

Tobogganing on the Invisible Hill

There is only one real problem about learning to land a glider – you only get one landing per flight.

...it takes practice to be able to see the subtle changes which indicate whether the glider is approaching accurately. ...it seems so difficult at first to gauge exactly where the glider will land.

– Derek Piggott

Will released from tow at 5300 msl, the fat hand at 5 and the slim hand at 3, and announced, “glider Sierra Lima Papa, left downwind Air Sailing, runway one-seven.”

It was an overcast day; Will arrived last evening for a week of soaring at this wonderful gliderport north of Reno, Nevada, and, after assembling, decided to use today’s poor soaring conditions to take some pattern tows and get used to the field, and to get the dust out of his own feathers.

Floating downwind, he gazed east, past the Red Rocks to beautiful Pyramid Lake. He looked down at the sage, and the long intersecting runways, with buildings tucked into the southwest quadrant of runways 03-21 and 17-35. The north-south runway is almost a mile and a half long, a brown sliver in the desert, decorated with a smaller streak of asphalt, to keep sand out of the tow plane’s prop, 20x1500 ft, in the south center.

Dogskin Mountain made a western wall for the valley; and Will thought it was all very beautiful.

Flying north, downwind, he didn’t quite feel comfortable. He was used to a short and wide grass strip, bounded by trees, flat agricultural land and buildings extending off into the hazy distance. He tried to guess his glide, tried to figure

out where he should turn downwind to base. It seemed like a good thing to use the north end of the runway, to keep out of anyone’s way who might take off.

The ground beneath him sloped up to the north and to the east, then rose sharply to form small towers and clefts of red rock.

He flew past the north end of the runway, and when it felt about right, announced turn to base, then studied the runways again. He turned final and announced. He felt low, but realized that the sloping ground might be deceiving. He picked an aiming point close to the end of the runway, and modulated his spoilers to make the descent look and feel right.

He tobogganed down the invisible hill, over the sage toward the runway’s end. Suddenly, he felt alarmed. Something wasn’t right! He was really too low! He stowed the spoilers, and put some back pressure on the stick – but he only descended faster.

He felt sick. He could see he would land about 50 feet short of the runway! He touched down; sage crackled; he bounced violently across the bumps. Just as he reached the verge, there was a loud crack and the glider jerked suddenly to a stop.

He sat in the cockpit for a few moments until the dust and his nerves settled; humiliation and grief flooded his soul. He could see a small ditch passing beneath his cockpit. The gear must have dropped into it. He didn’t want to think about the damage.

Inexplicably, he remembered a years-ago race with his cousin Fern down a steep country hill on a borrowed bike. At the bottom, the sandy road turned

sharply right to go along a lake shore. When they hit the turn, he discovered simultaneously that he was going too fast to make the turn, and that the bike had no brakes. He aimed the bike at a little sapling, which snagged it. Will flew over the handlebars, landed chest-first on a bed of slippery, brown, freshly fallen autumn leaves, and slid 35 feet to the lake shore. He stopped with his legs on the leaves and his chest over the rocky shoreline, the wind knocked completely out of him.

Now, instead of a rocky lake shore, his nose hung over the edge of the runway he should have made. Will wanted to go into the bif and forever latch the door. A runway measuring 7600 feet, and he couldn’t get there. What a week of soaring this was going to be! He was already dreading the friendly, “Well, honey, how was your week at Air Sailing?”

What happened to Will?

First, let’s repeat the principle governing this column. *Really good pilots unintentionally do things that look stupid to the “lookenspeepers” because the operating characteristics of the human perceptual system are prone to particular errors.* Any one of us could end up in Will’s shoes.

Let’s march through the particular errors that might delude us in judging our final approach.

Ambient cues

Visual ambience – the feeling and character of a place – creates a pattern in our brain. If we only fly out of one airport, then the cognitive pattern evoked by “landing” (the procedure itself, not the word), is highly specific.

As we gain experience by flying into a variety of airports, the cognitive pattern becomes more generalized, and our brain can decay the specifics of home – the tall trees near the end of runway 30, the cluster of buildings on the northeast – and can enhance the features common to every airport, creating a meta-airport gestalt.

It is always possible that a new airport will not fit our airport-gestalt. Because our unconscious brain tries to fit the “feeling” of any approach to landing into

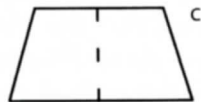
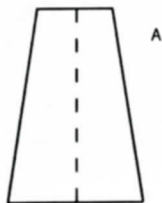


its airport-gestalt cognitive pattern, we should be concerned if we feel entirely comfortable during the approach to a brand-new place.

Does this make sense to you? Let me say it the other way. That feeling of mild discomfort or slight anxiety that we often have in the pattern to a unknown airport is *desirable* because it signals that our brain is unable to fit its cognitive pattern labeled "airport" around the new place. This creates appropriate alertness and caution.

If we feel *comfortable* during the approach to a new airport, especially one with unique features such as Air Sailing, this means that our brain has subconsciously found a way to ignore its uniqueness, and is comfortably fitting the square peg into a round hole. (To coin a phrase.)

This inappropriate comfort increases the risk that our perceptual judgment may be distorted, possibly causing expensive embarrassment like Will's, or injury, or damage, or death.



False horizons, false surface planes

Mountains create a false horizon; mountainsides and sloping valley floors create false surface planes. This creates errors of judgment regarding aircraft attitude and rates of climb or descent. This seldom causes accidents, and often creates pilot-induced awkwardness.

For wave soaring, it's useful to know that the horizon descends in our field of vision as we fly higher. The angular depression, in degrees, is equal to the square root of the altitude in kilometers. This can lead to inadvertent errors of airspeed control when we reflexively lower the nose so to the "right" angle, and is compounded by the large difference between indicated and true air-

speed at high altitudes.

(If you can calculate the square root of your altitude in kilometers, you are definitely *not* hypoxic. And on the other hand, if you think you ought to try the calculation, you probably *are* hypoxic.)

There are two particular ambient cues that consistently cause trouble for pilots on approach: size and shape constancy.

Size constancy

Runway width is a very important cue in deciding when to flare for landing. It also is a cue to how far away we are from the airport.

In my teens, I had been taking lessons at a paved strip 3000 feet long by 25 feet wide; one day my instructor had

me fly to a controlled field, where we were assigned runway 12. It just happened that this runway was a WWII relic, about 2500 feet long and about 300 feet wide. A more extreme change could hardly be imagined. I descended into the vastness of this new runway, began my flare. The instructor shouted, "What are you doing!?" as he shoved the yoke forward hard.

I began my flare at about 100 feet altitude! This was an interesting introduction to the size-constancy illusion years before I read about it.

A narrower runway than usual makes us feel high when we flare; a wider runway makes us feel we're low. This feeling operates subliminally, and may guide reflex actions inappropriately while our frontal cortex is worrying about the crosswind.

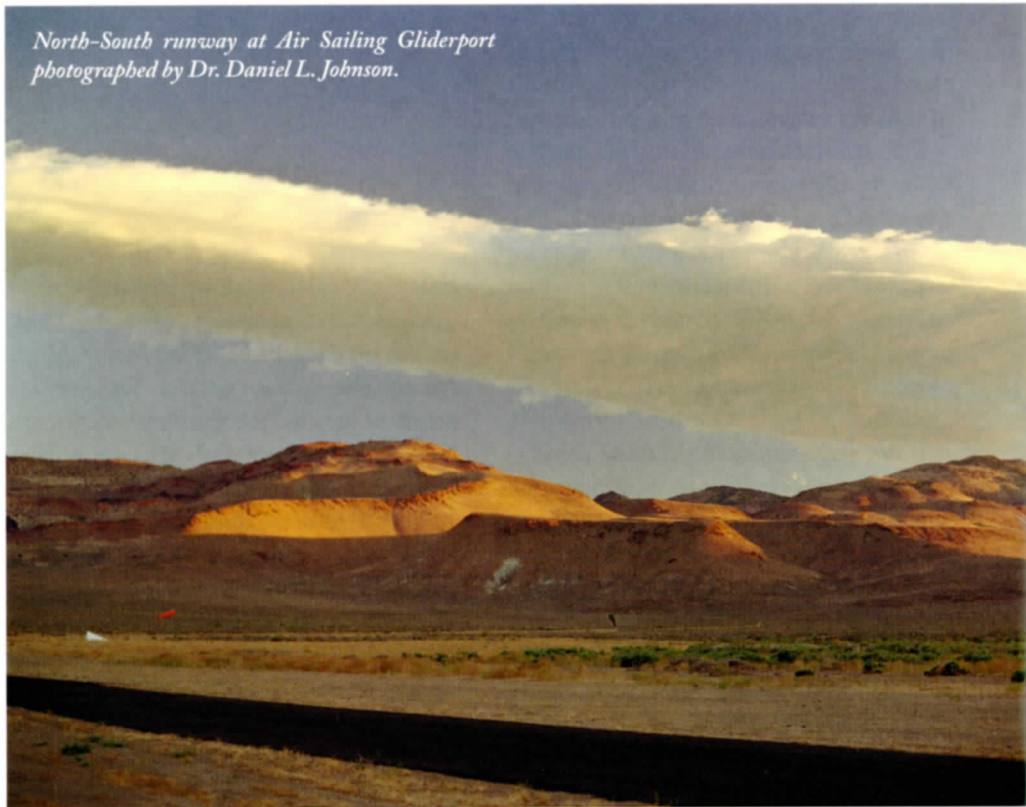
Shape constancy

Most runways are long rectangles. This is, of course, a convenience – not only to the pilot, who doesn't want to be bothered by cornering forces during takeoff or rollout, but also to the engineer, who probably lost his French Curve shortly after he graduated from college.

Of course, we do not see a rectangle during the final approach. We see a very tall trapezoid.

We may be used to the particular trapezoid of a level airport. If we then

*North-South runway at Air Sailing Gliderport
photographed by Dr. Daniel L. Johnson.*



land at an airport with a down-sloping runway of the same length as at home, it will seem shorter than it actually is, and will make us feel lower than we really are. So if our approach *feels* right, we may arrest our descent inappropriately and land long. It is not a good idea to land long on a down-sloping runway.

An up-sloping runway looks wider and shorter than a level runway of the

same length. Gliding down to it, we feel like we're too high, and may increase our descent, which creates a risk of hitting the end-marker lights, or landing in the ditch just before the approach end, creating financial and possibly medical embarrassment.

"Slope" constancy

I do think that a factor distorting

Will's perceptual judgment was the sloping ground. This is really very difficult to judge from above. It is well known, from accident data, that a pilot descending over down-sloping terrain is deluded into feeling that the approach is too shallow (not descending fast enough), and steepens the descent. The landing is then short. This is one of the factors that probably fooled Will.

A pilot descending across up-sloping terrain feels that the approach is too steep (approaching the ground too fast) and thinks it's necessary to pull up. The aircraft then lands long.

"Tree" constancy

The size of vegetation surrounding an airport gives an important clue to elevation.

During approach to a runway over tall trees, the aircraft's altitude feels too low, and the runway flanked by trees seems narrow and short. This leads to the pilot arresting the descent and landing long. One of my favorite Wisconsin airports is like this, and I have to

really focus carefully to make a proper approach.

During approach to a runway surrounded by short vegetation, the pilot feels high, and steepens the approach. This leads to a tendency to land short. This also was probably a factor in Will being fooled.

The focal point

We are all taught that the thing that doesn't move across the canopy is the thing we're going to run into. This is true whether it's an airplane flying nearby or a part of the airport – or, on the ground, the bicyclist approaching the driveway or the baseball hit straight at us.

The only thing that is always the same, at every airport, is that there is an aiming point on the runway, and this point should not be moving across the canopy. The ambient geography – the lights, the slope of the land, the tall trees, and, ironically, the lack of markings on the grass strip – are simply distractions that can distort judgment.

If we adjust our descent so that the aiming point on the runway stays at a constant point on our canopy as we slide our winged toboggan down the invisible hill, then we will begin our flare at that correct point. It does not matter then whether the runway is wide or narrow, long or short, sloped or flat. We will arrive at this aim point. ✈

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