Stranger in a Strange Land: How GPS Technology Can Be Applied to Cross-Country Horse Trials, From an Urbanite's Perspective

by
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Recently, the editors of this magazine posed to me a curious dilemma: how can one successfully integrate Global Positioning System (GPS) technology into the decidedly non-technical domain of cross-country horse trials? What initially proved problematic to me was my distinct lack of background in horsemanship, but such is the lament of a writer on assignment. A childhood on the streets of Brooklyn and amidst the skyscrapers of New York City, coupled with the unique demands of a career in the military lent nothing to my understanding of how to navigate horses over obstacles along rolling terrain, while a merciless clock ticks in the background, eager to judge the rider's performance against a single, optimal time. To my advantage was a wealth of experience with GPS technology – not just in theory and design, but the pragmatism of implementation as well. Getting lost in the countryside of Korea in my first assignment was finally going to pay dividends! In order to rectify my shortcomings, I set out to bridge my gap in knowledge of all things equine. My strategy included surfing the web in order to gain an initial familiarization with cross-country horse trials, an element of a larger field know as "eventing". Immediately, I recognized that one of the best ways to come to a greater understanding of the subject at hand was to conduct a Cognitive Task Analysis (CTA) of this domain, and then apply my inherent knowledge and understanding of GPS to determine the suitability of this modern technology to the antiquated realm of eventing. Herein, I present my findings of the critical elements of cross-country riding and an analysis of how GPS could be used to enhance rider performance.

Eventing Explained: A Cognitive Task Analysis of Cross-Country Riding

Like any task analysis, a CTA focuses on what actions or cognitive processes a participant must undertake in order to achieve a particular goal. Sounds great, but considering cross-country riding, what is the goal? Are there more than one? After perusing the United States Eventing Association's explanation of eventing (`http://www.eventingusa.com/about/whatis.htm`), I directed my attention to their rulebook for eventing (`http://www.eventingusa.com/publications/pdf/rulebook2004_single.pdf`) and was quickly able to surmise that the overarching goal of cross-country is to complete the course (which usually measures in the thousands of meters) with a time closest to the published optimal time and incur as few other penalties as possible while negotiating various obstacles that alight the course. The cross-country (or endurance) phase is one of three that comprise these two day events. This sounded straightforward, but I suspected that there was much greater detail at play and that I should investigate further in order to deepen my understanding. The most common approach to a good CTA involves studying and querying participants or experts and examining the artifacts that they use in their domain, so I attended a lecture hosted by a noted practitioner of cross-country riding, Margaret Nash.

She provided lucid commentary covering the rider-horse relationship, the critical tasks involved in approaching and negotiating obstacles, and the implications of the timing and obstacle faults that result in penalties. Also, she presented and narrated a video of one of her competitions, demonstrated the use of an eventing watch, which is used to aid the rider in keeping their pace while on the course, and exhibited a hand-drawn map of a course, which is distributed to all riders the day prior to their cross-country ride. She spoke of a "meter wheel" that riders can use to plot and measure their intended course, thus allowing them to get a precise measurement of the route they will take along a course. Despite this added advantage, Margaret claimed that she didn't use the meter wheel, as it required "too much math" and made things more complicated rather than easier. During the question-and-answer part of her lecture, a number of my colleagues addressed the applicability of GPS to the processes she had described – wouldn't a GPS receiver coupled with a notebook computer, they posed, render the analog means of route measurement obsolete, and abate Margaret's arithmetic-induced anxiety?

Eventing Watch This device is used by riders in order to monitor their time on the course and aid them in converging on the optimum time.

Applied Technology in an Anachronistic Domain?

It seemed intuitive that GPS – a technology that employs a constellation of 24 satellites orbiting the earth, which allow special receivers to determine precise location (usually within 5 meters) on the earth's surface – would contribute greatly to a rider's planning for a cross-country event. Our discussion also led to the "speedometer" capability of GPS receivers. Even the most rudimentary GPS receiver displays the current velocity, and most allow the user to select various units (knots, miles or kilometers per hour, meters per second, etc.) Surely, knowing one's speed while traversing the course would impact the rider's ability to come within the optimal time. My experiences with GPS reinforced this. While in the military, I relied on GPS technology to navigate on foot and in vehicles; to plan and conduct operations involving accurate locations and timings; and, in exceptional instances, to employ precision weapons so that they were maximally effective while being minimally destructive. But what does all of this have to do with riding a horse across rolling terrain and jumping over obstacles? That's what my editors asked me to find out.

Along with the constraints of having little insight into eventing, or for that matter, equestrian matters in general, Margaret's lecture left me with the sense that there was much more involved in the cognitive processes related to cross-country riding than she or her videos were able to convey. Having made sufficient progress in gathering background information about the domain, I made plans to visit an eventing competition in my area, observe the cross-country phase, interview stakeholders and perhaps experiment with a GPS receiver while on an actual course. This is another valuable method of the CTA approach – immersing one's self in the domain in order to garner a greater appreciation for the phenomenon involved. At the recommendation of my editors, I chose to observe a competition at the Novice and Training

levels, just two of a number of ability levels in eventing. The Novice and Training levels present the most interesting timing constraints on the rider. At these levels, the riders are presented with an optimum time for completing the course. A time exceeding the optimum time results in the assessment of penalties. The penalties increase in severity for each second by which the rider exceeds the optimum time. Along with the optimum time, the rider's performance is also bound by a "speed fault" time – anywhere from 30 seconds to a minute faster than the optimum time – wherein the rider is penalized only if their time is faster than the "speed fault" time. These conditions effectively establish an optimum time "window", where there are no penalties if the rider's time falls between the speed fault time and the optimum time. In the event of a tie in this phase, a winner is determined by whose time is closer to the optimum time. At the other ability levels, there is no speed fault time, so riders may navigate the course as quickly as they wish. One could presume that using GPS to plan and precisely measure a route, and even monitor speed while on the course, would facilitate a much better performance for the rider-horse team and increase the likelihood that the finish time would fall into the optimum time "window" described above. With this in mind, I set out to Fancy Hill Farm, located near Natural Bridge, Virginia, with a GPS receiver in hand and a number of questions to answer.

GPS Receiver A Garmin *etrex* handheld receiver, used by the author, can provide up to 5 meter accuracy and costs a little over $100.

Much More Than Meets the Eye

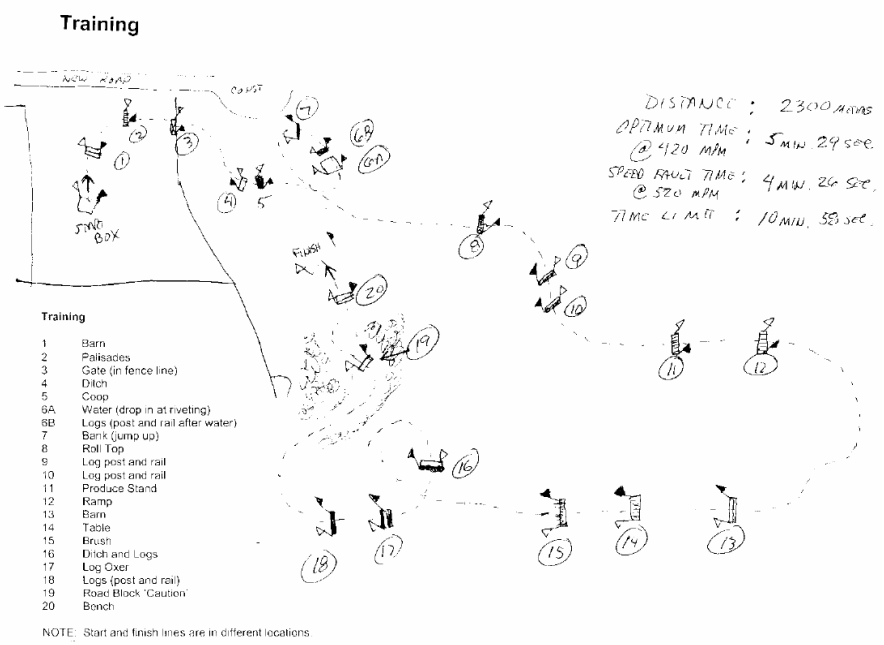
With a name like Fancy Hill Farm, I conjured images of British expatriate gentility congregating on the rolling central Virginia hillsides, stuffily looking down there noses at inferior competition and instilling an air of diluted hostility for those who dared to invade their realm. On the contrary, upon arrival I discovered a unique subculture of those with moderate wealth, possessing a competitive spirit and generally engaging demeanor, and willingness to entertain numerous questions about their horses, equipment and techniques. One of my colleagues was able to obtain copies of the course maps for both the Novice and Training levels of competition. As described in the eventing rulebook, both maps included the required information – the start and finish locations, required obstacles and passages, and the time constraints, including optimum and speed fault paces. Although drawn by hand and not to scale, these maps give the riders an opportunity to walk the course prior to riding it; plan their approach to the various obstacles; measure their precise route and perhaps refine the pace they wish to maintain; and consider points along the course where they may wish to slow down if going to fast, or speed up if going to slow.

While taking this all in, I imagined every techno-savvy rider would have walked the course with their own GPS unit prior to the competition, devised their optimal speed for completing the course based on their exacting measurement, and planned to monitor their actual speed on the course with GPS-enabled watches, which are available from Timex for as little as $150. I began

to envision a world of geographically-obsessed draftsmen meticulously composing routes on topographic maps readily available on notebook computers. Before forming any firm conclusions, I decided to abandon the sanctuary of the enclosed stadium on this particularly chilly day in mid-March and head out to the cross-country course and observe riders first-hand.

With a course map in hand, I was quickly able to locate the start box, from which all riders start their cross-country event. This particular course was comprised of twenty obstacles, yet there were other obstacles arrayed on the terrain that were not to be used. The rolling, open terrain did not lend itself to an intuitive sense of what direction the riders should follow, and subsequent obstacles were not always visible from the ones preceding them in the sequence as they were laid out. All of the obstacles the riders were to negotiate were numbered sequentially and any deviation from that sequence or failure to negotiate any single obstacle would result in elimination. I presumed that all of the cognitive processes involved in this activity would be fairly routine, since the horses had been trained to jump over obstacles prior to the event, and that horses naturally love to run. Easy, right? I found out otherwise as I ventured out on the course.

I spoke with an event official near the first group of obstacles about what she was evaluating and what penalties she could asses. Interviews with different stakeholders (not just participants) are an essential element of a good CTA. As she was explaining her role in assessing penalties for refusals, run-outs, falls and other violations specified in the eventing rules, I had my first opportunity to observe anomalous behavior on the course. I heard it before I looked up, but it was clear that at the first obstacle, a horse had refused to jump over a small, barn-like structure! What I heard was the commotion of the horse coming to a stop and grunting, and then I saw how the rider had to re-direct the horse back to the vicinity of the start box and approach the obstacle again. This would undoubtedly add time onto the ride, since the horse had to be coaxed back to a point where the rider-horse team could gain sufficient momentum and take the obstacle a second time. After negotiating the first few obstacles successfully, the rider-horse team was approaching where I was standing and I could hear the one-minute timer sounding on the rider's eventing watch. The



Example of a course map Maps like this are distributed to riders by 3:00 PM the day before the cross country event. This gives the rider an opportunity to become familiar with the course and plan their approach to specific obstacles

rider appeared consumed with keeping her mount on the route she had envisioned in her mind, and I could only imagine that she had been somewhat shaken by the horse's refusal right out of the start box.

As the horse and rider continued along the course, I assumed a position that would allow me a wide view of the first few obstacles so that I could observe another rider-horse team coming out of the start box and working their way through some obstacles. During her lecture, Margaret had spoken about how the rider directs the horse along an appropriate approach to an obstacle and leans forward in the saddle to encourage the horse to pick up speed. While I understood this conceptually, I wanted to see it put into practice and perhaps capture an image or two of the action. As the next rider was called into the start box, I readied my digital camera so that I could get a good, perpendicular shot of a nearby jump. As the rider-horse team approached, it happened again - another refusal! I saw this unfold in my off-camera eye, and while not as loud and disruptive as the first one I had encountered, it was plain to me as a neophyte that the horse DID NOT want to jump over that obstacle at that time. Either the approach was to slow, or the horse did not like not being able to see what was on the other side of the wall, or perhaps the rider has not taken the obstacle correctly. Whatever the reason, the rider-horse team had to circle back, similar to the first refusal, and take the obstacle again.

Approaching an obstacle after a refusal This horse-rider team approaches an obstacle after the horse initially refused. Note how the rider i*s not* leaning forward in the saddle - perhaps poor technique contributed to the horse's refusal.

Within a matter of moments, I'd witnessed two refusals and the riders' efforts to get their horse over the obstacle again. It started to become clear to me that cross-country riding was not as easy as it seemed during Margaret's lecture and that despite being trained, horses might not like to jump over things, especially with someone on their back. I also observed that as the rider-horse team negotiated the course, the rider was continuously talking to and encouraging the horse. In fact, while observing other riders in this portion of the course near the start box, I did not see one rider who appeared to look at their event watch – they seemed more concerned with coercing the beast beneath them to take each obstacle, despite their perhaps instinctual desire to *avoid* them. In my mind, I began to question the applicability of GPS to either the planning tasks or actual cross-country riding. Looking down at a watch and extracting information from it may be challenging enough in the ecological sense. Applying the information extracted to a cognitive process comparing the current speed with the desired speed, while considering the correlation of the route actually taken with what the rider planned a priori seemed like it would be either overwhelming or largely useless to these Novice level riders. Just getting the horse to do what one wanted to do appeared to generate a fair amount of workload for the rider.

Putting It All Together

Nevertheless, I continued my observation of the ongoing competition, with the intent of interviewing some of the riders after they completed the course. Interviewing practitioners and asking them for their thoughts and opinions of using GPS could lend additional insight into my editor's proposal. Near the finish line, I got a much better sense of how the rider-horse team could successfully negotiate an obstacle. I aligned myself perpendicular to the last obstacle observed what I was surmise to be good, proper form – rider off the saddle leaning forward, loose reins and verbal cues coaxing the horse for a little extra speed leading up to the obstacle and through to the finish. This came just a few moments after two rider-horse teams had missed an arrow indicating the direction they were to follow and came galloping over a slope toward me. After the riders recognized their miscue, they re-routed the horse from whence they came, presumably caught sight of the sign and resumed their ride. In these instances, the riders had missed visual cues and deviated from the optimal route. Knowing one's speed at this point while not knowing the deviation from the route would be of little help – the rider would know they had to make up time, but how much, and where? With a "speed fault" time looming, they could not just finish the course at maximum speed. There appeared to be a great deal for the riders to process cognitively, along with performing the mechanics of riding the horse. My working CTA provided increasingly helpful insight into this previously unfamiliar domain. As the sun slipped behind a cloud, I figured I should head off to the stable area in search of some riders.

Good form This rider successfully negotiated the obstacle and apparently their technique contributed to the accomplishment.

I wanted to conclude my observation by talking to riders and more than a few were complicit in helping me. I spoke with three riders in the stable area beyond the finish line and asked them if they were family with GPS. Much like Margaret, they appeared intrigued with this novel concept, but they also reinforced that cross-country was just one phase of eventing. Dressage and stadium competitions also had to be prepared for and conducted over the two day event, and devoting extra time to plotting a course with a GPS receiver, transposing it onto topographic maps and refining optimum times might prove non-optimal. A number of the eventers had to travel to this competition and were staying in nearby hotels with family members, enjoying the culture and the outdoorsmanship. While competitive, the event was still largely recreational, the riders still learning form and technique, and the Novice and Training levels remain far from world-class. My observations had confirmed that the riders already had to undertake a significant amount of cognitive workload while in the saddle. Adding further cognitive demands might degrade performance, even though the intent is to enhance it. This notion has been considered by designers and engineers in many domains, including aircraft cockpit design, automation and information display for vehicles, and even software for personal computers.

GPS: Terrific Technology, Inadequate Application

Upon completing my observations, I arrived at some conclusions due, in large part, to the CTA I conducted. In being presented with an unfamiliar domain, I presumed that a CTA would be helpful, and in hindsight, it truly was. Examining websites and rulebooks, listening to lectures and discussion, and even speaking with practitioners outside of their domain all provided critical insight into the tasks, demands and constraints of cross-country riding. It was the continuum of a thorough CTA, however, that allowed me to put all of the pieces together and arrive at a much greater appreciation for the phenomena under consideration.

GPS has proven itself to be reliable, and in many instances, indispensable to users. In the realm of Novice and Training level cross-country riders, the notion of applying GPS technology to route planning and mapping, or to enhancing timing while riding is probably counterproductive. Riders at these levels are still mastering the skills required to be competitive. They are concerned with more than just the timing phase of cross-country. The technology might prove beneficial to the more advanced riders who compete at these levels, expert riders at higher levels or to those who are already very familiar with GPS technology, like surveyors, architects or avid hikers who engage in eventing in their spare time. As a general tool for improving performance among Novice and Training level riders, GPS would best be left on the shelf.

Without direct observations of cross-country riding – a key element of a CTA – coupled with my familiarity of the technology, the consideration of this tool might remain largely conjecture. By interviewing stakeholders and gaining an intuitive sense of what cross-country riding is all about through the lens of observation, I can propose the following analogy; Novice and Training level riders adopting GPS in order to improve their timing would be like little-league baseball players picking up a major-league, 32 ounce baseball bat – a few may be able to hit a home run with it, but most would struggle under the unwieldy weight and cumbersome size relative to their own. The little-leaguer is still learning the nuances and subtleties of the game and is challenged by the movement of a pitch, the distraction of fielders and action on the base paths. It would be more appropriate for little-leaguers, and Novice or Training level riders to focus more attention on gaining experience and building proficiency rather than optimizing performance on a narrow skill. For those few who can master the tasks demands and successfully integrate new equipment, perhaps it is time to move up a level in competition. As a confirmed city dweller and former little-leaguer, I would not have reached these conclusions without the insights provided by a methodical CTA of the cross-country domain.