Copenhagen Study Guide

Copenhagen by Michael Frayn

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Contents

Introduction

The play does not provide a clear answer to the question of what took place during that meeting. It does, however, provide a lot of background information about these two powerful thinkers and the struggles they must have encountered in their attempt to honor their friendship during extremely turbulent, even life-threatening, circumstances. Both scientists were capable of figuring out how to create an atomic bomb. Bohr would eventually help the U.S. forces and he was instrumental in the creation of the atomic bombs that were dropped on the Japanese cities of Hiroshima and Nagasaki. But what happened to Heisenberg? Did he deliberately confound the Nazi efforts to create a similar weapon? Or did he attempt to create it but fail? Frayn leaves these overarching questions for the audience to ponder.

Margrethe Bohr is another character in this play. She was, in real life, an intelligent woman and a supporter of her husband. Although she did not have a science education like her husband, she typed all his research papers and was a strong sounding board for his theories. In the play, it is to Margrethe that the two men direct their discussion. They attempt, for her sake (and the sake of any nonscientific audience members), to translate their technological information into a language that everyone can understand. Margrethe also acts as a mediator and as a truth monitor. She makes the men look deeper into their actions, and insists that they shun personal emotion and get to the root of what is really going on between them.

Copenhagen opened on May 28, 1998, in London, at the Cottesloe Theatre. Two years later, it made its U.S. premiere at New York's Royale Theatre, on March 23, 2000. Since then, it has traveled around the world, receiving overwhelmingly high praise as a dramatic piece.

Author Biography

Frayn was born September 8, 1933, in London. His mother died when he was twelve, whereupon his father transferred him from an exclusive private school to a public school for financial reasons. He was later educated at Emmanuel College, Cambridge, where he studied philosophy. By age twenty-four, he was working at the British newspaper, the *Guardian*, as a reporter and columnist, and then moved to the London *Observer*. He is a prolific writer, mostly known as a playwright and novelist, who has more than a dozen novels and twenty-plus plays to his name. He has also written numerous scripts for television and film, and has translated many of Anton Chekhov's plays from Russian into English.

Since the 1960s, Frayn has won many awards for his work, including, to name just a few: the Somerset Maugham Award for *The Tin Men* (1965); the London *Evening Standard* Best Comedy of the Year Award, and the Society of West End Theatre Award for best comedy of the year for *Noises Off* (1982); the Antoinette Perry Award for best play and the Tony Award for best play for *Copenhagen* (2000); the Society of West End Theatre Award for best play of the year, Laurence Olivier Award for best play, *Plays and Players* Award for best new play, and New York Drama Critics' Circle Award for best new foreign play, all for *Benefactors*; and the Commonwealth Writers Prize and the Whitbread Award for best novel for *Spies* (2002). His film *First and Last* (1990) won an international Emmy Award.

According to writer and critic Blake Morrison, who is quoted in a Sarah Lyall article in the *New York Times*: "There are two sides to [Frayn]. . . . On the one hand he has a real taste for farce, but he's also a very serious-minded man, with an almost dry academic temperament." Although he is still a successful comedy writer, Frayn's subject matter has become more serious as he has aged. Larissa MacFarquhar, writing in the *New Yorker*, observes: "Frayn has reverted to older philosophical questions . . . [such as] What is a good life? What is forgivable? What is happiness?"

Frayn was married to Gillian Palmer, a psychotherapist, for thirty years, and the couple had three children together; they divorced in 1989. Seven years later, Frayn married Claire Tomalin, an author. He lives in London and continues to write. His play *Democracy* premiered in London in 2003 and in New York City in 2004. His play *Copenhagen* was adapted to film in 2002 by BBC-TV.

Plot Summary

Act 1

Copenhagen is set in one small space for the entirety of the play. The first act begins in the same way that the second act ends with a discussion of what took place during a visit between Niels Bohr and Werner Heisenberg in 1941. During the course of the play, the characters, from the afterlife, thrash out the details of this meeting, looking back and trying to grasp the feelings, the setting, and the circumstances that led up to the meeting, as well as what took place while the two scientists took a short walk outside of Bohr's home that fateful day.

The first act provides background details. Nazi Germany was occupying Denmark, where the Bohrs lived. Niels Bohr, Denmark's most revered scientist, was half Jewish, and his life was threatened by the occupation. Heisenberg was a high-ranking physicist in Nazi Germany. Both men had the knowledge of how to create a nuclear bomb. They were once cohorts but now stood on opposite sides of the war.

Frayn offer details about the relationship between Niels and Heisenberg. Niels, Margrethe, and Heisenberg discuss how Heisenberg, as a graduate student, came to study with Niels, who was considered the father of quantum physics. Heisenberg, for his own credit, would go on to create the basics of quantum mechanics. The men discuss the discoveries that each of them had come up with. They also discuss the more personal relationship between them, one that was described, at one point, as like father and son.

As the men reminisce, Margrethe keeps reminding her husband that Heisenberg was working with the Nazis and was therefore their enemy. Heisenberg does not totally deny this, although he does hint that, despite Heisenberg being German, he did all he could do to make sure that the Bohrs remained safe from the Nazis. Heisenberg was not completely safe himself during the war. He was constantly watched, had been considered a suspicious person, and was interrogated by the Nazis more than once. Heisenberg was called a "white Jew" by the Nazis because he taught Einstein's relativity theory what the Nazis referred to as "Jewish physics." Heisenberg recalls having been hesitant to talk to Bohr during their infamous meeting, knowing that Bohr's house had been wiretapped.

Heisenberg could have gone to the United States to teach, as many German physicists had done, but he wanted to stay in his homeland, wait out the war, and help to rebuild the scientific community in Germany after the war.

The Bohrs, in the meantime, talk about their concern about Heisenberg's visit. They did not want their fellow citizens to think they were collaborating with the Nazis. Before Heisenberg arrived at their home that night, Margrethe had cautioned Niels to stick to physics and not talk about politics.

Margrethe and Niels try to figure out why Heisenberg would want to visit them. The topic of fission finds its way into their talk. Niels had been working on fission for three years. He did not think that Heisenberg had done any work in that area. But Margrethe counters that everyone else was working on it, why not Heisenberg? He has been working on a weapon for Germany based on nuclear fission, Margrethe suggests. Niels does not believe so. According to calculations at that time, this advancement in weaponry was many years in the future. It was a complicated procedure that would take not only time but an almost incomprehensible wealth of resources. But the husband and wife continue to discuss nuclear fission, giving the audience background information on the history of the development of this inquiry into the splitting of the atom and its potential implications.

Then the three characters switch the time reference, slipping back to 1941 and playing out the scene of that meeting. They greet one another awkwardly. Many years have passed since they have seen each other. Many things have happened that have separated them. They begin their conversation by bringing up shared memories, those of skiing and vacationing together. Interspersed in their memories is a discussion of fission, as each scientist tries to feel the other one out, wondering where they are in their research. But the different politics, that of Nazism and the occupation of Denmark, as well as the Holocaust, keep interfering with the free flow of their conversation.

The three characters continue to discuss a mix of quantum physics□using metaphors of skiing to help explain the science□and personal tragedies, like the loss each family has felt upon the death of one son each. Then the two men go for their famous walk. While they walk, Margrethe fills in more personal details about the men's relationship. Upon returning from their walk, Niels's abruptness toward Heisenberg makes Margrethe suspect that whatever Heisenberg has said has deeply upset Niels. After Heisenberg leaves, Niels keeps repeating that Heisenberg cannot be right. When Margrethe asks what Niels is talking about, Niels goes into an explanation of what happens in a nuclear reaction.

Heisenberg, once again in the setting of the afterlife, returns to the discussion. The audience is provided with the beliefs that were held in the 1940s concerning why it would be so hard to create a nuclear bomb. The act ends with the men searching their memories in an attempt to figure out what was actually said at their meeting and why Heisenberg had come to visit. Their memories conflict on certain details, so no clear conclusion is reached.

Act 2

In act 2, the men exchange memories of what it was like when they first met, how they used to walk together to help them think, and how they inspired one another's creative thought processes. They also talk about the effect their discoveries had on the world at large. They mention the names of other scientists in their field and how their theories of complementarity and uncertainty□and the "whole Copenhagen Interpretation"□came about. Margrethe suggests, as the men recount the development of their relationship,

that maybe that is why Heisenberg came to Copenhagen in 1941. Maybe he wanted to get back to those earlier days when the relationship between Heisenberg and Niels was stronger and more productive. But immediately after positing this suggestion, Margrethe withdraws it. She reminds the men that they did not create their theories together. "You didn't do any of those things together," she tells them. Then she recalls how, even though they spent a lot of time together, they actually did their best work when they were apart.

At this point, the men turn to their metaphors for quantum physics and the difficulties in the evolving foundation of the science. There were contradictions and quarrels among the leading physicists as to how to proceed and how to calculate the data they were conceiving. Even Heisenberg and Niels fought. "You were the Pope and the Holy Office and the Inquisition all rolled into one!" Heisenberg tells Niels, referring to the fact that Niels tended to have the last word in the development of quantum physics at that time. Niels's word was revered in the sciences. But both Niels and Heisenberg were puzzled by the way quantum physics worked. The actions of a detached electron do not always follow the path that Heisenberg's mathematical structure suggested it should. "It was a fascinating paradox," Niels says.

In the end, Niels points out, after their three years of collaborative research and hypotheses, the two men changed the world. "Not to exaggerate," Niels says, "but we turned the world inside out!"

As the second act closes, the three characters return, once again, to the meeting in 1941. They discuss all the pressures they were feeling at the time. The conversation returns to the atomic bomb. Niels reminds Heisenberg that the reason Heisenberg was not able to create the bomb was that he forgot to work out a mathematical equation. Heisenberg, Niels suggests, made an assumption that turned out to be false. The solving of the mathematical equation would have showed Heisenberg his error, Niels claims. Meanwhile, Margrethe catches comments the men make that are not quite the truth. She digs deeper into what they are saying and makes them admit their personal reasons behind some of their decisions. She especially confronts Heisenberg, who tries to claim that he suffered during that time, that he was a victim. "On your hands and knees?" Margrethe says. "It's my dear, good, kind husband who's on his hands and knees! Literally." She is referring to the fact that Niels ultimately had to be smuggled out of Denmark to Sweden before the Nazis came to take him away to a concentration camp. He moved from Sweden to England, and eventually to the United States. Heisenberg then confesses that he was involved in Niels's successful escape to Sweden. He was the one who had sent word that the Nazis were coming for Niels.

The play closes on a philosophical note. The three characters remind one another that they, at the end of their lives, will turn to dust, as will their children. No more decisions will have to be made, Niels says, because at some point there may be "no more uncertainty, because there's no more knowledge." Then Heisenberg reminds everyone that there is still uncertainty. This is a reference not only to science but also to the fact that no one knows for sure what actually happened at that now famous 1941 meeting.

Characters

Margrethe Bohr

Margrethe Bohr is the wife of Niels. In real life, she was very close to her husband and very much aware of the details of his work as well as his challenges, both work-related and personal. Margrethe and Niels were a close-knit team; therefore, her participation in the discussions of this play are very significant. She provides a more objective view when the men's discussion becomes bogged down. She also offers a different perspective when the men come to a blockage either in memory or in tone. She chides both men from time to time, pointing out their recall errors. For instance, she reminds them that they accomplished their best work while they were separated, not while they were together. Margrethe also acts as an interpreter for the audience as well as a medium or substitute for the audience. The men remind one another that they must talk in plain language so that Margrethe can understand their concepts. This is done so the audience will not be overwhelmed by scientific jargon.

Niels Bohr

Niels Bohr, in real life, was considered the father of quantum physics. He was at one time a teacher or mentor to Heisenberg. He is older than Heisenberg, who considers Bohr a father figure. Niels was in real life distraught after the meeting with Heisenberg, and in the play he cannot exactly remember what happened on that 1941 night. He remembers that he was upset but he cannot completely put his finger on the reason. He knows it had something to do with fission and thinks he was concerned that Heisenberg might be trying to create a bomb for Nazi Germany. Niels was the theoretician. He imagined concepts that Heisenberg would then take and create practical models from. Niels's warmth for Heisenberg is apparent, despite his concern of what Heisenberg might have created.

Werner Heisenberg

Werner Heisenberg was a German who may or may not have worked for the Nazis. This possibility is very difficult for the Bohrs to deal with, despite the fact that they once considered Heisenberg as a son. Heisenberg, in the play, seems to come to the Bohr's house to either rationalize his involvement in the war or to ask for forgiveness for any hardships the Bohr's have suffered. However, he does this reluctantly. In the process, he also mentions the hardships that he too suffered. He even goes so far as to remind Bohr that it was Bohr who actually influenced the creation of the atomic bomb and not himself. Heisenberg was a student of Bohr's at one time, and that relationship is still apparent, even many years later. Heisenberg honors Bohr, even though he often kids him about being slow. Heisenberg, as portrayed in this play, appears to miss the close relationship that he once had with Bohr.

Themes

Morality in a Time of War

What is the role of the scientist in a time of war? Frayn appears to ask this question in *Copenhagen*. Is it the scientist's duty to use the results of the most recent and significant research to help to protect his or her homeland, even if it means the destruction of thousands of lives? Or does a scientist have a moral obligation to use his research to improve life on this planet? Who made the better decision between Bohr and Heisenberg? Was it Bohr, when he helped create the atom bomb, thus saving the world from several cruel dictators, despite the cost to Japan? Or did Heisenberg make a better moral decision, if in fact he did thwart the creation of an atomic bomb and thus disallowed the Nazis the upper hand in World War II? Can one even talk in terms of morality when the discussion of war is raised? Or do all morals go out the window in times of dire circumstances such as a war? These are some of the questions that Frayn raises in his play. And even though these questions are not answered, morality in a time of war is one of the main themes underlying Frayn's play.

Friendship

Another underlying theme of this play is that of friendship, or more specifically, how the social and political circumstances surrounding two people can strain their relationship. No one will ever know for sure how politics interfered with the relationship between the real Heisenberg and Bohr, but Frayn attempts to demonstrate that, even in times of war, fragments of friendship remained intact between the two men, at least on a fictional basis. Despite their contradictory political beliefs, their oppositional positions on either side of a brutal war, and possibly a conflict in their concepts of how scientists should use new discoveries to create destructive weapons, readers come away from Frayn's play with a sense that the deep-seated friendship between Heisenberg and Bohr was not completely eradicated. For example, Heisenberg confesses that he was behind the successful attempts at hiding and ultimately saving Bohr from the Nazis when they came looking for him in Denmark. Frayn also tries to show the depths of the men's relationship by describing it as a father-and-son connection, implying that, no matter what hindrances might be placed between the men, there was no denying that they would be forever linked. The men, according to Frayn, thought alike and promoted and complemented one another's creative and scientific thoughts.

Uncertainty

Uncertainty is one of the concepts behind quantum physics, but it is not only in reference to quantum physics that Frayn uses this theme. There is, of course, the uncertainty of what actually happened between Bohr and Heisenberg during their meeting in 1941. That is one of the main focal points of the story. But uncertainty does

not end with this unanswered question. It really only begins there. There is the uncertainty in life itself. Heisenberg discusses some of his wartime experiences; and Bohr talks about the death of his son. As long as there are things to learn and discover, there will be uncertainty, as Frayn relates to his audience at the close of the play.

Power of Science

Bohr's and Heisenberg's discoveries in quantum physics might truly have, as Bohr states in the play, turned the world inside out. Not only did science change but also the view of reality itself was changed with the men's discoveries and theories, which put the men in prominent positions. Their knowledge was coveted by the heads of state of several nations; and both Bohr and Heisenberg became pivotal figures in world politics.

Through Frayn's play, the reader grasps the significance of this political power, as well as the responsibility behind it. Frayn helps the reader realize the tremendous burden that falls on the shoulders of geniuses such as Heisenberg and Bohr□people whose intelligence allows them to create paradigm shifts in the way people all over the world think and perceive existence.

Fate

One of the more subtle themes of this play is fate. Consider the world, Frayn seems to be saying, if Heisenberg had created the atomic bomb and given it to the Nazis. What would the world be like if that had happened? As fate would have it, no matter what the reason that Heisenberg did not create the bomb□whether intentionally or by error□the explosion of the atomic bomb ended the war and eventually led to the supremacy of military power in the United States. If fate had also dictated that Bohr was killed while trying to flee Denmark to escape the Nazis, or if Bohr had been captured by the Nazis, the United States might not have been able to produce an atomic bomb. There is also the possibility that if Heisenberg and Bohr had not been brought together by fate in the first place, quantum physics may never have been imagined.

Style

Setting

Frayn's play takes place in the afterlife, as three characters reminisce about, and try to sort through, particularly interesting details of their lives. By placing these characters in the afterlife, Frayn has the freedom to allow speculation and reflection. The characters are able to come together and focus on their relationships, how they unfolded, what they entailed, and how they affected not only one another and their families but the world at large. In the afterlife, the characters are free to question one another's actions and motives; they can challenge one another's beliefs and memories; and they can look back more objectively, since their human egos no longer exist. The threats that existed during their lifetimes no longer concern them. They are able to see the consequences of their actions, which adds more weight to their decisions, and they can afford to be philosophical about the passions that drove their lives, without the psychological burdens that might have blinded them while they were still alive.

Talking Heads

There are no props involved in this play except for three chairs. The main focus is on the three characters and their accounts of the Copenhagen meeting between Heisenberg and Bohr, their discoveries, and their relationships. There is also little action other than the characters sitting and standing or varying their positions as they concentrate on one another. The heart of the play is a long, detailed discussion. No one leaves the stage; they wander off to the side if they are not included in the present conversation.

Since the play involves historic figures and a complicated branch of science, the characters must relay a wealth of information about themselves and their scientific discoveries to an audience that might know next to nothing about the lives of the characters and their impact on society. In order to do this, the characters bring up personal stories from their past, they use metaphors, and they provide everyday examples that illuminate some of the principles of quantum physics.

Conflict

The conflict in Frayn's play can be seen as a search for truth. There are three people involved in this play and each of them has their own version of what happened during that 1941 meeting. Each character offers an opinion of that night and an opinion of the effects that their relationships had on each other. Although the premise of the play is the search for the truth, the reader comes away wondering if there is one truth that all three characters would agree on. Each character's interpretation varies slightly from the others, possibly providing a germ of truth to the whole, but parts of each version conflict with the other character's versions.

For example, there is the question about Heisenberg's loyalties. Was he sympathetic with the Nazis? And if so, how deeply? The search for the truth of this question has deep implications, especially since Bohr was Jewish. Then there is the question of whether Heisenberg was working on the atomic bomb. Did Bohr believe this to be true? And if so, is that why he went to the United States to help that nation produce the atomic bomb first? Would Bohr have done that if he did not believe that Heisenberg would have done it first for Germany? There is also the conflict that is implied in each man's decision to become involved in the production of such a catastrophic weapon.

Balance of Forces

Although there is conflict in this play□among the characters as well as within each character□there is also a balance of forces. Bohr and Heisenberg, in other words, are equally matched. Both men have exceptional intelligence. They both worked toward a similar goal in science. They helped one another and were both equally capable of understanding and applying fission. Their discussion and arguments are equally believable. Another example of this balance is the male characters' attempts to keep their discussions on an even keel with Margrethe, who in many ways represents the reader. They keep their language in lay terms so that the science they discuss can be easily understood. This brings the reader into the discussion, thus keeping the balance even. The play would be senseless to most spectators and readers if the male characters became lost in an esoteric dialogue about quantum physics.

Historical Context

Werner Heisenberg

Heisenberg was born in 1901 in Würzburg, Germany, and as an adult he was the head of Nazi Germany's nuclear energy program. In school, he majored in physics and by the time he entered graduate school, at the University of Munich, it was widely accepted that the quantum theory as created by Niels Bohr was faulty. Heisenberg took it upon himself to figure out the quantum mechanics that would correct it. Toward this goal, in 1925, he created matrix mechanics. Two years later, he came to a conclusion that would be called the Uncertainty Principle, which states: the more precisely a position is determined, the less precisely the momentum is known in that instant, and vice versa. This was and still is a major principle of quantum physics. It was in that same year, 1927, that Heisenberg worked with Bohr in Copenhagen to create what would be called the Copenhagen Interpretation, which became the underlying interpretation of quantum mechanics.

At the end of World War II, Heisenberg, along with several other German scientists, was imprisoned and sent to England. He was later released and returned to Germany, where he continued in his role as teacher at the Max Planck Institute for Physics and Astrophysics. He was awarded the Nobel Prize in physics in 1932, for his discovery of allotropic forms of hydrogen.

Heisenberg was also a distinguished classical pianist. He was married to Elisabeth Schumacher, and the couple had seven children. He died in 1976.

Niels Bohr

Bohr was born in 1885 in Copenhagen. He received his doctorate in physics at Copenhagen University in 1911. Upon graduation, he worked on the problem of the structure of the atom. Eventually he created a new model of the atom and its electrons, which included the idea of quanta. His model helped physics move forward, despite inaccuracies that were later discovered in his theory. His concept was, however, finally proved to be correct.

In 1922, Bohr received the Nobel Prize in physics. He continued his research after winning the prize and created the theory of complementarity, which suggested that an electron might be both particle and wave. During the war, Bohr sheltered many Jewish scientists who escaped from Germany's Nazi regime. It was Bohr who leaked the information to the United States government that Germany was trying to build an atomic bomb. He and his family had to secretly leave Denmark and flee to Sweden, to escape the Nazis. He later spent time in the United States and was involved in the Manhattan Project at Los Alamos. He later had second thoughts about the bomb and, in 1955, created the Atoms for Peace Conference in Geneva.

Bohr spent most of his life in Denmark, where he was a professor at the University of Copenhagen. In 1920, he founded the Institute for Theoretical Physics and remained the Institute's director until his death. He married Margrethe Nørlund upon graduating from college, and the couple had six sons, one of whom was also a Nobel Prize winner. He died from a stroke in 1962.

The Manhattan Project and the Bomb

As rumors began circulating, around 1939, that the Germans were developing an atomic bomb, the United States government realized it must begin its own program. General Leslie Groves, a member of the Army Corps of Engineers, headed this plan, which was later termed the Manhattan Project.

There were several significant research programs going on simultaneously in the United States at that time, but it was at the University of Chicago, where scientists were studying atomic theory, that the first controlled nuclear reaction occurred on December 2, 1942. This portion of the program was managed by physicist Enrico Fermi, who had immigrated to the United States from Italy.

The next problem that scientists had to solve was the creation of the fuel for an atomic bomb. This undertaking occurred at a facility called Oak Ridge, located in Tennessee. The task was to separate the nuclear fuel U-235 from U-238, natural uranium. In the state of Washington, the Hanford Engineer Works produced plutonium.

J. Robert Oppenheimer was assigned the task of identifying the most qualified scientists and engineers to work on the Manhattan Project. He would go on to direct the facilities at Los Alamos, New Mexico. It was at Los Alamos that a group of scientists from all over the world would create the bombs. The plant in Tennessee eventually produced the fuel, U-235, which was taken to Los Alamos and used in the bomb referred to as Little Boy. The plutonium from Hanford was used in the bomb that was called Fat Man.

Little Boy was dropped on the city of Hiroshima, Japan. Over 66,000 people were immediately killed, and another 69,000 were injured. With the effects of radioactivity, it was estimated in 1945 that a total of at least 140,000 people died due to the dropping of Little Boy. Three days after the first bomb was dropped, the bomb called Fat Man exploded over Nagasaki, Japan. It has been estimated that at least another 70,000 people were killed by this explosion.

The Bohr-Heisenberg Meeting

Germany had conquered most of Europe and was threatening to take over Russia when Heisenberg traveled to Denmark to visit with his old teacher and former collaborator. The Danish physicist was living in the so-called Residence of Honor in Copenhagen, a palatial home reserved for the most distinguished scientist in Denmark. In turn, Bohr often entertained visiting scientists from other countries, so it was not unusual for Bohr

to receive Heisenberg as a guest, despite the tension that had developed in their relationship due to the hostile Nazi occupation of Denmark.

In spring 1941, Heisenberg had discovered the possibility of a chain-reaction that might occur in the splitting of the atom, the power of which he realized could be used to create a nuclear bomb. Later that year, he accepted an invitation to speak at a conference in Denmark, thus giving him a chance to meet with Bohr. They met sometime in the middle of September. There were no records kept at the meeting, but in 1956, fifteen years after the meeting, a journalist, Robert Jungk, wrote a book about the meeting, which was translated into English two years later as *Brighter than a Thousand Suns*. The book contained part of a letter that Heisenberg had written to Jungk, explaining the meeting Heisenberg had with Bohr.

Upon reading Jungk's book, Bohr drafted several letters addressed to Heisenberg. However, he never sent these letters and never had the letters published. After Bohr's death, Margrethe sealed these letters with other personal papers of her husband's. Until recently, the only published account from the Bohr family related to that meeting was contained in an article written in 1964 by Aage Bohr called *The War Years and the Prospects Raised by the Atomic Weapons*.

Another book, *Heisenberg's War* (1993) by Thomas Powers, was published about this topic. Powers's book inspired the ideas contained in Frayn's *Copenhagen*. In 2002, the remaining members of the Bohr family decided to end the speculation concerning the infamous meeting, and they opened the unpublished letters that Bohr had written. Copies of these documents can be found at http://www.nbi.dk/NBA/papers/introduction.htm. At http://werner-heisenberg.unh.edu/ readers can find copies of responses from the Heisenberg family.

Critical Overview

Copenhagen has won praise from audiences and critics alike, as well as several prestigious awards. It also has gained the attention of academics. Jonothan Logan writes in *American Scientist* that, although he found the play to be "quick, clever and artfully plotted," he is concerned about Frayn's alteration of the historical facts and his rearrangement of "the moral landscape the real Bohr and Heisenberg inhabited." Logan contends that Frayn's reliance on Thomas Powers's book *Heisenberg's War* for the content of his play was faulty because the Powers book was flawed and thus "won little respect from historians."

Another scholar, Paul Lawrence Rose, writing for the *Chronicle of Higher Education*, begins his article: "Scholars are never satisfied when they see their specialized subjects turn fodder for stage, screen, or novels." Rose is a specialist on Heisenberg and he praises Frayn for developing "through his often electric dialogue a synergy on stage that has made the play a success." Rose even goes so far as to state that there has not been another play that "has achieved the brilliance of *Copenhagen* in rendering the technical discussion of scientific ideas dramatically convincing and, at the same time, accessible to scientists and nonscientists alike." But Rose has problems with Frayn's depictions of the characters. In particular, he questions Frayn's depiction of Heisenberg: "Was Heisenberg really the character depicted so sympathetically on stage? Was his attitude toward Nazism really so ambivalent, or so justifiable, as Frayn variously suggests?"

Despite the controversy of historical fact versus Frayn's dramatic presentation, there is hardly anyone who has criticized the artistic value and presentation of the play. *Washington Post* reviewer Nelson Pressley concludes that *Copenhagen* is "as ingenious as advertised." Pressley even comments that, despite arguments against Frayn's "fairly sympathetic view of Heisenberg," the play is still a worthy creation:

Frayn entertains so many possibilities in this play, and is so direct about the stakes . . . that it's hard to imagine *Copenhagen* being invalidated by anything short of a complete transcript of the meeting [between Bohr and Heisenberg].

Jules Becker, in the Worcester, Massachusetts *Telegram and Gazette*, suggests that if nothing else, Frayn's play should excite the audience, inspiring them to go back to the textbooks and dig into history a little deeper to come to their own conclusions about the real-life counterparts of the characters depicted in the play. Becker observes: "*Copenhagen* may not ultimately explain whether Heisenberg visited Bohr to help the Nazis or to stymie their effort. Yet it does make a cogent argument for understanding the scientists along with their science and the importance of a science-friendly public."

Seattle Times reviewer Misha Berson calls *Copenhagen* a "brilliant, demanding play." Jack Kroll in *Newsweek* writes: "Frayn creates riveting suspense and, without dumbing down the dialogue, makes the discussion of matters like quantum physics and matrix mathematics seem like revelations of character." And *Washington Post* writer Peter

Marks points out: "Good writing has a way of relaxing the spirit in much the manner that a session in the hot tub releases the tension in one's neck and back, and Michael Frayn, author of the Tony-winning play, is in this regard a stress-relief wizard."

The questions that circle around the real-life Bohr-Heisenberg meeting may never be answered either in history or in drama, but Frayn's attempt in *Copenhagen* continues to inspire discussion. Whether it answers any questions, and indeed whether it is historically factual, is immaterial to many audience members and critics alike, including Julia M. Klein, who writes in the *Chronicle of Higher Education*: "All the letter writers, so intent on being right, are busy pounding a metaphorical mattress with a hammer. They haven't noticed that readers long ago started rolling their eyes."

Criticism

- Critical Essay #1

Critical Essay #1

Hart is a freelance writer and author of several books. In this essay, Hart focuses this essay on the various roles that the character Margrethe portrays in Frayn's work.

There are three characters in Michael Frayn's award-winning play *Copenhagen*, and the main focus of the play is on only two of them, Niels Bohr and Werner Heisenberg. This leaves the third character, Margrethe Bohr, in a very special position, one that changes depending on the needs of the play. In her various roles, Margrethe sometimes acts as the moderator of the discussions between Bohr and Heisenberg. At other times she plays out her role as wife and protector of Bohr. In different situations, Margrethe is representative of the general audience, someone in need of explanations in order to become more deeply involved in the dialogue. And in yet different settings, she is provides details for the audience's sake. In studying Margrethe's role, readers can get a better grasp on how Frayn smoothed out the flow of his play, a work that might otherwise have come across as a dry dialogue between two intelligent men whose esoteric language might not have been translatable to a general audience. Margrethe's role also offered Frayn a chance to add drama, background information, and interest to the otherwise scientific discussion.

It is Margrethe who opens the play with the question: "But why?" And it is this question that drives the play. Everyone wants to know why Heisenberg decided to come to the Bohr's house that night in 1941, while the city of Copenhagen was occupied by the Nazis. Why take the risk? What were Heisenberg's motives? And ultimately, what did that meeting accomplish? The actors are portraying three people who have already died, and yet, Margrethe states, these questions still linger like ghosts. As the opening dialogue between Margrethe and her husband continues, Margrethe fills in the background information that sets the tone of the play. She mentions the war, the occupation, and the fact that in Germany's eyes, she and her husband are the enemy. And although by the end of the play no one is wiser as to what occurred during Bohr's and Heisenberg's meeting, Margrethe provides the first clue in the play concerning the consequences or outcomes of these two scientists coming together on that night: "I've never seen you as angry with anyone as you were with Heisenberg that night," Margrethe offers. She also mentions that after that meeting, the friendship between the two men ended. So within just a few sentences, Margrethe has taken the audience back to that night, with all its tension and apprehension, preparing the audience for the discussion between the two scientists, which is yet to begin.

In the next section, Margrethe acts as a counterpoint to Bohr's memories of Heisenberg. Every time Bohr mentions something nice that he remembers, Margrethe contradicts him. This provides the audience with a fuller picture, a more colorful portrayal of Heisenberg. Bohr thinks of Heisenberg as a part of the family, for example, while Margrethe says there was something alien about Heisenberg. And when Bohr uses positive adjectives to describe Heisenberg, such as quick, eager, and bright, Margrethe turns these compliments toward the negative, stating that Heisenberg was too quick, too eager, and too bright. However, even Margrethe softens a little later in the play and

upgrades the way the men themselves describe their relationship. They refer to it as a business association, whereas Margrethe likens their connection to that of father and son. But no matter if she is condemning Heisenberg or praising him, her comments add complexities to the plot. Was Heisenberg a good man? Did he have moral perceptions? Or was he manipulative and exploitive? These questions are never clearly answered, but through Margrethe's role, a deeper intrigue is added to the play by her provision of questions and contradictions. These are not easy concepts, Margrethe seems to imply. There are no simple solutions.

As the play progresses, Margrethe returns to the role of information gatherer. She talks about the men's work and about politics. She also acts as historian, providing a more accurate recall of the 1941 meeting. She seems clearer than the men about the details of that meeting, demonstrating, possibly, a more objective vision, but also giving the play a further deepening of complexities. She offers details concerning why Heisenberg was in Copenhagen at that time. He was attending a meeting, of course, but Margrethe adds the fact that the organization that sponsored this meeting was known for spreading "Nazi propaganda." This places Heisenberg in a more precarious position. The Nazis were exterminating Jews□and Bohr was part Jewish. This makes the audience question whether Heisenberg was a friend or a foe. Bohr states: "Heisenberg is a friend." But back in her role as contrarian, Margrethe counters: "Heisenberg is a German." And she fears Heisenberg's visit will make her countrymen think the Bohrs are collaborating with Heisenberg. So not only is Margrethe questioning the politics of Heisenberg, she is also demonstrating for the audience's benefit, the depth of fear and the possible retribution this visit could have caused. In other words, this is not just a meeting between two friends, an old teacher and his student. It is not just simple curiosity that drives the question "Why did Heisenberg come and what did the two men discuss?" No, there is much more drama going on here. And it is Margrethe's role to emphasize and to clarify this.

In the middle of the first act, Margrethe's role changes a bit. She takes on an air of comedic relief. The men are deep in a discussion of quantum physics, mentioning the infamous Schrodinger's cat, which, according to theory, is both dead and alive at the same time, as long as neither condition is verified. Margrethe interjects at this point, "Poor beast," which provides the audience with a chance to catch its breath. The concepts of quantum physics are very lofty and require mental effort to comprehend. Margrethe's comment allows the audience to laugh, to relax. A little later, when Heisenberg again returns to physics, he comments that "the particle has met itself again, the cat's dead." To this, Margrethe says, "And you're alive." This comment might also arouse a giggle from the audience, but it is a double-edged sword. It sounds funny, coming immediately after Heisenberg's statement, but her comment also links back to an earlier discussion about why Heisenberg is still teaching physics in Germany, when most other physicists have already left the country. Margrethe's statement that Heisenberg is still alive is a subtle reference that she believes he is in an alliance with the Nazis. A few lines later, Margrethe returns more definitely to the side of comedy, when Bohr references how many times a theory of his had to be changed. Each time her husband mentions a change, Margrethe brings the discussion back to the audience by remarking on how many times she had to retype Bohr's paper. She again breaks the

monotony of scientific dialogue, bringing the common person in the audience something easier to think about, something everyone can relate to□the tedious work that is involved in even the loftiest concepts.

Close to the end of act 1, Bohr mentions that he and Heisenberg must talk in a language that is clear to Margrethe. He says they must use "plain language." But what is interesting is that Margrethe also has a request of sorts. She does not ask them to speak in plain language, but rather she asks that they look inside and speak the truth. She mentions the fact that Heisenberg used to refer to her husband as the Pope. This is not, according to Margrethe, because Heisenberg thinks of Bohr as a "spiritual father" as he proclaims, but because he wants "absolution." She suggests that the reason that Heisenberg came to see Bohr was to be forgiven for what he was about to do□help create the atomic bomb for the Nazis. And once she points this out, the conversation between Bohr and Heisenberg becomes more enlivened. The men drop the scientific details and begin to speak of feelings and the morality of war. Margrethe now has taken on the role of the truth detective. She is quiet for a long time as the men hash out their mutual roles in the development of atomic weaponry. And as they do this, Margrethe is listening. When the men reach a certain point just shy of a conclusion, she spurs them forward. She corrects their perceptions and prods them in a more honest direction. And out comes the truth (at least the dramatic truth if not the real truth). Thus through Margrethe, the play feels as if it has come to some sort of conclusion, despite the fact that there are still many questions left unanswered.

In act 2, Margrethe again focuses on truth-gathering as she sums up the closest thing to a reason that the play offers for Heisenberg's visit to Copenhagen. Whether this is factual truth or truth according to the playwright, it is Margrethe who mouths it. After a long dialogue between the characters about the accomplishments of both Bohr and Heisenberg, Margrethe faces Heisenberg with some interesting information. She states a catalog of events, such as Heisenberg's published paper on the uncertainty theory, which ensures him teaching positions at prestigious educational institutions. She references how young he was. "The youngest full professor in Germany," Bohr says, reinforcing Margrethe's comment. Margrethe states this fact of Heisenberg's youth to build up Heisenberg, to put his accomplishments in front of the audience. But her real motive is not to make Heisenberg a hero. She has another idea completely. She is back in her contrarian's role. Just as soon as she has poured over his credits, she slams the door in his face. "You came to show yourself off to us," Margrethe says, claiming this as the only true reason for Heisenberg's visit. "You've come to show us how well you've done in life." And in the play, at least, Heisenberg confesses this is true. Margrethe has further bared the truth. And as she says, her perceiving the truth leads others to admit to more truth. "A chain reaction. You tell one painful truth and it leads to two more." Here her character cleverly uses atomic reaction as a metaphor.

And so, through her various roles, Margrethe adds depth, comic relief, a search for honesty, and a possible conclusion. Her character, although not in the spotlight, is what binds the other characters with the audience and keeps the play lively and on track. Without the character of Margrethe, Frayn would not have had a vehicle through which to add dramatic effect. Using Margrethe in this way, Frayn can allow his two scientist

characters to renew memories, discuss physics, and question their moral decisions without constantly pausing to explain themselves. The character of Margrethe may play a supportive role, but it could easily be proclaimed that she is what holds the play together.

Source: Joyce Hart, Critical Essay on *Copenhagen*, in *Drama for Students*, Thomson Gale, 2006.

Adaptations

In 2002, PBS, in association with the British Broadcasting Company (BBC), produced a DVD of *Copenhagen*, starring Stephen Rea as Bohr, Daniel Craig as Heisenberg, and Francesca Annis as Margrethe.

Topics for Further Study

Research the later years of such physicists as J. Robert Oppenheimer, Enrico Fermi, Niels Bohr, and Werner Heisenberg. How did these men react to their part in the creation of nuclear weapons and the destruction that was caused by the bombs? Did their lives change because of the bombs? Were they more militant or less so? What activities did they later become involved in that might determine how they felt?

Read biographies of Bohr and Heisenberg and then read the letters that Niels Bohr wrote to Heisenberg but never sent (published online at http://werner-heisenberg.unh.edu) and create your own dialogue between these men as they comment on their meeting, their involvement in the development of the atomic bomb, and their concepts of morality during wartime.

Read the Geneva Convention rules of war. Then write a paper discussing the various tenets laid out by this document. Do you think the rules of war are moral? Do they go far enough? Would you add more rules? Be specific as to the laws you would discard or reinforce.

Pretend you are a scientist some time in the future. Imagine that you have created a scientific breakthrough. How would it help people? How could it harm people? What would be the moral questions that you would have to ask yourself as you considered going public with the results of your research.

What Do I Read Next?

A Landing on the Sun: A Novel (2003) is representative of Frayn's novel writing. This book presents a mystery about Brian Jessel, a member of Great Britain's cabinet office, whose death is somewhat suspicious.

For a funnier side of Frayn, try reading his play *Noises Off* (1982), a sexual farce that is actually two plays in one: the first of which is acted out on stage, and the second of which follows the disastrous events that occur backstage immediately following the presentation onstage, as bumbling actors and stagehands stumble through the production.

An Experiment with an Air Pump (1998), a play by Shelagh Stephenson, is set in two different time periods, 1799 and 1999. The focus of the first time period is on scientist Joseph Fenwick, who struggles with a mix of his own ambitions and desires for progress with his moral beliefs. In the second time period in the late twentieth century, his counterpart, a female genetic researcher, does the same. Many philosophical and social issues are discussed in this play.

Proof (2001) won the Pulitzer Prize for drama for its author, David Auburn. This play is centered on math and science, but only obliquely. It really explores love, relationships, genius, and madness.

Further Study

Cassidy, David C., *Uncertainty: The Life and Science of Werner Heisenberg*, W. H. Freeman, 1993.

Cassidy looks at the life and times of Heisenberg as well as at the influences that affected him. A history of quantum mechanics is woven through the story as Heisenberg struggles through trials of exploration.

Frayn, Michael, and David Burke, *The Copenhagen Papers: An Intrigue*, Picador, 2003.

This book has little to do with Frayn's play. Rather it is based on an interesting development that occurred while the play was in production. It is a dialogue of sorts that occurred between Frayn and Burke (an actor who portrayed Niels Bohr in Frayn's play). It is sometimes funny and always fascinating as the reader witnesses a witty exchange of ideas.

Groueff, Stephane, *Manhattan Project: The Untold Story of the Making of the Atomic Bomb*, Little Brown, 1967.

This book details the U.S. project of bringing together the most brilliant scientists of the 1940s in an attempt to be the first country to create the ultimate weapon of destruction.

Hey, Tony, and Patrick Walters, *The New Quantum Universe*, Cambridge University Press, 2d ed., 2003.

Hey and Walters treat the historic moments of discovery in quantum mechanics as well as its applications in the future. This book is accessible for general readers. Such futuristic topics as the nanotechnology revolution, quantum cryptography, computing, and teleportation are also discussed.

Murdoch, D. R., *Niels Bohr's Philosophy of Physics*, Cambridge University Press, 1989.

In this book, Murdoch explores the background of Niels Bohr's discoveries in physics□in particular, the differences between Bohr's concepts and those of Einstein's are examined, with a special emphasis on Bohr's theory of complementarity.

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