TEL. LAFAYETTE 3-8200
EXTENSION 382

JOHN A. ABBOTT, M.D.
MASSACHUSETTS GENERAL HOSPITAL
BOSTON 14, MASSACHUSETTS

Wed 1 June 55

Dear Professor Diener:-

Here are some photostated pages that you may like to have. I remember your saying that you had no reprint. In

order that I might study the papers at my leisure & have it on hand for reference, I had photostats made for myself & requested this extra set which I am sending you.

Sincerely,

John A. Ahlo

P. C. MAHALANOBIS, F.R.S.

NO. C 1643

NO. MD 81

INDIAN STATISTICAL INSTITUTE
CALCUTTA-35

7 June 1955

Dear Professor Wiener,

I received your letter on my arrival here this morning.

I am glad to know that you are now in Europe. I am asking the office of the Indian Statistical Institute to deposit two round trip fares between Geneva and Calcutta with Air India International and instruct them to issue these tickets to you from their Geneva office.

I am also requesting the Government of India to write to the Consul General for India in Geneva to issue the Indian visa and assist you in catching the Air India plane at Geneva.

I should suggest your kindly writing to the Air India International office (7, Rue de Chantepoulet, Geneva) to reserve two seats for you on the date convenient to you. This should be done at an early date as it is difficult to secure seats at short notice.

Rani and I are due to go abroad on June 14 for about a month or so. We hope to come back in good time to welcome you here.

With best wishes,

Yours sincerely,

P. C. Mahalanobis

Dr. Norbert Wiener, Ph.D.,
Massachusetts Institute of Technology,
Department of Mathematics,
Cambridge 39,
Mass.
USA.

mkg

P. C. MAHALANOBIS, F.R.S.

No. C.1643.

INDIAN STATISTICAL INSTITUTE
CALCUTTA-35

7 June 1955.

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With best wishes,

Yours sincerely,

P. C. Mahalanobis

Dr. Norbert Wiener, Ph.D.,
C/O. Mr. M. Richter,
Bahnof 1,
Heidenheim/ Brenz
Wurttemberg,
Germany.

rp.

THE COMMONWEALTH FUND
HARKNESS HOUSE
1 EAST SEVENTY-FIFTH STREET
NEW YORK 21, N. Y.
TELEPHONE: LEHIGH 5-0400

MALCOLM P. ALDRICH
PRESIDENT

DIVISION OF
INTERNATIONAL FELLOWSHIPS
E.K.WICKMAN
DIRECTOR
LANSING V. HAMMOND
ASSOCIATE
MARTHA M. ENGLISH
ASSISTANT

HARKNESS HOUSE, LONDON
35 PORTMAN SQUARE, W. 1.
TELEPHONE: WELBECK 5223

S. GORLEY PUTT
WARDEN

New York, June 8th, 1955

Dear Professor Wiener:

On a recent visit abroad I became acquainted with a young German mathematician and physicist, ~~Dr.~~ Thomas von Randow, who is living in Hamburg where he is working for the United States Information Service. I was informed that von Randow is the only individual in Germany who has become interested in cybernetics and was the only one invited from his country to attend the conference on this subject last year in Italy.

Dr. Alfred Stöhr, under whom he studied mathematics at Hamburg, though now teaching at Göttingen, assured me that von Randow has exceptional mathematical ability. I found him a very talented young man and eager for an opportunity to pursue his interests in cybernetics.

We have awarded him a Commonwealth Fund Fellowship for a year's study and travel in the United States. He would very much like to come to study with you. Would this be a possibility? I am enclosing a brief statement covering his curriculum vitae, his publications, and his proposed program of study. Von Randow tells me that while working in his present position with USIS he has continued his natural science studies and now has his doctorate thesis almost completed.

You may be interested to know that D. W. Davies, who was here on one of the Fund's Fellowships last year, has written me as follows with regard to von Bülow's 1954 article on "Mathematical Representation of Information":

> The paper on information theory certainly makes sense, though the English is a little quaint. As the writer says, the paper only gives some suggestions, and does not derive any results, nevertheless the suggestions are very interesting, and <u>might</u> lead to a new development of the theory. They are not along the lines of ordinary information theory at all, but form a new approach.

I shall be very glad to hear from you.

Sincerely,

E.K. Wickman

Professor Norbert Wiener
Department of Mathematics
Massachusetts Institute of Technology
Cambridge, Massachusetts
EKW:BM

[anz 6/10/55]

EXCERPTS FROM APPLICATION FOR COMMONWEALTH FUND CONTINENTAL FELLOWSHIP

Name	von RANDOW, Thomas
Address	Hallerstrasse 20, Hamburg 13, Germany
Born	December 26, 1921; Breslau, Germany
Nationality	German
Marital status	Married; children 13, 9, 2
University	1942-45 Universität Berlin, Diplom Mathematiker 1945-48 Universität Hamburg Studies in mathematics, physics, psychology, philosophy
Career	1941 war service 1942-43 Various jobs as a student such as taxi driver, worker in a watch factory, librarian in the university library, journalist 1943-45 Student-assistant at Mathematisches Institut, Berlin 1945-48 Assistant at Mathematisches Seminar, Hamburg (attached to Prof. Zassenhaus 1948-49 Mathematician for a Hamburg life insurance company (temporary work for the purpose to establish the procedure how to handle life insurances after the change of German currency) 1949-50 Dozent at Volkhochschule, Hamburg Since 1950 Programming assistant and later Assistant Program Supervisor at the U. S. Information Center, USIS, Hamburg
Publications	1945 "Über die Darstellung einfacher Gruppen," Einzelschriften des Mathematischen Instituts, Berlin 1954 "Mathematical Representation of Information" Consiglio Nazionale delle Ricerche, Roma
Fellowship program in the U. S.	I would like to read cybernetics, especially information theory, communication engineering, and courses in mathematical cybernetics. Besides that I would appreciate having the opportunity to work with a research laboratory and, if possible, to graduate in this field.

June 10, 1955

Mr. E.K. Wickman, Director
The Commonwealth Fund
Harkness House
1 East seventy-fifth St.
New York 21, N.Y.

Dear Mr. Wickman:

I have your letter of June 8 addressed to Professor Wiener concerning Thomas von Randow.

Professor and Mrs. Wiener have left for an extended trip to Europe, India and Japan and will not return to this country until September of 1956 so it will be impossible for Mr. von Randow to work with Professor Wiener next year. If he is interested in the following year I suggest that you get in touch with Professor Wiener some time later.

Very sincerely yours,

Ruth S. Goodwin
Secretary

Perhaps you'd like to look this man up when you're in Germany.
R.G.

[ans 7/6/55]

BOSTON UNIVERSITY
COLLEGE OF LIBERAL ARTS
725 COMMONWEALTH AVENUE
BOSTON 15, MASSACHUSETTS

June 13, 1955

Professor Norbert Wiener
c/o Professor C. L. Pekeris
Weizmann Institute of Science
Department of Applied Mathematics
Rehovoth, Israel

Dear Norbert:

I am sending under separate cover a copy of our recently completed paper on the measurement process according to our theory. It is ready for publication and awaits only your approval.

I would suggest sending it to the Physical Review. It is so short compared to the previous one that I would not anticipate any difficulty with the editorial board. One advantage of printing it in the Phys. Rev. is that it would call our Nuovo Cimento article to the attention of many people who might otherwise have missed it.

Sam Rankin and I spent a good deal of time with Unger up to his recent departure for Princeton. I hope he got what he needed from us; our discussions certainly seemed rich and we enjoyed them too.

Please give Margaret our best wishes. We and the children certainly enjoyed her card from shipboard -- I must say it puts to shame the usual efforts of traveling postcard writers.

We are all well, and trust you are the same.

Sincerely,

Armand

Letter answered
July 27

Department of HEALTH, EDUCATION, AND WELFARE • Public Health Service
National Institutes of Health • Bethesda 14, Md.
Building 10, Room 2N310

NATIONAL INSTITUTE OF ARTHRITIS AND METABOLIC DISEASES
NATIONAL CANCER INSTITUTE
NATIONAL INSTITUTE OF DENTAL RESEARCH
NATIONAL HEART INSTITUTE
NATIONAL INSTITUTE OF MENTAL HEALTH
NATIONAL MICROBIOLOGICAL INSTITUTE
NATIONAL INSTITUTE OF NEUROLOGICAL DISEASES AND BLINDNESS
THE CLINICAL CENTER
DIVISION OF RESEARCH GRANTS

June 23, 1955

Dr. Norbert Wiener
Massachusetts Institute of Technology
Cambridge 39, Massachusetts

Dear Dr. Wiener:

A great deal of the emphasis in mental health has been upon the detection, treatment, or confinement of behavior deviants. However, there has been a growing belief that this approach is inefficient. A preventive approach should be more effective and economical. One such approach is the control of the physical surroundings in which individuals mature and act. In other words if laws governing the use of space, and the consequences of such use, were known, it would be possible to recommend ameliorative courses of action.

As an experimental animal ecologist I have been working on the principles governing the utilization of space, and upon the consequences to the group of habitation in differently structured environments. Dr. Leonard Duhl, a psychiatrist here, is concerning himself with the interrelationship between mental health and the physical structures in which human communities exist. Together we have seen the need for more effective communication between a wide range of research fields which can contribute to an understanding of the space problem. More exact statement of problems and principles are also needed. These also need to be stated in such ways as to be of use to such action groups as architects, community planners, etc.

Our initial intent was to organize a symposium to be held in conjunction with the Atlanta AAAS meeting. An outline of the proposed range of subject matter or points of view is attached. The advice given by several persons whom we have contacted was that such a symposium at this time would be premature because of difficulties inherent in communication between participants with such widely diverse frames of reference and technical language.

Although our ideas are still quite fluid, we have decided to take the following steps:

1. Determine who might make significant contributions in each of the topics listed in the outline, and which ones of these persons are willing to attempt such a contribution.

Answered July 28
in the negative

2. Invite small groups (5-10 persons) for a day or two of informal discussion. Each of the four major topic areas will be represented by groups meeting at separate times.

3. A representative of each of these groups working with Dr. Duhl and me will then plan for the most effective way of organizing such a symposium and securing publication of contributions.

I do not know what interest you may have in this general topic. One thing is certain, there is great need for more rigorous formulation of concepts covered within the topic outline as dynamic systems which operate according to stateable laws. We will be most happy if you will consider participating or if you will suggest some others who might be interested. In contacting you we are really searching for two things. First, we wish contributions to specific topics. Second, we would like someone to perform the following task. Many of the contributions will be disconnected in relation to other contributions. Furthermore some will represent empirical operational procedures. After all presentations are through and all contributions at hand, we would like some one to examine them and attempt such synthetic formulations and projections as seem justified.

Any comments which will facilitate formulation of our presently nebulous plans will be appreciated.

Yours sincerely,

John B. Calhoun

John B. Calhoun
National Institute of Mental Health

Room 20 - B - 102
M.I.T.
Cambridge, Mass.
June 24, 1955

Dear Professor Wiener:

I am sure that you and your wife have enjoyed every day of the month and a half which has elapsed since the start of your journey. We in Professor Lee's group often think about you and the many people and places you are visiting on your busy schedule in Europe. We all send you our best wishes for a most enjoyable journey.

We are continuing research along the lines of your work, in which interest is constantly increasing. During your last week at M.I.T. we discussed a suggested method for obtaining an optimum nonlinear filter. You expressed a desire to look into the method for possible pitfalls and asked me to write it up for you. In the following pages I shall describe the method. I am very enthusiastic about it, since it is the first general approach to the nonlinear filter problem, made possible by your general theory of nonlinear system classification and synthesis.

Let us consider your method of characterization and synthesis of nonlinear systems and see how it can be used in the optimum filter problem. Your theory of nonlinear systems provides a method for characterizing nonlinear systems independent of their input and a method for synthesizing the systems from their characterizing parameters. The synthesis from the characterizing parameters is accomplished by specifying the parameters A_α through A_γ in a system of the general form shown in Figure 1. The general system of Fig. 1 is capable of producing an output $y(t)$ which is an arbitrary function of the past of the input $X(t)$ with the restriction that the output becomes less and less dependent upon the remote past of the input and that the output is continuous with respect to the input.

Knowing the form of the general nonlinear system (Fig. 1) we now have the problem of determining the parameters $A_\alpha, A_\beta, \cdots, A_\gamma$ of this general form for the optimum filter. In determining these parameters we shall make use of your procedure for the classification of nonlinear systems illustrated by the block diagram of Figure 2. The parameters $A_\alpha, \cdots, A_\gamma$

which classify the nonlinear system under test are obtained by averaging the product of the output of this system and the output of the Hermite polynomial generator when the system and the Laguerre network are excited by white Gaussian noise(noise with a Gaussian distribution and a flat power density spectrum). This Gaussian noise must have a flat power density spectrum in order to establish the statistical independence of the Laguerre coefficients (u_1 through u_5 of Figure 2) which in turn is necessary to provide the useful orthogonality relationship among the Hermite functions.

Let $f_i(t)$ be the given input time function and $f_d(t)$ be the desired output time function of our optimum filter. The suggested procedure for determining the optimum nonlinear filter is shown in Figure 3. The time function $f_i(t)$ is operated on by a transformation φ to yield a time function $X(t)$ with a Gaussian distribution and a flat spectrum (Brownian motion). We shall discuss the synthesis of φ presently.

The coefficients A_α through A_γ ,determined as indicated in Figure 3, correspond to the system which operates on the past of $X(t)$ to yield $f_d(t)$ with a minimum error. The error criterion is a weighted mean square; we shall state it presently). The desired optimum filter is a system which operates on $f_i(t)$ to yield $f_d(t)$ with a minimum error. It has the form shown in Figure 4. We can show that the necessary and sufficient conditions that the configuration of Fig. 4 be capable of representing the optimum filter in the general case are that the inverse of the transformation φ exist and be characterizable by your general theory. Physically we can see that this is reasonable from the point of view that no information is lost when the transformation φ is applied to $f_i(t)$ if the inverse of φ exists. From the method of synthesis of φ , discussed below, we can show that for all physical time functions $f_i(t)$ the inverse of φ exists and hence the optimum filter can always be represented as shown in Fig. 4.

SYNTHESIS OF THE SYSTEM THAT PERFORMS THE TRANSFORMATION φ

The purpose of the transformation φ is to transform the given random stationary filter input $f_i(t)$ into a time function with a Gaussian distribution and a flat power density spectrum. This transformation can be accomplished by first operating on $f_i(t)$ with a no-storage nonlinear device to change its probability distribution to a Gaussian distribution. The output of this no-storage nonlinear device is then fed into a linear network which flattens its spectrum. Since the latter network is linear it does not alter the Gaussian character of the time function on which it operates. Hence the output

of this linear network is a Gaussianly distributed time function with a flat power density spectrum. The block diagram for the synthesis of the transformation Φ is shown in Fig. 5. We shall now discuss the synthesis of the no-storage nonlinear circuit and the linear network in this order.

A) SYNTHESIS OF THE NO-STORAGE NONLINEAR CIRCUIT

As discussed in the above paragraph, the purpose of the no-storage nonlinear circuit is to transform the time function $f_i(t)$ into a time function with a Gaussian distribution. We can show that for all physical time functions $f_i(t)$ this transformation can be accomplished by a no-storage nonlinear circuit whose transfer characteristic(output vs. input) is a monotonically increasing function. An example of such a transfer characteristic is shown in Fig. 6. In this figure $X(t)$ denotes the input and $y(t)$ the output time function. From the construction in the figure it is clear that

$$P_1(x)dx = P_2(y)dy \qquad \text{Eq.(1)}$$

where $P_1(x)$ and $P_2(y)$ are the probability densities of $X(t)$ and $y(t)$ respectively. In the filter problem $P_2(y)$ is the desired Gaussian probability density and $P_1(x)$ is the probability density of the given filter input time function $f_i(t)$. Equation (1) enables us to solve for the desired monotonic transfer characteristic $y = f(x)$. This transfer characteristic is easily realized in practice by a function generator of the type described by you in your theory of nonlinear systems(a cathode ray tube with a special mask). Note that the only quantity that we must measure in order to synthesize this transfer characteristic is the probability density of the given filter input $f_i(t)$. This is easily measured. We in Professor Lee's group are now developing two types of instruments for this purpose.

B) SYNTHESIS OF THE LINEAR NETWORK WHICH FLATTENS THE POWER DENSITY SPECTRUM OF THE OUTPUT OF THE NO-STORAGE NONLINEAR DEVICE

We are only concerned with stationary random filter inputs $f_i(t)$. When the random function $f_i(t)$ is operated on by the nonlinear device described in Section A above, the result will be a random function with a Gaussian distribution. You have shown that for all physical random time functions the integral

$$\int_{-\infty}^{\infty} \frac{|\log |\Phi(\omega)||}{1+\omega^2} d\omega$$

converges and the power density spectrum is factorable into two factors, one of which is free from singularities in the upper half plane and the other is

free from singularities in the lower half plane. The factor which is free from singularities in the lower half plane can be synthesized as the transfer function of a linear network. The same is true for the reciprocal of this factor. Hence we can realize a linear network which flattens the power density spectrum of any random time function. Note that the only measurement necessary to synthesize this linear network is that of the power density spectrum of the output of the no-storage nonlinear device (Fig. 6). This measurement is easily accomplished in practice.

THE ERROR CRITERION

The optimum filter obtained by the procedure suggested in this letter is the optimum filter for a weighted mean square error criterion. Let $f_o(t)$ be the actual output of the filter and $f_d(t)$ the desired output. Then for the optimum filter the time average of the quantity

$$e^{\frac{u_1^2+\cdots+u_s^2}{2}}\left[f_d(t)-f_o(t)\right]^2$$

is a minimum. The u_j's in the exponential weighting factor are the Laguerre coefficients of the past of the filter input $f_i(t)$.

AN ALTERNATE POINT OF VIEW

The problem of finding an optimum filter as described above has an interesting alternate interpretation. In Fig. 3 we recall that the transformation φ is applied to the given filter input $f_i(t)$ to yield a time function $X(t)$ with a flat spectrum and a Gaussian distribution. Now consider the system of Fig. 7 in which $X(t)$ is imagined to be the excitation and φ^{-1} is the inverse of the transformation φ of Fig. 3. (This inverse will always exist). As shown in Fig. 7 $f_i(t)$ is the output of the circuit which performs the transformation φ^{-1}. $f_i(t)$ is then fed into an imaginary optimum filter which transforms it into the desired filter output time function $f_d(t)$. Remembering that $X(t)$ is Gaussianly distributed with a flat power density spectrum we see, by comparison of Figs. 2 and 7, that in Fig. 7 we are really classifying the imaginary system shown in dotted lines. Hence the desired optimum filter is found by cascading a system which performs the trnasformation φ with the system determined from the setup of Fig. 6. The result is shown in Fig. 4.

CONCLUDING REMARKS

The suggested experimental procedure for finding an optimum filter is shown in Fig. 3. The transformation φ can be synthesized conveniently as discussed. The resultant optimum filter has the form shown in Fig. 4. The setup of Fig. 3 can also be used to determine the optimum predictor (for the error criterion

stated) if $f_d(t)$ is replaced by $f_d(t+\alpha)$.

It is interesting to note that, in addition to determining an optimum filter, the setup of Fig. 3 enables us to construct a model of any system(not having an infinite memory) when the only information we have about the system is its excitation, which must be random, and its response time functions. Hence we can consrtuct models of systems without disturbing their normal excitations, providing these excitations are random.

I sincerely appreciate your interest in this problem and the invaluable help and inspiration you have given me during the sessions with Professor Lee last year in which you discussed your nonlinear theory. I shall be grateful for any comments, criticism or suggestions that you make concerning the material described in this letter.

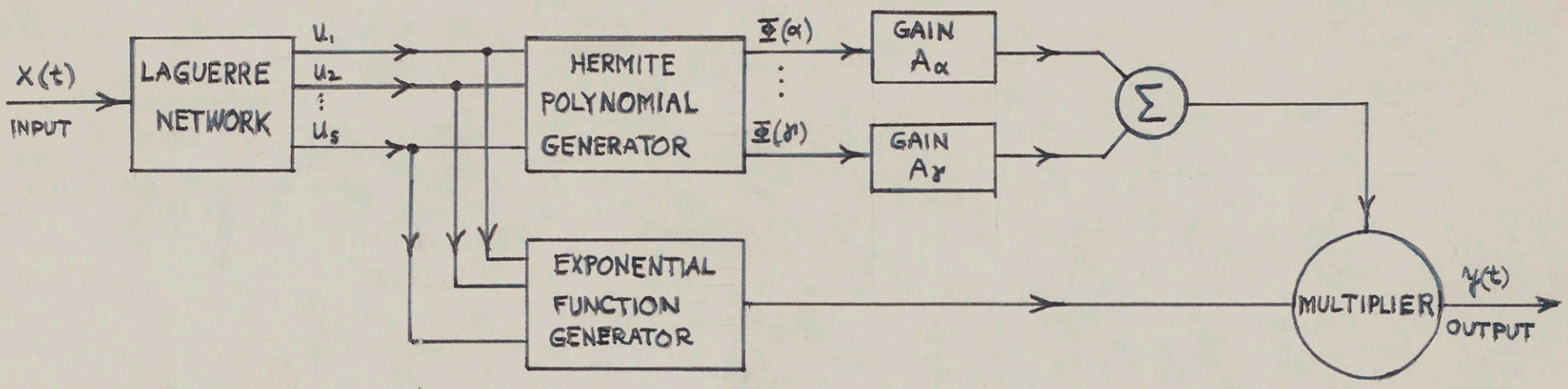
I am hoping that my trip to India will materialize next year. In the meantime I send my best wishes to you and your wife for a wonderful year of travel.

Sincerely yours,

Amar G. Bose

Amar G. Bose

AGB/sc



$$y(t) = \sum_{\alpha} A_\alpha \Phi(\alpha)\, e^{-\frac{u_1^2+\cdots+u_5^2}{2}}$$

FIGURE 1

BLOCK DIAGRAM FOR THE SYNTHESIS OF NONLINEAR SYSTEMS

BASIC EQUATIONS FOR NONLINER SYSTEM CHARACTERIZATION AND SYNTHESIS

u_j is the jth Laguerre coefficient of the past of the input

$y(t)$ is the nonlinear system output

$$y(t) = F[u_1, \cdots, u_5]$$

Making a Hermite function expansion

$$y(t) = \sum_i \sum_j \cdots \sum_h a_{i,j,\cdots,h}\, \phi_i(u_1)\, \phi_j(u_2) \cdots \phi_h(u_5)\, e^{-\frac{u_1^2+\cdots+u_5^2}{2}}$$

$$= \sum_{\alpha} A_\alpha \Phi(\alpha)\, e^{-\frac{u_1^2+\cdots+u_5^2}{2}}$$

where $\Phi(\alpha) = \phi_i(u_1)\, \phi_j(u_2) \cdots \phi_h(u_5)$

When the input to the Laguerre network is shot noise we can evaluate the parameters A_α which characterize the nonlinear system under test by use of the Ergodic Theorem. The result is

$$A_\alpha = (2\pi)^{\frac{5}{2}}\, \overline{y(t)\, \Phi(\alpha)}$$

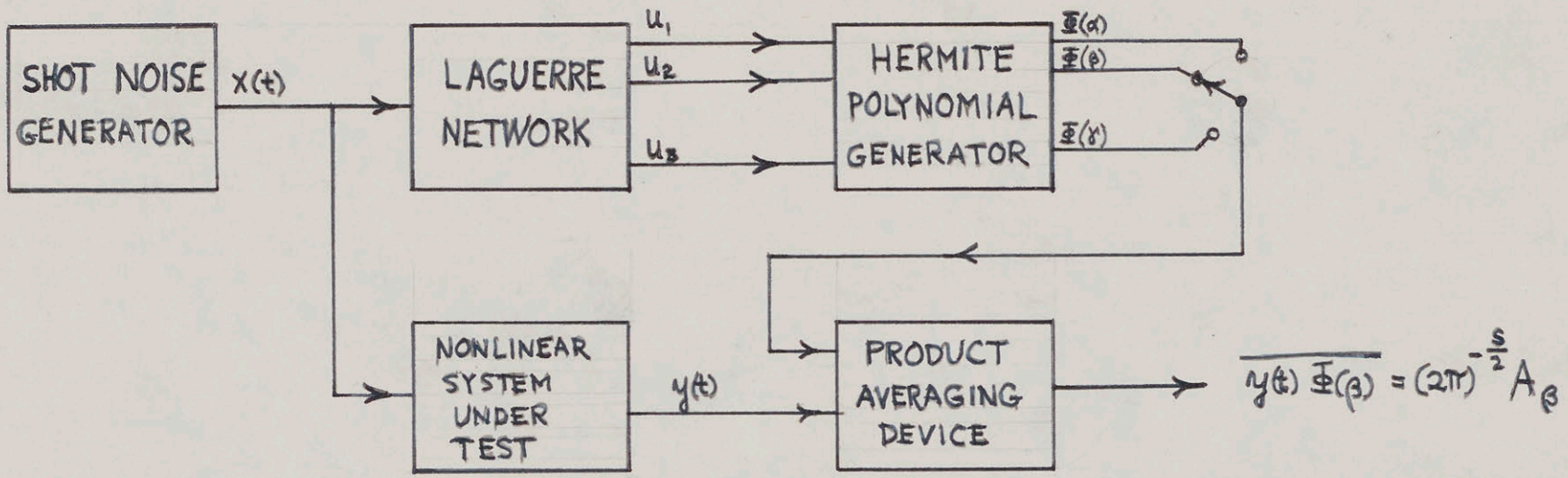


FIGURE 2

BLOCK DIAGRAM FOR THE CHARACTERIZATION OF NONLINEAR SYSTEMS

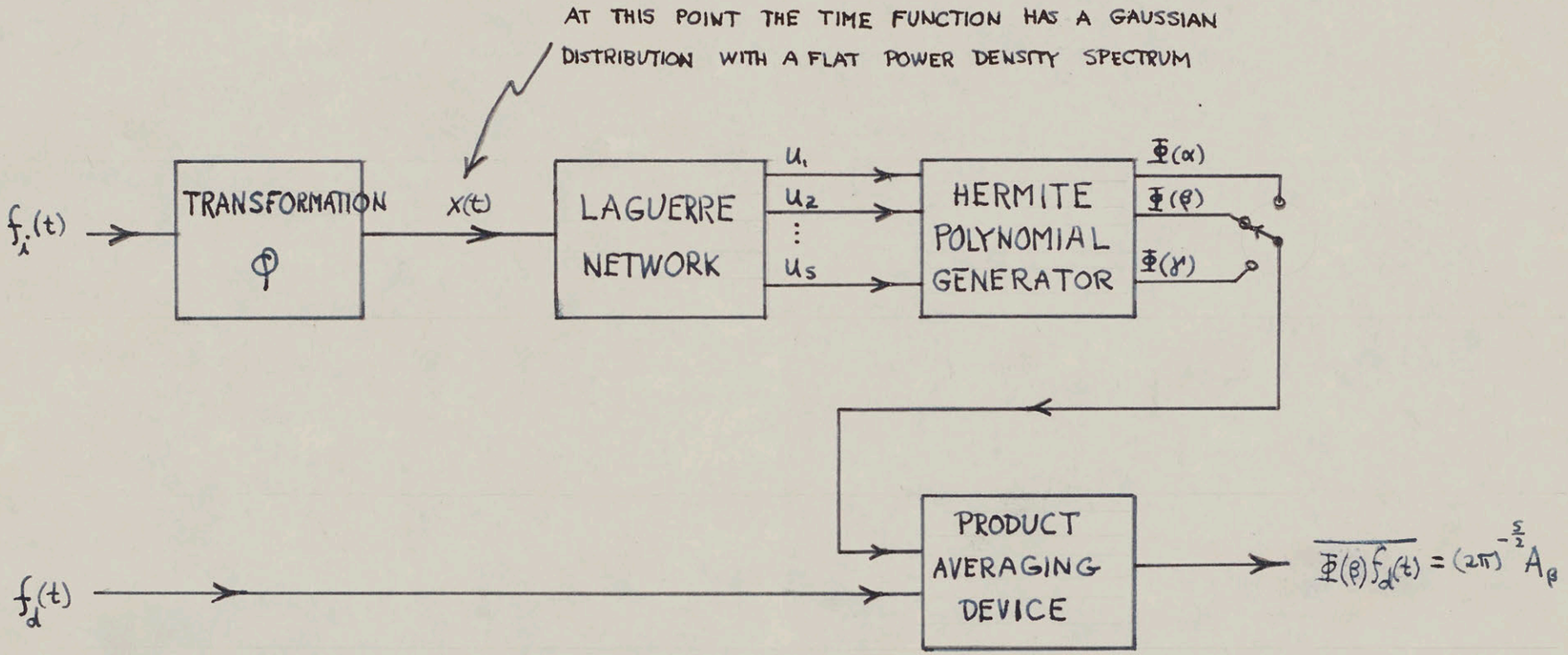


FIGURE 3

EXPERIMENTAL SETUP FOR THE DETERMINATION OF AN OPTIMUM FILTER

$f_i(t)$ is the given filter input.

$f_d(t)$ is the desired filter output

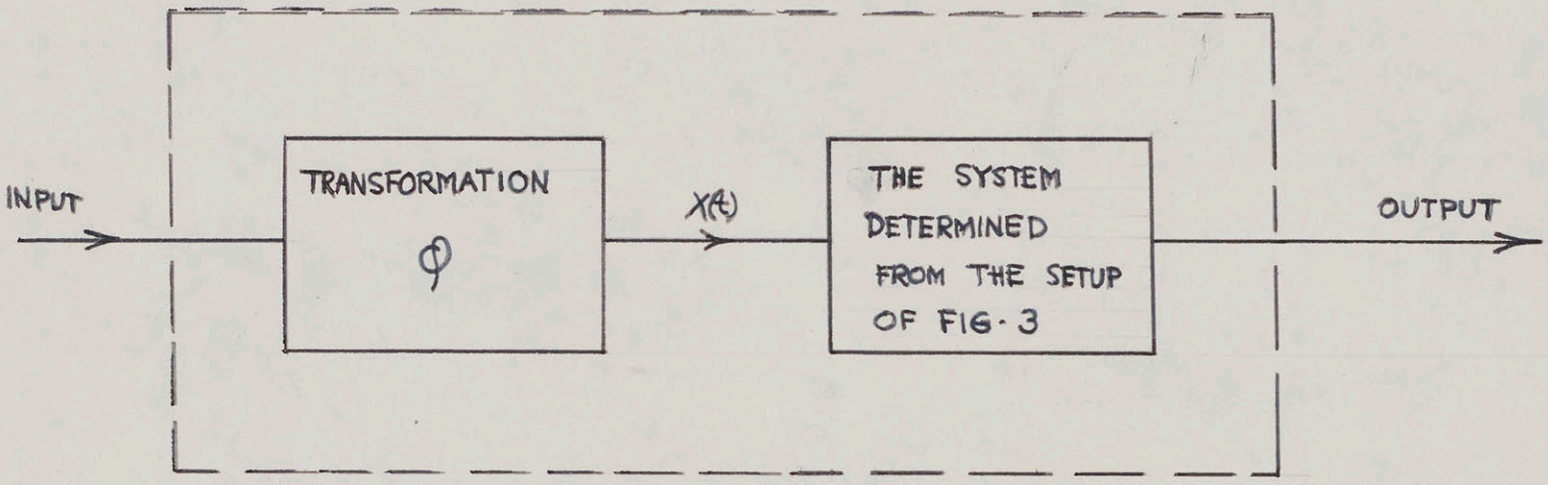


FIGURE 4

GENERAL FORM OF THE OPTIMUM NONLINEAR FILTER

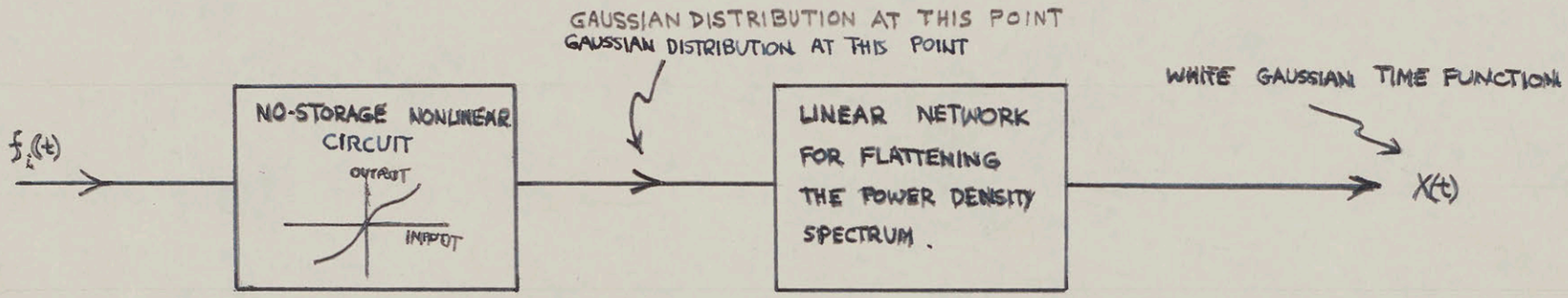


FIGURE 5

BLOCK DIAGRAM FOR THE SYNTHESIS OF THE TRANSFORMATION Φ

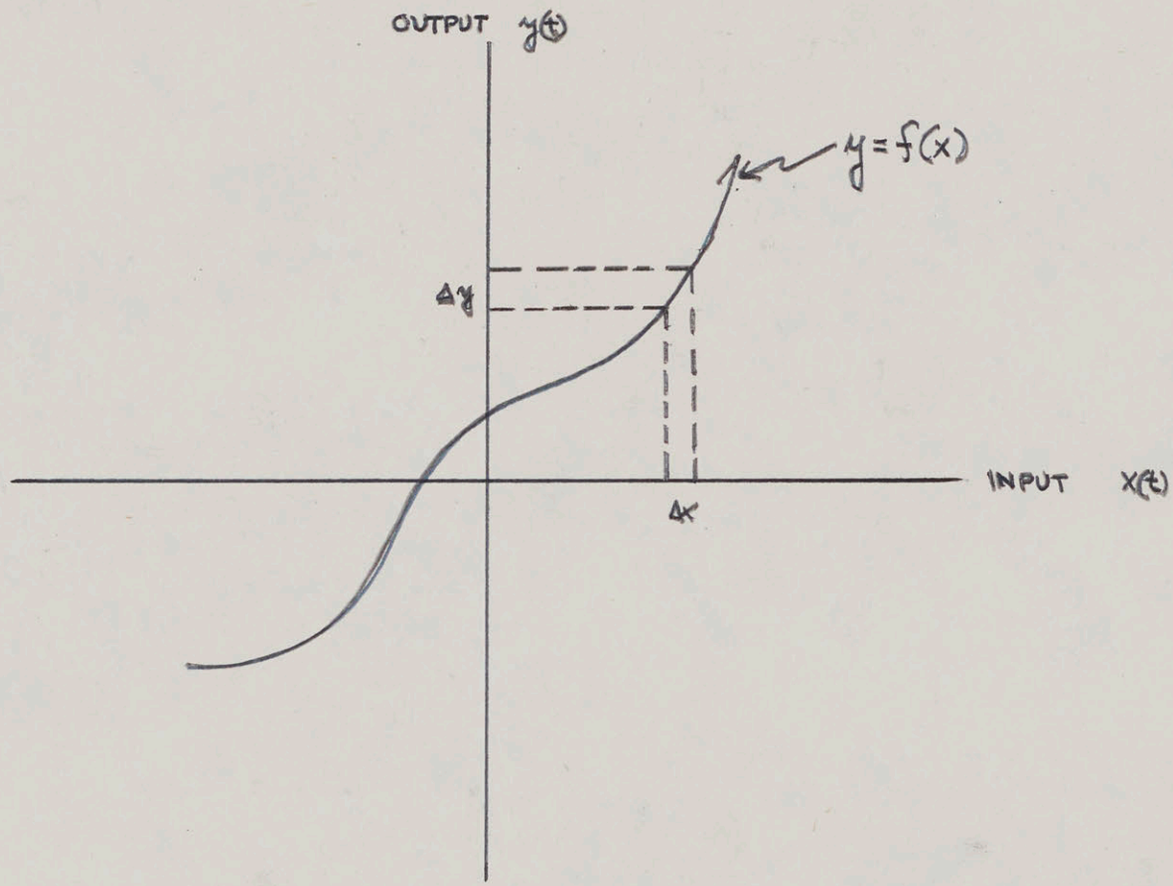


FIGURE 6

EXAMPLE OF A MONOTONIC NONLINEAR TRANSFER CHARACTERISTIC FOR THE TRANSFORMATION OF PROBABILITY DENSITIES.

$P_1(x)$ is the probability density of $X(t)$

$P_2(y)$ is the probability density of $y(t)$

From the construction in the figure it is clear that $P_1(x)\,dx = P_2(y)\,dy$.

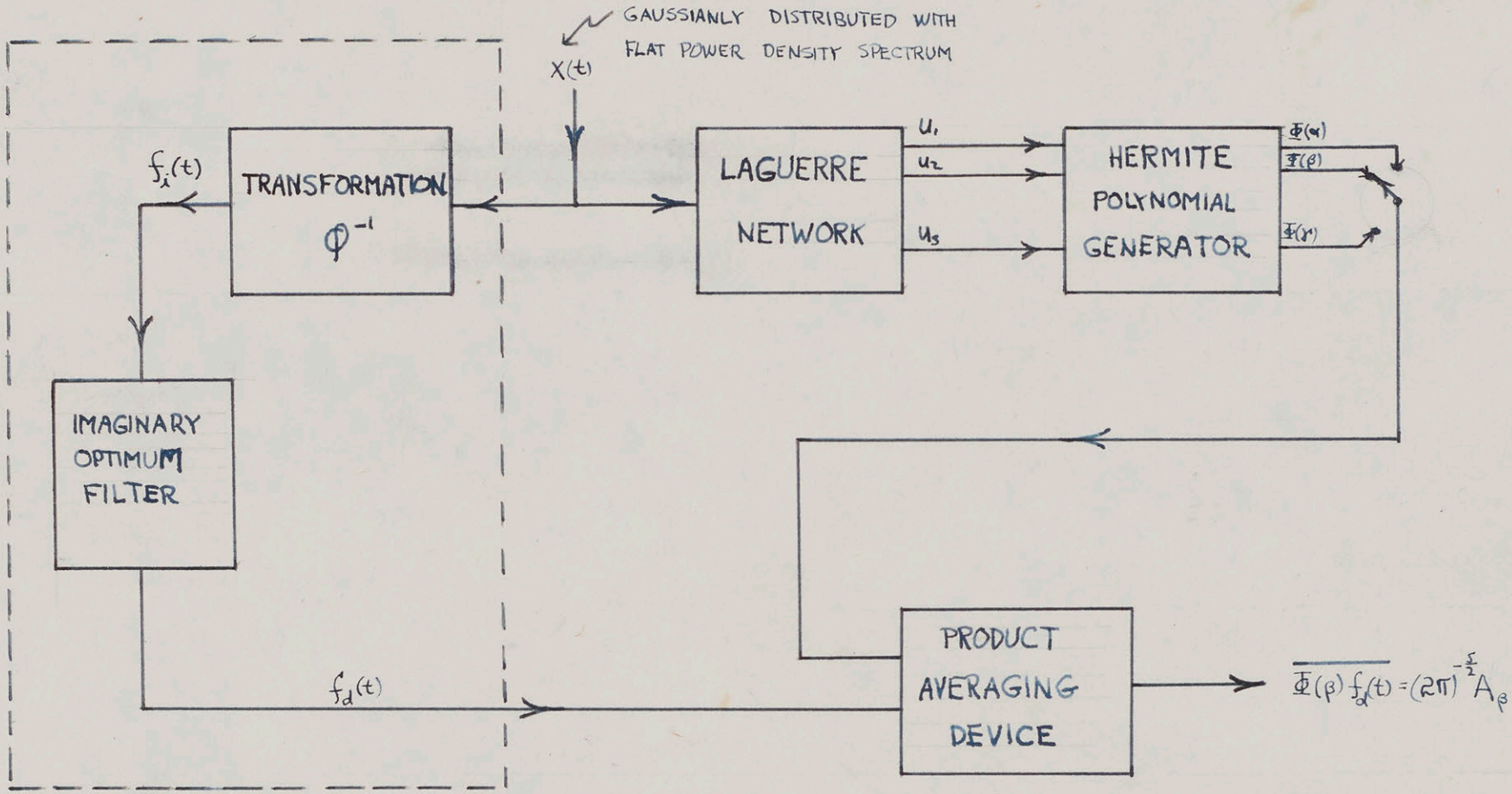


FIGURE 7
THE OPTIMUM FILTER PROBLEM VIEWED AS THE CLASSIFICATION OF A IMAGINARY SYSTEM

JOSEPH SCHLISSEL
CERTIFIED PUBLIC ACCOUNTANT
327 BEACH 67TH STREET
ARVERNE, N. Y.

NEPTUNE 4-3554

June 24, 1955

Dr. Norbert Weiner
Massachusetts Institute of Technology
Cambridge, Mass.

Dear Dr. Weiner,

I am writing this as a friend of parents who have quite a remarkable son. This boy has the fantastic faculty of 'alphabetizing' any word or group of words. By that I mean, that he puts into alphabetical order the letters of any word or phrase. For example, if he hears the phrase-'bachelor of science' he immediately says 'A*B*C*E-F-H-I-L-N-O-R-S.' Please note that although a letter may appear more than once, he says it only one time. The unexplainable part of the whole thing is that he does this instantaneously and without any thought whatever. Moreover, this is done even with words or phrases that the boy never heard before or even understands, such as technical or special words.

This young fellow is about 16 years old. He appears to be normal and average in every other respect.

This is written with the hope that you would be kind enough to suggest whether anything should be done to have this boy's unique faculty further looked into with the possibility of putting it to good use in our scientific-minded world. Perhaps certain psychological tests or interviews with qualified persons can be arranged.

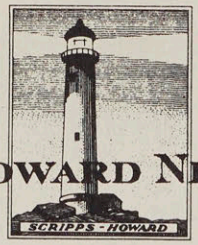
We would be most grateful for any suggestions or advice you wish to offer.

Respectfully yours,

Joseph Schlissel

Joseph Schlissel

Card sent
7-12-55



SCRIPPS-HOWARD NEWSPAPERS

DAVID DIETZ
SCIENCE EDITOR
THE CLEVELAND PRESS BUILDING
CLEVELAND 14, OHIO

June 28, 1955

Dr. Norbert Wiener
Massachusetts Institute of Technology
Cambridge, Massachusetts

Dear Dr. Wiener:

I thought you might like to see the enclosed clipping from the editorial page of The Cleveland Press of a recent article of mine dealing with your address at the University of Southampton. This article was sent to all of the Scripps-Howard Newspapers.

Perhaps I told you at some time that my daughter Patricia, after graduating from Western Reserve University, learned to operate an electro-encephalograph at the Cleveland Clinic and for more than a year did the brain wave recordings at the Cleveland City Hospital. She is now using somewhat similar equipment at the same hospital to study patients with peripheral vascular diseases.

Perhaps you have seen my new book, "Atomic Science, Bombs and Power." You will be interested to know that it has just gone into its second printing.

It has been a long time since I have seen you. Perhaps we can persuade you to visit Cleveland again one of these days.

Sincerely yours,

David Dietz

DDmg
Enc.

Letter answered July 27

DAVID DIETZ—

Electric Waves Create Clock in Brain

A new electronic brain is being used to analyze human brain waves in a joint project of Massachusetts Institute of Technology and the Massachusetts General Hospital.

For several decades now scientists have been recording the electric waves of the human brain with the aid of an electronic device known as the electro-encephalograph.

These brain waves have been used to diagnose such conditions as epilepsy and to locate brain tumors. It has been felt, however, that they concealed far more information than medical scientists are yet able to recognize.

One of the difficulties of analyzing brain waves has been their great complexity and their shifting patterns.

The new device, a very special type of electronic computing machine known as an analog correlator, automatically analyzes the brain waves which have been recorded on a moving tape in the ordinary way.

By automatically comparing brain waves in one short interval of time with those which preceded them, the computer shows a time sequence of brain wave activity.

Researches with the new device were described earlier this month in a lecture at the University of Southampton, England, by Dr. Norbert Wiener of M.I.T., who pioneered in the development of new types of electronic brains during World War II.

The new studies, Dr. Wiener told his British audience, makes it possible to describe the rhythmic brain waves as "an accurate clock in the brain of man, a clock of good consistency, beating about 10 times per second and keeping phase with itself for perhaps hundreds of seconds.

"Clocking is both a useful and recognized phenomenon in many mechanical control machines," Dr. Wiener continued, "and it seems likely to be equally essential in the control machine of the brain. Here we think it may have something to do with the human being's intelligence and organized functioning."

The clock-like signals are found combined with a great number of tiny random electrical impulses. The contribution of the new machine at M.I.T. has been to sort automatically this random activity in order to get at such consistent signals as those which Dr. Wiener described.

In some individuals, he said, these minute but precise electrical signals "stand out with utmost clarity and persistence, continuing at about a constant level for what we know to be as much as 15 seconds."

However, in other cases, this time signal is not so clear or persistent. At the present time, it is not possible to say what this difference means.

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Paris, le 28 Juin 1955

Monsieur Norbert WIENER

Monsieur,

Nous avons l'honneur de vous donner ci-dessous le Relevé de vos droits d'auteur sur vos ouvrages vendus, comptes arrêtés au 31 Décembre 1954, et dont détail suit :

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Veuillez agréer, Monsieur, l'assurance de nos sentiments distingués .

Paris, June 30, 1955

Dear Professor Mahalanobis.

I have received your letter of June 7 in which you tell me how to get our tickets to India.

We have already obtained our visas for India from Washington before leaving the United States. We have gone to the Air India Office here in Paris and they are already reserving the seats for early in September. At the same time we obtained other relevant information, for instance, the amount of baggage allowed. Even with reducing our baggage to the minimum, we find it impossible to reduce it to the 44 pounds allowed in tourist class. for the period of our stay in India. Would you please advise us what you are prepared to do about this.

The negotiations with Japan are far enough along now to enable us to say that sometime next April we shall leave India for Japan. Therefor would you still want us to apply for a return trip ticket, Geneva-Calcutta-Geneva, with the return part to be converted to a ticket to Tokyo(in India which, by the way is about three hundred rupees less) or should we apply for a one way ticket, Geneva-Tokyo? now?

As the plane to Calcutta makes a stop in Bombay, would you think it desirable for me to stop over for a few days to renew my contacts there? My lectures in England and Israel are behind me, and I expect to spend July and August in or near

in or near Germany, Our forwarding address there is:

i/c M. Richter Bahnhof 1

Heidenheim/Brenz, Wurttemberg, Germany.

With best wishes to you and Mrs. Mahalanobis, I remain

sincerely,