PRESENTER OUTLINE

Introduction to Scene 1

Suppose you're a world-class scientist. Brilliant, amazingly quick and intuitive, a pioneer in a cutting-edge field. You're almost always the smartest person in the room, even a room filled with the best, most creative scientists in the world. And you have a serious problem.

It's September 1941. World War II is two years old. Germany has conquered all of Western Europe – France, Belgium, the Netherlands, Norway, Denmark – and its armies are now moving past Poland deep into Russia. England is still holding out, and America is not yet at war.

You deeply love your country. But your country is Nazi Germany, and you know it is in the wrong in this war. So when your government asks you to lead the development of a new, frightening weapon that will devastate your country's enemies, killing hundreds of thousands of people in the process, what do you do?

This is the dilemma facing Werner Heisenberg, a leading developer of quantum physics, who won the Nobel Prize for Physics in 1932. Heisenberg visited Denmark to talk to his mentor and friend, the equally great physicist Niels Bohr, who had won his Nobel Prize for Physics in 1922, about what to do. In Michael Frayn's play *Copenhagen*, Bohr and Heisenberg, in a fictional afterlife, try to recall what they said to each other in 1941.

Scene 1

p. 34 (Bohr, "Here I am, walking very slowly and popishly") through p. 37 (Heisenberg, "To tell them that we can stop it together.")

DISCUSSION

Talking points/questions:

- What do you think Heisenberg should do?
- What about the American and European scientists who worked in the U.S. to actually develop the bomb? Are their moral issues different because they know their country is in the right in the war?
- There's an old patriotic saying, "My country right or wrong, but my country." What happens to love of country when you believe your country is deeply wrong about something important?

Introduction to Scene 2

Heisenberg and Bohr had come to this point in their lives because, in the 1920s, they had led a revolution in thinking about how the smallest units that make up our universe – atoms and subatomic particles – behave. The subatomic world is very different from the world we see every day, where something is real because you can see it and touch it and measure it. Different rules apply. And figuring out those different rules was a matter of intense excitement to Bohr and Heisenberg.

Heisenberg came up with the idea of "uncertainty" or "indeterminacy" to describe what they found. Very briefly, this idea means that you can't determine with precision the location of a subatomic particle and its speed at the same time. Bohr added the idea of "complementarity," which basically means that in order to describe the behavior something in an atom, sometimes you have to look at it as a particle, and other times as wave. These ways of looking at something are, on their face, contradictory, but you must accept the contradiction to account for what you see.

In this scene from *Copenhagen*, Heisenberg and Bohr talk about their thought process.

Scene 2

p. 57-58; skip to Bohr at the bottom of 59 "But it's more important than that." Through top of p. 60, Bohr "Only through the understanding lodged in the human head."

Discussion

Talking points/questions:

- What about that understanding lodged in the human head? How definite, how certain is that?

- Think about criminal law cases: How reliable is eyewitness identification testimony?

- When you remember things – from your younger days, for example – how accurate are those memories? Are those memories the same or different as those of other people who were there at the same time?

- How well do you understand what's in your friends' heads, or those of family members? How well do you know what they're really thinking?

- Are their situations in life today where you have to accept both sides of an apparent contradiction to make sense of the world?

- Do you ever say one thing when you're thinking something else?

- How do you know what you think you know, and can you trust it?

Conclusion

Here's something Michael Frayn, the playwright, had to say on the subject:

"We can [in theory] never know everything about human thinking.

I wanted to suggest with *Copenhagen* that there is some kind of parallel between the indeterminacy of human thinking, and the indeterminacy that Heisenberg introduced into physics with his famous "uncertainty principle."

Though I'm not trying to say they're exactly parallel.

The uncertainty principle says that there is no way, however much we improve our instruments, that we can ever know everything about the behavior of a physical object.

And I think it's also true about human thinking.

How we know why people do what they do, and even how one knows what one does oneself.

It's a fundamental question...this is the heart of the play."

And at the end of the day, there isn't any definite answer – nothing one can check off, as on a multiple-choice test. There's just the job of living and working ethically in a world that is forever uncertain.