  - Could this have an effect on the way we look at weather information?

Review of Relevant Literature

Situation Awareness

- Definition
- Factors for SA:
  - Weather conditions
  - Traffic
  - Flight conditions
  - Locations for potential emergency landings
  - Navigation aids, etc.
- This study focused on the meteorological aspect of SA, or, Situation Awareness in Meteorology (SAM)

Importance of conducting research on SAM

- Continued VFR (Visual Flight Rules) flight into IMC (instrument meteorological conditions) is one leading causes of fatal accidents in the general aviation industry.
  - This accounted for 27% of fatalities in general aviation accidents. (AOPA, 1996)
- Weather-related mishaps have the highest fatality rate of any kind (AOPA, 2009)
- The NTSB mentioned "Identifying and Communicating Hazardous Weather" in their 2014 Most Wanted List.

Previous Research

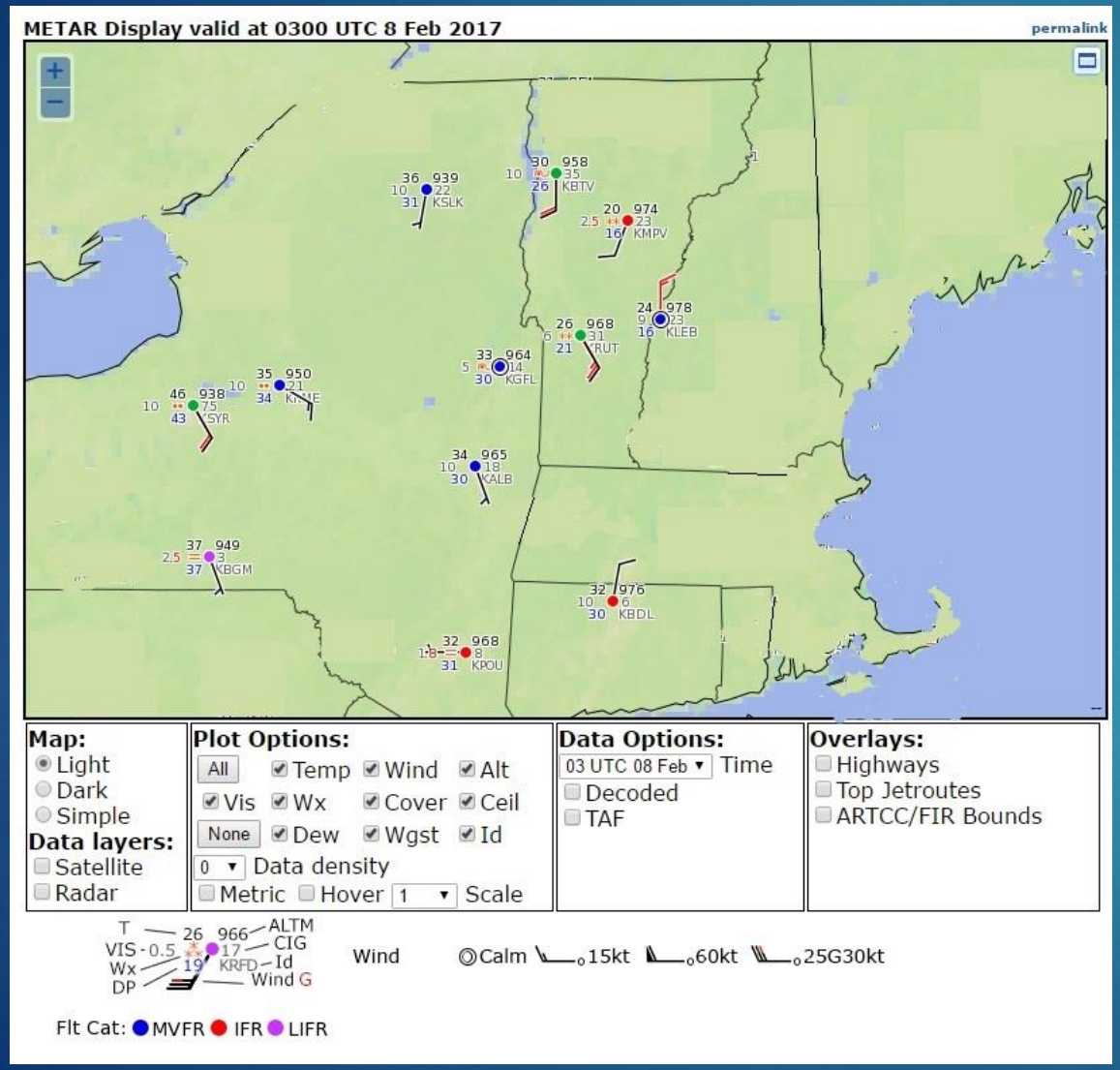
- A study showed that VFR flight into IMC conditions primarily involved inexperienced pilots. (Detwiler, Holcomb, Boquet, Wiegmann, & Shappell, 2005)
- The way people learn varies from person to person.
  - VARK Model (Fleming & Mills, 1992)
  - Study showed that 61% of medical students had multimodal preferences (Kharb, Samanta, Jindal, & Singh, 2013).

Previous Research cont.

- Endsley (1995) found that 88% of major airline accidents involved problems with lack of SA.
- Some pilots brief themselves on weather rather than contacting a professional weather briefer. (Casner, Murphy, Neville, & Neville, 2012).

Methodology

GWI and TWI



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KBDL 080251Z 01008KT 10SM BKN006 00/M01 A2976
KMPV 080251Z 20010KT 2 1/2SM -SN OVC023 M07/M09 A29
KBTV 080254Z 18010G20KT 10SM -FZRA OVC035 M01/M03 A2958
KSLK 080251Z 19005KT 10SM UP OVC022 02/M01 A2939

Participants

- 20 Participants
  - SONA Systems recruitment
  - E-mails (ETA messages)
  - Posted flyers

Materials

- TWI and GWI
- CERTS Lab
- Advanced flight simulator running FSX
- Modified version of SPAM to assess participants' SAM
- Headset with Audacity
- Questionnaires and Forms

Textual Weather Information	Graphical Weather Information
METARS	Graphical METARS
TAFS	TAFS
AIRMETS/SIGMETS	AIRMETS/SIGMETS
Winds/Temps Aloft Forecast	Wind Streamlines / Temps
Area Forecast	Flight Category Chart

Control

No.	Flight 1	Flight 2	No.	Flight 1	Flight 2
1	KSYR - KBUF T	KRUT - KRME G	11	KRUT - KRME T	KSYR - KBUF G
2	KSYR - KBUF T	KRUT - KRME G	12	KRUT - KRME T	KSYR - KBUF G
3	KSYR - KBUF T	KRUT - KRME G	13	KRUT - KRME T	KSYR - KBUF G
4	KSYR - KBUF T	KRUT - KRME G	14	KRUT - KRME T	KSYR - KBUF G
5	KSYR - KBUF T	KRUT - KRME G	15	KRUT - KRME T	KSYR - KBUF G
6	KSYR - KBUF G	KRUT - KRME T	16	KRUT - KRME G	KSYR - KBUF T
7	KSYR - KBUF G	KRUT - KRME T	17	KRUT - KRME G	KSYR - KBUF T
8	KSYR - KBUF G	KRUT - KRME T	18	KRUT - KRME G	KSYR - KBUF T
9	KSYR - KBUF G	KRUT - KRME T	19	KRUT - KRME G	KSYR - KBUF T
10	KSYR - KBUF G	KRUT - KRME T	20	KRUT - KRME G	KSYR - KBUF T

Procedure

- Sign consent form
- Demographics questionnaire
- VARK questionnaire
- Practice flight
- Review weather information for flight 1 (20 minutes)
- Simulate flight 1 and answer SAM questions (20 minutes)
- Review weather information for flight 2
- Simulate flight 2 and answer SAM questions
- Debrief

Treatment of Data

- Scoring
  - Notes from flight plan to determine go/no-go decisions and hazard encounters
  - Each correct answer for a SAM question was one point. A higher score meant higher SAM.
  - Data imported to SPSS
- Analyses (SPSS)
  - Chi-square
  - *T*-tests
  - *Correlations*

Results

TWI Versus GWI on SAM

- Accuracy of SAM questions
  - GWI group answered significantly more SAM questions correctly than those in the TWI group.
  - T-test was significant, $t(19) = -2.33$, $p = 0.03$, Cohen's $d = 0.52$

Correlations

Correlations

	GWI Score	Verbal Score	TWI Score
Visual Score	0.34	0.24	-0.46*
GWI Score		0.47*	-.54*
Verbal Score			-0.15

*Correlation is significant (two-tailed)

Discussion, Conclusions, and Recommendations

Discussion

- Go/No-Go decisions and hazard encounters
- SAM question scores
- Learning styles and SAM scores correlations
  - Using two VARK measures versus all four
  - What each VARK score represents
  - VARK Visual and TWI Score (negative)
  - VARK Verbal and GWI Score (positive)
  - TWI and GWI Score (negative)
  - Final thoughts on correlations

Conclusions and Recommendations

- Results showed GWI to be better than TWI for SAM
- Performance in flight planning

- Future direction
  - Further research for TWI vs GWI
  - Get all important information visually?
  - R&D for new products
  - Test new products
  - Vision for final product

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