A Normanistic Interpretation of the Garman Bike Computer the Edge 800 by Phil Feldman and Brian Frey For IS 629: Fundamentals of Human-Centered Computing November 11, 2013

Abstract

Bike computer are becoming extremely complex navigational and training aids. We attempted to determine if it was possible to intuit the use of one of the most complex of these devices, a Garmin Edge 800, by only looking at the affordances, constraints and mappings. It turned out that this could not be done, but by adding the transfer of training from other riders in this small community and reading the quick start, an accurate conceptual model was built by the user, which allowed successful operation.

Executive Statement

A high end Garmin bike computer was examined. After an initial out of the box evaluation, it was taken on the road by an experienced cyclist on a sixteen day, thousand-mile trip. He (Phil) rode rode from Seattle, WA to Boise, ID with a group of sixteen other riders. Initially we were guided very well and was able to proceed without the manual. However difficulties eventually arose and complete operation wasn't possible without consulting the manual and a community of riders experienced with GPS bike computers. Normanian identifiers are found throughout the review as well as a feedback section and an index of links to the actual trip data.

Introduction

Though bike riding may start as a somewhat solitary activity, either for transportation, fitness, or some other reason; it tends to become more social as one becomes more involved in it. By the time that purchasing a \$350 bike computer seems reasonable, it must be a near certainty that the user will be part of a club, team, or some other group in which other members have the same device or a similar one. This *transfer of training* from my peer group was certainly the case, and it strongly affected the way I (Phil) learned about using the device.

Although cyclists tend to ride in groups, it is unlikely that the entire group will ride together, or even within miles of each other. This is because of two reasons primarily. First, riders of different abilities can go at vastly different speeds. In the club that I belong to (The Baltimore Bike Club, or BBC), there

are riders that can average 10 mph over flat terrain and riders that can average nearly 20 mph over mountains. The second (and related) reason for groups to break apart is that rides can be quite long. Bike rides of 40-60 miles are common. Every year, many riders will ride one or more "centuries" which are rides that cover 100 miles. Even two closely matched riders that average only one mph difference on average can easily be 5-10 miles distant by the end of a century. Add to that different climbing abilities and a group that start out as 20 people will almost inevitably break into several sets of individuals and smaller groups of riders with closely matched abilities.

How We Ride 'as a Group'

The way that bike clubs have dealt with this issue is to produce what is called a 'cue sheet', a detailed list of directions that guide an individual rider along the planned route. A section of an example is shown below:

Dist	Turn	Road	Delt
0.0	R	Mt. Carmel Rd.	0.2
0.2	R	Falls Rd.	0.3
0.5	R	Ridge Rd.	1.7
2.2	R	Black Rock Rd.	3
5.2	L	Lower Beckleyville Rd. (Rt.	0.7
5.9	x	Main St. becomes Houcksville	3.9
9.8	L	Carrollton Rd.	0.2
10 0		TRA Carrollton Rd @ Waslav	1 2
		Figure a grammle que aboat	

Figure n, example cue sheet

A sheet of paper containing all the turns required for the route is handed out to the riders at the scheduled ride start. Each rider typically clips the cue sheet to the handlebars and then in coordination with a trip computer that is set to zero at the beginning of the ride, the rider will look for the next turn indicated by the distance indicated on the computer and use that distance to find the next turn. If the rider "goes off the cue", there is often a map printed on the back, so that (with luck) the rider can figure out where they wound up and find their way back.

This method of laying out a ride dates back to mimeograph machines, and has survived into the age of the laser printer, though now GPS units such as the Garmin 800 allow for rides to be done entirely based on the data shown on the computer. This is a huge change in how rides are managed, and is still in the process of being figured out by manufacturers, cyclists, and the web sites that have sprung up to support riding.

The process of creating a ride used to be:

- 1. Decide where a ride would start and go to, and an approximate distance.
- 2. Using a collection of detailed regional maps, determine a 'rough' cue sheet
- 3. Using the rough cue sheet and bringing the maps, drive the route and use 'ground truth' to adjust the route's distances and directions to reflect the actual conditions.
- 4. Lead the ride, note the errors, fix and repeat. A good cue sheet can typically take 3-6 revisions before it is 'error-free'.

Nowadays, a ride can be created the following way.

- Using a computer, log into one of the several websites that support rider creation. Sites such as MapMyRide.com and RideWithGps.com are popular.
- Trace the route and adjust until the distance is within the range of what is desired and the roads look good for riding. Since these sites typically use Google maps as their mapping back end, satellite and street view perspectives are often available to determine if a road is reasonable to ride on.
- 3. Publish. This means that the ride is visible in several formats: A traditional (albeit computergenerated) cue sheet, a GPX (GPS Exchange Format) file, and/or a TCX (Garmin-specific) file.

Out of the Box

It is fairly typical behavior to relegate reading the manual to after the box is opened. This group of users is no exception to that truism. To that end we opened the box and attempted to operate the device using only affordances, constraints and mappings provided by the Edge 800and the transfer of training from other objects in this category and similar categories, such as personal computers. The opened box with all the elements is shown below:



Figure n, Opened box and contents

Recorded Interaction Steps

- 1. Opened package
- 2. Was able to determine handlebar mounts. Constraints are how the unit fits with its interface, how the interface mates to its rubber fitting (logical constraint, since the handlebar and the mount are slippery). There was only 'rubber band' that would fit the circumference of the handlebar (physical constraint).
- 3. Tried to turn on the unit by pressing on the two front buttons. First tried the start/stop, short and long, then the lap/reset short and long, then both short and long. Decided that the unit needed charging, since there was no way to open it to add a battery. Constraint, lack of access to battery, transference of training (T of T) this object is powered by electricity; a mini USB slot on the device supplements mental mapping.
- 4. I (Phil) found the USB cable and plugged the unit in. To a PC. Based on prior experience with other devices (T of T), I expected drivers to download and install. They did without problems, and Windows informed me when that process was completed successfully (feedback on completed task).
- 5. The screen also lit up with the word "Garmin" and a charging indicator (feedback).

- 6. There was an opening for a mini-SD card. Since we had one lying around, we attempted to stick it in. At first I put it in the wrong way, but was prevented from inserting fully by the physical constraint. Turning the card over resulted in a smooth insertion and a reassuring (spring-loaded) 'click'; that indicated the card was seated (feedback).
- Once the software was installed, and after a pause that was a little too long to be comfortable (20 seconds? (poor feedback based on mental map)) I (Phil) was able to open the device as a drive and look inside:
- 8. Inside the Documents folder was a file called 'START_HERE.html'(strong social affordance)
- 9. Clicking the file brought up the following in the browser
- 10. Clicking (feedback) on the "English" icon brought up a sub menu (affordance):
- 11. Looks like I've been 'led by the nose' (near constraint) to the manual regardless. Since we are not supposed to review a website, I will skip what's covered in there. Regardless, at this point, I would have been forced to read at least the quick start guide since with the unit unplugged and charged (constraint), I was unable to turn it on.

After getting the Garmin started with relatively few problems and then left it charging overnight. The next day I (Phil) tackled the operations of the device.

Based on my past knowledge of bike computers, GPSs, and some reading of the manual, I was able to get the 800 working as a regular bike computer (transfer of training). I was able to time a ride, get speed and distance to function, even see my position on a map. Even after reading the manual and quick start more carefully, I was unable to determine the best way to download and use routes. A quick Google search led me to the Garmin forums, where the question had already been asked and answered.

To load a TCX file on to the Garmin 800 is not obvious, and not covered well. With the Garmin plugged into the USB port, The user needs to drop the TCX files into the E:\Garmin\NewFiles directory. The unit will then processes these files and makes them accessible within the menu screens of the Garmin 800 as shown below:



Figure n: Sequence showing the selection of a route using the touchscreen

Furthermore, getting GPX files from websites is somewhat problematic and unique per website. What this means is that for multiday rides one person typically downloads the ride files and makes them available on media such as a USB drive. Once the route is selected, then the user is rewarded with a map of the start, and some obvious icons for additional actions, ranging from starting to deleting the route.



Figure n: Map loaded screen

The group of users that I ride with have noticed that the default options for the map view are not optimal. So instead of simply selecting "go", it is best to select the wrench (settings) option and select "Guidance On" and "Virtual Partner Off". This would not be so inconvenient, except that there seems

to be no way to set these as defaults, so the same action is required for each route loaded.



Figure n: Default navigation settings

Usability On The Road

Shown below are the navigation screens in sequence of presentation:



Figure n: Navigation screens

The order of these screens is set, though the content of the data screens can be changed (within constraints) as described above. The pictures of the screens were taken on the top of Blewett Pass in Washington, and represent what a typical ride might look like.

Screens can be rotated though in forward or reverse order, by either "swiping" the touchscreen horizontally, or by tapping the left and right arrow. The touch screen is not multi touch. This is because the touch surface is a resistive not a capacitive. This older technology is ideal because it can be operated with gloves, which are a necessary part of bike riding (constraint).

One of these screens is a mystery. 'Data 2' never appears to show any useful data. For example, there is a large space for 'Average Speed', which is shown in 'Data 1' as 11.1 mph. You'd think it would show up in this display, but nope. Since displays are somewhat customizable, I was hoping that the map could be inserted into that space, which would allow me to build a display that would have a map with speed and distance info, but that was not an option. As a result, this particular screen is both useless and annoying, since I have to scroll through it on the way to something else.

Note also that there are six screens that can be scrolled through in forward or reverse order. That order has to be memorized. I'm always getting lost in the display. When I'm rested and focusing, I can recall the order and get to the screen, but after riding hard for hours, I do not have the mental capacity to deal with figuring it out. So I scroll through the screens in my guess as to what is the right direction until I hit the screen I want. My main screens are Profile and Map. In reality, I would need the Data 1 display as well, but I have avoided having to do that by attaching another computer to my handlebars, as well as a printed cue sheet. This means I'm getting all the information I need in one view, which is extremely valuable on long, high speed descents on roads that I don't know. However, if there was ever a picture that shows the failure of a bike computer to provide the information a rider needs in a clear and immediate presentation, it is the following:



Figure n: Too many computers!

Garmin Usability Issues:

- The on-off switch is easily missed. I could not find it for quite a while. The two buttons on the front of the unit drew my attention, and based on the use of many other bike computers, I expected them to turn the unit on if pressed together, or for a few seconds or some similar action. Since the true on/off button is a small bump with the power icon only being an impress, it was not easy for me to find until I really started to look for it, knowing it had to be there.
- 2. It was not clear what files work, or even how to upload TCX/GPX files into the unit. Had to look in the forums for the answer.
- 3. Not clear that the timer can run for the duration of the ride, and that the moving averages will be calculated when the data is uploaded to such websites as GarminConnect.
- 4. No way to adjust the thresholds for audio (off route) alerts. Riding on trails makes the device beep constantly. The only option appears to be disabling audio alerting.
- Not clear how to change the fields in the data screens (pressing and holding on the field to change) The expectation would be that this is set in the "settings" section of the menu screens. A note describing how to make the changes would work very well here.
- 6. Need to be able to set the order of the navigation screens so that the most desired screens can be placed closely together.
- 7. Need to be able to put data displays on the map screen, or offer a hybrid screen. Without this

option, many users wind up having two computers mounted on the handlebars. That's just silly.

- 8. This device is bought by wealthier riders who are typically older. This means eyesight issues. Many users are unable to focus on the small text and the small icons on the map displays. This should be made adjustable, particularly since this device me being read in risky situations, such as a high-speed descent.
- 9. The scale of the climbing profile screen does not appear to be scalable. Have not looked on the forums for this yet.
- 10. No way of setting default navigation settings (e.g. Virtual Partner Off)
- 11. Virtual Partner does not stop moving when the unit does. Garmin attempts to deal with this issue by having the VP average your total time that the unit is on, including when the unit is stationary. However, stops for food, repairs, or trains are quite variable, and the VP's on-the road speed is either considerably higher or lower than your actual average speed including stops. Essentially, your virtual partner is The Terminator, a relentless being who exists only to get to the end of the course. It will never rest, never eat, never pause until it gets to it's goal. Hard to compete with that on a longer ride.
- 12. The unit has no way to compensate for vibration and/or speed. Given that the device has a small screen and has to provide a lot of information, it would be helpful if the unit could compensate for poor viewing. For example, in the map view, the text that has the name for the road that is the next turn is in something like 8 point type. This is difficult to see when the unit is not moving and held at arms length. When moving 20 mph down a poorly paved road, it is virtually impossible. Sensing the speed and/or vibration of the unit, and presenting the information in sufficient size and contrast would be very useful. Since some information would have to be prioritized over others for the screen real estate, there should be a default priority that can be user-customizable.

Conclusion

Shortcomings aside, this is an exceptionally usable device. It provides real-time information about location and trip-so-far in a pocket-sized device that you can operate with one hand while pedaling over a mountain at thirty mph. It's set up and operation are informed by good design principles. With feedback and additional iterations these shortcomings can be overcome or even eliminated.

Appendix 1: Index of Links to Trip Data

The stretches where the speed is zero are where we took breaks. At that point I was far enough away

from the bike that any heart rate readings are probably spurious.

http://connect.garmin.com/activity/224281990 http://connect.garmin.com/activity/224281975 http://connect.garmin.com/activity/224282472 - 1 http://connect.garmin.com/activity/224282572 http://connect.garmin.com/activity/224865406 http://connect.garmin.com/activity/224865465 http://connect.garmin.com/activity/225093411 http://connect.garmin.com/activity/225332390 http://connect.garmin.com/activity/225786461 http://connect.garmin.com/activity/226310519 http://connect.garmin.com/activity/226670075 http://connect.garmin.com/activity/227011055 http://connect.garmin.com/activity/227579106 http://connect.garmin.com/activity/227579070 http://connect.garmin.com/activity/227963806 http://connect.garmin.com/activity/228231256

 This section is where I (Phil) forgot to turn the timer back on. It's that straight line in the middle. I did this because the average speed on the device doesn't account for stops. I discovered that later on uploads. I got a moving average, which is much more useful.

Appendix 2, cool pictures from the trip:



Hells Canyon



Blewett Pass on Fire



Enjoying the Ride!