Remarks of John D. Graham, Pardee RAND Graduate School of Policy Analysis

I am delighted to have this opportunity to offer some comments on the paper by Professor Fiore and colleagues. When I saw the title of the paper, "Virtual Experiments and Environmental Policy", I expected to be unenthusiastic. After all, I am far from a computer buff and I certainly have not generated much personal utility from playing computer games! Indeed, I am one of those dinosaurs who is mildly intimidated by the many advances that creative software engineers have produced for scientists.

The authors define "virtual reality" as "any computer-mediated synthetic world that can be interactively experienced through sensory stimuli".
My daughters insist that it is fun! Although I was a skeptic at the outset, this paper did persuade me that virtual reality is likely to have a significant role in the future of environmental policy.

I see at least four applications for this technology in environmental policy, some that were not even mentioned by the authors.

1. More rigorous stated preference research. When we elicit monetary or utility values from lay subjects, we struggle with making sure that the subject appreciates the good or service that is being evaluated. Like the authors, I share the view that virtual reality experiments can be a significant helper to the stated preference researcher.

2. Conflict resolution in the local community. Many environmental disputes at the local level appear to be exacerbated by misunderstandings between the mental frames of experts and laypeople.
Virtual reality experiments may help bypass jargon and build communications bridges between people with different cognitive frames.
Although this technology cannot resolve fundamental factual or value disputes, it can help participants in local policy making share a common understanding of the dilemma that is being addressed.

3. Assist policy makers in understanding complex technical models. It is well documented that policy makers, whether they be legislators, regulators or judges, have difficulty understanding the results of complex technical models. As a result, policy makers may not fully appreciate the value or limitations of the models of the Hudson River, the stratospheric ozone layer or the oceans. Virtual reality experiments may help decision makers understand what to make of these models.

4. Informing voters about ballot propositions. When I moved from the East Coast to California last year, I quickly learned that direct democracy is alive and well in some parts of the country. California has been a pioneer of the direct ballot proposition, often placing highly complex, multi-faceted issues on the ballot for resolution by voters. Many voters may arrive at the booth with candidates in mind, and then realize that they are also suppose to have thought through several ballot propositions. I can envision a future world where virtual reality experiments would assist voters in their efforts to make heads or tails out of these propositions. Information via virtual reality could be supplied by a neutral source, like the standard information currently supplied about each proposition, or it could be provided by advocates on one side or another of the proposition. If each citizen is going to vote on new highway projects or congestion pricing schemes, then why not use virtual reality technology to offer citizens an opportunity to better understand what they are voting on?

Based on the paper, I see three key advantages to information conveyed through virtual reality compared to information conveyed through other means.

First, allowing subjects to "explore" and "experience" technical and policy information is much more appealing than "force feeding" them pre-ordained perspectives. And since policy choices

are often as much about values as about facts, the interactive feature of virtual reality allows subjects to learn about aspects of issues that are most important to them.

Second, the flexibility of virtual reality allows technical information to be portrayed in multiple ways. We all struggle with understanding probabilities but some of us prefer odds, others prefer pie charts, others prefer risk ladders and others respond to analogies with card games. Since we do not all learn in the same way, virtual reality can be adapted to respond to the diversity in our learning styles.

Finally, we need to find better ways to explain to journalists, opinion leaders and citizens the long range consequences of environmental policy. Virtual reality experiments can help us understand the long range impacts of human activities on everything from forests and oceans to endangered species and biodiversity.

Since I am running the risk of sounding like a new convert to virtual reality, let me conclude by raising some concerns about virtual reality experiments. They both relate to any form of stated preference research but their ramifications are much broader and they are dramatized by the new technology.

First, virtual reality may cause a blurring of the distinction between objective research into stated preferences and social marketing. With sufficiently compelling cues from virtual reality, I have no doubt that we can generate significant willingness-to-pay values for a wide variety of poorly-appreciated environmental goods. But do these values represent stable, well-considered preferences, or are they constructed or contrived preferences that could be easily overruled by other virtual reality experiences? In order to be balanced, do we also need a virtual reality exploration of the joys of spending our money on non-environmental goods, such as music, a new Mercedes or a renovated family room? If we highlight environmental goods through virtual reality, and mention the opportunity costs only in sanitized words, I fear that the results we generate may resemble the impacts of social marketing more than the findings of objective social science research.

Second, virtual reality may tempt researchers to present too much information to lay subjects, thereby distracting them from the changes in key policy outcomes that need to be evaluated.

Let me draw an analogy to a current dilemma in research about human health preferences. When we elicit lay preferences about health outcomes, should we mention and describe specific diseases and treatments, such as cancer and chemotherapy? There is no consensus in the health literature but a growing number of health researchers are saying "no". They believe there are too many public misunderstandings about health and medicine to attempt to dispel them in a scenario description. Instead these researchers are using an alternative, indirect approach to valuation that simply asks subjects for their preferences toward key dimensions of health such as longevity, pain, emotional functioning and so forth. The valuations are then performed on these end states, rather than the diseases and treatments that produce the end states.

When we perform valuation research on fire management or climate policy, we face an analogous dilemma: Do subjects need to know the specific of how the policies work, or can we simply assess the ends states of policies?

One of the risks of virtual reality technology is that we will strive to immerse subjects in a wide range of technical information that subjects cannot possibly process sensibly. As a result, there are so many variables in the scenario description that the stated preference researcher cannot possibly know what is driving what. A more simplified approach that asks respondents to value changes in outcomes, without even describing or visualizing how those changes are produced, may have
considerable merit.

In summary, I would like to offer a qualified endorsement of more virtual reality experiments. And to set the record straight: I want it to be known that I did not endorse California's infatuation with ballot propositions. As a devout admirer of Alexander Hamilton, I am deeply skeptical of the entire notion of direct democracy. However, if we are going to have direct ballot propositions, and they are as popular as ever in California, then it seems to me that virtual reality has a role to play in making a bad practice less dangerous.

Thank you very much for the opportunity to offer these views.