Received December 12, 1765.

XXXIV. *On the Tranfit of* Venus *in* 1769.

To the RIGHT HONOURABLE

The Earl of MORTON, Prefident,

To the COUNCIL and FELLOWS

Of the ROYAL SOCIETY,

This DISCOURSE is, with all Humility, infcribed,

By their humble Servant,

Thomas Hornfby.

Read Feb. 13, 1766.

THE obfervations of the late Tranfit of Venus, though made with all poffible care and accuracy, have not enabled us to determine with certainty the real quantity of the fun's parallax ; fince, by a comparifon of the obfervations made in feveral parts of the globe, the fun's parallax is not lefs than $8''\frac{1}{2}$, nor does it feem to exceed $10''$. From the labours of thofe gentlemen, who have

I   attempted

attempted to deduce this quantity from the theory of gravity, it fhould feem that the earth performs its annual revolution round the fun at a greater diftance than is generally imagined: fince Mr. Profeffor Stewart has determined the fun's parallax to be only 6″, 9, and Mr. Mayer, the late celebrated Profeffor at Gottingen, who hath brought the lunar tables to a degree of perfection almoft unexpected, is of opinion that it cannot exceed 8″ *.

In this uncertainty, the aftronomers of the prefent age are peculiarly fortunate in being able fo foon to have recourfe to another tranfit of Venus in 1769, when, on account of that planet's north latitude, a difference in the total duration may conveniently be obferved, greater than could poffibly be obtained, or was even expected by Dr. Halley, from the laft tranfit.

The experience which we gained in the year 1761, the knowledge of the errors, from whatever caufe they may arife, which muft unavoidably be committed in obfervations of this kind, will enable us to put in practice every method of folving this problem, and to determine with what degree of accuracy, and within what limits, the true quantity of the fun's parallax may be obtained, and confequently the dimenfions of the whole folar fyftem.

But, before I proceed to give a computation of the effect of parallax at the feveral places where this tranfit ought to be obferved, it will be neceffary to premife the principles upon which the general calculus was

* Mr. Machin, Profeffor of Aftronomy at Grefham College, deduced the fame quantity many years ago. See a tract entitled *The Laws of the Moon's Motion according to Gravity*, p. 24.

formed.

formed. Having found, by computing the obſerva-
tions made on the tranſit in 1761, that, when the
Abbé de la Caille's ſolar tables are uſed, the epoch of
the mean motion of Venus for 1761, as given in Dr.
Halley's tables, requires a correction of $+ 52'' \frac{1}{2}$;
and that the place of the aſcending node was, at the
beginning of the ſame year, in 2ˢ. 14°. 31'. 10'':
having collected alſo, by computing the obſervations
of Mr. Horrox in 1639, with the aſſiſtance of Dr.
Halley's tables of Venus, and the ſolar tables above-
mentioned, that the motion of the planet's mean
longitude is 6ˢ. 19°. 12'. 22'', and of the node 52'.
18'', in 100 Julian years: I have ſuppoſed the mean
longitude of Venus, in the beginning of the year
1769, to be oˢ. 5°. 23'. 48'', and the place of the
node to be in 2ˢ. 14°. 35'. 21''—; and have aſſumed
the reſt of the planet's elements as given in Dr. Hal-
ley's tables. According to theſe numbers, and the
Abbé de la Caille's ſolar tables, the ecliptic conjunction
will happen on June 3d, 1769, at 9ʰ. 59'. 24''
mean time at Greenwich, the planet's geocentric lati-
tude being 10'. 13'',5 N. The log. of the earth's
diſtance from the ſun $= 5.0065166$; the log. of
Venus's diſtance from the ſun $= 4.8610947$; and
of the planet's diſtance from the earth $= 4.4606784$;
and the equation of the præceſſion of the equinoctial
points $= + 17'',7$. By computing the geocentric
longitude and latitude of the planet three hours be-
fore and three hours after the ecliptic conjunction, I
find the planet's hourly motion from the ſun in the
ecliptic $= 3'. 57'',7$; the hourly motion in the re-
lative orbit $= 4'. 0'', 3$; the hourly motion in lati-
tude $= 0'. 35'', 45$; the angle of the planet's path
with

with the ecliptic $= 8°. 29'. 02''$; the angle of the ecliptic with the equator $= 7°. 02'. 54''$; and therefore the angle made by the planet's vifible path with the equator $= 15°. 31'. 56''$. The geocentric latitude is, as has been obferved, $= 10'. 13'', 5$: and hence it is eafily determined that the leaft diftance of the centers will be $10'. 06'', 8$, and the interval between the time of the ecliptic conjunction and the middle of the tranfit $= 22'. 21''$. of time. As the planet has not yet paffed its node, the middle of the tranfit will therefore be at $10^h. 21'. 45''$ mean time at Greenwich. In every inferior conjunction the motion of Venus is retrograde, and therefore the effect of the aberration of light in long. $= 3'', 7$, when reduced to time $= 55''$, is to accelerate the feveral phafes of the tranfit; the equated mean time of the middle, therefore, will be at $10^h. 20'. 50''$. But the place of the planet is alfo affected by the aberration of light in latitude; and as Venus's latitude is decreafing, the leaft diftance of the centers will be increafed by $1'', 35$. The equated leaft diftance of the centers, therefore, will be $10'. 08''$, 15. Now, fuppofing the femi-diameter of the fun $= 15'. 45'', 6$, and of Venus $= 29''$, the femidurations, or intervals between the middle and the external and internal contacts, will be found $= 3^h. 10'. 08'', 5$, and $2^h. 51'. 13'', 2$. The equation of time is about $2'. 14''$ at the middle of the tranfit, by which quantity the apparent time is before the mean, and decreafes at the rate of about $2''$ in 6 hours. Therefore the apparent times of the feveral phafes of this tranfit for the meridian of Greenwich are as follows.

App. time.

	h	′	″
Firft external contact, June 3,	7	12	56
Total ingrefs ———— ————	7	31	52
Middle ———— ———— ———	10	23	04
Beginning of egrefs ——— ———	13	14	16
Laft contact ———— ————	13	33	11

Hitherto we have had no regard to parallax, and the above times are fuch as would be obferved from the earth's center. To the Britifh ifles, and to the neighbouring parts of the continent, the effect of parallax is nearly at a maximum, and will confiderably accelerate the times of external contact and ingrefs. If we fuppofe the fun's parallax on the day of the tranfit $= 8″,7$, the horizontal parallax of Venus from the fun will be $21″,87$; and the times of the external and internal contacts vifible in England will be accelerated by the joint effects of parallax, both in the direction of the planet's path and perpendicular to it; the former by $7′. 09″$; the latter by $7′. 12″$. And therefore Venus will be feen to touch the fun's limb at $7^h. 5′. 47″$, more than an hour before the time of fun-fet; when the apparent altitude of the planet above the horizon will be about 8 degrees: and the total ingrefs will happen at $7^h. 24′. 40″$, when the planet's altitude will exceed 5 degrees.——— If the fun's parallax fhould be one fecond larger than we have fuppofed, or $9″,7$, the time of ingrefs will happen at $7^h. 23′. 51″$.

Thefe times are not here given with any great degree of confidence: but as the errors in the planet's orbit will, in June 1769, be nearly the fame with thofe

thofe which were obferved 8 years before, it may be prefumed that the foregoing computation will be found not to differ very widely from the truth.

Having rectified the globe to the declination of the fun at the middle of the tranfit $= 22°. 26'. 40''$, and alfo at the times of the two internal contacts, I find that the whole tranfit will be vifible to a confiderable part of Swedifh Lapland, the northernmoft parts of Afia, and the northern and N. W. parts of North America; for the circle of illumination at the firft internal contact paffes along the weftern coaft of Africa from Cape Verd through the Straits of Gibraltar to Clermont in France, leaving Paris about a degree and a half to the Weft; from thence it paffes through Germany and along the Baltic Gulf, through Wibourg and Archangel, along the northern coaft of Afia; and then traverfing the N. E. parts of Siberia, it paffes over Japan, enters the great Atlantic ocean, leaves the Marian ifles and New Zealand on the Weft, and running round Cape Horn, and near Falkland ifle, paffes on to Cape Verd through the Ethiopic ocean, in a direction nearly parallel to the eaftern coaft of South America. All places fituated under the firft part of this line from Nova Zembla towards Cape Horn will fee Venus enter upon the fun at the time of fun-fetting, and at fun-rifing under the other half of it. — The circle of illumination at the beginning of egrefs enters Europe to the North of Drontheim in Norway, and croffing the Bothnic and Finland gulfs, paffes over Mufcovy and the Cafpian fea; and running through Perfia traverfes the Arabian gulf, going fouthward near the ifles of Maldivia, and taking a large circuit towards the South

Pole,

Pole, returns through Mexico, Louifiana, Canada, and the fouthern parts of Greenland, to Drontheim. So that almoft all Africa is deprived of a view of this tranfit, and a very confiderable part of Europe.

If we examine the obfervations of the tranfit in 1761, in places where there were more obfervers than one, and where the contacts were obferved when the fun was near the horizon, and at higher altitudes, we may fafely conclude that the obfervations will be made with fufficient accuracy when the fun is at fuch altitudes above the horizon, as not to be greatly affected by the vapours. At the Obfervatory at Upfal, when the fun's altitude at the ingrefs was $3\frac{1}{2}$ degrees, three obfervers differed 22″, whereas at the egrefs, when the fun was $44°\frac{1}{4}$ high, the difference amounted only to 6″. It fhould feem, therefore, that obfervers ought not to be fent to places where the fun will be much lefs than 5° high at the time of either of the contacts.

It appears by computation, that the joint effect of the parallaxes both in longitude and latitude to lengthen the total duration, will be the greateft to thofe places which are about 24° or 25° to the Eaft of Greenwich in the 66th or 67th degree of N. latitude, when the fun's altitude is about 5° at each contact, or if the fun's altitude at each contact be required $=$ 10°, the latitude of places under the fame meridian muft be 73° or 74° N. In the former cafe, this tranfit may be very advantageoufly obferved at Tornea°, Kittis, and the adjoining parts of Swedifh Lapland; in the latter, at Wardhus, and in the neighbourhood of the North Cape: for an error of one or two degrees either in longitude or latitude will make

but

but a very inconfiderable difference in the parallactic time; as will fufficiently appear from an infpection of the following Table, which contains the joint effect of the parallaxes of longitude and latitude in accelerating the times of the two internal contacts at Tornea°, Kittis, and Wardhus, for each of which places the parallactic angle, or the angle made by a vertical circle with the orbit of Venus, was carefully computed.

	Firſt intern. contact	Second intern. contact	Total effect of par. = 8″,7	Total effect of par. = 9″,7	Difference for 1″ of parallax.
	′ ′	′ ″	′ ″	′ ″	′ ″
Tornea°	6 53	4 47	+11 40	+12 58	1 18
Kittis	6 51	4 43	+11 34	+12 51	1 17
Wardhus	6 38	4 41	+11 19	+12 37	1 18

Having determined the greateſt effect of parallax in lengthening the total duration at fuch places to which obfervers may conveniently be fent, let us examine how far we may be enabled to obtain obfervations in fuch parts of the earth's furface where the effect of parallax will be contrary; and confequently where the total duration will be as fhort as poffible. By the affiftance of calculation it may be found, that in the latitude of about 54° South, and in 155° of Weft longitude nearly, the total duration will be the fhorteft, when the fun's altitude is 5°; or in about 47° of South latitude under the fame meridian, when the fun is 10° high. And accordingly, by computing the parallactic angle for the latitude of 55° South, and the meridian oppofite to that of Tornea°, I find

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that

that the total duration will be ſhortened by parallax no leſs than 12′ 53″, ſuppoſing the ſun's parallax = 8″,7. and conſequently that there might be obſerved a difference in the total duration between this place and Tornea° of 24′ 33″ : a difference conſiderably greater than was expected by Dr. Halley in 1761 ; and, ſuppoſing with that aſtronomer, that the obſervations at each contact may be taken true to a ſingle ſecond, (which indeed experience will not warrant) ſufficient to determine the ſun's parallax within $\frac{1}{750}$th part of the whole.

But as this and the other point fall in the great South ſea, where it does not certainly appear that there is any land, let us enquire in what parts of the South ſea we may reaſonably expect to find land. From the accounts of ſome of the circumnavigators, it ſhould ſeem that there are iſlands ſcattered here and there about the tropic of Capricorn, particularly the iſland or iſlands of St. Peter, in about 150° of W. longitude from Greenwich, and in about 21° of S. latitude. I have therefore computed the parallactic angle for a place 10ʰ 22′ 50″ to the Weſt of Greenwich, and in 21° of S. lat. and find that the ingreſs will happen 6′ 10″ later, and the beginning of egreſs 6′ 6″ ſooner, than if ſeen without parallax ; that the total duration is therefore ſhortened 12′ 16″ by parallax ; and conſequently that there is a difference of 23′ 56″ in the total duration between Tornea° and this iſland, ſuppoſing the ſun's parallax = 8″,7 on the day of the tranſit ; or of 26′ 39″, if that parallax be ſuppoſed = 9″,7.

About the latter end of the 16th century, Don Pedro Fernandez de Quiros made two voyages for
the

difcovery of the fouthern continent and iflands, under the patronage of the Viceroy of Peru. From feveral memorials which he prefented to the court of Spain in the year 1609, with a view to procure a fettlement of the countries he had actually difcovered, it appears that he had found many iflands, and particularly a large tract of land lying in or near the 15° of S. latitude, well peopled and well cultivated, the inhabitants generally of a peaceable difpofition. The produce of this country is reprefented to be fuch as to render it a fit object to any commercial nation; confifting of gold, filver, pearl, fpices of many forts, and fugar-canes. He defcribes feveral fafe and commodious harbours, particularly Puerto de la Vera Cruz in lat. 15° 40′ S. capable of holding 1000 fhips, with a fafe anchorage in every part; and where he himfelf actually ftaid thirty-fix days with three fhips. From the wholfomenefs of the air, the fertility of the foil, and many other cir-cumftances peculiar to this continent, he makes no fcruple to prefer it to every country which the Spa-niards had conquered whether in the E. or W. In-dies *.—I muft, however, obferve, that, if this country be 195° to the W. of London, the whole of the tranfit, in all probability, will not be vifible; as Venus will enter wholly upon the fun's difk at, or a few minutes before, the time of fun-rifing.

The Spaniards gave the name of the Iflands of Solomon to certain countries in the South feas, re-ported to be very rich in gold. They were firft dif-covered by Alvarez de Mendoza in 1527, and are fup-pofed by fome to be the very lands which were after-wards found by Fernandez de Quiros. The Spaniards

* Harris's Voyages, 2d Edit. Vol. I. p. 63.

are

are said to have had very clear and satisfactory accounts of these islands; but to have destroyed them for political reasons, by express orders from Old Spain, when Sir Francis Drake sailed into the South seas *. Their situation is not known ; and from some fruitless attempts to find them, it has been, and is still, perhaps, questioned whether there be any such islands. — Some time after the year 1720, while Capt. Betagh, Commander of the Marines on board of Capt. Shelvocke's ship, was in Peru, the discovery of these islands was again attempted, upon some fresh information, by command of the Viceroy † ; but without success : for the latitude of these islands is not even nearly known. They are, however, supposed to lie between the 10th and 20th degree of S. latitude, in about 175° of W. longitude from London, according to the best English and French maps : or, according to some geographers, these islands are only 120° to the W. of London.

Soon after the government of the Dutch in the East Indies was settled at Batavia, it was thought proper by the Dutch East-India company that an exact survey of their countries already discovered should be made and preserved. For this purpose Capt. Abel Jansen Tasman sailed from Batavia in 1642. In this voyage several lands were discovered, particularly the two islands of Amsterdam and Rotterdam, lying in 21° and 20° of S. latitude and in 173° or 174° of W. Longitude. The islanders are represented to be of a civil and peaceable dif-

* Harris's Voyages, 2d Edit. Vol. I. p. 63.
† Id. ib. p. 245.

position,

pofition, and to all appearance unacquainted with the ufe of arms; the lands well cultivated, and planted with all kinds of fruit-trees *.—Not far from thefe two iflands are nineteen or twenty more, in 17° or 18° of S. latitude, and 4° or 5° to the W. of the former.

Mr. de Chabert, in the Memoirs of the Academy of Sciences for 1757 †, has given an account of four iflands in the South fea, lying in about 10° of S. latitude, and 134° or 135° to the Weft of London, difcovered in July 1595, by Alvaro Bendano de Neyra, commander of a Spanifh fquadron of four fhips, in his fecond voyage for the difcovery of the Solomon-ifles.

" The firft and eafternmoft he named the Ifland " of Magdalene. It is about fix leagues in circuit, " with high coafts and mountains in the middle; and " is extremely well peopled. More than forty In- " dians came on board the fhip.

" To the N. W. at the diftance of about ten " leagues, lies the ifland of St. Peter, near three " leagues in circuit, and prefenting an agreeable " profpect to the eye.

" About five leagues to the S. W. of St. Peter is " another and larger ifland, named Dominica, about " fifteen leagues in circumference, well peopled, and " affording beautiful profpects.

" To the South of this ifland is St. Chriftine, near " eight leagues in circumference.

* Harris's Voyages, 2d Edit. Vol. I. p. 327.
† Memoires de l'Academie des Sciences pour 1757, p. 50.

"The whole fquadron paffed between this ifland
"and Dominica, and anchored in a very good ha-
"ven, to the Weft of St. Chriftine, in the latitude
"of 9° 30′; near which they found a rivulet of
"very fine and frefh water. The coafts of all the
"iflands feemed in general very fafe and commodi-
"ous for fhipping.

"In this harbour they found all kinds of re-
"frefhment; as fowls, hogs, fugar-canes, plan-
"tanes, cocoa nuts, and many forts of other fruits.

"They converfed with the natives of the country,
"and erected three croffes."

Befides the countries already mentioned, it fhould
feem from Mr. de Lifle's map of the fouthern he-
mifphere, that there are many iflands fituated be-
tween the parallels of 5° and 23° of South latitude
in the great Pacific Ocean; the moft remarkable of
which, together with thofe already mentioned, are
given in the following Table.

	W. Lon.	S. Lat.
Ifland of St. Peter, according to fome maps	130	18
Iflands of Mendoza	135	9½
Iflands difcovered by Quiros, 1605	138	21
Ifles des Tiburons, or Dog Ifland	141	16
Ifle Habitée	144	17
Iflands of St. Barnard	150	11
Water Ifland	151	15
Fly Ifland	153	15½
Land difcovered by Mendana	157	4
Ifle de la Belle Nation	160	12
Ifland of Jefus	162	7½
Rotterdam I.	173	20½
Amfterdam I.	174	21
Solomon Ifles	175	10
Ifland of Taumaco	177	13
Prince William Iflands	178	17
Terra Auftralis	190	15

It

It appears, I think, not only poſſible, but highly probable, that obſervers may be ſtationed in the South ſeas. I have, therefore, computed the parallactic angle for different longitudes and latitudes, anſwering to ſuch places whoſe poſitions ſeem to be moſt certainly known; the reſult of which calculations is given at one view in the following Table.

W.long.	S. lat.	Places Names.	Firſt intern. contact	Second intern. contact	Tot. eff. of par. $=8'',7$.	Difference in tot-dur. from Torneaᵒ.
			′ ″	′ ″	′ ″	′ ″
155 42	21 0	Iſland of St. Peter	6 10	6 06	12 16	23 56
135 0	9 30	Mendoza Iſles	4 31	6 49	11 20	23 00
173 0	20 30	Amſterdam and Rotterd. I.	6 19	4 42	11 01	22 41
190 0	15 0	Terra Auſtralis	5 43	3 16	8 59	20 39

By the laſt column it appears, that if an obſerver be ſtationed in any of the above places, perhaps in any part of the South ſeas where the whole tranſit is viſible, and the total duration obſerved there be compared with that at Torneaᵒ, we may obtain a difference in time from 20 to 24 minutes; which is indeed ſo conſiderable, that the ſun's true diſtance muſt be aſcertained more exactly than can poſſibly be expected from any other method.

But, if it ſhould be found impracticable to ſtation an obſerver in the South ſeas, the loſs may in a great meaſure be repaired, if the tranſit be obſerved in ſuch parts of North America where the whole is viſible. At Mexico the total ingreſs will happen when the ſun is very near the meridian; and, if the longitude of the place and the general computation may be depended upon, the beginning of egreſs will happen towards the time of ſun-ſet, when the apparent altitude of the ſun will not much exceed four degrees.

X x 2 Obſervers

Obfervers therefore fhould be ftationed farther to the
Weft about Cape Corientes; at which place and at
Mexico, though in about 20° of N. latitude, the ef-
fect of parallax will ftill be confiderable, particularly
at the egrefs, as appears from the following Table.

Places.	First internal contact.		Second internal contact.		Total effect of par. $=8'',7$.		Difference in tot. dur. from Tornea°.	
	′	″	′	″	′	″	″	″
Mexico	1	07	5	03	6	10	17	50
Cape Corientes	0	26	5	00	5	26	17	06

By comparing the obfervations to be made at either
of the above places, or in any of the neighbouring
parts, with thofe of Tornea°, a difference of more
than feventeen minutes in the total duration may
commodioufly be obtained; by which the quantity
of the fun's parallax may be determined agreeably to
the method propofed by Dr. Halley in the cafe of
the laft tranfit, and in which no error but that of the
obfervation can take place, fuppofing the fituation of
the two places to be nearly known.

When Dr. Halley's computation was examined,
and it was found that fo great a difference in the to-
tal duration of the tranfit at any two places as had
been expected could not conveniently be obtained;
another method was propofed, and was accordingly
carried into execution, viz. to ftation two obfervers
in fuch a manner that one of the internal contacts
might be obferved with the greateft difference poffible
arifing from a contrary effect of parallax at the two
places. This method, though neceffarily inadequate,

becaufe

becaufe the longitude of the two ftations muft be ri-
goroufly known, may be practifed at both contacts
in 1769.

It appears by computation that the time of the firft
internal contact in the evening is accelerated as much
as poffible by parallax in 48° 42′ of N. latitude, and
6° to the Eaft of Greenwich, at or near Nancy in
France. But this computation is framed upon a
fuppofition that the fun's center is in the very horizon:
in which circumftances no obfervation can be taken.
If the fun's altitude at the time of the contact fhould
be required equal to 5 or 10 degrees, then it will
appear that Greenwich and Dublin are ftations very
advantageous; and we have already feen that the
time of ingrefs at the former place will happen 7′ 12″
fooner than if feen from the earth's center, on
account of parallax. Indeed the effect of parallax
will be nearly the fame to every part of Great Bri-
tain. The part of the earth's furface, where the effect
of parallax upon the planet at the fame contact will
be as great as poffible in a contrary direction, when
the fun's altitude is about 5°, is in 46° of S. latitude
nearly, and in 168° or 169° of W. longitude from
London, in the great Pacific Ocean, where it does
not at prefent appear that there is any land. If, how-
ever, an obferver fhould be ftationed in any of the
iflands in the South fea, for which a computation has
already been made, even in the iflands of Mendoza,
the morning ingrefs will be found to be retarded by
parallax 4′ 31″; and confequently a difference at this
contact of 11′ 43″ may be obtained by comparing
the obfervation of the firft internal contact with the
obfervations at Greenwich; or 11′ 24″, if the fame
obfervation be compared with that at Tornea°.

In

In order to fee the beginning of egrefs accelerated by the greateft effect of parallax poffible, when the altitude of the fun is 5°, an obferver muft be ftationed in about 123° of Weft longitude from London, and in about 19° of S. latitude; or, as it does not appear at prefent that there is land there, the obferver may be ftationed with confiderable advantage either in the iflands of Mendoza, or in the ifland of St. Peter. The fame contact will be as much retarded on account of parallax to an obferver placed under the tropic of Cancer, in about 67° of E. longitude from London. This point indeed falls into the Gulf of Sindi; but as a difference of many degrees, either in longitude or latitude, will occafion but a very inconfiderable difference in parallactic time, this contact may be very advantageoufly obferved on any part of the coaft from the mouth of the Indus to Cape Comorin, and from thence along the coaft of Coromandel and Golconda as far as the mouth of the Ganges. It may naturally be expected that the end of the tranfit will, if the weather be favourable, be obferved at many of our own fettlements in thefe parts: I have therefore computed the effect of parallax at the egrefs for Madrafs and Calcutta, at which places the laft tranfit was obferved; and find that the time of the fecond internal contact will happen 6′ 41″ later on account of parallax at the former, and 6′ 44″ at the latter, than if feen from the earth's center. By comparing the obfervations made at either of the above places with the correfponding obfervation at Mexico, we may obtain a difference of 11′ 44″; a difference greater than could be obtained by any obfervations that could conveniently be made at the egrefs in the tranfit of 1761.

Upon

Upon the whole, the neceſſity of ſending an obſerver
into the South ſeas ſufficiently appears, whether it be
propoſed to determine the ſun's parallax by the dif-
ference in the total duration of the tranſit, or by the
obſervations of the internal contaĉts either at the in-
greſs or egreſs. For if there ſhould happen to be no
land in the meridian oppoſite to Tornea° and in about
21° of S. latitude ; yet if an obſerver can be ſtationed
either in the iſlands of Mendoza, or in the iſlands of
Amſterdam and Rotterdam, a difference in parallaĉtic
time will be obtained as in the following Table.

Places compared.	Difference in total duration.		Difference at ingreſs.		Difference at egreſs.	
	′	″	′	″	′	″
Tornea° and Mendoza Iſles	23	00	11	24	11	36
Tornea° and Amſterdam or Rotterdam	22	41	13	12	9	29
Tornea° & the opp. merid. in 21 S. lat.	23	56	13	03	10	53

If the ſky ſhould prove favourable, the obſervations
made at Tornea° and in any of the above places will
enable us to determine the ſun's parallax with great
preciſion, and independent of the exaĉt knowledge of
the longitude of either place. But as the ſituation of
Tornea° is perhaps very exaĉtly known, if it ſhould
be convenient to the ſouthern obſerver to continue
long enough upon his ſtation to determine the exaĉt
longitude of it, to which the ſituation of Jupiter at
that time will greatly contribute, both methods might
be praĉtiſed at the ſame time, and they would mu-
tually confirm and illuſtrate each other.

An opportunity of obſerving another tranſit of
Venus will not again offer itſelf till the year 1874.
It behoves us therefore to profit as much as poſſible

by

by the favourable fituation of Venus in 1769, when we may be affured the feveral Powers of Europe will again contend which of them fhall be moft inftrumental in contributing to the folution of this grand problem. Pofterity muft reflect with infinite regret upon their negligence or remiffnefs; becaufe the lofs cannot be repaired by the united efforts of induftry, genius, or power. How far it may be an object of attention to a commercial nation to make a fettlement in the great Pacific Ocean, or to fend out fome fhips of force with the glorious and honourable view of difcovering lands towards the South pole, is not my bufinefs to enquire. Such enterprizes, if fpeedily undertaken, might fortunately give an advantageous pofition to the aftronomer, and add a luftre to this nation, already fo eminently diftinguifhed both in arts and arms.

Oxford, December 1, 1765.

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