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From: ANDY SEDGWICK

Subject: MOON THEATRE

Date: 19.4.91

Ref/Job no: --

Total Pages:
(Including this page) 8

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Message

HUMBERT,

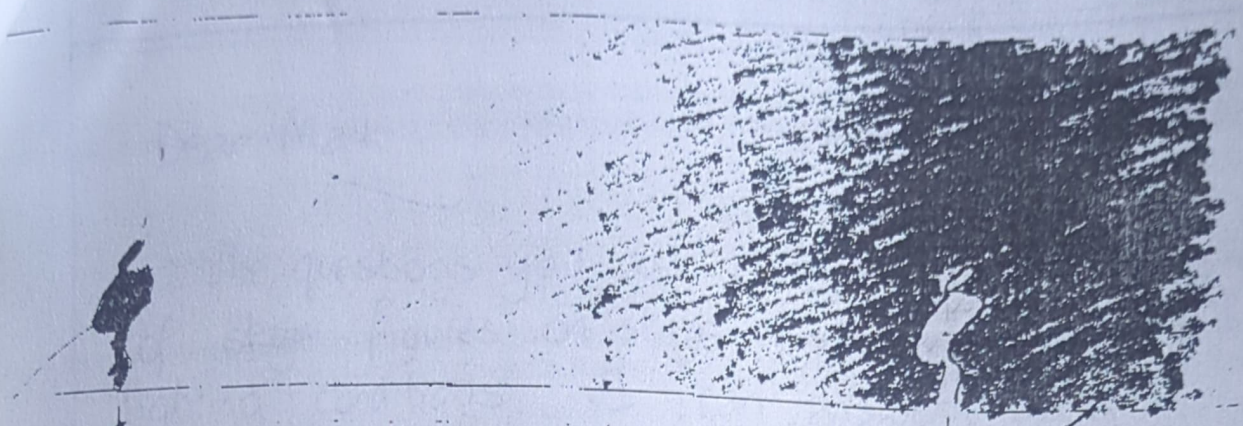
ONE OF THE STUDENTS AT PENN. STATES ASKED PETER SOME INTERESTING QUESTIONS REGARDING PERCEPTION AND LIGHT AND SHADOW - SEE THE NEXT PAGE.

I'VE ATTEMPTED TO ANSWER THESE QUESTIONS, AND IN SO DOING HAVE FOUND NEW ~~EMPIRICAL~~ EMPIRICAL WORK THAT SUGGESTS PERCEPTION IS BETTER THAN WE ORIGINALLY PREDICTED FROM THEORY. THE NEW PREDICTED LEVELS OF PERCEPTION (SEE MY ANSWERS ATTACHED) SEEM CLOSER TO THE EXPERIENCES I DESCRIBE BY EXPERIMENT.

WORK PROGRESSING ON GEOMETRY AND CONSTRUCTION OF MIRRORS - I'LL SEND AN UPDATE OF PROGRESS ON MONDAY.

BEST REGARDS, Andy.

Dark Eyes



Max. distance = 20 meters

figure in shade against full moon intensity (assumed at .25 lux)

figure illuminated to 6.25 lux against dark field

Audience member at a distance of 22 meters from the 2 figures and unshaded from direct moonlight coming from behind figure in shade

What is the audience members ability to perceive the 2 figures simultaneously?

What effect will decreasing the distance between the figures have on audience members perception? (How close can they get?) (Will producing light behind the illuminated figure allow for a closer distance?)

What effect will decreasing the distance between the figures and the audience member to 10 meters have on audience member's perception?

What effect will shading the audience member from the moonlight have on his perception?

Is 25 times moonlight intensity (.25 lux × 25 = 6.25 lux) sufficient for perception at 22 meters distance? at 10 meters?

Dear Mark,

The questions you ask concern the perception of ~~stage~~ figures on stage under different lighting conditions. I can answer these questions only in a technical sense of "what level of detail can be perceived under each condition". The full meaning of 'perception' is much greater than this - and involves some highly subjective and philosophical concepts I think.

The questions break down into two fundamental problems:

i) what is the effect of on visual acuity (perception of detail) of different foreground/background luminances (contrast)?

ii) to what degree does direct moonlight in the field of vision disturb perception?

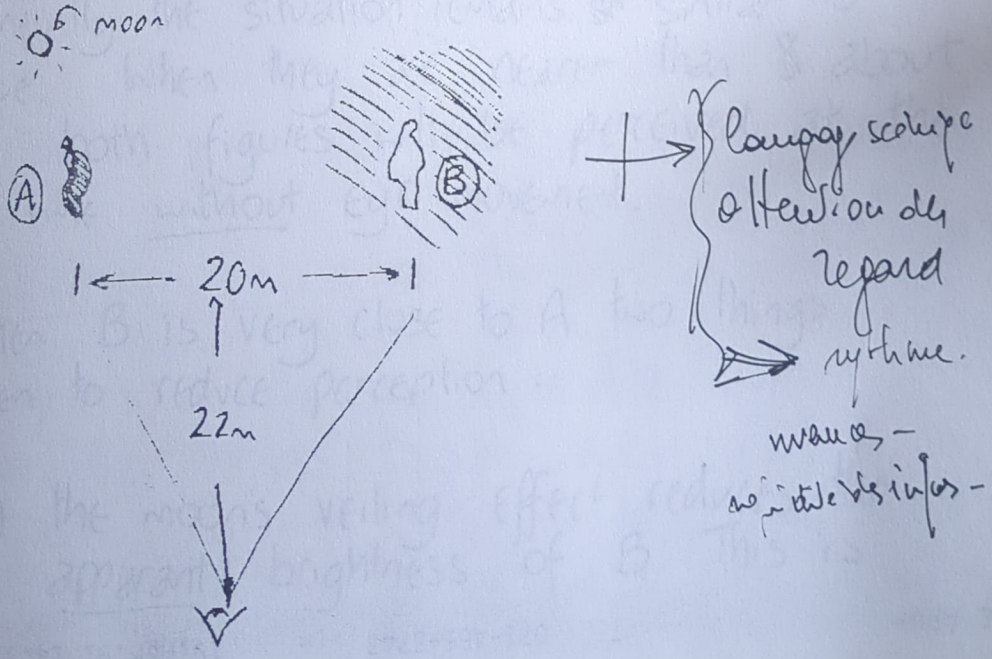
To answer these questions I have used empirical information - mainly from medical sources - regarding the functioning of the eye. In previous experiments relating to the Moon Theatre we have found that this information tends to be quite conservative - ie. we normally find we can see rather

more than the formulae predict. I think the information is based on a level of visual performance acheived by 80% of the population (with their glasses etc) - so this includes a lot of older people who suffer from greater scattering of light within the eye. What follows is therefore likely to be slightly pessimistic:

some assumptions:

costume reflectances : 50% (pale grey)
moon altitude = 15%
(lowest during performance - higher angles have lesser effect)
ground reflectance = 30% (grass)

(1)



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The viewer will be able to see both figures without moving his head, but will move his/her eyes from one figure to the other.

When looking at figure A only details of a size ~ 300 mm or greater would be perceived - the figures head would be perceived as distinct from the body, but not the nose distinct from the head. With eyes fixed on figure A one would be aware of figure B, but would not perceive any detail ~~as~~ on B unless the eyes are moved.

When looking at figure B ~~also~~ smaller details will be perceived - down to a size of about 50 mm. Figure A would probably not be noticed with eyes fixed on B.

(2) Figure B approaches A.

Generally the situation remains ~~so~~ similar to above. When they are nearer than ~~&~~ about 8 m both figures will be perceived at the same time without eye movement.

When B is very close to A two things happen to reduce perception:

i) the moon's veiling effect reduces the apparent brightness of B. This is

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only a small effect, increasing the size of minimum detail perceived by around 10%.

ii) light is scattered of B and hits A, reducing silouette effect of A. This may make A almost invisible unless there is a strong colour difference between A and the background.

I estimate that these two effects are both short-range :- when A and B are within 2 or 3 metres.

Light from behind B is to be discouraged as this would tend to reduce the contrast between B and its background.

(3) ~~With A and B~~
Decrease distance from audience to stage

With A & B 20 metres apart it would not be possible to see both by eye movement only when the audience is closer than about 18 m.

At 10 m the audience would need to move their heads through about 60° to see both. Perceived detail would be increased by a factor of about 2; ie. objects

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of size ≥ 150mm would be perceived on A, 25mm on B.

(4) Shading the audience from moonlight

This removes the veiling effect of the direct moon, so increases the apparent contrast between a figure and its background. This would mean an improvement at A from ~ 300mm to ~ 150mm in minimum size for perceivable detail.

(5) Is *25 times enough?

From my above answer (1) I would think the answer is yes. The question is more likely to be is ×5 enough?

I think this about the limit to which the empirical formulae can be put - I would have much greater confidence in real experiments - which could of course, be simulated with artificial lights until moonlight concentrators are available.

×

I hope this is of interest and perhaps some help.

Regards, Andy Sedgwick

P.S. The above work assumes night adapted eyes – an adaption period of at least ten minutes should be allowed for night vision to develop after exposure to bright lights.

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TELECOPIE

Date : 23-4-91

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Affaire: T.P.L
Objet : visite du 25/4

Nombre de pages : /
De: Alexandre GOT
Copies: A. Sadgwick

Humbert,

Je prend l'avion Paris-Montpelier IT 7483 de 19h 35 le 25 Avril.

Je reviendrai a paris par Montpelier-Paris IT6874 de 7h05 du 27 Avril.

- j'amenerai avec moi
  - 1 camescope
  - 1 cellule.
  - 1 voleur matière reflechissante.

- Andreas S. prepare à Landes un type de reflecteur a construire, probablement en contreplaqué. Avez-vous un tire fort ou un moufle (de bateau)?. A.S et Moi même allons decider du materiel necessaire.
- Dois-je me loger à l'hotel, Avez vous une adresse?
- Dois-je Louer une voiture, comment arriver chez vous? Je vous telephone