

NUMBERS: A STUDY OF PROBABILITY AND ART

By

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## Artist Statement

Abstract

The relationship between random chance and choreographic techniques were experimented with in the creation of the ballet piece *Numbers: A Study of Probability and Art*. Research on probability theory including the law of large numbers, the binomial coefficient and the Poisson distribution as well as certain elements of chaos theory were used to justify the effectiveness of the compositional strategy of “chance dance.” Notable choreographer Merce Cunningham’s choreographic strategies were analyzed and his procedures were used as a model for constructing the piece. An equation was used with discrete inputs to generate a number sequence to be interpreted by a code of ballet terms. Ultimately, phrases were constructed in this “chance dance” way to create the choreography of the piece. The musical choice, structure as well as performance of the dance are discussed, followed by a reflection of the choreographic success of this process. It is determined that using random chance to create choreography presents a unique opportunity to construct fascinating phrases that would not have been thought of otherwise.

*“Light or luminosity is created by the way elements are juxtaposed. They become reflective and a radiance comes from putting different things together.”*

*Merce Cunningham<sup>1</sup>*

How does an artist create art? Can the creative process be described in words fully? How does the brain synthesize concepts, emotions, thoughts, inklings, inexplicable urges and individuality to construct something of beauty and grace, with power and intention? An artist can describe their personal rationale behind the elements of their creation, explain the idealistic goals and intended message of the piece, justify the distinctive features of their art, and detail their step by step procedure from beginning to end, but the question remains. How does an artist create art?

When studying avant-garde constructions, minimalist masterpieces, surrealist creations, and other styles of artwork, observers may find themselves questioning the definition of art itself. What is so special about Yves Klein’s eleven monochrome paintings of a single shade of blue painted on square canvases and displayed in art galleries? Sure the pure simplicity of a work like James Turrell’s projection piece *Afrum* (Pale Pink) makes the work exquisite. Yet how many people have ever seen a piece of art, listened to a composition of seemingly random sounds or watched a dancer casually walk across a stage and have considered that they could have thought of that idea themselves? And if they were to do it themselves with their own creative process, would it then be considered art?

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<sup>1</sup> Quoted by the Merce Cunningham Trust.

<sup>2</sup> Chance dance or choreography by chance is a compositional strategy first developed and used extensively by Merce Cunningham and will be explored extensively in this

With these ideas in mind, the creative process of choreographing dance is the subject I have experimented with. Inspired by the idea of bringing together my two majors of study into one cohesive exploration, I began research on using mathematical concepts to construct creative works in dance. I wanted to learn if there was some sort of mathematical influence that could be used in choreography and was curious if there was a more scientific, mathematical formula or procedure that could be followed to create beautiful yet unique dances. Former professor emeritus Douglas Neilson from the University of Arizona's School of Dance first ignited my interest in the relationship between math and dance when employing the so-called "chance dance" techniques in my advanced choreography courses.<sup>2</sup> In these classes, I began experimenting with and noticing the effects of probability on dance performance. Neilson would have students choreograph dance works in silence, without any music, soundtrack or sound effects in mind. When the dancers had completed their pieces, Neilson would pick a CD at random from a bag of nearly twenty discs that contained music of various genres, spoken word, sound effects and ambient noises, and again choose a file at random from the disc. The dancers would then have to perform the choreography with the randomly chosen sound, trying their best to keep the integrity of the choreography without being influenced by the sounds of changing the meter of the phrases. As a trained dancer who is taught to perform with the music and to execute the counts of the steps accurately, this disjointed relationship between music and dance seems counterintuitive, producing awkward, purposeless choreography, which lack cohesion, beauty and elegance. Yet to my

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<sup>2</sup> Chance dance or choreography by chance is a compositional strategy first developed and used extensively by Merce Cunningham and will be explored extensively in this paper.

surprise, the choreography and sound effects somehow tied together with a unique and graceful aura on multiple occasions! How could it be that such random events that were brought together without intention would be so pleasing to the audience more often than not? Was it merely the fact that dance is art to be enjoyed, especially by a biased dance adoring artist like myself? Or could there be some sort of favorable probability in nature that caused the human brain to draw connections and look for ways to create unison among chaos? As an aspiring mathematician and trained dancer, my interest was peaked as I witnessed the trend that time and time again the movement, the music and the environment came together to create mesmerizing pieces of beauty and cohesion even when the collaborations were unsynchronized.

Wishing to learn more about randomness and chance, I took the upper division math course, Theory of Probability in the fall of 2016 as an elective math course. This class began with the basic fundamentals of probability, built on simple events of random chance like coin flips and dice rolls. Simplicity turned complex as theorems, equations and advanced mathematics were applied to seemingly trivial problems of chance. However, a conclusion I took away from the course was that random chance does not necessarily equate with unlikeliness. Often, the words random and unlikely are used interchangeably in everyday vocabulary, however, when the core mathematical principles of a situation are indeed analyzed, the two are different concepts. *Random* describes a process and can be defined as “without aim, direction, rule, or method” (“Random”). Whereas *unlikely* describes an event or outcome as improbable. For example, say a biased coin has a 95 percent chance of landing on heads. Therefore it is unlikely that the coin will land on tails, however, it is not considered random if the coin lands on tails.

The process of flipping the coin gives random results but there are only two possible outcomes.

The mathematical brainteaser known as the “birthday problem” or “birthday paradox” in probability theory illustrates the idea that random chance does not necessarily lead to unlikely outcomes. The problem concerns the probability distribution that in a set of  $n$  randomly chosen people, some will have identical birthdays. Upon first glance and to an untrained mathematician, it seems extremely unlikely that identical birthdays will occur in a small group of people. Yet if approached and solved using a Poisson approximation for the binomial,<sup>3</sup> it can be determined that the probability reaches above 50 percent likely that two people will have the same birthday with a group size of only 23. Furthermore, the group of people only needs to be of size 60 for a 99.4 percent chance that two people will share a birthday! Thus, the birthday problem illustrates that random events that seem improbable by intuition are not necessarily as unlikely as anticipated (Hand).

An event that occurred in the Bulgarian lottery nine years ago illustrates another example of a seemingly unlikely long shot event occurring when the true mathematical probability of the event was actually probable. 4, 15, 23, 24, 35, 42 were the randomly chosen winning number sequence of the Bulgarian lottery on September 6, 2009. What caused the jaw dropping media sensation was that the following week, the exact same sequence of numbers happened to be the winner once more! Fraud? A miracle? What was

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<sup>3</sup>  $X$  has a Poisson distribution with parameter  $\lambda$  ( $> 0$ ) if  $X$  takes values  $\{0, 1, 2, \dots\}$  and

$$P(X = k) = \frac{\lambda^k e^{-\lambda}}{k!} \quad \text{for } k = 0, 1, 2, \dots \quad (\text{Grimmett et. all 26})$$

to explain this surprising coincidence? Mathematics. Specifically the law of large numbers and the binomial coefficient (Hand).

The law of large numbers is one of the principle theorems of probability theory. The theorem states that if  $X_1, X_2, \dots, X_n$  are a sequence of independent<sup>4</sup> random variables each with a mean,  $\mu$  and a variance  $\sigma^2$ , then the average of  $n$  approaches  $\mu$  as  $n$  goes to infinity. Essentially, the law of large numbers says, “if we repeat an experiment many times, then the average of the results approach the underlying mean value” (Grimmett and Welsh 134). In the case of the Bulgarian lottery, the sheer number of lottery draws significantly increased the probability of a duplicate draw.

The binomial coefficient is a number that gives the total number of combinations of size  $n$  within a set of  $k$  distinct objects or events. It is expressed mathematically below.<sup>5</sup> Upon analysis of the binomial coefficient, one can see that the number of combinations within a set increases exponentially as the number of elements in the set increases. What does this mean? This is actually an intuitive concept. If one has a huge gathering of dancers to learn a duet, then the total number of possible pairings among the group will also be extremely large. In the case of the Bulgarian lottery, each draw of a lottery number sequence could potentially match with any previous draw in the entire history of the lottery. There are plentiful possible combinations that a match is bound to show up given enough time! Once the totally number of lottery draws is large enough, it would actually be unlikely for every single lottery draw to be unique! Like the birthday

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<sup>4</sup> Two random variables A and B are ‘independent’ if the occurrence of one of them does not affect the probability that the other occurs (Grimmett and Welsh 12).

<sup>5</sup> The binomial coefficient, read “ $n$  choose  $k$ ,” where “!” denotes factorial.

$$\binom{n}{k} = \frac{n!}{k!(n-k)!} \quad (\text{Grimmett and Welsh 250})$$

problem, if one had a group of 365 randomly chosen people, the probability that there was a birthday represented for every single calendar day in the year would be miniscule.

Returning to the Bulgarian lottery problem, when calculated, there are 4,404 draws needed for the probability of choosing two identical number sequences to be greater than 50 percent. Consequently, if there are two weekly lottery draws or 104 total in a year, then it would only take 43 years until the chance of drawing the same six numbers twice was more likely than not. The Bulgarian lottery was around for 52 years (Hand).

So how can all of this probability theory relate to dance? When experimenting with chance dance choreographic techniques in my advanced choreography classes, it was always shocking to see a piece of choreography match so closely to soundtracks chosen at random. However, if one considers the concepts of the law of large numbers and the binomial coefficient, these seemingly rare yet pleasing coincidences found in the random juxtaposition of artistic choices are not actually that uncommon. There are bound to be many inventive combinations of random events in choreography if given sufficient time.

With this in mind, if one is a skeptic of chance dance, it is not that surprising that the pioneer of chance dance techniques, Merce Cunningham, was greatly successful with his innovative collaborations and choreography. Granted, Cunningham is considered an artistic genius with a vast collection of masterpieces and I am no way discounting his creative talent and unique eye for movement. Yet he did have major theories of probability to support his innovative choreographic ideas throughout his seventy-year career. Born April 16, 1919, Cunningham was an American dancer and Avant-garde



choreographer who is considered to be one of the most influential choreographers of our time. He studied dance at numerous colleges including the Cornish School of Fine and Applied Arts, Mills College with Lester Horton and Bennington College. It was at Bennington College when Cunningham became a soloist in Martha Graham's company and began working with his life partner John Cage. Encouraged by Graham, Cunningham began to choreograph in 1943 and by 1952, he had formed his own dance company. Together, Cage and Cunningham began exploring random phenomena in the structure of music and dance ("The Editors of Encyclopedia Britannica").

Cunningham began experimenting with probability and chance by creating movement phrases and sequences that were determined by random events closely tied to the foundations of basic probability theory. Beginning in 1951, his piece *Sixteen Dances for Soloist and Company of Three* was the first time Cunningham arranged dance sequences by coin flips. By doing so, Cunningham utilized "an 'impersonal' (and much more objective) mode of aesthetic decision making, rather than structuring the dance according to the subjective dictates of his own instincts or taste" (Copeland 71). Soon after, Cunningham pushed the boundaries of chance in art even further in his 1953 classic *Suite by Chance*. This early work was the first time every single critical space and time variable was determined by pure chance. The entirely electronic score was completely autonomous from the movement and a stopwatch was used as a controlling device instead of set counts, a technique that would be used more extensively in his later works. This 1953 idea is still a radical notion in dance performance today (Copeland 23). Yet what was the purpose of this seemingly thoughtless and uncreative process? According to Cunningham, by stripping away the consciousness and emotion of personal creative

choices, the purest form of dance could be achieved. Banes and Carroll described

Cunningham's movement as not:

A representation of romance, an expression of primal instincts, or a journey of self-discovery, but rather a sequence of steps, evolving their own intrinsic cadence, a cadence with a temporal pulse tangibly different from any other sort of movement. That is, by using movement that is unequivocally dancerly to the naked eye, Cunningham intends to show us the quiddity of pure dance.

Forgoing narrative, organic flow, cause and effect as well as theatrics and tricks, movement could be appreciated as its own entity. Cunningham explored this even further in his 1959 work *Rune*. Not only was the piece created with chance techniques as independent events occurred simultaneously on the stage, but the order of each individual section of the work also changed from performance to performance. Thus, Cunningham created a work without a fixed order. This lack of order could even be described as chaotic, a description that many audience members including mathematician James York did indeed use to describe the quality of Cunningham's choreographic pieces. York explained it as "wild disorder embedded in stable structure" (Copeland 109). Steve Paxton explicitly compared Cunningham's choreographic style to mathematical theories of chaos with his statement, "They say in fluidics that if you have a very clear pattern that becomes chaotic, a more recognizable pattern will emerge again underneath that chaos if you watch it long enough" (Copeland 109). How exciting to an undergrad like myself studying the merging of mathematics and art! After studying the general theory of stability and bifurcation and receiving an introduction to chaotic dynamics in the course Ordinary Differential Equations and Stability Theory, I could begin to appreciate the beauty of chaotic structures. Conventional choreography with a linear structure of beginning, middle and end is predictable. Conforming to the status quo of choreographic

procedures lacks uniqueness and creativity while exploring with chance to create unexpected movement and phrasing is fascinating. It is here in my research that I began my own exploration of chance and chaos in my own creative process.

For my thesis, my task was to choreograph a dance employing the theories of probability and chaos using chance dance techniques. However, I wanted to experiment with something outside of what had already been fore fronted by Cunningham. To do so, I decided to create a mathematical function to be interpreted by a dance code. I was immediately drawn to incorporate the Poisson distribution of probability theory in some way because of its abundant usage in real world applications. As mentioned before, it was used to solve the birthday problem above, but it is also commonly used to model the probability distributions of a number of random events such as the number of fish caught in a lake, the number of emails hitting a server on a given day, the number of raindrops hitting a slice of pavement, as well as numerous other situations commonly found in the natural world. The Poisson distribution models discrete probability<sup>6</sup> (as opposed to continuous) and could therefore be more easily used to interpret discrete events like generating steps for a piece of choreography. This method would provide a systematic approach to developing a movement sequence.

Since the Poisson distribution requires the parameter  $\lambda$ , to calculate the different probabilities, I chose  $\lambda$  to equal Euler's number or  $e$ , which is approximately 2.71828, the base of the natural logarithm. I chose this number for my parameter because  $e$  is a mathematical constant that commonly shows up in the natural world as well as in

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<sup>6</sup> Discrete refers to the condition that the event  $X$  only takes on countable values (Grimmett and Welsh 25).

probability theory for exponential growth and Bernoulli trials.<sup>7</sup> In essence, the probability distribution I created is a random number generator for discrete inputs, designed to mimic math found in the natural world. Yet even with the randomness of the distribution and the unnatural, almost forced choreographic process, I wanted my movement to feel and look organic, exemplifying what Cunningham may describe as dance in its purest form. Thus, I used my Poisson distribution and mathematical code as a guideline that is ready to be manipulated. The phrases I created this past year are just that – a natural evolution of the original code.

What may seem ironic to some is that Cunningham used a balletic movement vocabulary as opposed to the radical modern movement style of Graham, his teacher and former artistic director. Yet according to Copeland:

Chance and the ballet vocabulary are essentially two means toward the same end: they liberate the choreographer from the limitations of his own instincts... Clearly there's a connection between the impersonal nature of the 'ready-made' ballet vocabulary and the transcendence of personal intention implicit in chance operations. (107)

Using a vocabulary strongly based in ballet technique was perfect for my own composition procedure rooted in chance. As a dancer with a ballet background extending over fourteen years, I knew I wanted my piece to be in the ballet genre with modern elements and a contemporary essence. Thus my code for integers 0 through 9 included the following ballet steps in the respective, sequential order: *port te bras*, *arabesque*, *pirouette*, *rond de jambe*, *assemble*, *relevé*, *développé*, *jeté*, *sauté* and *plié*. From here, I began using my Poisson equation and my code to construct phrases. In one sense, the

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<sup>7</sup> The simplest non-trivial distribution. The Bernoulli distribution takes only two variables, 0 and 1. A coin toss is the most standard Bernoulli distribution and is one of the building blocks of probability theory (Grimmett and Welsh 26).

“creative” part of choreographing had been removed since I was required to use this regimented procedure to create my dance. Yet what may seem like a simple instruction to insert *port to bras* or a *plié* is actually quite the opposite. Any dancer can see that there are myriad ways to execute *port te bra*. Not to mention other choreographic elements like facings, rhythm, timing, dynamics, spacing and the list goes on. From one perspective, by implementing my chance dance code, I removed the creative freedom of stringing together dance steps to create a more “scientific” procedure of choreographing. Yet the style and the quality of the steps were still entirely my own choice as an artist.

Once I choreographed my phrases, I began my search for music. Like Cunningham, I did not create my movement phrases to any set counts or with any particular music in mind. Dance and music were to be separate entities that occurred simultaneously but were not dependent whatsoever. Author Sally Banes described this juxtaposition of music and dance in Cunningham’s work and contrasted it to the choreography of George Balanchine, another revolutionary artist and choreographic genius who similarly created dance for the strict purity of the dance itself. Banes described Cunningham’s idea:

Music and dance are presented as disjunct, unsynchronized events, each comprehended in its own right. They are not fused in a single *Gesamkunstwerk*<sup>8</sup>. This division of music and movement distinguishes Cunningham from George Balanchine, a choreographer who in many other respects shares some of Cunningham’s ideals of bodily intelligence. (110)

It is at this point of my choreographic process that I began to diverge from strictly following each one of Cunningham’s choreographic ideas. This choreography would be my first full composition ever and the abstract use of chance dance concepts to form my

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<sup>8</sup> German term meaning “total work of art” or “aesthetic” used famously by opera composer Richard Wagner in 1849 in a series of essays (Moss).

movement phrases was the one variable I wished to experiment with. I chose to keep the other aspects of assembling a piece up to my own conscious choice and only changed one variable – the actual sequencing of steps – to be constructed by chance.<sup>9</sup> Yes, my original phrases had no internal meter or counts given but upon picking my music, I began to create solid counts and coordinate musical cues to the general outline of the piece. After struggling to find a song that was simplistic and pure yet “edgy” and modern, I ultimately picked *Fortune* by Darling Farah. I was drawn to its repetitive sound, simple melody and background ambient noise. *Fortune* begins with simple, clear beats, becomes more complex with additional overlays of sound and slowly returns to a simple rhythmic pulse. Unlike Cunningham, I decided to synchronize these three distinctive sections in the music to mark three unique sections of the dance.

The first section began with my entire cast of five girls in pointe shoes.<sup>10</sup> They emerged from upstage, walking simply to create a reverse “V” position. This section was marked with simple, pure, slow and refined yet stationary and frontal balletic movement. With drastic *épaulement*, I wanted to showcase the pureness of the balletic lines and the power of exact unison among a group of dancers. Even Cunningham employed unison in his works and audience members praised this surprising element in his chance driven choreography. Paxton remarked, “As for the unison: I fell for this company in the first year I saw it...It was extraordinary in its power...This (unison) is another manifestation of the possibilities” (Copeland 109). Yes, Cunningham often staged multiple focus

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<sup>9</sup> This can be compared to a scientific experiment where one variable is changed while the rest are kept constant.

<sup>10</sup> The cast of five girls included Wen Na Robertson (soloist), Michaela Harrington, Kaley Jensen, Haley Miller and Samantha Routsis. All five girls are dance majors in the University of Arizona BFA program.

points occurring at once, but ignoring unison would be overlooking one of the possibilities, or set outcomes in the mathematical sense, of movement design.

About a minute into the piece, there was a shift in the music, marking the second section. Four of the dancers exited the stage, leaving behind the soloist, Wen Na Robertson, who began a chance dance generated phrase. This section was marked by notably quicker and more dynamic jumping and turning movements, which traveled across the stage until she exited. The sequence was difficult and required rehearsals outside of the main group sessions so that clarity and stamina could be built. For the most part, the chance sequence was kept intact, with minor adjustments made to correct spacing and to better fit the movement quality of Robertson's artistry. Like Cunningham, the movements required elite training and skill, especially with the addition of pointe shoes. Thus, even if the movements were created by random circumstance, the actual dance itself could stand alone as an impressive phrase of technique.

Once again, the music shifted gears, marking the third and final section of the piece. It was here where I experimented with multiple focal points occurring simultaneously. Michaela Harrington and Haley Miller danced together but on reverse sides while Kaley Jensen and Samantha Routsis dance in unison until they broke off from each other. Robertson reentered and joined Harrington and Miller until she broke off and reprised material from her solo. The piece closed with the dancers moving in silence repeating short phrases multiple times. Robertson danced a pirouette phrase from the second section while Jensen ran to exit. Harrington and Miller executed a simple *tendu* phrase moving directly downstage. Routsis then joined in the *tendu* phrase but with her back to the audience and moved directly upstage. This final section was my attempt at

organized chaos, featuring multiple areas of focus, none of which was an obvious focal point to draw in the audience. According to Banes and Carroll, by “developing simultaneous points of attention, Cunningham suddenly brings to the fore an explicit awareness of how our perception of dance is standardly orchestrated, instead of guiding our eyes so smoothly that we fail to take note of the artifice” (Banes and Carroll).

With the creation of this piece ruled by chance, rooted in probability theory and chaos, how does one measure success or failure of this experiment? Cunningham was the pioneer of chance in composition technique, revolutionizing the concept of pure dance while tearing down the boundaries presented by classical dance and ordinary choreographic practices. He had his own company of dancers and equally famous musicians, set, lighting and costume designers to collaborate with. Cunningham’s radical ideas and series of works were presented in theaters nationally and internationally for decades, even up to his death at age 90 in 2009. He had a greatly successful career marked by awards, including the National Medal of Arts in 1990, as well as admirable reviews in newspapers and magazines (“The Editors of Encyclopedia Britannica”). He is studied and featured in books and documentaries and will be remembered as an important historical figure in dance for generations to come. As for my own choreographic endeavors, what determines my success?

I presented my piece at the UA dance student choreography showings midway through spring semester. After much deliberation, I choose to title my piece in way that would explicitly showcase my use of chance dance: *Numbers: A Study of Probability and Art*. However, about an hour before the start of the show, one of my cast members, Samantha Routsis, sprained her ankle on her way to the studio. The athletic trainer



advised that Routsis should not dance, let alone put pointe shoes on. Slightly panicked, I decided to step into my own piece and perform it rather than leave an empty hole in the dance. Although it may seem easy to dance my own choreography, I found that I was extremely shaky and uneasy. I had never before run the dance myself and was suddenly worried about performing it for the first time in front of an audience made up of the entire UA dance faculty and my own peers. Yet the show must go on! What was the probability that my piece would have an unexpected, surprising and unintentional change just an hour before its first presentation?

After performing the piece for the first time at showings, I wish I could say that it went perfectly and that *Numbers: A Study of Probability and Art* made it into the Jump Start Student Spotlight show. However, this was not the case. Unfortunately, I believe that the last minute change amplified already jittery attitudes among my cast and we did not have a clean, solid run. Upon reflection, I wish that I could have remained calm during the hour before showings, reminding my dancers that it was just another run and to hold on to the notes given during rehearsals. Instead I acted upon fight or flight fear urges and acted in a flustered way that permeated into the spirits of my cast. Am I surprised my piece didn't get in the program? No. The weak run through as well as the intention behind the creation of the dance, to explore unconventional chance dance choreographical techniques rather than create a dance pleasing to the eye, were sufficient enough reasons in my mind.

Does this make my thesis experiment a failure? Although the piece didn't make it in Jump Start Student Spotlight, the movement phrases were created by chance which was my main task of this entire procedure. I genuinely enjoyed researching probability

theory, chaos and Cunningham and I was both pleased and impressed by my dancers in the final product. The chance dance technique became an unusual guide that helped me create some exciting sequences that I would not have thought of otherwise. I was pushed outside the boundaries of my choreographic tendencies and created my first full-length piece! The process itself was tedious and at times frustrating but I am grateful for the new movements it helped me generate. There was never a moment where I was “stuck” trying to figure out what to choreograph next because I had an explicit code that defined exactly what would follow. The strict instruction for the sequence of my steps gave me the sense that the piece was part of a “bigger picture” which could be thought of as falling under the theme that everything happens for a reason. It was controlled by nature and had some inner organic quality. Cunningham himself spoke of this same feeling in 1968:

When I choreograph a piece by tossing pennies – by chance, that is – I am finding my resources in that play which is not the product of *my* will, but which is an energy and a law which I obey. Some people think it is inhuman and mechanistic to toss pennies in creating a dance instead of chewing the nails or beating the head against a wall or thumbing through old notebooks for ideas. But the feeling I have when I compose in this way is that I am in touch with (something) far greater than my own personal inventiveness could ever be, much more universally human than the particular habits of my own practice. (Copeland 111)

Although I likely won't use this exact function and code, approach when choreographing an entire piece in the future, I may use this technique to help me if I ever get stuck or lost in my choreographic process. The limits of choreography are endless as the sheer number of possible dance movements and combinations of steps and phrases are infinite. Dance as an art has no limit. There is such a vast pool of possibilities, innovative ideas, creative choices and choreographic methods that makes dance so exhilarating and breathtaking. According to Cunningham, “Our ecstasy in dance comes

from the possible gift of freedom, the exhilarating moment that this exposing of the bare energy can give us. What is meant is not license, but freedom” (“Merce Cunningham Trust”)

*Numbers: A Study of Probability and Art* will be performed one last time on Tuesday May 2<sup>nd</sup> during “Last Chance to Dance.” This piece fulfills my senior capstone for the Bachelor of Fine Arts in Dance.

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