Physics Integration Lesson 16 – How Fast Can You Change?

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Have you ever started a project with a lot of energy only to see it wane as time goes by? You make great strides initially, but as the project comes to an end it seems progress is slow and change is small. At times, it seems hardly worth the effort. However, your response to this situation makes a difference between a hobbyist and a professional, between success and failure.

The casual computer programmer puts together an app or game until it functions as expected most of the time. Since it is a personal project, the interface may be arcane, only usable by the programmer, but not to others. When effort to modify the interface and/or find hidden bugs takes too long, the project is placed on the shelf and a new exciting project is started.

Professional programmers would never succeed if they operated this way. With the right set of software tools it is amazing how quickly the basic program flow can be established and connected to a graphical user interface. However, it take much more time to do the long tedious work of perfecting an interface and removing bugs. Even more so, to document the program so it can be maintained and expanded in the future. This 'hidden' work is undervalued because it doesn't give the immediate reward of progress, but it is vital for an app or game to succeed.

The disparity between visible effects and amount of effort applied appears in many disciplines and areas of life from engineering to performance-based activities. The difference between an accomplished pianist and a concert pianist is thousands of hours of practice. Both can perform the technical aspects of a musical score, but it is obvious who is the professional. Often comparisons are made between excellent college football teams and under-performing professional teams. However, if both teams took the field against each other, it would soon become clear who were the professionals.

So what does this have to do with this week's lab? A charging capacitor is neither a hobbyist nor a professional. It is only obeying a mathematical relationship that is a solution to a first-order differential equation (DE). Although it is a simple idealized system, other more complex systems can also be modeled with first-order DE from chemical reactions to ecological populations and the sociology of human behavior. A simple physics experiment can act as an object lesson to illustrate effects that are seen in many areas of life: the first 80% of your goal is achieved quickly while the last 20% may take forever.

1. Do you see this effect operating in your studies, practices and spiritual life? If the charging capacitor were used as an object lesson would you find it helpful or irrelevant? Would you find it encouraging or discouraging? Consider your answer in light of the Apostle Paul's statement in his own life expressed in Philippians 3:12-16.
2. The exponential function that acts as a solution to a first-order DE is sometimes mistaken with power-law distributions. The DE is describing how a single system behaves into the future, but the power-law distribution observes many similar systems and describes their statistical behavior. For the non-mathematical crowd power-laws are simplified into what is called the Pareto principle or the 80/20 rule. An example from the computer world is that "20 percent of the code has 80 percent of the errors."[1] Applying this personally, 20% of your personal habits

[1] Pressman, Roger S. (2010). Software Engineering: A Practitioner's Approach (7th ed.) Boston, MA: McGraw-Hill.

contribute to 80% of your wellbeing and success. List two good habits that have a significant impact on your life. How can they be improved and strengthened?