

Stage Two

Getting to the Other Side

14-1 **Recalling the “Activity” Diagram**

Chapter 3, section H: In this section we learned that, in between two equilibrium states of a target object, lies the activity region. The target object is in one equilibrium state and needs to be *transported* to the other equilibrium state. Doing unconventional things, as we often do, we assumed that such a transportation would be carried out by an agency called the *force* (or a *net force*). No rationale here either, except for our observation that we always use a force judiciously, to do whatever we want to do. Non-judicious, unwarranted or malicious use of force lands us in jail

Chapter 3, section H, also tells us that the projected role of the net force can be viewed in two independent ways. One, by monitoring the time for which the net force acted on the target object (the *time-dependent* approach). The other, by monitoring the distance (in a straight line) through which the net force drove the target object (the *time-independent* approach). The two possibilities were shown in a diagram, which is reproduced here:

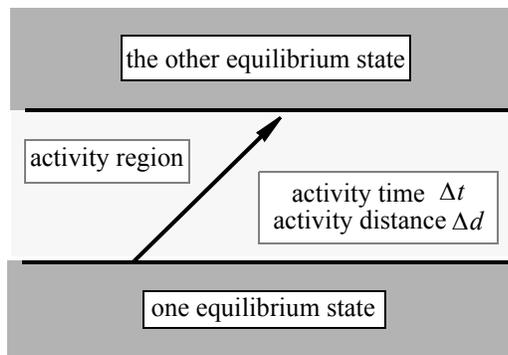


Fig (1) The Original “Getting to the Other side”

More from Chapter 3:

The *time dependent* approach is called the *Force Approach*. It is governed by the law known as *The Impulse-Momentum Theorem*. While the *time independent* approach is called the *Energy Approach*. It is governed by the law known as *The Work-Energy Theorem*.

As a loose analogy consider a passenger to be driven in a taxi cab from location *A* to location *B*, where *A* and *B* are equilibrium states. Let the road, the traffic conditions, the time involved, and so forth, comprise the activity region.

The role of the cab driver represents the *force approach*. He picks up the passenger from outside of one door (equilibrium state  $A$ ) and drops him off outside of the other door (equilibrium state  $B$ ). He doesn't know (and doesn't have to know) what is inside those doors. His entire concern is with the road, the traffic conditions, the time involved, and so forth, which comprise the activity region.

The role of the passenger, on the other hand, represents the *energy approach*. The passenger gets picked up outside of door  $A$  and is dropped off outside of door  $B$ . The passenger however, has complete knowledge of what is inside those doors and that is where his main concern lies. The passenger, however, doesn't know anything about the road, the traffic conditions, the time involved, and so forth, which comprise the activity region. The passenger doesn't even have to know those things. In other words, he passes through the activity region without even being aware of it.

**Table 1:**

|                        | Contents of Equilibrium States | Contents of Activity Region | The Law                         | Monitoring                            |
|------------------------|--------------------------------|-----------------------------|---------------------------------|---------------------------------------|
| <b>Force Approach</b>  | <b>Totally Unaware</b>         | <b>Fully Aware</b>          | <b>Impulse-Momentum Theorem</b> | <b>Time</b>                           |
| <b>Energy Approach</b> | <b>Fully Aware</b>             | <b>Totally Unaware</b>      | <b>Work-Energy Theorem</b>      | <b>Linear Distance (Displacement)</b> |

We must admit that we have implicated *force* (or *net force*) in our discussions without introducing it in a gentlemanly fashion. Many of the other statements, above, are also irrational by any standard (shot in the dark), at this time. Illegal? May be. But the idea is to give you an overall picture of what's to come. Rest of *mechanics* deals with these two techniques of doing physics (and solving problems). It is very important to show the basic difference between the two parallel techniques in physics. There are some other distinctive features as well, but we shall talk about them later.

For the sake of clarity, we split the above diagram into two diagrams, one for monitoring the *time of activity* and the other for monitoring the *distance of activity*. These are shown in Fig (2).

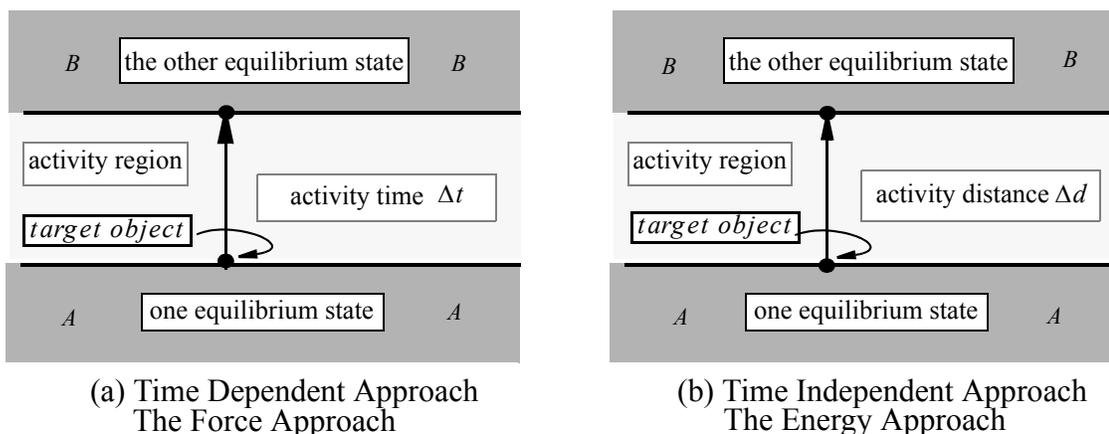


Fig (2) Getting to the Other Side

We shall start by rationalizing and legitimizing all of the above.

The *Force Approach* is formulated in Chapter 16, while the energy approach is outlined in Chapter 17.