In this paper we discuss the aspect of randomness in the arts and some of its underlying mathematical principles. The aim of this text is to give the reader an overview of the usage of randomness in the visual arts and contrast it with the design of randomness on the computer. We are especially interested in the evolutionary process of random paintings and dynamic algorithms, related to works in animated generative art. Exemplarily, we consider pieces of Arnulf Rainer, Jackson Pollock, Mark Rothko and Alexander Cozens and draw connections to animations generated by algorithms using random functions.

**Keywords:** generative arts, randomness, evolution, diffusion, algorithms, computer simulations.

**AMS Subject Classification:** 00A66, 11K45, 35K05, 35G20.

1. Introduction

Randomness is one of the most important elements of modern art production. In works of Pollock, Rainer, Rothko and Warhol random, unintentional or accidental elements are powerfully combined with seriality and/or repetition. In this article we are interested in random structures that are created with computer software. In particular, we consider pseudo-random number generators, white noise, and diffusion as tools to produce random structures, and investigate their ability to mimic or explain techniques and strategies in modern art production.

*Corresponding author. Email: cbs31@cam.ac.uk*
A first example for random structures that we generated on the computer is given in Figure 1. This sequence of four images is a sample from an animation that we implemented with the open source software Processing [19, 22]. There, a plain rectangular domain is painted over with black splines, whose control points, stroke thickness, length and grey value transparency are chosen randomly, compare Section 3 for a more detailed discussion of this example. The output attempts to mimic random structures similar to those appearing in artworks of Arnulf Rainer. Rainer is famous for his expressive, impulsive style of painting. His paintings Hügel (Hill), 1963 and Knie (Knee), 1956 in Figure 2 represent an archetype of modern art. These works are examples of his so-called Übermalungen (blackenings, overpaintings) where photographs or prints of historic artworks are painted over with an informal, heavily expressive and very dense net of strokes.

The present article is an extended version of an earlier proceedings article of the authors for the Bridges conference 2010 [17]. It includes sample images from some newly created animations which are further explained within a broader artistic and mathematical context. All animations but one are generated with the Processing software. The last example is the result of an implementation in Matlab.

Outline of the paper: In Section 2 we discuss the historical role of randomness in the visual arts. This discussion gives rise to structures that can be simulated mathematically in terms of pseudo-random numbers, white noise and diffusion processes. In Section 3 we explain these tools and use them to produce random structures on the computer. We then relate the so created random patterns to some of the artworks presented in Section 2.

2. An Overview of Randomness in the Visual Arts

In the following we shall present some artistic approaches to integrate randomness in the visual arts. Here, randomness does not have a unique but many different definitions and expressions. Our discussion in this section leads us from its meaning of being not fully controllable while still influenceable to being purely random in the mathematical sense. In particular, we will investigate the technical use of randomness to create natural repetitive structures, the conceptual use of randomness in works of the Dadaist and Surrealist movement and in action painting, and eventually computer generated randomness and its role in modern art production.
2.1. Randomness enhances techniques of representation of nature

The use of random, here meaning “not totally controllable”, structures in the visual arts is probably much older than the Italian renaissance. Then Leonardo da Vinci gave the advice to use random structures one can see on corroded, humid walls as inspirations for painting landscapes, rocks, rivers or unstable phenomena like fluids, smoke or clouds, compare [12, pp. 63–65] and Figure 3. The tradition of using random elements in modern arts ranges from compositions of landscapes and clouds with “blotting” (Alexander Cozens in Figure 4, Claude Lorraine, 18th century) [11, pp. 154–169] to the creation of automatic paintings and structures by surrealist techniques of the frottage (brass rubbing) or the décalcomanie by Max Ernst in the beginning of the 20th century [12, pp. 75–83], see Figures 5 and 6.

In the 1780’s Alexander Cozens published a book called “A New Method for Assisting the Invention in the Composition of Landscape” [11, p. 155]. Like Leonardo, he found out that accidental stains on a piece of paper stimulated the imagination of his pupils at Eaton College. His ideal landscapes had to be made as instinctively as possible. He uses his “blotting” method to generate accidental shapes of washes which could be overpainted and elaborated later on. His works “Blot” Landscape Composition (1760s) in Figure 4 and Streaky Clouds at the Bottom of the Sky (1786) are representative examples of stains of washes which can be recognised as landscape and clouds respectively [11, pp. 154–169].

This (not expressive but constructive) attitude in getting inspiration from random structures has its equivalent today in the use of random noise generators to create 2d and 3d procedural texture maps with painting- and 3d animation-software algorithms [13, pp. 278–280]. Historic examples of mimicking nature as well as software generated procedural textures show the intention to provide artists with low-threshold techniques for creating realism through randomness. While the structures or phenomena that artists are aiming to represent in their works are the result of the extremely complex system of nature, artists use elements of randomness to imitate them. The obtained results are often guided and further processed by the artist in order to enhance realism.

In the 1920s techniques like frottage and décalcomania (developed by Max Ernst) were used to produce similar effects as the ones Leonardo and Cozens aimed for, compare Figures 5 and 6. While the results are similar, there is a big difference in the approach though. The surrealist movement was interested in methods which are not mind–controlled. The objective was to produce automated paintings or drawings that are also inspired by influences like psychoanalysis or mysticism.
2.2. Randomness as a conceptual tool is constitutional for contemporary art production

Apart from the importance of randomness as a technical tool, the introduction of randomness in modern artworks also shows up in two other interesting new ways in modern art production. At first artists shifted the origin of a piece of art from being the result of a totally planned artistic process to a conceptual use of randomness, a process being described as aleatoric [20]. Moreover, this kind of randomness challenges the viewer to accept the change of focus from technical mastership to more intellectual levels of reception. The viewer has to deal with ambiguous and inconsistent impressions. This is one of the key features of modern art.

Non-controllable aspects are fundamental for the visual arts in the beginning of the 20th century, when artists of the Dadaist and Surrealistic Movement begin collecting so-called *Objets Trouvés*, valueless pieces they found on the street. Marcel Duchamp defined his famous ready-mades as objects selected by the artist guided by his lack of interest in them [18, pp. 205–206]. The influence of randomness can be shifted to a level where the non-controllable factors even
replace scientific constants. In 1913 Marcel Duchamp created a new method of measurement with his work *Trois Stoppages Étalon*, see Figure 7. He explains the idea of its fabrication as follows: “If a thread one meter long falls straight from a height of one meter onto a horizontal plane, it twists as it pleases and creates a new image of the unit of length.” [8, p 12]. Duchamp’s concept of art — to bring objects not made by the artist but from industrial production into a new context — is influencing the art world to this day.

Randomness is of similar importance as two other significant aspects of modern art: seriality and repetition. A contemporary example which subsumes these two aspects is *The SHAPES Project* (since 2005) by Allan McCollum, see Figure 8. McCollum is known since the 1980s for his installations with series of identical or slightly varying objects. He uses a computer-aided system (Adobe Illustrator) to design the shapes. Here, the computer is only aiding the artist; the assembling process is guided by the artist himself. As such McCollum’s strategy has the potential to produce more than 31 billion different shapes: More than enough to give every person on earth an individual shape [26]. Note however, that this mass production apparently is not the intent of the artist. “McCollum has a workshop-type approach, and understanding the tedious labor involved is something he considers to be an important factor in understanding and enjoying the project.”

Repetition and randomness also appear in the works of Pollock and Warhol. One of the most well-known modern paintings created without total control of the artist himself are the so-called Drip Paintings of Jackson Pollock (“Jack the Dripper”) [6, p 47]. His piece *No 31* (1950) in Figure 9 represents the archetype of action painting. Pollock developed techniques which were outrageous – compared to the traditional techniques of painting – in the 1950s. He used paint and brushes in a totally different way than traditional artists. His Drip Paintings can be seen as prototypes of artworks where randomness is the constitutional factor of production. Pollock’s paintings were the topics of several scientific studies. In [25, p. 422] the authors state that, “in conclusion, Pollock’s contribution to the evolution of art is secure. He described nature directly. Rather than mimicking nature, he adopted its language — fractals — to build his own patterns.” Apart from the final artistic result itself, the heroic act of production in an expressive vital way becomes very important in action painting and abstract expressionism in general - often even more important than the result itself.

These developments — seen as accidental mistakes and artistic failure in all previous periods of art history — constitute the most cliché attribute of avant garde painting [7, pp. 168 - 171] in the 1950s. They are later transferred to ornaments in ironic appropriations by pop artists like Andy Warhol and Roy Lichtenstein. The *Oxidation Painting* series (1978) by Andy Warhol

---

1 from http://allanmccollum.net/amcnet2/album/shapes/shapesworksheet.html
can be understood as a reaction to action painting, compare Figure 10. Pop Artists like Warhol, Lichtenstein or Oldenburg made sarcastic comments on expressive art, with its white, male, and often macho connotations. Warhol produces random structures like Pollock’s by urinating on the canvas. It is the reaction of the chemical elements initiated by the dripping urine which produces the oxidation of the copper paint on the canvas.

Another abstract painter of the mid twentieth century that should be mentioned here is Mark Rothko. Rothko is famous for his so-called Multiforms. His mature work consist of pictures with blurred blocks. He often painted those in pure colours and sometimes in harsh contrast to the background, seemingly vibrating against it, see Figure 11. The technique of painting developed by Rothko is very advanced. His general method was to apply layer after layer of thin oil paint (often pure pigments with binder) to create a dense mixture of colours. Rothko intended a more metaphysical and mystical reception of his Multiforms. He applied these layers with fast and light brush strokes [23, p. 180]. In contrast to works of abstract expressionism, his paintings are produced under much more control of randomness.
2.3. Different modes of randomness in art related to the amount of artistic control

So, what is randomness? Peter Bürger draws a distinction between direct (unmittelbarer Zufall) and indirect randomness (mittelbarer Zufall) [4, p. 91]. As examples for direct randomness he refers to spontaneous forms of creation in fine arts like Action Painting and Tachism. There the artist is concentrated on the process of production, suspending rules of composition and form. On the other hand the indirect use of randomness is characterised by exactly calculated ways of composition and construction. Paraphrasing Adorno in his Aesthetic Theory: the human subject is in total consciousness of its disempowerment through technology and puts this insight on top of its agenda [1, p. 43].

In contrast, Hans Ulrich Reck suggests in [20, p. 160] that there is no randomness (Zufall) in visual art, though many things look accidental. What we call randomness is a peripheric factor within an extremely complex process. The viewer as well as the artist himself recognises its impenetrability as a characteristic feature. We call its sub-structures arbitrary or random in the attempt to give a name to modifications, changes and alterations that are vaguely ephemeral. Reck says: “Randomness is the description of an ending process, a result, a certain function, whose module is even then intended when its form has not been able to be anticipated.” [20, p. 160] (translation F. Schubert).

Using randomness in art — creating art not fully determined by the subject — is one of the strategies to undermine the heroic aspects of being an artist. According to this theory, randomness is only one variable among others in a series of decisions, but it always acts as a catalyst in the arts. Random elements in representations of nature or the conceptual use of aleatoric art are results of the real world and its underlying principles. In using computer generated random functions, artists are able to control the amount of randomness within the overall production process and are able to use a much more uncorrelated randomness with regard to its predictability.
2.4. **Computer generated randomness**

In what follows we will focus on the use of randomness generated by algorithms used in computer software. According to Schwab [21, p. 29] “to create random numbers, programmers have designed a special type of algorithm called ‘random generator’. Random generators can produce random numbers only when fed with a ‘seed’. A seed is a number taken from somewhere outside of the algorithm (usually the time, the temperature of the processor, or other sources accessible to the algorithm)”.

Moreover, King [14] says that “most computer–generated or computer-manipulated images will be the result of a balance between the two approaches of arbitrary and algorithmic synthesis, . . ., but it is my strong belief that the computer offers something radically new to the artist when they explore the algorithmic side of image generation. As well as a range of imagery not realisable through other methods there is also the attraction of serendipity: there is the possibility of an unpredictable but satisfying outcome”. Note that this type of randomness – randomness generated by random functions and random numbers on the computer – is much stronger than the randomness discussed in the above historical context. Apart from some guiding principles, like fixing the range of random values, these random numbers are “purely random” in the mathematical sense that will be defined in the next section. We will show however, how such random generators can be used to understand and mimic seemingly random structures in the artistic context.

3. **Computer Generated Randomness and Its Mathematical Description**

In the following we discuss several examples for computer–generated randomness and their mathematical description. On the one hand we shall see a randomly evolving process based on uniformly distributed random numbers, see Figure 12 for instance. Here, randomness is the seed of every single output produced by the process. On the other hand, we present a higher-order nonlinear diffusion process, whose evolution is dependent on an initial “random” state (seed), compare Figure 15.

3.1. **Pseudo random numbers, white noise and diffusion**

The random numbers used to create our examples in Figures 1 and 12–14 are computer–generated random numbers. Namely, they are generated on the computer by special methods which are called random number generators (RNG). Most programming languages and software packages use a deterministic RNG [16]. The so–generated numbers are called *pseudo random numbers*. Here, “pseudo” stands for the fact that these numbers, although they look random enough for the observer, strictly speaking are not random since they result from a deterministic process. However, for our needs of “visual” randomness, the quality of this pseudo RNG is enough. Our random numbers are *uniformly distributed* within a predefined range of values. This means that every number within this range appears with the same probability $= 1/|\text{range}|$ [9].

All algorithms for the generation of these pieces have been written in the *Processing software* [19, 22]. F. Schubert: “For an artist working with video and 3D animation but educated in several painting techniques and with only basic programming skills the use of the Processing software is obvious.” As the developers and authors of the Processing software [19] state: “. . . it allows computer programming within the context of the visual art . . . It targets an audience of computer-savy individuals who are interested in creating interactive and visual work through writing software but have little or no prior experience.”

The artistic effect of the algorithms chosen is (in most examples) to redraw artworks using aleatoric techniques and arbitrary processes (painting expressively, working with numerous, thin
and transparent layers of paint, wet on wet treatment, etc.) chosen by artists at different times and with often diverging concepts of art. This means that an algorithm providing random functions can both support an artist in achieving more illusionistic representations of nature and also reconstruct autonomous, self-referenced concepts based on randomness.

With our examples, we apply random functions to redraw techniques of painting on a flat canvas or paper. Some of them represent natural phenomena; some retrace expressive, gestural and hardly controllable action painting. In our examples time is the crucial parameter. As the Processing software achieves its results by applying thousands of strokes per second, it reveals the dynamic process of generating images by animating a multi-layered and continuously evolving structure of multiple layers. One can stop the simulation at any given time to get a single image, but there is also the possibility to receive it as an animated sequence.

We will now give a description of the creation process for each of the pieces shown in Figures 1 and 12–14 and draw connections to some of the artworks discussed in the previous section. In the subsequent examples the following elements of the painting process are randomised:

- Strokes are painted with rgba values \((r, g, b, a)\) that range in \(\{0, 1, \ldots, 255\}\).
- Stroke lengths and widths are measured in pixels.
- Stroke angles measured in degrees.
- Stroke positions are given in pixels relative to the origin in the lower left corner of the window.

Figure 1 Arnulf Rainer piece (on the first page of this paper) is created by a set of random curves that are drawn sequentially, that is one after the other. The curves consist of cubic Hermite splines that interpolate six points \((x_0, y_0), \ldots, (x_5, y_5)\). A cubic Hermite spline for two control points \((x_k, y_k)\) and \((x_{k+1}, y_{k+1})\) and its tangents \(\vec{t}_k, \vec{t}_{k+1}\) is given by a cubic polynomial \(p(t)\) parametrised with \(t \in [0, 1]\) and fixed at the endpoints with

\[
\begin{align*}
p(0) &= (x_k, y_k), & p(1) &= (x_{k+1}, y_{k+1}) \\
p'(0) &= \vec{t}_k, & p'(1) &= \vec{t}_{k+1}.
\end{align*}
\]

To define an interpolation by splines over more than two data points, a rule for computing intermediate tangents has to be fixed. Depending on this choice different sub-groups of cubic Hermite splines exist. The Processing software uses so-called Catmull–Rom splines, which guarantee that the interpolating curve possesses a continuous tangent everywhere.

All parameters of these curves experience randomness constrained to a range of values within the borders of the window frame. For every newly created curve our algorithm randomly shifts its endpoints within a neighbourhood of the left and right border respectively. Then the algorithm randomly chooses the four intermediate control points in dependence of the end points in a way which creates this characteristic shape of the curves shown in Figure Arnulf Rainer piece. The computer draws all lines in black with a random transparency \(a \in [5, 20]\), that is rgba value of \((0, 0, 0, a)\), and a random width between 0.05 and 0.3 (fractional stroke weight by anti-aliasing [28, Chapter 14., pp. 392-417]). The resulting line-like structures give a similar impression as the Arnulf Rainer piece shown on the right in Figure 2. See also Roman Verostko’s works in which he uses splines with randomly-generated control points [27].

In Figure 12 From Pollock to Rothko we show a sequences of images, generated by random strokes distributed within a predefined rectangle. More precisely, we iteratively fill the rectangle with black lines with random lengths, random widths, random positions and random angles that are uniformly distributed within specified ranges. The computer plots the black lines with transparency 1, that is with an rgba value of \((0, 0, 0, 1)\) [24]. The painting process consists of two nested iterations. We initialise the outer iteration with a random position within the rectangle. Then, from this position, an inner iteration draws a vertical line of random width and of random length between 0 and 10 pixels. Next, from the endpoint of this line we shift the position by 8 pixels to the right, alter the slope of the line by a random angle and decrease its width by
one. This inner iteration stops when the width equals zero. Then the outer iteration starts again with a new random position and a vertical line as before. In this way, our algorithm iteratively fills the centred rectangle with an increasing amount of black and slightly transparent random strokes.

*From Pollock to Rothko* shows, not a single frame or image of art, but rather an animation which could be stopped at any time to archive structures like in Pollock’s paintings, compare Figure 9. The sequence produces a transformation of such chaotic images to a more compact shape which evokes associations to Mark Rothko in Figure 11.

The example in Figure 13 *More Pollocks* exhibits a slight variation of the random process in Figure 12 *From Pollock to Rothko*. Instead of black, we colour the strokes now in a dark blue, that is with rgba value of (45, 50, 67, 1). We allow angle and thickness of the strokes to randomly

![Figure 12](image12.png)

Figure 12. Carola-Bibiane Schönlieb, Franz Schubert: *From Pollock to Rothko (One Way)*, Processing Algorithm, 2010.

![Figure 13](image13.png)

vary in a range of $-90$ to $90$ degrees and $1$ to $38$ respectively. For every drawn stroke we add a new random translation, which results in a more expressive animation.


In Figure 14 *Cloudy sky* we initiate the painting process by a line starting in the middle of the frame and ending at a random position constrained to lie within a predefined rectangle within the window frame. The next line drawn starts at the end point of the previous line and ends at a new random point, and so forth.

For the piece *Cloudy sky* we altered the variations of our algorithm to produce more horizontal lines mimicking Rothko’s style. The random distribution of the strokes gives us the impression of a cloudy sky which gets denser as the code iterates. Here, randomness is used both as a constructive and as an expressive method to create this piece of art.

The grey value of every random stroke in Figure 12 *From Pollock to Rothko* has an rgba value of black with transparency $a = 1$. This means that the grey value at a position $(x, y)$ is approximately given by

$$g(x, y) = \sum g_a \cdot p(x, y),$$

where $\sum$ sums over all iterations, $g_a$ denotes the grey value black with a percent transparency, and $p(x, y)$ is the probability that a stroke colours the pixel $(x, y)$. In the example *From Pollock to Rothko* the probability $p$ is nearly uniformly distributed. From the central limit theorem [9] we deduce that the grey values $g$ are approximately normally distributed. In fact, the central limit theorem tells us that the average of elements of a sample of independent and identically distributed random variables tends to a normal distribution as the sample size increases. Hence,
the average value of \( N \) identically distributed numbers is approximately normally distributed and in the limit \( N \to \infty \) exactly normally distributed. As a consequence, the averages of random colours of the strokes created in Figure From Pollock to Rothko tend to get closer and closer to a normal distribution as the iterative painting process progresses (until all pixels are coloured in black). A similar effect arises in the dynamics of the examples Arnulf Rainer piece, More Pollocks and Cloudy sky. This leads us to another interpretation of our generative process as a generator of Gaussian white noise, that is statistical noise which is normally distributed.

Another consequence of the central limit theorem is the close connection of the randomness visualised in our examples so far with a random walk and in the continuum limit with solutions to the diffusion equation. Roughly speaking, the end points of a random walk in the plane are normally distributed and their probability density \( g \) in the continuum limit (that is the limit for letting the step size of the motion tend to zero) is a solution of the linear diffusion equation in the plane, that is

\[
\frac{\partial g(x, y, t)}{\partial t} = \Delta g(x, y, t) = \frac{\partial^2 g(x, y, t)}{\partial x^2} + \frac{\partial^2 g(x, y, t)}{\partial y^2},
\]

where here the time-variable takes over the role of the spatial steps for the evolution process of the random walk.

### 3.2. Pattern formations

Starting from a simple linear diffusion process as in (1), we eventually consider more sophisticated forms of evolutionary diffusion, i.e. highly-nonlinear and higher-order diffusions. The nonlinearities in such equations can be interpreted as constraints on the random process and promise to produce visually interesting patterns. One example of such an equation is the so-called Cahn-Hilliard equation [3]. We define solutions \( g(x, y, t) \) of this equation on a rectangular domain \( (x, y) \in \Omega \) in the plane and for all times \( t > 0 \). Starting with a randomly chosen initial state \( g(x, y, t = 0) = g^0 \) the Cahn-Hilliard equation reads

\[
\frac{\partial g(x, y, t)}{\partial t} = -\epsilon \Delta^2 g(x, y, t) + \frac{1}{\epsilon} \Delta W'(g(x, y, t)), \quad \text{on } \Omega,
\]

where \( \Delta W' \) is the derivative of the free energy functional at \( g \).

![Figure 15. Carola-Bibiane Schönlieb, Franz Schubert: Evolution of the Cahn-Hilliard equation for two randomly ("white noise") chosen initial states, Matlab 2010](image)
where the nonlinearity \( W(g) = g^2(g - 1)^2 \) is a so-called double-well potential. Fixing the values of the solution on the boundary \( \partial \Omega \), the “randomness” in (2) is uniquely defined by the initial state \( g^0 \) of the evolution process, that is the initialisation of the process by the artist. One example for two different initial states and the corresponding algorithmic dynamics is given in Figure 15. For this example we used the mathematical software MATLAB. For the level of mathematical terminology needed for solving (2) (i.e. finite elements have been implemented to solve the equation) Matlab was much more convenient to use in this case.

Note that the Cahn-Hilliard equation is one of a more general set of reaction-diffusion equations used to create so-called “RD textures” for computer graphics applications. Some of them have been successfully used in modern art production, see for example Brian Knepp’s Healing installations [15].

Conclusion

We outlined the importance of randomness in generative art and its expression in computer supported, algorithm based, arts production. By means of several examples, we sketched the possibilities of an algorithmic approach to produce random structures using sophisticated mathematical tools, like RNG’s and higher-order diffusions.

The generative art created constitutes an interesting example of the impression obtained from the dynamics of randomness and its connection to noise. In particular in Figures “From Pollock to Rothko”, “More Pollocks” and “Cloudy sky”, the visual noisy effect in the image sequence is directed by uniformly distributed random choices of parameters like position, length, width, angle and transparency of the strokes. Starting with a blank rectangle, we fill it by random strokes with a certain transparency which start looking more and more like “white” noise as the painting process evolves and reach a kind of stationary state when the whole rectangle is painted in black. The “white noise” effect leads us into the area of constrained diffusion processes initiated by a random state. In all examples the remarkable aspect of randomness lies in the dynamic evolutionary process rather than the final result only.

Acknowledgements

The authors acknowledge support from the project WWTF Five senses-Call 2006 project nr. CI106 003. C.-B. S. also acknowledges the financial support provided by the Cambridge Centre for Analysis (CCA), the DFG Graduiertenkolleg 1023, funding from the Royal Society International Exchanges Award IE110314 and the EPSRC first grant Nr. EP/J009539/1.

We also thank the reviewers for their very interesting and detailed comments which have improved the presentation of the manuscript.

References

Figure references

Figure 2: Arnulf Rainer: Hügel (Hill), 1963, etching, 37.5 x 54.1 cm, ©Studio Arnulf Rainer.

Figure 2: Arnulf Rainer: Knie (Knee), 1965, etching, 49.7 x 34.5 cm, ©Studio Arnulf Rainer

Figure 3: Leonardo da Vinci: A Deluge, with a Falling Mountain and Collapsing Town 1515, black chalk, The Royal Collection ©2011 Her Majesty Queen Elizabeth II

Figure 4: Max Ernst: Le Forêt pétifié, 1929 Frottage, 74 x 98 cm, ©VKB, Wien 2011

Figure 5: Alexander Cozens, “Blot” Landscape Composition, 1760s, a brown wash drawing, 16 x 20.6 cm, ©Trustees of the British Museum

Figure 6: Max Ernst: Attirement of the Bride, 1940, Oil on Canvas, 129.6cm x 96.3cm Décalcomanie (Decalcomania), ©VKB, Wien 2011

Figure 7: Marcel Duchamp: Trois Stoppages Étalon, 1913, Mixed Media, 28.2 x 129.2 x 22.7 cm, ©VKB, Wien 2011


Figure 9: Jackson Pollock: No. 31, 1950, oil and enamel on Canvas, 269.5 x 530.8 cm, ©VKB, Wien 2011


Figure 12: Mark Rothko: No. 7, 1964, mixed media on canvas 236.4 x 193.6 cm, ©VKB, Wien 2011

Figure 12: Mark Rothko: No. 14 (White and Greens in Blue), 1957, ©VKB, Wien 2011