We Now Assume the following Model:

We have a pari-mutual machine which operates in the following manner: It selects (uniformly) one of the $N$ states ($X_i$) and posts it.

It then selects a number $Q$ uniformly from which gives the "odds" that $X_i$ really obtains.

A player then has the choice of either Betting $\frac{1}{Q}$ on $X_i$, or refraining from betting. If he elects to bet, then he wins amount $\left(\frac{1}{Q} - 1\right)$ is $X_i$ actually obtains and forfeits his dollar otherwise. If he pays $\frac{1}{Q}$ for ticket, gets value $\frac{1}{Q}$ if he wins, 0 otherwise.

We now assume that the individual possesses a subjective Prob. $\bar{P}_i$ which indicates to him the Prob. that $X_i$ actually obtains.
Then in this case he will clearly act if and only if \( P_i > Q \) (in case the \( i \)th alternative is announced with "odds" \( Q \)) since in this case his expectation is

\[
\frac{P_i}{Q} - 1
\]

Now his A priori expectation on the \( i \)th event (before the odds are posted) is clearly

\[
\text{Exp}_i = \int_0^\infty \left[ \frac{P_i}{Q} - 1 \right] dQ
\]

\[
= P_i \ln \left[ \frac{P_i}{Q} \right] - (P_i - \varepsilon)
\]

\[
= P_i \ln \frac{P_i}{\varepsilon} - P_i \ln \varepsilon - P_i + \varepsilon
\]

since \( Q \) is chosen uniform over \([\varepsilon, 1]\)
finally, since the event itself is chosen uniformly after the set \[ X_i \] 
the overall A-priori Expectation of the Player is:

\[
Ex = \frac{1}{N} \sum_i \text{Exp}_{i} = \frac{1}{N} \left[ \sum_i P_i \ln P_i - \sum_i P_i \ln 3 - \sum_i P_i + \sum_i \right] 
\]

\[
= \frac{1}{N} \left[ \sum_i P_i \ln P_i - \ln 3 - 1 + N3 \right] 
\]

If model changed slightly so he is free 
on each alternative, then he is free to bet 
on not on any more adventures, and his 
Expectation is:

\[
\frac{\sum_i P_i \ln P_i}{\sum_i} - \ln 3 - 1 + N3 \uparrow \text{const.}
\]

so that in this model his Expectation he would be willing
is directly his information and to pay eliminates 
dollars for some of costs
Further note \( N \varepsilon - 1 - \ln N \varepsilon \) is always \( > 0 \) for \( \varepsilon \leq 1 \)

(since his expectation \( \exp_i > 0 \) \( \Rightarrow \) not necessarily)

but \( \sum_i \rho_i \ln \rho_i = \ln \varepsilon - 1 + N \varepsilon \)

\[ \geq - \ln N - \ln \varepsilon - 1 + N \varepsilon \]

\[ = \ln \frac{1}{N \varepsilon} + N \varepsilon - 1 \geq 0 \]

but \( \min \) of \( x - \ln x \) goes from \( \pm \infty \) at \( 0 \)

\[ \Rightarrow 1 - \frac{1}{x} = 0 \]

\[ \frac{1}{x} = 1 \quad x = 1 \] is \( \min \)

Since we have \( -\ln x + x \geq 1 \) \( \forall x \geq 0 \)

\[ = 1 \] only \( x = 1 \)
ie, in are the cutoff \( E \) has the value \( \frac{1}{N} \) then \( \text{Expect} \ 0 \) if only if the Information minimum (uniform distribution) otherwise \( \text{Exp} \geq 0 \). 

If we consider only the information difference from that of the Uniform over these objects, we will then always have positive information from 0 to \( \log N \)

\[ I = I + \ln N \]

so that here

\[ \text{Exp} = \sum \text{phi} \cdot \ln E - 1 \cdot N \frac{3}{2} \]

\[ = I' - \ln N - \ln E + N \frac{3}{2} - 1 \]

\[ = I' + \left( N \frac{3}{2} + \ln \left( \frac{1}{N \frac{3}{2}} \right) - 1 \right) \]

\[ \text{Exp} = I' \text{ direct} \]
We can now make it an n-person game by requiring the n-players to support the bank mutually, in which case the different information of the players is a direct measure of their advantage in the game. Information can even be sold or traded in this case, with 1 bit being worth precisely 1 dollar. (provided the number of players is sufficiently large.)
In our model for differing subjective distributions, ie variable in question chosen from joint dist. $P, \ldots, q$, with various players to be told other variables.

ie. Assume $P_1$ is to be told nothing, then his subjective distribution is $P_1$ with info $I(P_1) = \sum \ln P_1$.

Suppose $P_2$ will be told the value of $\beta$, then his dist. will be $P_2 = \frac{P_2}{P_2}$, which depends upon $P$, and his information will be $\sum P_2 \ln P_2 = I_2$.

And his expected information on $\alpha$ is $\sum P_2 I_2$.

$= I_\alpha + C_\alpha \beta$

So that his advantage over $P_1$ given that he will be told the value of $\beta$ is precisely $C_\alpha \beta$ (the correlation of $\alpha$ with $\beta$).

Similarly with further players - the
advantage of a player who is informed of $\rho \varphi \delta \xi$
over one who is simply informed of $\beta \chi$.

\[
C_{\Delta \delta \xi} - C_{\Delta \rho \xi}
\]

\[
\frac{I_{\Delta \varphi \xi} - I_{\Delta \rho \xi}}{\Delta \rho \xi} = I_{\Delta \varphi \xi} - \left[ I_{\Delta \rho \xi} - I_{\Delta \rho \xi} + I_{\Delta \rho \xi} \right]
\]

\[
\frac{I_{\Delta \varphi \xi} + I_{\Delta \rho \xi} + C_{\Delta \rho \xi}}{\Delta \rho \xi} = C_{\Delta \rho \xi} - C_{\Delta \rho \xi}
\]
\[ \frac{(\alpha \beta \gamma) - (\xi \eta \zeta)}{\rho \sigma} = \frac{(\alpha \beta \gamma) - (\xi \eta \zeta)}{\rho \sigma} \]

\[ = \frac{I_{\alpha \beta \gamma} + I_{\xi \eta \zeta} - I_{\alpha \beta \gamma} - I_{\xi \eta \zeta}}{\rho \sigma} \]

\[ = \frac{I_{\alpha \beta \gamma} + I_{\xi \eta \zeta} - I_{\alpha \beta \gamma} - I_{\xi \eta \zeta}}{\rho \sigma} \]

\[ \text{Question is} \quad \frac{\alpha \beta \gamma + \xi \eta \zeta - \rho \sigma}{\xi \eta \zeta} = ? \]

\[ = \frac{\alpha \beta \gamma}{\xi \eta \zeta} \quad \text{(No)} \]
\[
\begin{align*}
&= \sum_{x, y} \ln \frac{p_{xy}}{p_x p_y} + \sum_{x, y} \ln \frac{p_{xy}}{p_x p_y} - \sum_{x, y} \ln \frac{p_{xy}}{p_x p_y} \\
&= \sum_{x, y} \ln \left( \frac{p_{xy} p_x p_y}{p_x p_y} \right) - \ln \left( \frac{p_{xy} p_x p_y}{p_x p_y} \right)
\end{align*}
\]