Lecture 6: Independent and Dependent Variables

Till now we have learnt about articulating hypothesis, and after this lecture we will be able to design the independent and dependent variables needed for the experiment.

**Independent Variable (IV)**

It represents the variable that we are going to manipulate in order to elicit the change. It is a factor which when varied as a part of experiment gives us data. A researcher is interested in how a change in IV will bring about a change in dependent variable. This is independent because the participant has no control over it and it is controlled by the experimenter. There should be at least one Independent variable in one experiment and there should be at least two levels in every IV. Levels represent the different options or testing subtypes available under IV.

Example 1- To study which is the most read newspaper in Gainesville. 
Here we study the readership of newspaper like NYT and WSJ in Gainesville.

So, “newspaper” is the independent variable, since it is changing. 
“NYT” and “WSJ” are two levels of this independent variable.

Example 2- To study which is the preferred medium of reading a newspaper?  
Here we test different medium like paper, online or an app.

Here, the Independent Variable is “Medium” since it is being manipulated. 
Paper, Online and App are three levels of this Independent variable.

A main effect is the effect produced by one IV and an interaction effect is produced by the interaction two or more IVs. Thus it is better to keep less number IVs to keep the observation and conclusion precise keeping in mind that independent variables start interacting with each other to give complex observations.

Example- To study which is the most read newspaper on an app in Gainesville.

Here the only IV is the newspaper, so there will be only one effect, either NYT will be more read or WSJ.

Example- To study the most read newspaper and the preferred medium in Gainesville.

Here we have two IVs, “newspaper” and “medium”. 
We will first have two main effects for each IV, like NYT is more preferred that WSJ, and Online is a more preferred medium to read newspaper that an App and Paper.
However, the interaction of these two IVs can produce interaction effect like NYT is more read online while WSJ is more read through paper.

The following table gives the number of the types of main and interaction effect possible with the varying number of independent variables-

<table>
<thead>
<tr>
<th>Interaction Variable</th>
<th>Interaction Effects</th>
<th>Total Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Main</td>
<td>2 Way</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>$^4C_1 = 4$</td>
<td>$^4C_2 = 6$</td>
</tr>
</tbody>
</table>

**Table 1- Correlation between IVs and number of interaction effect**

**Dependent Variable (DV)**

It is an interaction variable that gives us measured response to the independent variable. It represents the variable which is actually being measured in the experiment and which a participant can influence by whatever he/she is told to do. It also indicates the type of data which experimenter is going to collect.

More clear dependent variable give more precise, reproducible and crisper experiment. Some common DVs are- accuracy, time taken to complete task, speed, satisfaction etc.

For example- To study which is the most read newspaper, we can take responses on a survey from the participants and calculate how many preferred NYT or WSJ.

Here the *total score* becomes the DV since it is measured by the experimenter and based on it we can make our conclusion. So, the newspaper with the maximum score would be adjudged as the most read if only the total score is the DV.