# For Week 2 Post

## Prompt

Discuss in one or two paragraphs, what topical area in human factors appeals to you the most. That is, present, in a general fashion, an area you would like to do research if given the opportunity. As usual, make sure you respond to AT LEAST one other student in the course.

## SOC

This exercise is going to help a lot. I wish I had started it a month ago.

I have many topics of interest, but I have no idea how to simplify them into something workable. Among my interests:

* Aviation in the context of complex systems
* Mindset and mental models while operating aircraft
* Tools IN aviation vs. the task OF aviation
* Why does it take longer to solo a pilot
* Training away risk in addition to automating it away
* Policy that invites non-compliance
* Decision support systems like Visual Landing Data

### Aviation in the context of complex systems

Airplanes are COMPLICATED systems. They take inputs and produce (usually) predictable outputs through mechanics, physics, electromagnetics, etc. A complicated aircraft is a component of a COMPLEX system called aviation. If we assume all aircraft components are operating normally using predictable inputs, the COMPLICATED system operates in its predictable way. But the result of that operation is related to the environment in which it exists (including the pilot at the controls) and may not be predictable at all. For an introduction to complex systems read the preface in Cilliers (1998).

I am curious about aeronautical decision-making (ADM), automation, and decision support systems. I am curious if safety would be enhanced in two ways, 1) by training pilots to differentiate between tool and task and 2) by providing decision support systems that addresses motivation rather than just presenting data. I am no longer surprised by the shockingly bad decisions I sometimes make when operating aircraft – all of which I debrief with “I know better than that!”. As a Check Airman for a major airline, I was relieved to see I was not alone! Suppose we redesigned training and decision support in the context of complex systems. The pilot becomes a node that receives multiple inputs; the relative weight of each input influences decision-making. Training and decision support then attacks the weight of inputs rather than the behavior of the node.

Cilliers, P. (1998). Complexity and post-modernism: Understanding complex systems. Routledge. <http://web.a.ebscohost.com.portal.lib.fit.edu/ehost/ebookviewer/ebook/bmxlYmtfXzczMTIxX19BTg2?sid=de61aaa7-ea5d-4da6-871a-186cb83c2a93@sdc-v-sessmgr02&vid=3&format=EB>

#### Unused Discussion Post

Consider the idea that aviation could be modeled as a complex system. This is different than a complicated system. Paul Cilliers (1998) describes a 747 as a complicated system. One can quite accurately predict a system’s response to a given a set of inputs. When flying a 747, discrete components receive inputs from sensors and actuators (actuators that include the pilot). Through mathematics, mechanics, and physics, a predictable result occurs. Contrast the complicated system with Cilliers description of a complex system. For example, aircraft, pilot, airspace, controller, weather, etc. each represent discrete components, or nodes, of a network (like neurons in the brain). The relationship between nodes (the synapse) will influence the behavior of the next node. But the behavior of any node is unpredictable unless you know the influence of every other input. Could this construct help explain why, for example, Stabilized Approach Criteria is routinely ignored? In present theory, when a pilot applies aircraft parameters to Stabilized Approach Criteria, the go-around decision should be a “no-brainer” unless the pilot is just non-compliant. But in a complex system, those aircraft parameters represent an input to a node (the pilot) with many inputs (knowledge, motivation, mental model, bias, etc.). What else is influencing the node called “pilot” when faced with a choice?

#### Another unused post

One can look at aviation as a complex system; a system where relationships between components determine outcomes, not the components themselves (like neurons and synapse in the human brain). In this view, the introduction of a technically advanced aid to safety (automation or decision support) may perform in unpredictable ways. It would depend entirely on the connection between the component and all other components (the operator, the aircraft, the environment, etc.). This would be true of stick shakers, autopilots, and operational policies (yes…policy attempts to automate decision-making).

#### Incentivized Simulation Experiment

Goal is to find a way to incentivize pilots to complete the mission. Most simulation experiments look to evaluate performance as it relates to compliance or knowledge or resilience to malfunction. Suppose we give pilots a budget. They burn the budget with flying time or fuel. What’s left is theirs in $. The objective is to take advantage of the human condition of loss aversion to amplify the weight of perception over the weight of compliance under observation.

### Mindset and mental models while operating aircraft

Mental models direct attentional assets. Promoters of Recognition-Primed decision models say that one recognizes the pattern of their environment then directs attention to sources of information that are important in that situation. The additional information adjusts the operator’s model of the environment causing them to act. Attention is then directed to either the results of the action or to an additional input, or to a salient distraction, etc. If a pilot’s mental model of a HUD approach is to maintain vigilance on the FPM, they are not directing attention to other cues that may further define the environment. Boeing and others proved this with the rate of missed traffic conflicts using HUDs.

### Tools IN aviation vs. the task OF aviation

Related to Mindset and mental models while operating aircraft, this idea differentiates tools in aviation (like the HUD or the FPM) from the task OF aviation (Pitch and Power). This must be more carefully described.

#### Descriptions of tools and Tasks

|  |  |  |
| --- | --- | --- |
| Task | Tools | Tools that confuse the task |
| Engine Start – Make the engine start running and ensure it is running properly | Starter Switch  Start Lever  RPM gauge  EGT/CHT gauge  Oil Pressure gauge | One-button Engine Start |
| Takeoff – Accelerate the aircraft down the runway to an appropriate speed for liftoff while monitoring engine performance, pathway clearance, and critical systems. After liftoff establish an appropriate deck angle for the given weight and power setting to climb to a safe obstacle clearance altitude. | Engine Instruments  Airspeed Indicator  Rudder pedals  Lights and annunciators | HUD Takeoff   * focus on FPM not runway centerline * Focus on FPM, not deck angle * Distracted by warning systems (Stick shaker, unrelated warnings) |

#### Unused Discussion Post

I have been interested in aviation’s approach to automation and innovation – especially as it relates to the way we fly airplanes. Those who’ve been classmates of mine have heard me ponder the difference between the tools used in aviation and the task of aviating.

There are many ways to model the task of aviating – balanced forces, pitch and power, angle of attack, etc. I suspect automation (Flight Path Markers, Flight Directors, Autopilots, etc.) have been introduced as an alternative to these classic mindsets. In fact, pilot deskilling is now a very well-known and extensively researched topic. Might we improve safety and fault tolerance by training automation as tools, not the task? Doing so makes the Flight Director a tool used to verify our control inputs rather than the little bar we follow. The PFD becomes the source of airspeed information for the new student to verify the wind noise she hears is about 85 knots. Most of my peers soloed in less than 10 hours; why is the new average almost 20? We are still surfing the same wing through the same air. Automation is useful, convenient, and usually reliable. It makes operating an aircraft easier. But might it be safer to train pilots to be aviators instead of operators?

### Why does it take longer to solo a pilot

The FAA requirements for pre-solo are [here](https://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&sid=40760189a03dfea0b501608f33820a45&rgn=div5&view=text&node=14:2.0.1.1.2&idno=14#se14.2.61_187).

### Training away risk in addition to automating it away

When there is an aircraft malfunction, we correctly try to automate away the risk of subsequent failures. In some cases, we train for the failure. More appropriate would be to train away the risk. For example…

### Policy that Invites Non-compliance

Conversation with Keith and Gary – UPS cell phone use. Drivers are not allowed to use cell phones even at stoplights. Keith and Gary are safety inspectors. Asked if they use their phones at a stoplight, etc they say they do. Asked if they would do so on a “ride-along” they said, “absolutely not”. It is an example of a policy that is written but few if any follow it. In aviation that policy might be stabilized approach criteria or sterile cockpit or …

Having the policy invites non-compliance. If it’s generally ok to violate those rules, in the spirit of complex systems, we have no idea what risks we are creating. We don’t know what relationships are affected by a weaker adherence to certain rules.

On the other hand, having a “Utopian” view of an operation and acknowledging that view is not always reality may serve to set the bar to a higher level than attainable with a lower expectation. This becomes a practice in fulfilling expectations. That is not bad.

Sometimes a routinely ignored policy is cited as a factor in an accident. That cannot be viewed as an isolated non-compliance event.