

# **Pedometric Measurement of Bipedal Locomotion in a Design Automation Conference Attendee**

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## ***Abstract***

Pedometric data was gathered to determine the distance traveled by foot for a test subject attending the Design Automation Conference.

## ***1. Motivation***

Chronic foot pain and leg fatigue are common ailments among frequent Design Automation Conference attendees. Over the years, there has been a great deal of speculation as to the source of these symptoms. Several theories have been proposed to explain this phenomenon including the theory that “you walk a hell of a long way at one of these things”.

The purpose of this research was to gather empirical data to determine the distance walked by a test subject while attending the 44<sup>th</sup> DAC.

## ***2. Prior work***

While a great deal of anecdotal information has been exchanged on this subject (often on the exhibition floor during the keynote address), little hard data has been previously published.

## ***3. Experimental methodology***

An Oregon Scientific pedometer model number PE829A was attached to the test subject (Subject M) each morning prior to leaving the hotel room. The instrument remained attached to the test subject until the subject returned to the hotel room to retire each evening. This protocol was followed each day from Sunday Jun 3, 2007 to Thursday June 4, 2007. These dates correspond to the last set-up day for the

exhibition through the last day of the exhibition. No measurements were taken on Friday June 5, as the subject did not participate in any tutorials this year. The subject had duties as both an exhibitor and as a conference attendee, so was active during the set-up period as well as during the conference itself.

The Oregon Scientific pedometer uses a centrifugal actuator to measure the number of times the body of the instrument reverses direction. With the instrument affixed to the hip of the test subject, this is generally accepted as a way to approximate the number of steps taken. The information is recorded digitally within the instrument. A digital readout can be used to determine the number of steps taken since midnight on the current day. A running total of the number of steps in the previous 7 days is also available.

The protocol followed was to record the daily total and the weekly total each night upon retiring on a Post-it™ note. One difficulty in the protocol is that the test subject is required to check the instrument each night before midnight to directly gather the daily data. On two occasions the test subject was unable to gather the daily data prior to midnight. The test subject reports “I danced right through midnight the night of the Denali party!”

This deficiency was repaired by continuing the measurements until one week after the last missing data point and deriving the daily information from the (now declining) weekly total. The complete raw data set can be made available to qualified researchers.

The PE829A includes an FM radio. This feature was not used during this experiment, so no conclusions can be drawn as to whether listening to music would affect

either the objectively measured distance traversed, or the subjective experience of the travel.

#### 4. Results

The total number of steps traversed during the 5 day experiment was 82,438. The daily breakdown (measured from midnight to midnight) is summarized in table 1.

Sunday	17,215
Monday	13,915
Tuesday	17,646
Wednesday	13,328
Thursday	20,334
<b>Total</b>	<b>82,438</b>

Table 1.

On Tuesday and Wednesday evenings, the subject showed continued activity after midnight. 2,674, and 2,040 steps were measured after midnight on each of these evenings respectively. These data were recorded upon retiring, and were credited by the instrument toward the total for the "next day". Adjusting for these data, the number of steps walked on each "subjective day" is summarized in table 2.

Sunday	17,215
Monday	13,915
Tuesday	20,320
Wednesday	12,694
Thursday	18,294
<b>Total</b>	<b>82,438</b>

Table 2.

To convert from the raw step data to distance, the subject was asked to take 4 average steps across a hotel room floor. The endpoints were marked and the distance was measured using a standard 11.5 x 8.5 piece of paper as the metrology instrument. The total distance was determined to be "eight and one half pieces of paper lengthwise plus about 3 inches" which equates to 25.1875 inches per step. Converting to miles results in the data in table 3.

	Calendar Day		Subjective Day	
	Steps	Miles	Steps	Miles
Sunday	17,215	6.84	17,215	6.84
Monday	13,915	5.53	13,915	5.53
Tuesday	17,646	7.01	20,320	8.08
Wednesday	13,328	5.96	12,694	5.71
Thursday	20,334	8.08	18,294	7.27
<b>Total</b>	<b>82,438</b>	<b>32.77</b>	<b>82,438</b>	<b>32.77</b>

Table 3.

As you can see in the preceding data, the subject displayed the greatest activity on Tuesday, corresponding to the occurrence of the "Denali Party". This result was anticipated by the researcher, and a special measurement was made at 8:00 PM just prior to entering the party facility indicating that up to that time the subject had walked 11,918 steps indicating that the subject recorded 8,402 steps or 3.34 miles within the party facility.

#### 5. Conclusions

Due to the small sample size, few statistically significant conclusions can be drawn. Substantially more funding will be required for acquisition of sufficient instrumentation for a larger study, as well as for additional promotional efforts, administrative and research staff, and of course to cover food, beverage and entertainment expenses.

Nevertheless, the test subject reports "It sure *felt* like I walked a hell of a long way!"

#### 6. Future work

Additional research is needed to develop specific methods for the interpretation of pedometric data gathered while dancing.

Fundraising and planning have begun for a larger study to be conducted at the 45<sup>th</sup> Design Automation Conference in June of 2008.