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# **Probability in the Sixteenth and Seventeenth Centuries: An analysis of Puritan Casuistry**

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### Summary

English Puritan casuistry is examined over the time period 1575–1640 for arguments concerning the nature of a chance event. The examination reveals that elementary randomizers and games of chance influenced the Puritans' conception of a chance event. It may be concluded from this analysis that the elementary probability calculations which appeared prior to 1654, also inspired by games of chance, were part of a more general examination of chance and chance events during the sixteenth and seventeenth centuries.

Key words: Casuistry; Chance; Divine providence; Gambling; History of probability.

## **1** Introduction

The beginning of probability calculus is usually dated from 1654, the time of the Pascal–Fermat correspondence. Prior to 1654 there were sporadic appearances in published or unpublished form of probability calculations for certain games of chance. After 1654 there was a sudden burst of activity in the area. Viewed in this way the emergence of probability in the seventeenth century falls neatly into Kuhn's (1970) theory of paradigms or exemplars in the history of science. The apparently sporadic nature of the work before 1654 is an example of the randomness exhibited in research in the 'preparadigmatic' time, a phenomenon which Kuhn claims is typical of any new science. Assuming that elementary probability calculus, or the enumeration of the fundamental probability set, was well known before 1654, the paradigm under which researchers worked immediately after this date was that of mathematical expectation. The concept of expected value is often attributed to Huygens but is more likely originally due to Pascal; see Edwards (1982) for a discussion.

Several questions might be asked about the work in probability before 1654. Three are posed here. What is the historical significance of the work before 1654? What held up the flowering of probability until 1654? And what motivated people to work on problems in probability? In examining, but never answering the second question, partial answers to the first and third questions are obtained. Attempts at an answer to the second question have been given by several authors. Garber & Zabell (1979, p. 49) list five answers:

imperfections in dice (David, 1955, § 10), the use of dice in religious cermonies (David, 1955, §§ 11-12), absence of economic motivation (Maistrov, 1974, pp. 3-7), religious worldview (Kendall, 1956, § 35), absence of a suitable notion of chance event (Kendall, 1956, §§ 31-34; Sambursky, 1956).

They go on to say that

the last would seem to us the most promising, but further study of the question is clearly indicated if we are to understand fully why the doctrine of chances took as long to develop as it did. In addition, Hacking (1975) has suggested that the emergence of probability in the 1650's is tied to the concept of internal evidence, a concept that, he claims, was lacking until the end of the Renaissance. Much of Garber & Zabell's article is spent in refuting Hacking's hypothesis; they claim that the concept of internal evidence is much older than what was assumed by Hacking.

Each of these explanations for the late development of probability has its drawbacks including 'the most promising one'. With the exception of Maistrov's economic theory, criticisms of these explanations are given by Maistrov (1974) and Hacking (1975). When examined closely even the economic theory falters. There existed economic motivations which could have led to developments in probability long before the seventeenth century. For example, the trial of the Pyx to control the quality of Great Britain's coinage has been held continuously from the thirteenth century (Stigler, 1977). A description of a trial dated circa 1280 contains some elements of randomization; however the trial apparently inspired no developments in probability theory.

In an attempt to examine the most promising explanation, that of 'absence of a suitable notion of a chance event', Puritan casuistic literature with regard to gambling and divination was examined for the approximate time period 1575-1640. This body of literature was chosen because the theologians were arguing about the very item of interest, the nature of a chance event. The time period chosen was also propitious; it was just prior to the generally accepted time of the emergence of probability. Rather than adding more promise to the most promising explanation, an examination of the literature revealed that the development of an elementary theory of probability, assuming that it existed prior to 1654, ran parallel to or even pre-dated the evolution of the ideas concerning the nature of a chance event in a deterministic system. This puts into question, for example, Kendall's (1956 §§ 31-35) view that the theology of divine providence, philosophies of the determinism, and the lack of a notion of a chance event discouraged investigations into probability. The current study gives further insight into Hacking's (1975, pp. 2–3) observation:

Europe began to understand concepts of randomness, probability, chance and expectation precisely at that point in its history when theological views of divine foreknowledge were being reinforced by the amazing success of mechanistic models. A good many different kinds of determinism have appeared in various ages and cultures. Most of us think only of the mechanistic attitude to causation that first came into being in the seventeenth century. Far from this 'mechanical' determinism precluding an investigation of chance, it was its accompaniment.

An examination of the literature then attempts to answer the first, instead of the second, question: what is the historical significance of the work prior to 1654? Hacking (1975, p. 56) claims that the work consisted of 'isolated anticipations of little historical interest', Garber & Zabell (1979, p. 47) reply that Hacking was forced into this position by his own thesis of the emergence of probability. They provide a far more compelling interpretation of the pre-1654 work:

But these pre-Pascalian documents show something quite different, we think. They suggest that at least the basic principles of the theory of games of chance may have been widespread. In none of these early sources is it suggested that something conceptually new or unfamiliar is being presented. Much, for example, has been made of the presence of some dicing calculations in a Dante commentary dating from the second half of the 15th century (see, e.g. Todhunter (1965, p. 1); David (1962, p. 35)). But it is hardly likely that the theory of dicing was developed in order to explicate Dante, and first presented there. It is far more likely that the author of this commentary is making reference to facts known by some experienced gamblers of the day, though, perhaps, unfamiliar to typical readers of Dante. F.N. David (1955 §17, 18), (1962. pp. 62–63, 70, 71) and M.G. Kendall, (1956, §25, 27) likewise argue that by the time of Galileo simple gaming calculations

were well known to Italian mathematicians and that such a tradition was then transmitted to France.

On assuming that this interpretation is the correct one, we see that an elementary probability calculus was inspired by games of chance. What we shall see from the Puritan literature is that, parallel to this development, games of chance and simple randomization devices are also leading theologians to reevaluate the nature of a chance event.

As a by-product of this study the third question posed earlier can be addressed by the literature examined here. It has been said in many places that gambling was the mother of probability. This common view has been questioned by Maistrov (1974, pp. 7–15) who ties the birth of probability to economic factors. Maistrov's viewpoint is shared by Sheynin (1977, p. 203) and to some extent, by Hacking in the forward to Maistrov's book (Maistrov, 1974, pp. vii–viii). Maistrov's position is reasonable for developments after 1654. However, as supported by Garber & Zabell (1979), before 1654 gambling remains a primary, though not necessarily unique, impetus for developments in probability. Gambling encouraged the growth of Puritan casuistry and this literature reflects some rudimentary probabilistic ideas formulated through gambling practices.

#### 2 Puritan casuistry

Every ethical or moral system has a set of guiding rules or principles. Casuistry is a method of applying these principles to specific situations, or cases of conscience, to determine what is right or wrong moral conduct in these cases. Christian casuistry grew out of its ancient Hebrew counterpart, which, in turn, developed in response to practical considerations in the day-to-day application of the Law (of Moses). Casuistry occupied a central place in the teachings of the Church of Rome after the Fourth Lateran Council (1215) when an annual confession was required of all believers.

The first generation of Protestant reformers denounced cases of conscience or casuistry identifying it with Rome. In addition, under the doctrine of justification by faith it was felt that this type of literature was not necessary. Once faith was present good works would follow naturally. However, as the Reformation continued, a demand arose for a Protestant ethical system. Many believers wanted to know what to do in specific situations; others did not live up to their calling. Moreover, the Catholic theologians of the Counter-Reformation, especially the Jesuits, were highly critical of the lack of Protestant ethical literature. As a result, the second generation of Protestants began to write casuistic handbooks for the faithful. Included among the topics of discourse were divination, in particular the practice of divination by lot, and gambling.

By the sixteenth century casuistry in the Church of Rome was based on a large accumulated body of authority. On the other hand the Puritans were starting with a clean slate. For this reason the Puritan literature is in some sense vibrant and reflects some of the current philosophy and theology of the day. Moreover this reflection goes beyond the small group of clergymen who produced this literature. Merton (1970, pp. 59–60) comments that the Puritan literature contains 'expressions of the sentiments and values which permeated the thought and action of believers'. This casuistic literature was often based on sermons that were regularly preached to the faithful so that Merton further comments that this literature probably 'not only reflected but reinforced the dominant sentiments of the day'. In some of the literature examined here the authors explicitly state that what they have written resulted from sermons preached on the subject. The earliest Protestant casuists were from the continent. English casuistry followed in the 1570's. In general the English casuistic literature, which includes the works examined here was

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highly regarded by many Protestants; 'their skill in practical divinity became proverbial' (Sprunger, 1972, p. 161)

For the Puritans the starting point for any ethical discussion was the Bible. In discussions of gambling and divination by lot, the passages of interest were the instances of divination by lot. Rabinovitz (1973, Ch. 2) and Lichtenstein (1972) have discussed several of these examples from the Old Testament; the Puritan writers refer to many of these examples. In the New Testament the practice of divination by lot appears only once, in the choice of Matthias as the successor to Judas (Acts 1: 23–26). Two other passages in the New Testament refer to random events: the entrance of Zechariah into the Temple sanctuary (Luke 1: 9–11), and the division of the Christ's garments by the Roman soldiers at his execution (Matthew 27: 35–37; Mark 15: 22–24; Luke 23: 35; John 19: 23–24). Neither of the latter two are examples of divination and thus were generally ignored by the Puritan writers. One of the problems faced by the Puritan writers was how to reconcile the use of randomizers, such as cards and dice for gambling and other games, among their followers with the use of randomizers in the Bible. The attempts at reconcilation between 1575 and 1640 show an increasing appreciation among the writers of some elemenatary probabilistic ideas.

#### 3 Probabilistic notions in Puritan casuistry on gambling and divination

Before turning to the Puritan literature it would be instructive to examine the Roman Catholic causistry that preceded it. Unfortunately, the literature is almost all in Latin and is also not readily available. This compares to the Puritan literature which is mostly in English and is widely available on microfilm. Moreover, the one study (Michaud-Quantin, 1962) of the Roman Catholic literature, which the present author has seen, does not possess enough detail to shed any light on the nature of a chance event as viewed by medieval theologians. For example, Michaud-Quantin (1962, p. 50) has described a manual used by those taking confession. The manual was written by Jean de Fribourg, probably a student of St. Thomas Aquinas. Michaud-Quantin gives a brief checklist of sins from this manual from which a penitant could refer before making confession. Included in the list are 'practiques magiques ou superstitieuses', an entry which could include divination by lot. However, no further discussion of this entry is given.

One, and probably the most important, medieval source that is available in translation is *Summa Theologiae* by Thomas Aquinas. The translation used here is the Blackfriars edition begun in 1964 and which runs to 60 volumes. Rather than referencing each volume used, the usual reference method to *Summa Theologiae* will be used. The work consists of three parts of which the second part itself consists of two parts. Within each part there are a series of questions each followed by a number of points of enquiry or articles. The references I.103.1 and II.II.95.8 refer to Part I, question 103, article 1 and the second part of Part II, question 95, article 8, respectively.

Thomas Aquinas' ideas on probability and chance as expressed in *Summa Theologiae* are discussed in detail elsewhere; see Byrne (1968) and Sheynin (1974), for example. Of interest here are St. Thomas' comments on the nature of a chance event, and any connection these comments may have to the moral status of divination and gambling practices. In St. Thomas' worldview, events which occur are divided into two mutually exclusive sets, the necessary and the contingent. A necessary event always follows from its causes while a contingent event may or may not follow from its causes; chance falls in the realm of contingent events. A chance event has the characteristic of unpredictability (I.57.3). Although chance is allowed, the whole system is providentially deterministic: (I.19.9)

Hence the ultimate reason why some things happen contingently is not because their proximate causes are contingent, but because God has willed them to happen contingently, and therefore has prepared contingent causes from them.

In commenting on divination by lot (II.II.95.8), St. Thomas first comments that the result of the casting of lots can 'be ascribed to chance or to some directing spiritual influence'. If ascribed to chance, then he says that there is no vice involved other than vanity. If ascribed to a spiritual cause then one must be careful since a demonic influence frequently may be expected. He goes on to give various rules of conduct in divination by lot when God's influence in the cast is expected. St. Thomas does not comment on the nature of chance in games of chance. In his commentary on whether the winnings from gambling can be used as alms (II.II.32.8), he merely lists some types of gambling that are forbidden by divine law:

winnings at the expense of minors and those out of their minds, who have no power to alienate their property; or out of sheer greed to induce someone else to gamble; or again, to win by cheating.

In the discussion to follow we shall see that the Puritan writers also had a providentially deterministic worldview. However, the early Puritan writers went beyond Thomas Aquinas' views on divination by assuming that God directly determines the outcome of all randomized events both in divination and in gambling. This view was later questioned by Thomas Gataker (1619). He was able to describe a chance event in a deterministic system without any special intervention from God. This applies to both divination and gambling. Like Thomas Aquinas, Thomas Gataker saw a chance event as one in which the outcome was unpredictable, the difference being that Gataker took this as his definition of a chance event rather than relying upon a system of contingent causes.

In their writings on gambling and divination the Puritans often use the words 'lot' and 'lottery'. Their usage of these words is similar to some modern usages but differs slightly from the most common usage. By 'lot' the Puritan writers mean any randomizer such as cards or dice; by 'lottery' they mean any outcome determined by randomization.

One of the first Protestants to write on ethical behaviour was a French Calvinist, Lambert Daneau. His books, many of which are translated into English, influenced many English Puritan writers. The text examined here is an English translation (Daneau, 1586) of an earlier Latin work (Daneau, 1579). Daneau had previously written about dicing and gaming (Daneau, 1566) but that text was unavailable to the present author.

In Chapter 6 of the 1586 translation Daneau specifies which types of games should be permitted for play among Christians. Games of pure chance, he says, should be forbidden while games of mixed chance and skill are allowable. In the latter situation his reasoning for allowance is that undesirable outcomes obtained through a chance event could be overcome by the industry or skill of the player. Games of pure chance are referred to as 'alea' and are defined as those games

that hang and depend (as it were) upon mere chaunce of casting: wherein a mans industrie (if there be no packing, falsehood and cogging deceipt used) can nothing availe.

The reference to packing, falsehood and cogging is contemporary jargon for various methods of cheating at cards and dice. Later in the text Daneau says that these practices 'help the chaunce'. These methods of cheating are obviously 'skills' which can overcome undesirable outcomes; however Daneau excludes them from the allowable games of mixed chance and skill, referring to anyone who engages in such practices as 'a leud fellowe and a cogging Verlot'.

Further on in his treatise (Ch. 9) Daneau provides some explicit reasons why he considered games of chance to be inappropriate for Christians. His first argument is that

engaging in games of chance violates the third commandment not to take the name of God in vain. Daneau bases this conclusion on the assumption that God determines the outcome of a randomized event; to use randomizers for trifling matters such as gaming is to profane the majesty and power of God. He expresses the role of God in lotteries, or in the determination of a randomized event as follows:

And there upon they gather, that in Lotte casting (in which kinde (doubtlesse) Dyceplaye is contained,) we ought not in any wise for maintenaunce of our peevish pleasures, to use vaine and ydle matters, in steede of grave and godlie exercises: for that therein we doe after a sorte make a mock of Gods providence, and rashly abuse the greatest testimonies and effects thereof, such as Lotterie is.

Since it is God that determines randomized outcomes Daneau concludes that lotteries can be used for important matters such as in the election of magistrates or in the partitioning of lands among several heirs. Part of the argument Daneau has used is reminiscent of Thomas Aquinas' discussion of divination by lot (II.II.95.8). As previously stated, St. Thomas provided some rules to indicate when divination by lot was allowable. These rules are very similar to the situations that Daneau describes as appropriate instances of the use of lotteries. The point of departure of Daneau from Thomas Aquinas is in the nature of a chance event. Daneau sees all randomized events as emanating from a spritiual cause, using St. Thomas' phraseology.

The first English Puritan to write in this genre was John Northbrooke. His work (Northbrooke, 1577?) takes the form of a dialogue between Age and Youth in which Youth asks the questions about correct moral behaviour and Age provides the answers. Like Daneau, Northbrooke briefly discusses and condemns cheating at dice; however, there is no reference to improving the chance through cheating. Northbrooke (1577?) also elaborated on the role of divine providence in a lottery or randomized event. He says that 'the lot is one of the principal witnesses of Gods power (as Salomon recordeth) that is ruled and governed immediately by his hande, power and providence' (p. 107). This line of thinking ran through the Puritan literature for the next 30–40 years. Arguments on the role of divine providence similar to Daneau (1586) and Northbrooke (1577?) are made by Thomas Wilcox (1581, Ch. 6), Dudley Fenner (1587, Rule 4 of 'special rules of recreation') and James Balmford (1593). Balmford explicitly and in several places states that God determines the outcome of a lottery or randomized event. Two quotes from Balmford (1593), on pages 5 and 6 respectively, illustrate this point:

 $\dots$  that a Lot in the nature thereof doth as necessarily suppose the special providence & determining presence of God.

... the use of Lots is not to be in sport. Againe, we are not to tempt the Almightie by a vaine desire of manifestation of his speciall providence.

The condemnation of the use of divination by lot for fortune-telling followed similar arguments. William Perkins (1608) wrote that

the Lot is an ordinance of God, appointed for speciall ends and purposes, but when it is thus applied [for fortune-telling] it ceaseth to be lawfull, because it is abused to other ends than God by his word & ordinance hath allowed.

The key words in an interpretation of the role of the Divine in determining the outcomes of a randomized event are 'special' or 'immediate' providence. These terms differ from the concept of 'God's providence' or 'general providence'. Some more modern interpretations (Davison, 1922; Harkness, 1960, pp. 32–33) refer to 'general providence' as the ruling hand of God in the world, or what we might consider the law of nature. 'Special providence' can be more in the line of the miraculous or a special direct

intervention by God in some particular situation. Similar interpretations held in the sixteenth and seventeenth centuries. Van Beek (1969, p. 114) defines 'special providence', as used by the Puritans, as 'a particular act of direct divine intervention'. Based on these interpretations of the key words it is reasonable to conclude that these early Puritan writers believed that the outcomes of a randomized event are not determined by the usual laws of nature but by God directly intervening to select the outcome for his own, perhaps unknown, purpose. In other words they believed or at least argued that a miracle occurred every time the dice were thrown.

Thomas Gataker (1574–1654), an eminent English Puritan divine, came into direct conflict with this mode of thinking on the role of the Divine in randomized events. He believed, and argued forcefully, that certain types of gambling should be allowed. His opinion that divination by lot should not be used went beyond the opinions of some other Puritan casuists, but for different reasons. Throughout his work many of his thoughts on the nature of a chance event are inspired by the common uses of simple randomizers such as cards and dice.

Gataker's first work on lots and lotteries was published in 1619. He begins (Gataker, 1619, p.9) his arguments on the nature of lots or randomized events by broadly defining a lot to be a casual event used for determining some doubt. Examples are the tossing of a coin to determine who plays first in some sport or the throwing of dice in a gambling game to determine who wins the pot. He then goes on to define a 'casual' event in a deterministic world (p. 12) as

an Event contingent, not directed or determined by any fore-cast or fore-sight. A Contingent, I say, that is, an uncertaine or variable Event, as all grant it to be: And that againe so uncertain as the uncertainty of it is not directed or determined by the skill, counsell, or fore-cast of him to whom it is causall; not that it is not effected and produced by knowne naturall causes, but that neither his skill or counsell hath any hand in the directing of those causes in the producing of that effect, nor his fore-cast can determine what the effect will be in particular but by meere conjecture onely.

Following on this definition Gataker (1619, Ch. 3) makes several conclusions about the nature of chance or casual events. Of importance to the arguments here, when looking at the earlier Puritan anti-gambling arguments, is Gataker's second conclusion (p. 22): 'The casualtie of an event doth not simply of it selfe make it a worke of Gods speciall or immediate providence'. Throughout the rest of the book Gataker examines various kinds of chance events using randomizers to judge whether or not it could be assumed that the outcomes fell under God's special or immediate providence. He argues that, since the outcomes of a randomized event are initiated by individuals and not by God, it is reasonable to conclude that the outcomes are determined by the regular, perhaps unknown, laws of nature rather than God's special or immediate providence. Gataker's position is best stated on pp. 146–147:

Againe who seeth it not that the lighting of Lots in this or that manner ordinarily commeth immediately from the act of the Creature? For example: In the blending of scrols or tickets together, the motion of the vessell wherein they are blended (no regard had to the end for which it is done) causeth some to ly this way and some to ly that way, (every new shaking thereof causing a new sorting) and so some to ly higher and neerer at hand, if a man will draw of the next, some lower and further of, not likely to be drawne so soone, unless he dive deeper. Neither can any man say certainely that there is ordinarily any speciall hand of God, in the shuffling and sorting of them, crossing the course of nature, or the naturall motion of the creature, and so causing those to ly higher and so neerer at hand, that would otherwise have lien lower, and those to ly lower and so further from hand that would otherwise have lien higher. So in the shuffling of Cards, the hand of him that shuffleth them is it that disposeth them, and that diversly as he lifteth either to stay or to continue that act of his. In the casting of dice the violence of the Caster causeth the Creature cast to move, till either that force failing, or some opposite hindring it, it cease to move further, and so determine the chance.

Gataker (1619, p. 159) also makes an interesting argument against Divine intervention in randomized events using a proof by contradiction. He notes that in repeated trials it is unlikely that the same outcome will always recur. He argues that if the lot is used to find God's purpose and the outcome of the lot is variable then God must be fickle; but God is not fickle and hence God must not determine the outcome. He says:

But then an ordinary Lot there is nothing more uncertaine, ready upon every new shaking of the Lot pot to give out a new sentence. For suppose we that some one Minister of a whole hundred in our head City should by Lot be selected to visite the Pesthouse, would the Lot drawne in this foure or five times together with never so great solemnity light certainely and constantly ever on the same man? Or suppose foure or five several Companies in severall places should, after the busines solemnly by praier commended to God, cast Lots upon the selfe-same imployment among the same parties, were it certaine, yea or probable that they should all light upon the same person? Or were it not frivoulous, if not impious, therefore to say, that upon every second shaking or drawing God altereth his sentence, and so to accuse him of inconstancie; or that to severall Companies he giveth a severall sentence, and so to charge him with contradiction and contrariety?

Although no probability calculations are made Gataker definitely has a grasp of highly unlikely events.

In the examination of individual types of lotteries Gataker has an initial categorization of lots into ordinary and extraordinary lots. Within ordinary lots are the subdivisions of serious and lusorious lots. Serious lots include random methods to determine the composition of civil committees or to appoint magistrates to hear a legal case (civil lots). Lusorious lots refer to gambling games or any lottery used in recreation. Extraordinary lots refer to divination by lot. Based in part on his interpretation of the role of the Divine in a lottery, Gataker concludes that ordinary lots are generally permissible. God does not intervene directly to determine the outcome of a randomized event so that there is no blasphemy involved in using randomizers for sporting or recreational purposes, for example. The same argument is used to condemn divination by lot. The outcome of the extraordinary or divinatory lot is not necessarily determined directly by God so that a lottery of this type does not necessarily reveal God's will.

Two other items are of interest in Gataker's 1619 work other than the role of the Divine. First, Gataker (1619, p.24) has a decidedly subjective view of a chance event. He says:

That may be casuall to one that is not casuall to another; where there is forecast and fore-knowledge and counsell fore-seeing or directing and disposing it in the one, and not in the other; and that may semme such, which indeed is not. For the better conceiving hereof we are to consider that in casuall events two things do concurre, ignorance or want of fore-knowledg forseeing them, and inconsideratenes, or want of fore-cast directing them: for these things make the event of them uncertain to us: & uncertainty breedeth casualty.

The second item is that at one point in his book (p. 166), Gataker makes a simple probability statement. He notes that in civil law there is a provision that properties inherited by a number of beneficiaries can be divided by lot. However, if the magistrate involved in the case deems that the individual parcels of land are not of similar value he may overturn the outcome of the lottery. In commenting on this point of law Gataker says that the 'hazard of lighting upon the lesse part and so of sustaining the losse was alike to either' [party].

The publication of Gataker's (1619) work caused much controversy. The first published reaction to it was by James Balmford (1623). This work contains a reprint of his earlier book (Balmford 1593) and is followed by a lengthy rebuttal of Gataker's views on gambling, divinatory lots, and the nature of a chance event. Balmford (1623, pp. 26–29) claims that he moved to reply to Gataker since Gataker had attacked Balmford's views in

the pulpit. Also, several others had urged him to reply to Gataker since he was the last surviving author among the group including Daneau, Perkins and Fenner who had written on ethical problems in the use of lots. Balmford's main argument against Gataker is his insistence that the outcome of a randomized event is determined directly by God. The argument is made in several forms and places in the book. Two quotations given here show the flavour of his argument (pp. 102 and 107 respectively):

We are not to tempt the Almighty by a vaine desire of manifesting his power, and speciall Providence: But by using Lotts in sport we tempt the Almighty, vainely desiring the manifestation of his speciall Providence in his immediate disposing; Therefore we may not use Lotts in sport.

There is an immediate providence in an ordinary Lot. Therefore God is tempted by using Lotts in sporte: Therefore Prayer expressed, or to be understood, is required of them who use an ordinary Lot: and Therefore an ordinary Lot is an holy thing.

Gataker (1623) replied at length to Balmford. Throughout the third part of his reply Gataker (1623, pp. 163–217) argues against Balmford's assertion that the outcome of a randomized event is attributable to God's special providence. The arguments he uses are similar to those in the original 1619 treatise.

A second edition of the original work came out in 1627 (Gataker, 1627). This second edition caused a reaction from the radical Puritan theologian William Ames, who was living in exile on the continent. Earlier in his career Ames had condemned cards and dice as the device of the devil (Sprunger, 1972, p. 23). Later, in reference to Gataker's work, Ames (1629) affirmed his belief in the presence of God's special providence in a randomized event. He says that 'the lot of its own nature has a certain relationship to a singular and extraordinary providence of God which controls a purely contingent event' (Eusden translation, 1968, p. 272). Ames goes on to define a purely contingent event, or an event subject to mere contingency. Two translations of the 1629 text are presented, the first from Ames (1638, p. 262), and the second from Eusden (1968, p. 271):

But we doe not place a Lot simply in contingency, but in meere contingency (contingentiâ morâ): because there are three degrees of things contingent: some often happening, some seldome, and some so far as we can understand, equally having themselves on either part (equaliter in utramque partem): for in other Contingents there is some place left to Conjecture by art: but in meere contingency there is none.

But we place lots not in the category of contingencies in general, but in that of pure contingency, for there are three degrees of contingencies, some happening often, some seldom, and some, as far as we can understand, equally divided between these possibilities. In other contingencies, there is room for skillful conjecture, but not in pure contingency.

The reference to 'mere' or 'pure contingency' recalls Daneau's (1586) use of 'mere chance'. In Ames' use of 'mere contingency' the interpretation of the phrase is definitely 'equiprobable'. Ames is saying that God determines the outcome of a lottery only in situations in which the outcomes are equally likely. This is a slight retreat from the stance of earlier Puritan writers who claimed that all randomized outcomes are determined by God. In using the phrase 'mere chance', did Daneau (1586) also mean equiprobable? From the context in which he used the phrase it is impossible to tell. What can be concluded so far is that the concept of equally likely outcomes was known by 1629 and that there is a hint that it may have been known 50 years earlier.

Gataker (1638) replied to Ames (1629) and to another, a Dutch Puritan Gijsbert Voet, who had criticized his work. Sprunger (1972, p. 176) claims that Gataker waited until Ames had died to make his reply; even in exile Ames was a highly respected and influential Puritan theologian. Gataker's previous argument against divine intervention into randomized events was that since the act of randomization was initiated by the

creature and not the Creator then the Creator's involvement in the outcome could not necessarily be assumed. To respond to Ames, Gataker constructed a randomized event without equally likely outcomes. He says (translated from the Latin, pp. 12–13):

It could be mentioned that with respect to the common and customary use of lots, when, in place of every single inscribed paper, thirty or even forty unmarked papers are placed in an urn, it rarely happens that an unmarked paper does not appear and that the lots do not hold themselves *equally in either direction*, (a fact) which is clearly known by the lot-drawers themselves: and (a fact) which is clearly known by the lot-drawers themselves: and (a fact) which is clearly known by the lot-drawers themselves.

From this quote it is obvious that Gataker's ideas about chance events were inspired by simple randomization methods and gambling.

Gataker's opinion on the nature of lots eventually was commonly accepted. Plagiarized versions of his arguments in favour of the use of cards and dice in sport appeared as early as 1633 (Downe, 1633). Clark (1916) credits Gataker's (1619) work as instrumental in ending the Christian practice of divination by lot, although it was practiced sporadically by some Christian groups including the Wesleys into the eighteenth century.

#### 4 Discussion

The arguments about the nature of a chance event were definitely inspired by gambling practices and simple games of chance. As seen in Ames' and perhaps Daneau's work the concept of equally likely outcomes is present and has an influence on their thoughts. In Gataker's work there are hints that he was aware of a very elementary theory of probability.

Prior to 1654, the development of an elementary probability calculus ran parallel to, or even pre-dated, the evolution of ideas concerning the nature of a chance event. One thing that can definitely be said about the historical importance of the probability calculus prior to 1654 is that it was part of a larger body of literature concerned with chance and random events, and inspired in part by gambling practices. The early calculations were not isolated incidents. There is at least one more body of literature, also inspired by gambling, that falls into the same general framework. This is the portion of early English rogue literature, see, for example, Aydelotte (1913), that describes cheaters and methods of cheating in games of chance. These stories, plays and tracts, written to englighten the innocent gambler, may also reveal further information concerning ideas of chance and elementary probability calculus. In summary the very early work in probability calculus need not be viewed as 'isolated anticipations of little historical interest', but instead as an integral part of a more widespread examination of chance and chance events.

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#### Résumé

Cet article se veut une étude de la caustique prévalent au sein de l'Angleterre Puritaine au cours de la periode s'etalant de 1575 à 1640 en regard d'arguments concernant la nature d'un événement aléatoire. Il ressort de cet examen que la conception qu'avaient les Puritans d'un événement aléatoire fut influencée à la fois par des procédés aléatoires élémentaires et certains jeux de hasard. On pourrait conclure de cette analyse que les calculs de probabilités élémentaires qui firent leur apparition avant 1654, incluant ceux dérivés à partir de jeux de hasard, s'inscrivaient dans le contexte d'une étude globale du hasard et des événements aléatoires au cours des seizième et dix-septième siecles.

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