CHAPTER 16
COHESION AND COHERENCE

Cohesion in a text is provided by a network of lexical, grammatical, and other relationships that provide links in the surface structure of the text. Cohesion can be evaluated objectively, but different languages use cohesive devices (reference, substitution, conjunction, lexical and syntactic cohesion, chunking of information in sentences and paragraphs) differently. Translators have to consider the adjustment of cohesive devices from the SLT to the TLT. These devices reflect rhetorical purpose and control interpretation of the text, so changes may affect both the content and the line of argument. Adjustments will mean advantages and disadvantages that will have to be judged in the light of the skopos of the translation and the TLT readers. “The topic of cohesion has always appeared to me the most useful constituent of discourse analysis or text linguistics applicable to translation” (Newmark, 1987: 295).

Coherence in a text is provided by a network of relations that underlie the surface text and organize and create the text. To a certain extent, it is subjective, and each reader will find a greater or lesser degree of coherence depending on his or her extratextual knowledge of the world. Different societies view the world differently; therefore, a network of relations that may be valid in one social context may not make sense in another. This is important for the translator who has to take into account the skopos of the text and the TLT reader’s knowledge of the world.

No text is inherently coherent or incoherent. In the end, it all depends on the receiver, and on his ability to interpret the indications present in the discourse so that, finally, he manages to understand it in a way which seems coherent to him—in a way which corresponds with his idea of what it is that makes a series of actions into an integrated whole. (Charolles, 1983: 95)
TEACHING UNIT 27. SYNTACTIC COHESION

Objectives

1. To show the importance of the repetition of syntactic and tachygraphic strategies in providing textual cohesion.

2. To find alternatives for strategies used in the SLT that do not have direct equivalents in the TL.

3. To provide insight into comparative structures in Spanish and English.

4. To show how textual coherence is achieved by the network of relations in the text, but that this coherence would be totally clear only in the context in which the text was written, the days leading up to the Gulf War. If time and place separate the TLT readers from that context, a considerable amount of explication would be needed to make the text coherent.

Tasks

1. The students are asked to analyze a short text written by a Uruguayan writer, Eduardo Galeano, just before the outbreak of the Gulf War in 1991. They are asked to identify the tachygraphic and syntactic devices that provide cohesion in the text.

2. They are asked to think of how they can preserve this cohesion when translating the text into English.

3. They are asked to list the network of references that provide textual coherence to the text.

4. They are asked to consider which implicatures would have to be explicited to make the text coherent to someone who had been marooned on a desert island from August 1990 to August 1991.

Commentary

Textual cohesion is provided by the repeated use of the question form and the subjunctive in the SLT. The inverted question mark at the front of a question in Spanish is a tachygraphical extra marker that does not exist in English. There is word play between *Para qué* (Why?) and *Para que* (So that), and most of the sentences (which are organized as a list) begin with either one or the other. This play on words is not possible in English, but most of the question words in English begin with *W*, so a cohesive effect can be achieved by starting all the sentences with *W* and trying to reinforce the effect by alliteration in the rest of the text. Word order is more fixed, therefore more repetitive, in English than in Spanish, contributing to greater cohesion. The subjunctive in Spanish has no direct equivalent in modern English and perhaps the conditional would be appropriate here instead. Another play on words
that cannot be reproduced is _Si estalla la guerra_ at the beginning of the text and _Si estalla el mundo_ at the end.

Although others may find different coherence patterns in this text, I recognize three main referential networks: (a) war and violence, (b) human rights, (c) black gold.

a) _guerra, invasión, carnicería, armamentos, guerra fría, arsenal, cuartel, crimen, suicidio, grandes potencias, Sadam, Kuwait, Bush, Panamá, Gorbachov, Lituania, Israel, palestinos, Hitler, judíos, árabes_

b) _derecho, privilegio, destino, humanidad_

c) _árabes, financien, petróleo, dos millones de dólares por minuto, vendido_

The text is based on implicatures, so any reader who did not know the background to the text would need to have it explained. What is it that Bush did to Panamá that Saddam cannot do to Kuwait?

**TASK SHEET 45. SYNTACTIC COHESION**

**Instructions**

1. This short text is very well put together; it is highly cohesive. Which tachygraphic and syntactic devices are repeated throughout the text to contribute to this cohesion?

2. Suggest ways of keeping cohesion in translating this text into English.

3. Translate the text, trying to preserve the cohesion.

4. Do the extratextual references make one or more lexical networks? List any network of references you see.

5. Imagine you are translating this text for someone who was a castaway on a desert island from August 1990 to August 1991. Which of the references would have to be explained?

_El País, 17 de enero de 1991._

**Preguntitas**

¿Y si hoy estalla la guerra?

¿Para qué?

¿Para probar que el derecho de invasión es un privilegio de las grandes potencias, y que Sadam no puede hacer a Kuwait lo que Bush hace a Panamá y Gorbachov a Lituania?

¿Para que Israel pueda seguir haciendo a los palestinos lo que Hitler hizo a los judíos?
¿Para que los árabes financien la carnicería de los árabes?
¿Para que quede claro que el petróleo no se toca?
¿O para que siga siendo imprescindible que el mundo desperdicie en armamentos dos millones de dólares por minuto, ahora que se acabó la guerra fría?
¿Y si un día de éstos, estalle o no estalle la guerra, estalla el mundo? ¿El mundo convertido en arsenal y cuartel?
¿Quién ha vendido el destino de la humanidad a un puñado de locos, codiciosos y matones?
¿Quién quedará vivo, para decir que ese crimen de ellos ha sido un suicidio nuestro?

Eduardo Galeano (escritor uruguayo)

Possible Translation

**Question Marks**

EDUARDO GALEANO

What if war broke out today?
What would it prove?
Would it prove that only the superpowers have invasion rights and that Saddam cannot do to Kuwait what Bush did to Panama and Gorbachev to Lithuania?
Would Israel be able to go on doing to the Palestinians what Hitler did to the Jews?
Would the Arabs go on paying for the slaughter of Arabs?
Would everyone understand that oil is out of bounds?
Would the world understand how important it is to go on wasting two million dollars a day on arms now that the Cold War is over?
Whether the war breaks out or not . . .
What would happen if the world, this warehouse for weapons, exploded?
Who has sold the future of mankind to a handful of greedy, murderous madmen?
Who will be left alive to weep and tell the tale of their crime, which is our suicide?
TEACHING UNIT 28. REFERENCE, CONJUNCTIONS, AND PARAGRAPHS

Objectives

1. To make students aware of the importance of reference and repetition in providing cohesion in an English text. Unlike Spanish, the English system makes very few distinctions in terms of number, gender, and verb agreement; therefore, greater attention must be paid to making references clear. Patterns of referential cohesion can be adjusted in the SLT to reflect TL preferences.

2. To make students understand that conjunctions are formal markers that signal the way the writer wants the reader to relate what is going to be said to what has been said before. English tends to use more conjunctions than does Spanish, but adjustments for translation purposes are complicated. Conjunctions reflect the rhetorical purpose of the text and control the interpretation; therefore, adjustments affect both the content and the line of argument.

3. To consider how far argument lines can be altered by adjusting conjunctions and so on. Obviously, this will depend on the skopos of the translation.

4. To consider the difference between the “orthographic” or “typographical” paragraph and the “structural” paragraph (Hatim, 1990: 120) with the suggestion that the latter should be the focus of the translator.

Tasks

1. The students are asked to list all direct references to Xenophon in the Spanish and English texts and to compare the results.

2. They are asked to do the same with the conjunctions.

3. They are asked to make an outline of the structure of both texts and decide if the “orthographical” paragraphs coincide with the “structural” paragraphs. They are asked to compare the results in Spanish and English.

4. They are asked to translate the Spanish text for British secondary-school students.

Commentary

Direct references to Xenophon are much more frequent in the English text (37) than in the Spanish text (11). This provides greater surface cohesion in the English text.

<table>
<thead>
<tr>
<th>Direct reference to subjects in English</th>
<th>Direct references to subjects in Spanish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xenophon</td>
<td>Jenofonte</td>
</tr>
<tr>
<td>Xenophon's</td>
<td>su</td>
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<tr>
<td>he</td>
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<td>his</td>
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</tbody>
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| 10                                      | 4                                        |
| 6                                       | 7                                        |
| 13                                      | 11                                       |
| 8                                       |                                         |
| 37                                      |                                         |
The English version begins with the question of the causes of the subject's exile. The main part of the text is organized around arguing the pros and cons of the different events of his life in relation to this question. And it has 15 argumentative conjunctions: therefore, nevertheless, moreover, however, rather, but, in short, and so on. The last part of the text is a brief account of the last thirty years of his life and includes 5 temporal conjunctions.

The Spanish text gives a brief chronological account of his whole life (employing 5 temporal conjunctions) and only at the end gets to the main issue: Entre las incertidumbres de su biografía, la que tiene un mayor interés por su significación es la que corresponde al momento preciso de su destierro. This last part of the text, which is the second part of a long paragraph, includes 6 argumentative conjunctions: sin embargo, desde luego, and so on.

The English text is organized in 7 “typographical” paragraphs, which correspond to the “structural” paragraphs.

The Spanish text has only 2 “typographical” paragraphs, the second of which is very long. In my opinion, this “typographical” paragraph is divided into four “structural” paragraphs: (a) Xenophon with the Ten Thousand, (b) Xenophon fighting on the side of the Spartans, (c) Xenophon as a writer in exile, (d) the most interesting question of all: why and when was he exiled? Adjustment of “typographical” paragraphs to fit “structural” paragraphs is a justifiable translation strategy in this case.

ENGLISH

First typographical paragraph
1. X. 428–354 BC
2. Therefore contemporary with Plato.
3. Wealthy family but difficult times.

Second typographical paragraph
4. Nevertheless wealth reflected in his writing (It is important to note this: his writings, not Socrates’s).

Third typographical paragraph
5. 401 left Athens
6. 399? exiled
8. Moreover, admiration for Sparta was related to oligarchic tendencies.

SPANISH

First typographical paragraph
1. ¿Nacido Atenas? ¿430 ?
2. No se sabe nada de sus primeros 30 años.
3. Sólo Diógenes describe su amistad con Sócrates. Estos años: Guerra del Peloponeso

Second typographical paragraph
4. 401 con los 10.000
5. Lideró el retorno de los Griegos (Anabasis)
6. Luego campaña en Asia Minor (Helenicas)

Third structural paragraph?
7. Años con Esparta, hasta tal punto, luchó contra Atenas.
Fourth typographical paragraph
9. However, not very interested in politics.
   Admired the old virtues (military, Sparta) but critical of Sparta in Hellenica.

Fifth typographical paragraph
10. Unpopularity related to Socrates (not only some of Socrates's circle oligarchic, but all rich men suspected).

Sixth typographical paragraph
11. In short, while in exile because of oligarchic tendencies, also pro-Sparta

Seventh typographical paragraph
12. Rest of life
13. Left Athens 401 to help Cyrus
13. Led the Ten Thousand back to Greece? (Anabasis)
14. Short period as a mercenary in Thrace
15. Fought with Sparta 399-94, however, uncertain whether fought against Athens at Coronea.
15. For the next 30 years, country gentleman.
17. Until death in Athens.

Fourth structural paragraph?
8. Luego exilio (escritor)
9. Hasta que fue a Corinto
10. En algún momento volvió a Atenas donde murió.

Fifth structural paragraph?
11. Muchas incertidumbres pero momento exacto del exilio más significativo (KEY SENTENCE).
12. Después de Coronea, regalo de Escilunte, ¿acusado de filolaconismo y traición?
13. Sin embargo, los clásicos lo relacionaron con los 10.000.
14. Desde luego, Ciro enemigo de Atenas, pero, además el momento de la muerte de Sócrates.
15. En tales circunstancias, ¿la relacionaron con Ciro y más tarde con el filolaconismo?

TASK SHEET 46. XENOPHON AND JENOFONTE

Reference and conjunctions are devices used to give a text cohesion.

Instructions
1. Compare these parallel texts about Xenophon, taken from the introductions to an English edition of his Conversations of Socrates and a Spanish edition of his
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Helénicas. List all the direct references in the English text to Xenophon, such as Xenophon, Xenophon’s life, he, his view. Now, do the same for the Spanish text.

2. Now list and identify the conjunctions or link words in the English and Spanish texts.

The main relations expressed by conjunctions are:

a) additive: and, or, also, in addition, furthermore, moreover, besides, similarly, likewise, by contrast, for instance.

b) adversative: but, yet, however, instead, on the other hand, nevertheless, at any rate, as a matter of fact.

c) causal: so, consequently, it follows, for, because, under the circumstances, for this reason.

d) temporal: then, next, after that, on another occasion, in conclusion, an hour later, finally, at last.

e) continuatives: now, of course, well, anyway, surely, after all.

3. Make a brief outline of both texts and compare the organization of the information: ordering, paragraphs, sentences, and so on. Do the “typographical” paragraphs coincide with the “structural” paragraphs?

4. Translate the Spanish text into English, making any adjustments in cohesion that you consider would help a secondary-school reader to understand the text.

Xenophon (Waterfield, 1990)

Xenophon, son of Gryllus, was born in Athens c. 428 BC and died c. 354; he was therefore an exact contemporary of Plato (429–347), the other author whose Socratic writings survive. Xenophon’s family was fairly well off, but we must take into account Athens’s stormy political history in the last decade of the fifth century, and the fact that the Peloponnesian War, which Athens eventually lost, began in 431 and ended in 404. Under such circumstances, and particularly during the formative years of one’s life, wealth does not necessarily imply security.

Nevertheless, many details of Xenophon’s life, and the topics on which he wrote, reflect the concerns of the well-to-do. He wrote, among other things, on hunting, horsemanship and cavalry command, estate management, and military history. It is important to note this right from the start, so that when we find these topics peppering Socrates’s conversations as reported by Xenophon, we avoid the temptation to think that these were Socrates’s interests and experiences rather than Xenophon’s.

In 401 Xenophon left Athens, and soon afterwards (possibly in 399) he was formally exiled. What were the reasons for this official disfavour? The last couple of years of the fifth century saw a fervent return to democracy in Athens, following the arbitrary and tyrannical rule of the Thirty Oligarchs in 404–03. Quite possibly, then, Xenophon had, or been suspected of, oligarchic
inclinations. The historian Thucydides, whom Xenophon held in great esteem, expressed admiration for the moderate oligarchy of 411, and the young Xenophon, too, may well have been impressed by this form of government. Moreover, Xenophon’s life and writings reflect an admiration for Athens’s enemy Sparta, and such admiration was often expressed by those in Athens who tended towards oligarchy.

However, it is probably more true to say that Xenophon was not particularly passionate about politics; rather, he commended the traditional virtues wherever he found them and, as a soldier, particularly the military virtues of Sparta. In his view, although Athens’s past reveals these virtues, Sparta’s present more closely conformed to his ideal. But when Sparta acted viciously, he was prepared to condemn it (*Hellenica*).

The question of Xenophon’s unpopularity in Athens cannot be separated from his association with Socrates. The duration and depth of this association can only be guessed, but it was there, and in a town as small as Athens was at the time it would have been well known. Not only were several members of Socrates’s circle overt or covert oligarchs, but they were all, without exception, members of the upper classes, which in divided political times are always suspected of seeking dominion in one way or another. And the restored democracy was to put Socrates himself to death in 399.

In short, while there are reasons to think that Xenophon was not especially committed to politics, the charges that led to his formal exile are likely to have been based on suspicions of oligarchic and pro-Spartan tendencies.

The rest of Xenophon’s life can be briefly chronicled. On leaving Athens in 401, he joined (apparently not with Socrates’s wholehearted approval) Cyrus the Younger’s expedition to wrest the Persian throne from his brother Artaxerxes. The attempt failed; Xenophon chronicles the expedition and his own part in leading—if he is to be believed—the Greek mercenary troops back to Greece in *Anabasis*. After a short period as a mercenary in Thrace, from 399 to 394 Xenophon fought for Sparta; however, it is not clear whether he actually fought against Athens in the battle of Coronea in 394. For the next thirty years he lived, with his wife and two sons, the life of a country gentleman under Spartan protection, until he returned to Athens in 365 (his exile had been repealed in 368), where he lived until his death.

**Jenofonte** (Plácido, 1989)

Jenofonte nació en Atenas, o en un distrito del Ática, hacia el año 430 a.C. De los treinta primeros años de su vida no se sabe prácticamente nada. Sólo Diógenes Laerco que lo incluye en *sus Vidas de filósofos*, cuenta la anécdota de cómo se convirtió en discípulo de Sócrates. La imagen de Jenofonte como
filósofo socrático era, según se desprende de esto, bastante predominante en la Antigüedad. Estos tuvieron que ser los años, coincidentes con la guerra del Peloponeso y sus inmediatas secuelas que desembocaron en la condena del maestro, en los que Jenofonte mantuvo contactos con él.

En el año 401 intervino activamente en la expedición de los Diez Mil, formada por soldados mercenarios para apoyar a Ciro el Joven en sus pretensiones de conseguir la realeza persa frente a su hermano Artajerjes. Ciro murió en el intento y Jenofonte regresó al mando de la expedición, lo que sirvió de motivo para la redacción del *Anábasis*. Luego se incorporó a las campañas que en la década de los 90 estaba llevando a cabo Argesilao, rey de Esparta, en Asia Menor. Serán los “Círeos” mencionados en las *Helénticas*. Y continuará su colaboración con los espartanos, hasta el punto de que en la batalla de Coronea, en el año 394, combatió de su lado frente a los tebanos y a sus propios compatriotas atenienses. Luego vivió, desterrado de su ciudad, en una finca donada por los espartanos en Escilunte, en Elide, donde escribió una buena parte de su variada obra, hasta que después de la batalla de Leuctra se trasladó a Corinto, y allí vivió un tiempo indeterminado. En algún momento regresó a Atenas, donde murió posiblemente hacia el año 354. Entre las incertidumbres de su biografía, la que tiene un mayor interés por su significación es la que corresponde al momento preciso de su destierro. La residencia en Escilunte, a continuación de la batalla de Coronea, ha llevado a atribuir el motivo del destierro a su filolaconismo, que había llegado a convertirse en auténtica traición. Sin embargo, las fuentes antiguas relacionan el hecho más bien con la expedición de los Diez Mil. Ciro había actuado, desde luego, en los últimos años de la guerra del Peloponeso, de manera hostil a los atenienses, pero, además, la expedición coincide con los momentos dramáticos de la historia ateniense que llevaron a la condena de Sócrates. En tales circunstancias, ante un sistema democrático a la defensiva, cabe la posibilidad de que la aproximación a Ciro de un individuo cercano a los círculos socráticos se haya interpretado como una forma de traición identificada más tarde con el filolaconismo.
TEACHING UNIT 29. COHESIVE REPETITION AND VARIATION

Objectives

1. To show how English has a preference for lexical repetition and pronominalization, whereas Spanish tries to avoid lexical repetition and overuse of pronouns and prefers to use synonyms, superordinates, general words, or paraphrase.

2. To show how comprehension is aided by following the anaphorical chains related to the main concepts discussed in the texts.

Tasks

1. The students are given parallel texts. The first is an extract from the second chapter of *A Brief History of Time*, by Stephen Hawking, in which he explains how Einstein's theory of relativity altered physicists' concepts of reality (time and space). The second is an extract from *El sentido histórico de la teoría de Einstein*, by José Ortega y Gasset, in which he discusses the same phenomenon. The students are asked to list the network of references to the main concepts being discussed in both texts: (a) references to physics before Einstein, (b) references to the theory of relativity, (c) references to reality (or the universe) and time/space.

2. They are asked to compare the networks and draw conclusions about the different strategies used by both writers.

3. They are asked to consider which adjustments might be made to the cohesive devices in the Spanish (SL) text in order to make it easier for the English-speaking (TL) reader.

Commentary

In the parallel biographical texts in Teaching Unit 28, there were many more direct references to the subject of the biography in the English text than in the Spanish text. It was suggested that this was due to the fact that English grammar does not give so many clues of gender, number, and so on, as does Spanish. Therefore, in English it is more important to establish reference and cohesion clearly in other ways. Lexical repetition and pronominalization are strategies used.

Anaphorical chains used by the writers as cohesive devices are essential for understanding texts of the difficulty in this unit. The translator should consider the *skopos* of the translation and decide if the variety of referential devices used in the Spanish text should be unified in the English translation in order to aid comprehension. However, the author of the Spanish text is Ortega y Gasset, and with a writer of his stature, considerable care should be taken in adjusting the SLT to TLT readers' expectations.

The referential networks show quite clearly the absence of repetition and the variety of references in the Spanish text. Ortega y Gasset was a great writer, and the
language he uses is very rich. He avoids repetition whenever possible (*tiempo* is only repeated three times in his text, whereas in Hawking’s text *time* is repeated seventeen times). Hawking writes about complicated subjects with great clarity. He does not avoid repetition (*time and space* is repeated six times in one paragraph) and he exemplifies the Anglo-Saxon virtues of sincerity, brevity, and relevance. However, we should not assume that these virtues, enshrined in the co-operative principle, are universal (Grice, 1975). Just as there are Anglo-Saxon readers who dismiss some German academic writing as “chaotic,” there are German readers who find English-language publications too “narrow” or conclude that they are not saying very much (Clyne, 1983: 43).

### SPANISH TEXT

1. **References to Physics before Einstein**

   - la mecánica clásica
   - el clásico edificio de la mecánica
   - al de Galileo y Newton
   - éstos
   - la física de Galileo y Newton relativas

2. **References to the theory of relativity**

   - la teoría de Einstein
   - su nombre propio
   - la relatividad
   - el relativismo de Einstein
   - la mecánica de Einstein
   - su física relativista
   - su relativismo
   - la física de Einstein

3. **References to reality: space/time**

   - en el espacio y el tiempo
   - duración colocación y movimiento
   - un espacio, un tiempo y un movimiento absolutos
   - éstos
   - ellos
   - éste
   - su existencia
   - noticias indirectas
   - meras apariencias
   - valores relativos

### ENGLISH TEXT

1. **References to Physics before Einstein**

   - Newton’s law of motion
   - Before 1915
   - The old idea

2. **References to the theory of relativity**

   - general relativity (2)
   - the theory of relativity (2)
   - the general theory of relativity (2)
   - this new understanding
   - the notion of a dynamic, expanding universe
   - that revolution

3. **References to reality: space/time**

   - time (3)
   - space
   - space and time (8)
   - space/time
   - absolute time (2)
   - fixed time (2)
   - a fixed arena
   - in which
   - dynamic quantities
   - universe (5)
   - a finite time (2)
esos inequívocos absolutos en el espacio
el
tiempo y la realidad
las determinaciones concretas que antes
parecían relativas, libres de la
comparación con el absoluto
las únicas que expresan la realidad
una realidad absoluta
otra realidad
aquélla
una sola realidad
ésta
la que la física positiva
aproximadamente describe
esta realidad
una realidad relativa
esta realidad relativa
la única que hay
la relativa
la realidad verdadera
la realidad absoluta
la realidad es relativa

In the story of the twins paradox, Hawking uses the following referential chain: a pair of twins, one twin (2), the first twin, they, the other, one of the twins, he (3).

TASK SHEET 47. STEPHEN HAWKING

Instructions
In this text, Stephen Hawking explains how Einstein's theory has changed our view of time and space.

Make lists of the referential networks related to the main topics of the text:

1. Pre-1915 theories of physics
2. Einstein's theory
3. The universe: space and time

STEPHEN HAWKING

A Brief History of Time

Another prediction of general relativity is that time should appear to run slower near a massive body like the earth. This is because there is a relation
between the energy of light and its frequency (that is the number of waves of light per second); the greater the energy, the higher the frequency. As light travels upward in the earth's gravitational field, it loses energy, and so its frequency goes down (This means that the distance between one wave crest and the next goes up). . . .

Newton’s laws of motion put an end to the idea of absolute position in space. The theory of relativity gets rid of absolute time. Consider a pair of twins. Suppose that one twin goes to live on the top of a mountain while the other stays at sea level. The first twin would age faster than the second. Thus, if they met again, one would be older than the other. In this case the difference in ages would be very small, but it would be much larger if one of the twins went for a long trip in a spaceship at the speed of light. When he returned, he would be much younger than if he stayed on Earth. This is known as the twins paradox, but it is a paradox only if one has the idea of absolute time at the back of one’s mind. In the theory of relativity there is no unique absolute time, but instead each individual has his own personal measure of time that depends on where he is and how he is moving.

Before 1915, space and time were thought of as a fixed arena in which events took place, but which was not affected by what happened in it. It was natural to think that space and time went on forever.

The situation, however, is quite different in the general theory of relativity. Space and time are now dynamic quantities: when a body moves, or a force acts, it affects the curvature of space and time—and in turn the structure of space-time affects the way in which bodies move and forces act. Space and time not only affect but are affected by everything that happens in the universe. Just as one cannot talk about events in the universe without the notions of space and time, so in general relativity it becomes meaningless to talk about space and time outside the limits of the universe.

In the following decades this new understanding of space and time was to revolutionize our view of the universe. The old idea of an essentially unchanging universe that could have existed, and could continue to exist, forever was replaced by the notion of a dynamic, expanding universe that seemed to have begun a finite time ago, and that might end at a finite time in the future. That revolution forms the subject of the next chapter. And years later, it was also to be the starting point for my work in theoretical physics. Roger Penrose and I showed that Einstein’s general theory of relativity implied that the universe must have a beginning and, possibly, an end.

TASK SHEET 48. ORTEGA Y GASSET

Instructions

In this text, Ortega y Gasset compares the concept of relativity in space, time, and movement in classical theories (represented by Galileo and Newton) with the concept of relativity in Einstein's theory of relativity.

1. Trace and list all references in the text to (a) the classical theories, (b) Einstein's theory, (c) space and time.

2. Compare the results with the reference system to the same concepts in the text by Stephen Hawking.

3. The text by Ortega y Gasset is going to be included in an undergraduate textbook on the history of science. Summarize the main idea of the text in one sentence.

4. Translate the text into English. Your first priority is to make the text as easy to understand as possible. Pay attention to the way you refer to the key concepts used in the text.

ORTEGA Y GASSET

El sentido histórico de la teoría de Einstein

La mecánica clásica reconoce igualmente la relatividad de todas nuestras determinaciones sobre el movimiento, por lo tanto, de toda posición en el espacio y en el tiempo que sea observable por nosotros. ¿Cómo la teoría de Einstein, que según oímos, trastorna todo el clásico edificio de la mecánica, destaca en su nombre propio, como su mayor característica, la relatividad? Este es el multiforme equívoco que conviene, ante todo deshacer. El relativismo de Einstein es estrictamente inverso al de Galileo y Newton. Para éstos, las determinaciones empíricas de duración, colocación y movimiento son relativas porque creen la existencia de un espacio, un tiempo y un movimiento absolutos. Nosotros no podemos llegar a éstos; a lo sumo, tenemos de ellos noticias indirectas (por ejemplo las fuerzas centrífugas). Pero si se cree en su existencia, todas las determinaciones que efectivamente poseemos quedarán descalificadas como meras apariencias, como valores relativos al punto de comparación que el observador ocupa. Relativismo aquí significa un defecto. La física de Galileo y Newton, diremos es relativa.

Supongamos que, por unas u otras razones, alguien cree forzoso negar la existencia de esos inasequibles absolutos en el espacio, el tiempo y la transferencia. En el mismo instante, las determinaciones concretas, que antes parecían relativas en el mal sentido de la palabra, libres de la comparación con el absoluto, se convierten en las únicas que expresan la realidad. No habrá ya una realidad absoluta (inasequible) y otra relativa en comparación
con aquélla. Habrá una sola realidad, y ésta será la que la física positiva aproximadamente describe. Ahora bien: esta realidad es la que el observador percibe desde el lugar que ocupa; por tanto, una realidad relativa. Pero como esta realidad relativa, en el supuesto que hemos tomado, es la única que hay, resultará, a la vez que la relativa, la realidad verdadera, o, lo que es igual, la realidad absoluta. Relativismo aquí no se opone a absolutismo; al contrario, se funde con éste, y lejos de sugerir un defecto de nuestro conocimiento, le otorga una validez absoluta.

Tal es el caso de la mecánica de Einstein. Su física no es relativa, sino relativista, y merced a su relativismo consigue una significación absoluta. Para la física de Einstein, nuestro conocimiento es absoluto; la realidad es relativa.