

Ethernomicon White Paper

Horror on the Blockchain – Crypto meets Call of Cthulhu...

Abstract:

The 'Ethernomicon' card game brings horror-based collectable card gaming to the blockchain. This paper outlines how cards are issued and covers the basic gameplay of Ethernomicon.

Other papers in the series cover gameplay implementation and the architecture of the Ethereum contracts used to support the game.

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Ethernomicon: Cards and Game

Crypto Cards for the Ethernomicon Trading Card Game

Dr Christopher Betts

August 29, 2018

Ethernomicon: Cthulhu on the Blockchain

Ethernomicon is a traditional trading card game with a twist: the actual trading cards are registered on the Ethereum blockchain, allowing gamers a convenient way to buy, sell, and trade cards.

Because the cards are published on the blockchain, they can also be reused in a variety of online card games, allowing gamers to use their cards freely – unlike other online collectable card games (such as Blizzard's Hearthstone) gamers can use their cards with any vendor, giving them the same freedom of use as physical cards, but with the convenience of online play.

A further advantage is the permanent nature of the blockchain; unlike physical cards that endure wear and tear, or an online game that may become unsupported, Ethernomicon cards will endure as long as the Ethereum blockchain.

Ethernomicon Pty Ltd is a joint venture between Chaosium Games, the makers of the "Call of Cthulhu" roleplaying game and related card and board games, and a team of blockchain developers based in Melbourne, Australia.

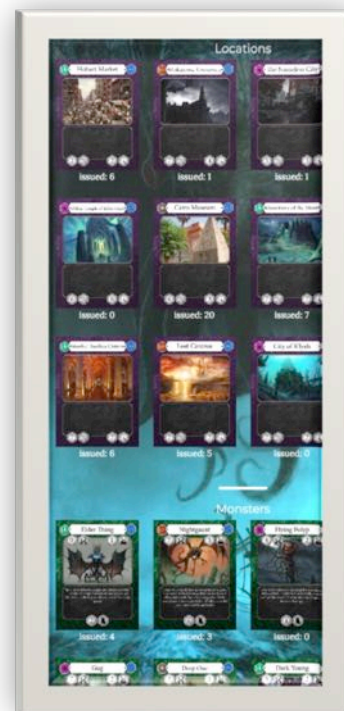
Initial On-Chain and Off-Chain Games

Ethernomicon cards can be used in a wide variety of games, including games created by third parties. Initially however we are releasing two basic games; one "on-chain" and the other a traditional web based card game.

Due to the expense of turn-by-turn play on the blockchain, the initial on-chain game requires the complete player deck of cards to be submitted in advance, with each player arranging their cards into a seven move deck that will then be played out on the chain.

There is also a web version, where players can practice the 'pre-commit' version of the game, as well as playing a more traditional turn-by-turn version. (The web based version also allows us to run variants such as 'adventure paths' without the cost of on-chain play.)

Over time, we see permanent game crypto assets of this type being part of an ecosystem where third party developers can build their own games, using the game tokens in ways we can't even anticipate at launch!



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Outline of Gameplay

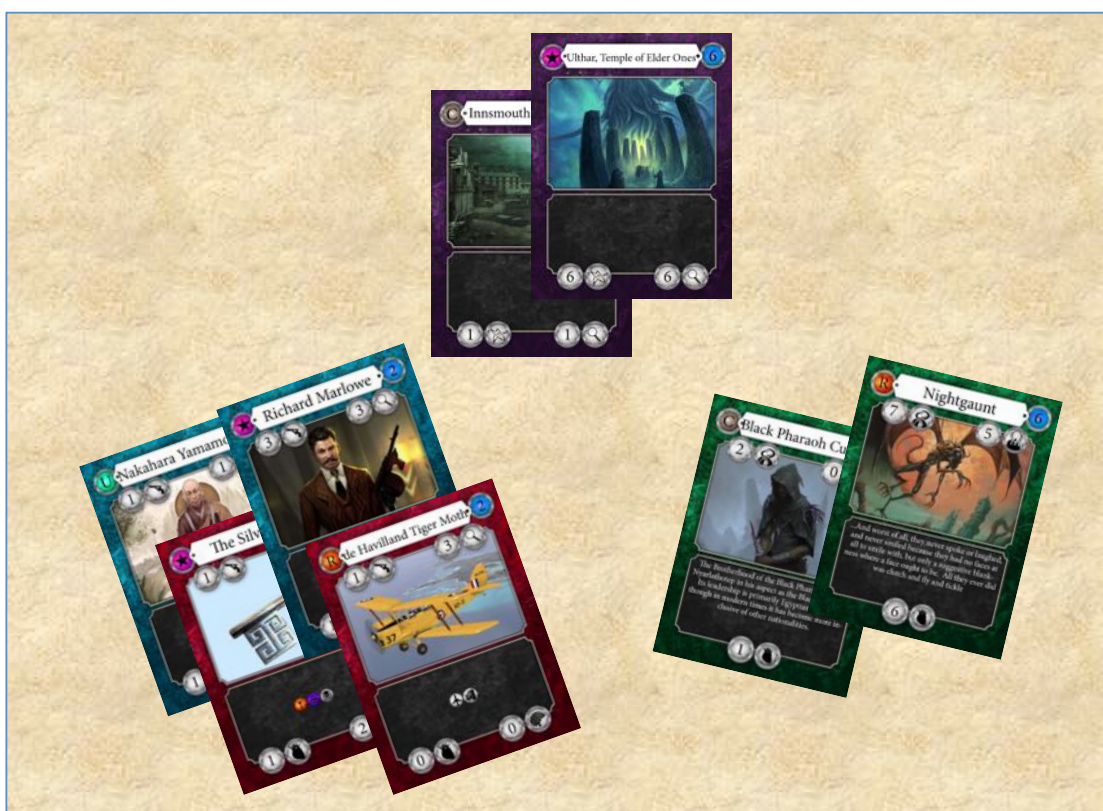
Players play as rival teams of investigators, with a deck comprised of *Locations* (and *Events*), *Monsters*, *Investigators* and various *Items* (equipment, magical tomes and so on).

Each turn a player plays a *Location* or *Event* which provides *Mythos Points*. These points are then spent to play a selection of *Monsters*, *Investigators* and *Items*. Play is then simultaneous with three phases in every turn;

1. Investigation Phase: Investigators investigate the opponents locations, reducing their "Mystery Level" – any locations that have their Mystery reduced to zero are removed.
2. Monsters Attack: *Monsters* attack *Investigators* doing sanity and health damage. Investigators who are reduced to zero health are removed, while those who are reduced to zero sanity are 'flipped' and become weak *Monsters* (cultists) for the opposing player.
3. Investigators Attack: Surviving *Investigators* attack *Monsters* doing health damage. Any *Monsters* who are reduced to zero health are removed.

The cards interact with each other via *aspects*, which allow for combinations of cards to be more powerful when well matched, with a player's *Locations* strengthening their *Monsters*, and *Items* strengthening *Investigators*.

At the end of the Game the players count the points value of their surviving cards, and the player with the most points wins!



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Details of Card Types

There are four general types of cards: locations, monsters, investigators and items, that together are used to play the game.

Locations:

Represent a place in the Cthulhu mythos. They provide "Mythos Points" which are then spent to play other cards in a given round. Some 'Locations' are temporary 'Event' cards that last a single round.



The Location card is the Foundation card for Ethernomicon, and sets the scene for every round of play. It has a '**location cost**', which is the minimum round it can be played in (e.g. a card with a 'cost' of 3 cannot be played until the third round). This mechanism paces the game, as the more powerful locations (e.g. Leng, R'lyeh, the Dreamlands) can only be played late in the game.

Each Location card also provides a certain number of '**Mythos Points**' which can be spent on playing other cards in the same round the Location is played. These Mythos points must be shared between monsters, investigators and items.

Locations have a certain '**Mystery**', representing how hard the location is to investigate or "solve". Investigators who make successful investigate rolls will reduce the 'Mystery' until it reaches zero, at which point the card is removed.

(Option: later on we may make locations 'flippable', revealing an item to be used by the opposing player. For game balance the revealed item would be less valuable than the location, however this mechanism would allow a wider range of location attribute values).

All cards have a '**rarity**' value – common, unusual, rare and ultra-rare. There are 256 types of Location, which will be issued incrementally over the game's releases.

Locations have '**aspects**' (such as 'ocean' or 'time') which provide benefits to some Monsters.

Finally, Locations are destroyed (removed from play) when an Investigator finishes Investigating them.



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Monsters:

Represent an adversary in the Cthulhu myths. They attack investigators both physically and mentally, doing health and sanity damage. Surviving investigators can counterattack.



Monster aspects may match with the location aspects in play, in which case they receive bonuses to either their physical or mental attack, depending on the precise aspects.

Monsters attack investigators using a 'dice pool' system, doing both **physical damage** and **sanity damage**. The strength of their physical and mental attack represents the number of eight-sided dice rolled; generally a result of '6', '7' or '8' equals a point of damage to the investigators health or sanity.

Monsters have **health** themselves, this is their defence against Investigator's attack.

Not all monsters will have both a physical attack and a mental attack; e.g. a cultist might have only a physical attack, while a ghost might have only a mental attack. All monsters will have a health score however.

There are 256 Types of Monsters which will be issued incrementally over the course of the game's releases.



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Investigators:

The heroes and heroines of the game, Investigators explore locations and battle monsters. Unfortunately, they frequently die or go insane. Insane investigators generally become cultists, making them a monster which is then used by the opposing player.



Investigators have four primary attributes, aside from the **rarity** and **cost** common to other cards.

Their **Attack** strength is the dice pool used to reduce a monster's health; when attacking the Investigator rolls this many 8-sided dice, with a '6', '7' or '8' representing a success.

Their **Investigate** skill is used to investigate locations, the number is the dice pool to find 'clues' to reduce the locations 'mystery' clue level.

The investigator's **Health** is used to resist the physical attacks of monsters. When it is zero, the Investigator is dead and removed from play.

The investigator's **Sanity** is used to resist the mental attacks of monsters. When it is zero, the investigator becomes *insane*, and the card is *flipped*, and the investigator becomes a cultist. The cultist has no mental attack, simply keeping the investigators existing physical attack (ignoring items), and maintaining their current health.

Investigators also have *aspects*, which may give them bonuses to particular skill when using certain Items. For example the aspect 'academic' may give an investigate bonus when using a particular book, while the aspect 'firearms' may give a bonus when using a handgun.

There are 256 Types of Investigators which will be issued incrementally over the course of the game's releases.



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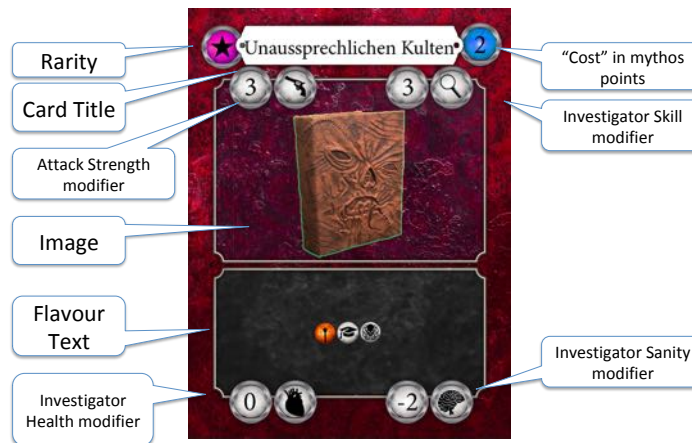
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Items:

Are weapons, magic items, rare books and other equipment that can aid investigators. They generally add to one or more of an investigators abilities, although rarely they may also subtract as well...



From a game mechanics point of view, investigators tend to cost less, and be less powerful, than monsters – however accompanied by items, and in particular items that match their own aspects, they can be quite powerful.

Items represent all the different magical and mundane objects investigators may use to help them investigate locations and overcome monsters. They generally act as a simple buff to one or more of the investigators base skills; **attack**, **investigate**, **health** and **sanity**, however some items may actually decrease a specific ability, while adding a greater bonus to other abilities (for example the terrifying magics of the Cthulhu Mythos may provide power, but at a terrible cost to sanity).

Items also have aspects, which if aligned to an Investigators aspects add bonus dice to the appropriate base skill.

There are 256 Item Types which will be issued incrementally over the course of the game's releases.

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Game Play:

Each turn players simultaneously reveals a location, which must have a 'mythos cost' equal to or less than the number of the turn. At the same time they may also play a single card of each of Investigator, Monster and Item.

They do not have to play a card of each type, and indeed may choose not to in order to concentrate on a particular strategy (e.g. a player may choose to only play an investigator, or only play a monster).

(Note that while an item can theoretically be played on its own, it has no effect, as an item only buffs the investigator it is played with.)

Play then proceeds with a number of attacks using a dice pool mechanism, where each player rolls a number of 8 sided dice, doing a point of damage on a roll of '6', '7' or '8'. This damage reduces a 'stat' of the opponent (either health, sanity or mystery), and this damage carries over from round to round.

Investigate Phase: All of a players Investigators may now investigate a location each. (In the general game players may choose their targets, in the on-chain game the order is always oldest first for both investigators and locations). Each investigator rolls their 'investigate' dice pool, adding any investigate item bonus, along with an extra die for every 'investigate' aspect they have which is matched to an aspect on their item.

Any 'success' (being a roll of '6', '7' or '8' on an 8 sided die) reduces the "Mystery" of a location by one. Investigators may not 'split' their investigation against multiple locations. When a locations 'Mystery' is reduced to zero, the Location has been fully investigated and is removed from play.

Monsters Attack: At the next phase Monsters attack Investigators in two sub-phases:

Physical Attack: Monsters may choose investigators to physically attack, rolling their attack dice pool, and any aspect bonuses from any location their owning player has, to increase their roll by one die per aspect. (In the general game players may choose their targets, in the on-chain game the order is always oldest first for both monsters and the investigators they attack). Any investigators who have their health (including item and aspect bonuses) reduced to zero or less are removed from play.

Mental Attack: Any newly played monsters that have been revealed this turn now attack the sanity of *all* investigators, rolling their sanity dice pool against every investigator. (As the investigators realise the new horror that has been revealed). Any investigators that go mad join the other player as cultists and may attack the following turn, if they survive.

Investigators Attack: Finally, Investigators attack the monsters, using their physical attack skill and any bonuses from items or aspects to form their dice pool. They attack the Monsters health, and any Monster whose health falls to zero or below is removed from the game.

Game End: Game play continues for seven rounds, at the end of which players add up the cost of their remaining cards, and the player with the most points wins.



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Blockchain Representation:

Each card is represented on the blockchain as a general type, a rarity value, and number of 'attributes', combined with a unique identifier. We also include some unique randomness or 'entropy' to allow for future expansion.

Cards combine the general attributes of their 'type' (e.g. all Deep Ones have the same basic stats) with some card specific data, such as the exact issue number of the card of each type (e.g. this is the 32nd Deep One issued) and the overall serial number of the card (this is card #122,332).

Each individual card also includes some randomness or 'entropy' – essentially some extra random numbers, currently unused - to allow for future game expansion, either by the Ethernomicon team or others. This means we may 'discover' new aspects of existing cards in future, or 3rd party developers may find new ways of describing the cards in future games.

Game play on the blockchain is handled via a 'pre-commitment' mechanism, with players submitting their hands in advance. The website shows the game playing out turn by turn, and a blockchain based smart contract then evaluates the final result after seven rounds.

Game play on the web can be more flexible, with players choosing their cards every turn, and choosing the targets of their cards during play. However the web version still tracks the ownership of cards, ensuring people can only play with cards they own.

As the game progresses, and more cards are issued, it is likely we will implement further game play options, including solo 'adventure paths' and other games. In particular, we will be evaluating how keen players are for on-chain vs off-chain play, and focussing on further development in the area where there is the most demand.

```
// we have four categories of cards
uint8 public constant LOCATION_CATEGORY = 0;
uint8 public constant MONSTER_CATEGORY = 1;
uint8 public constant INVESTIGATOR_CATEGORY = 2;
uint8 public constant ITEM_CATEGORY = 3;

// we have ten possible card attributes, but no card category has
// (all cards have a cost and a rarity however. Category is impl
uint8 public constant COST = 0;
uint8 public constant RARITY = 1;
uint8 public constant HEALTH = 2;
uint8 public constant INVESTIGATE = 3;
uint8 public constant SANITY = 4;
uint8 public constant ATTACK = 5;
uint8 public constant CULTIST_STRENGTH = 6;
uint8 public constant MENTAL_ATTACK = 7;
uint8 public constant MYTHOS_POINTS = 8;
uint8 public constant ASPECT = 9;

// a minimum pack price, below which the contract will not issue ne
uint private minimumPackPrice = 0.005 ether;

uint8 public constant MAX_CARD_TYPES = 255; // maximum number of
monster
uint8 public constant CARDS_PER_PACK = 10; // don't change this

// Lists of Card Templates
CardTemplate[] private locationTemplate;
CardTemplate[] private monsterTemplate;
CardTemplate[] private investigatorTemplate;
CardTemplate[] private itemTemplate;

// Lists of number of cards issued, for stat display and to set in
uint32[MAX_CARD_TYPES] private locationCardsIssued;
uint32[MAX_CARD_TYPES] private monsterCardsIssued;
uint32[MAX_CARD_TYPES] private investigatorCardsIssued;
uint32[MAX_CARD_TYPES] private itemCardsIssued;

// details of card releases - each release specifies a starting in
uint8[] releaseStartIndex;
uint8[] releaseRange;
```



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Card Issuance

The Card Issuance algorithm is coded into the blockchain, ensuring that there is no 'cheating' in the issuance of cards – for example the team is unable to issue particular cards to themselves (or others), all they can do is buy packs like everyone else.

The algorithm also allows us to guarantee the distribution of cards:

Card Type	Frequency
Common	70%
Uncommon	20%
Rare	9%
Ultra Rare	1%

The overall number of cards, and the number of types of cards, is hardcoded into the contract. Actual card numbers will vary slightly from an average, because the actual cards of each type are issued randomly, and because there is a random element in the issuance of rare and ultra-rare cards. When each pack of 10 cards is issued, an ultra-rare card is generated 10% of the time, determined randomly, while a rare card is generated the other 90% of the time.

Cards	Number Limit
Total Number of All Cards	4,194,304
Total Number of Cards per Category (Location, Monster, Investigator, Item)	1,048,576
Types of Card per Category	256
Total number of Card Types	1024
Common Cards (per Category)	734,003
Common Cards (of a Given Type)	11,470 (average)
Uncommon Cards (per Category)	209,715
Uncommon Cards (of a Given Type)	3,277 (average)
Rare Cards (per Category)	94,371 (average)
Rare Cards (of a Given Type)	1,474 (average)
Ultra Rare Cards (per Category)	10,486 (average)
Ultra Rare Cards (of a Given Type)	164 (average)

In addition, a small number of cards will be marked as a special 'foil' card with enhanced graphics – however this will have no game play effect.

Avoiding 'Pay to Win': Ethernomicon is designed to avoid any 'pay to win' aspect (beyond the obvious advantage that having a wide set of cards to choose from brings). Rarer cards are likely to have slightly more aspects, however gameplay is balanced to avoid this being unbalanced – good card design and strategy will be far more important.



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Auction and Trading System

We are developing two ways for users to acquire cards other than simply purchasing packs; an Auction system and a Trading system.

For the Auction system users simply list cards or decks for sale, with buyers paying in Ether (the Ethereum cryptocurrency).

However we are also building a trading system, where users can trade cards and decks directly, without paying Ether up front (although the nature of the blockchain means there will still be a small cost to transfer ownership records on the Ethereum ledger).

Release Plan

We aim to do a series of releases as we develop the game, starting with an initial release of 256 cards to allow people to play the basic game, and moving on to themed releases later on as we develop the game further. (Note that there is a lower limit to pack prices coded into the contract however, which means that new cards will not be released if the price falls below a certain threshold in Ether, and there is an absolute limit to the number of cards that can ever be issued.)

Pre-Sale: Release 10,000 packs of cards (100,000 cards) of the first 64 card types (e.g. 16 of each category – Locations, Investigators, Monsters and Items). This implies that there will be over 4,000 of each type of common card, and around 60 of each type of rare card, ensuring that there are enough of every card type to play test the basic game.

Release 1 – “Cthulhu on the Blockchain”: This will release a further 90,000 packs with another 192 cards, giving us 64 of each type of card, and a fully playable game. The cards will cover all aspects of the general Cthulhu Mythos.

Release 2 - "Dream Lands": This will issue a further 256 card types and will concentrate on the creatures and locations of the Dream Lands; Uther, Kadath, Leng...

Release 3 - "The Deep": Along with a revised game, we would issue a further 256 card types while exploring the reefs of Innsmouth, the court of Dagon, and of course the secrets of R'lyeh...

Release 4 - "Other Worlds": Another issue, this time of 192 more card types concentrating on Mythos worlds far away in Space and Time, and their inhabitants.

Final Release – “Twilight”: The last release which would complete the issuance of Game card types, is a bookend release of 64 card types and 9,430 packs, focussed on Death, Graves, and the loves of Richard Pickman...



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