

Real-Virtual Lab

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The Universal Digital Library (UDL) project has raised the possibility of expanding the scope of a library from that of a *repository* of information to a *source* of information. The researcher's symbiotic relationship with the library has traditionally reflected a three step process whereby the researcher a) accesses the knowledge reserves of the library, b) carries out research on the basis of these reserves and c) ultimately adds to the library's reserves in the form of new results derived from this research. A digital library could conceivably shift the second of these stages from the researcher's lab into the library itself. The virtually unlimited storage capacities afforded by the UDL as well as its widespread accessibility make it an ideal platform on which to build what may be called "Real-Virtual" labs (RVL). These online labs would greatly aid researchers in their empirical studies if developed in the manner described below.

The purpose of the RV lab would be to help the user design new experiments and not simply run existing ones. The latter has already been implemented by several schools and colleges for instructional purposes in several fields. For instance, the Howard Hughes Medical Institute (www.hhmi.org/biointeractive/vlabs/) has made available an interactive website with several virtual labs. Their Neurophysiology Lab allows students to perform activities such as observe the electrical response of neurons to a mechanical stimulus attached to the skin and "inject" neurons with dyes in order to study their morphology. In addition to academic institutions there are several online resource sites that have set up virtual labs. The Virtual Labs & Simulations site (www.hazelwood.k12.mo.us/~grichert/sciweb/applets.html) maintains collections of several interactive learning labs dealing with various topics in Physics from Optics to Material Science to Astrophysics. The Chang Bioscience site provides Bioinformatics tools for researchers and students (www.changbioscience.com/). The ChemCollective at Carnegie Mellon University (www.chemcollective.org/applets/vlab.php) similarly offers a virtual learning lab in Chemistry. The team of Tom Alloway, Greg Wilson, Jeff Graham and Alan Sura have created **Sniffy the Virtual Rat**, (www.wadsworth.com/psychology_d/special_features/sniffy.html) a simulation of a rat in a Skinner Box that

allows students to run experiments that demonstrate the phenomena of classical and operant conditioning. Further, some researchers have attempted to set up "online" psychology experiments allowing people to register and participate as subjects. For example, the Social Psychology Network (fields of www.socialpsychology.org) provides links to several professional studies in Interpersonal Relations, Social Perception and Judgment and Decision Making, to mention a few. This list is by no means exhaustive and particularly encouraging as it shows that there is a "market" for online experimental activities. However, the goal of the RV lab would be to take the next step and make it possible for students, researchers and anyone interested in the field to generate *new* experiments and contribute to the development of the field.

1. REDUCTION IN NEED FOR REPLICATION

There are numerous benefits of setting up an RV lab. Researchers often replicate studies in an attempt to either confirm existing results or to establish a "baseline" for their proposed study. This essential but time consuming step in the planned study could be expedited if the original researchers could make available their entire experiment to their colleagues. However, the experiment would have to be in a form that would enable, at the very least, changes in experimental parameter values. Posting compilable versions of the experiment would also make the various experimental procedures transparent. This would eliminate the difficulty that can arise when "identical" experiments conducted by two different researchers yield non identical results.

2. EXPERIMENTAL TEMPLATES

Empirical studies often tend to fall under one or the other experimental paradigm. For instance there are numerous studies in cognition that make use of rating scales for capturing subjective responses to various stimuli or those that make use of the technique of Multi Dimensional Scaling (MDS). The current state of the field is that experimenters interested in exper-

ing these paradigms in their studies must from scratch write programs that have already been written by researchers elsewhere. Therefore, another idea would be for researchers established in their fields to provide experimental “templates” corresponding to these various paradigms. This time saving measure would spare new researchers the need to reinvent the wheel and enable them to achieve their specific goals in a short amount of time. At the very least researchers could conduct “pilot” studies in order to obtain preliminary results. Thus the organization of the experiments in RV lab might reflect a grouping by paradigm as well as by topic.

3. DESIGNING NEW PARADIGMS

A further extension of the RV lab would be to provide the user with the means to devise new experimental paradigms, allowing him/her to vary not just the parameters of an experiment but the design itself. These newly developed paradigms would then be made available to other users of the RV lab after undergoing review by peers. This would be particularly useful in fields where researchers are still engaging in both the theoretical as well experimental aspects of their studies. Physics as a field has profited enormously from the theory-experiment specialization allowing each group to focus on and develop it’s own principles. The introduction of a similar formal distinction in a traditionally empirical field such as Psychology, would allow researchers to develop a more rigorous theoretical account of phenomena. Thus “psych-theoreticians” could post their theories on the RV lab inviting empirical tests of the same while “psych-empiricists” could post their experimental designs and results inviting computational explanations from the former.

4. CROSS CULTURAL STUDIES

Another facilitating factor of the RV lab is the possibility of *conducting* experiments online where, say, human subjects are involved. This is particularly useful to the researcher interested in conducting cross cultural studies. Rather than physically travel long distances the researcher could invite subjects all over the world to participate in her/his experiments online. This could even be set up as a joint venture with schools and colleges abroad to ensure instructor supervised participation by students. There are several psychology experiments being run online such as University of Salamanca, Spain’s studies in Non Verbal behavior, (www3.usal.es/~nonverbal/varios.htm#experiments) and those of the University of the Saarland, Germany (www.uni-saarland.de/fak5/ronald/) on physical attractiveness, mate choice, personality, and evolutionary psy-

chology, to mention a few. However, these online studies are typically run independently of any kind of standardization. The RV lab under the UDL project could fill this gap by specifying global standards along the lines of INCITS, (www.incits.org) the International Committee on Information Technology Standards.

5. UNIVERSAL ACCESS

In keeping with UDL’s spirit of free access the RV lab could also be made available to people not enrolled in schools and colleges, for example, to those unable to afford formal education due to time or monetary constraints. This would provide them the opportunity to participate in scientific research, an activity typically reserved for a very small minority. A greater variety of experimental programs as well as paradigms obtained through widespread use of the RV lab will serve to reduce over reliance on existing paradigms. The latter can be a problem as the paradigm can often become conflated with the problem being studied, biasing the manner in which it is represented.

6. CONCLUSIONS

Much as the Internet has revolutionized communication, bridging physical and economical distances, it is expected that the UDL will usher in a new era of learning. The RV lab, under the UDL project, would reflect UDL’s arguably limitless applicability, presenting a novel paradigm in the way scientific research is conducted and disseminated.

References

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