

## The “accusing glance”: change in eye movements during the observation of a Van Gogh’s painting before and after artistic information on the work of art.

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### **Abstract:**

What is the influence of artistic information on our glance? The variation of ocular movements in 15 voluntaries wealthy subjects was studied, before and after they had received detailed information about the last painting of Vincent Van Gogh, a work finished just before he died, called “Wheat field with crows”. Since Yarbus’ primary works in 1967 (1) we know that the eye moves 230,000 times a day, it is one of the most frequent movements of the body. Through multiple fixations and saccades (2), the eye collects information that are transmitted to the brain. Subjects observed, during 30 seconds, the painting on the screen of an eye tracker (Metrovision). Before, but also after information, we see that scan paths describe a circle movement between the four opsiemes (the smallest discrete unit that can be isolated in the visual chain): the sky, the wheat, the birds and the paths. The main difference between the pre and the post information’s seeing is the fact that the eye tips over in the right crows’ zone, and we scrutinize the birds’ flight. The glance changes after general knowledge information. Here, the visitor’s eye seems lost because Van Gogh’s mind is lost at that time. The construction is wrong, with a vanish point reversed. With an unusual construction, result of the psychological disease, the study of the visual strategy informs us of the helpfulness narration before the sighting.

### **Aim of the study:**

What is the influence of artistic information on our glance? The variation of ocular movements in 15 voluntaries wealthy subjects was studied, before and after they had received detailed information about the last painting of Vincent Van Gogh, a work finished just before he died, called “Wheat field with crows” (**fig. 1**). Two days later, the painter decided to come back at the same place to “shoot the crows”, but shot a bullet in his chest instead.

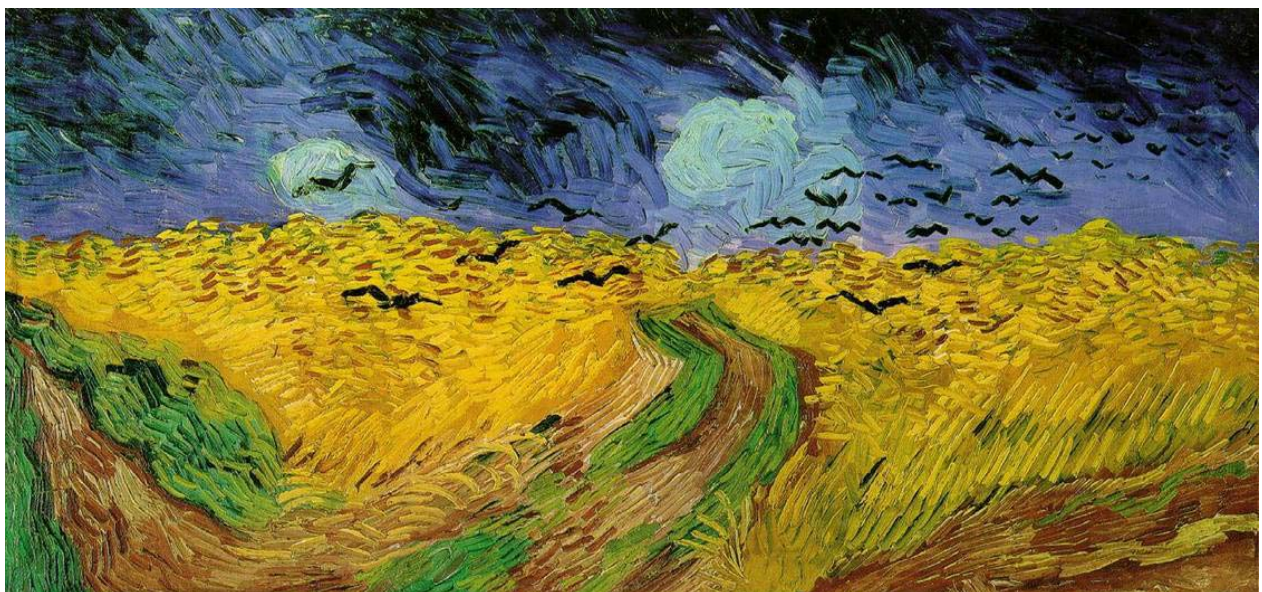
### **Introduction:**

The retina is made of specific cells called cones and rods. The cones account for human's accurate vision. Within the retina a small surface, called fovea, contains only cones. At the periphery of this area the retina contains both rods and cones providing blurry images. This aspect of the eye explains why moving the ocular globe is required to observe an object or a specific detail.

This sequence, fixation and saccades (very rapid movement from one to another point) [1] may be recorded by an eye tracker. Such a method allows for the understanding of the information collected by the eye ("visual tool") and transmitted to the brain. Since Yarbus' primary works in 1967 [2], this technique has been applied to several fields ranging from neurosciences to driving exercises.

### Materials and Methods:

15 left handed subjects ( $44 \pm 11$  years, 2 men – 13 women) observed, during 30 seconds, the painting on the screen of an eye tracker which measures the glance's direction from the eye's image collected in a near infra red. The number and the mean duration of the fixations, the number, the mean amplitude, the frequency and the direction of the saccades for the all painting were recorded by the device. Areas of interest were selected: 2 horizontal zones (1H: sky, 2H: ground) (**fig. 2**), 2 verticals zones (2V: on the right, 1V: on the left of the central path) (**fig. 3**), 6 zones (zone 1: crows on the left, zone 2: center, zone 3: central path, zone 4: left path, zone 5: right path, zone 6: crows on the right) (**fig. 4**). The access time to these six zones was also carefully monitored. These areas of interests allowed us to evaluate the role of the artistic stimulus on the ocular movement (3). A questionnaire was submitted after the two observations (knowledge of the painting, of the painter, glance's attraction before and after information). The student's test was used for statistical purposes (mean comparison on dependants groups).



*Fig. 1: Wheatfield with crows*



Fig. 2 : 2 horizontal zones



Fig. 3 : 2 vertical zones

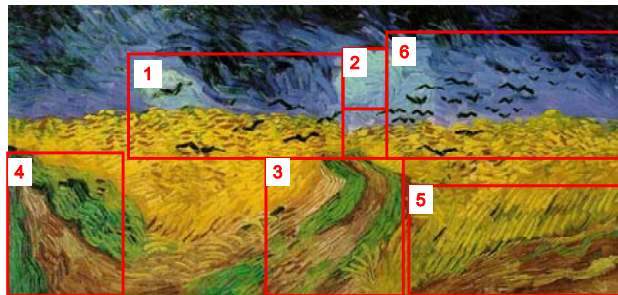


Fig. 4: 6 zones

## Results:

### A/ Two horizontal zones:

We did not observe, for the zones 1H (sky) and 2H (wheat and paths) before and after information, changes in the number of fixations, mean duration of the fixations, total duration of the fixations, saccades' total number, left and right saccades' number, saccades' mean amplitude in the 2H zone, mean amplitude of the left saccades, right saccades' mean amplitude in the 2H zone.

After information, in zone 1H, a decrease in the average saccades' amplitude in zone 1H ( $7.12^\circ$  vs  $6.56^\circ$   $p = 0.06$ ), and a diminution of the right saccades' amplitude ( $7.13^\circ$  vs  $6.46^\circ$   $p = 0.079$ ) was noticeable, but these differences are not significant.

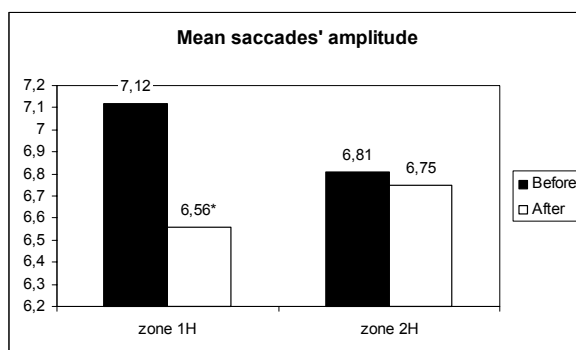


Fig. 5:  
zone 1H \* $p = 0.06$ ,  $t=1.65$  dof 14 unil

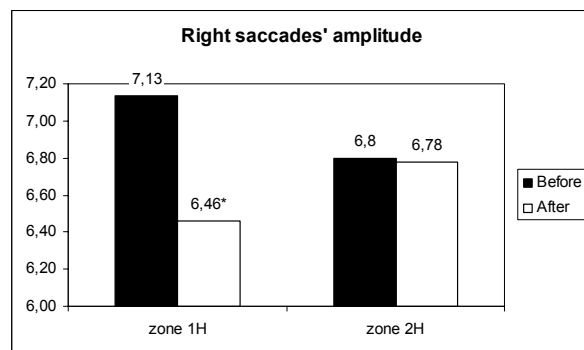


Fig. 6.:  
zone 1H \* $p = 0.079$ ,  $t=1.49$  dof 14 unil.

### B/ Two verticals zones:

We did not observe, in the zone 1V and 2V (respectively on the left and the right of the central path) before and after information, differences in the fixations' number in zone 2V, fixations' mean duration, fixations' total duration, saccades' total number in zone 2V, fixations' mean duration, fixations' total duration, saccades' total number in zone 2V, number of left and right saccades, mean amplitude saccades, mean

amplitude of the left saccades, mean amplitude of the right saccades in zone 2V. After information, in zone 1V, we notice a decrease in the fixations' number (31 vs 28  $p = 0.08$ ), in the amount of the saccades (30 vs 27  $p = 0.09$ ), and in the number of the right saccades ( $8.70^\circ$  vs  $7.87^\circ$   $p = 0.12$ ) but these differences are not significant.

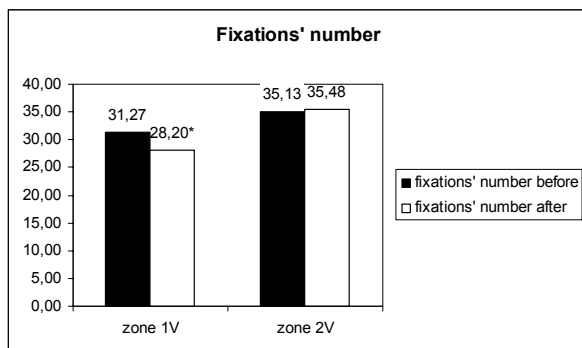


Fig. 7:  
zone 1V, \* $p = 0.08$ ,  $t=1.43$  dof 14 unil.

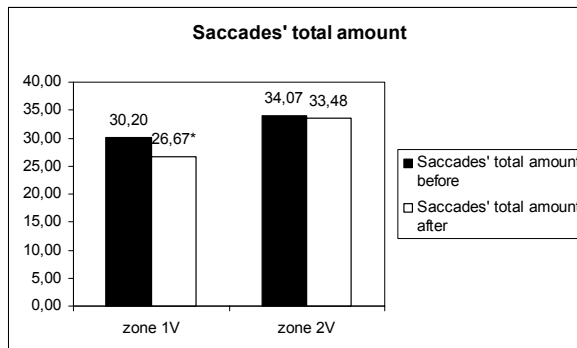


Fig. 8:  
zone 1V, \* $p = 0.09$ ,  $t=1.37$  dof 14 unil.

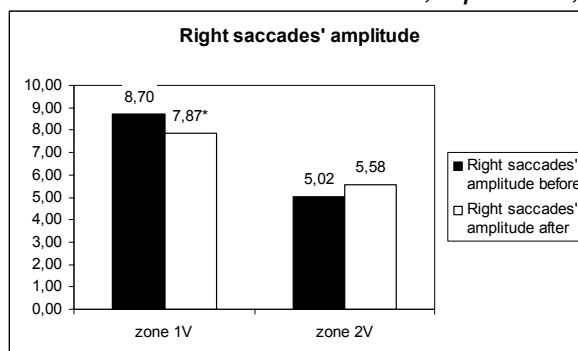


Fig. 9: zone 1V, \* $p = 0.12$ ,  $t=1.27$  dof 14 unilateral

### C/ Six zones:

**C1/ Fixations' number:** We observed after information a switch in the repartition of the fixations' concentration. Before information, the zones more often observed, regarding the amount of fixations are the zone 1 (16.60), then the zone 6 (12.80). After information, we found the opposite and the zone 6 became the most visited (16.53) in front of the zone 1 (12.87). The decrease in fixations' number is significant for the zone 1 ( $p = 0.008$ ) and for the zone 2 (6.13 vs 3.93  $p = 0.016$ ). The increase in the fixations' number in zone 6 after information is significant ( $p = 0.047$ ).



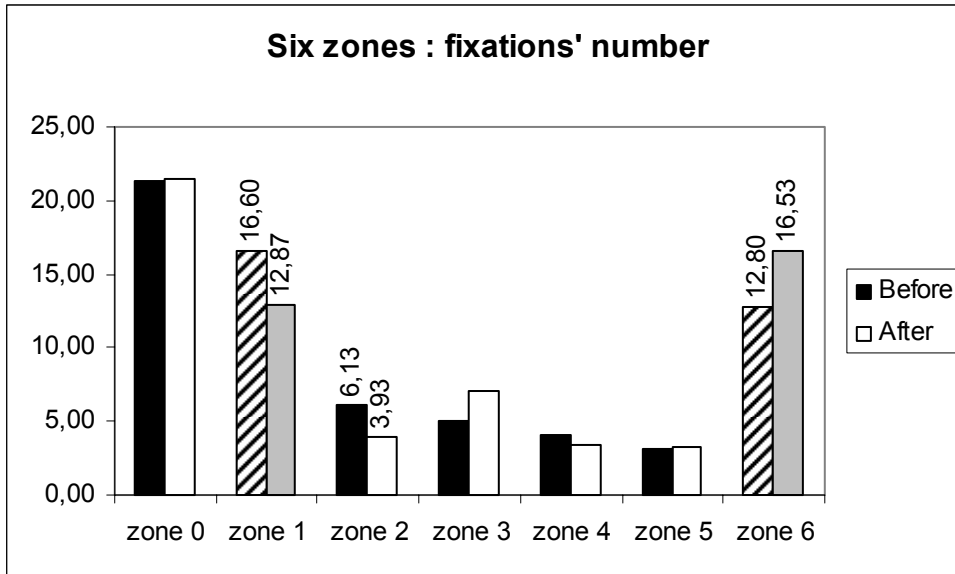




Fig. 10: fixations' number. Cutting out in 6 zones.

Zone 1 : \*\*  $p = 0.008$ ,  $t = 2.68$  - Zone 2 : \*\*  $p = 0.016$ ,  $t = 2.36$  - Zone 6 : \*\*  $p = 0.047$ ,  $t = 1.79$   
 dof 14 unilateral  Zone 1 and 6 before  Zone 1 and 6 after

	Before	After
zone 0	21,27	21,47
zone 1**	16,60	12,87
zone 2**	6,13	3,93
zone 3	5,07	7,07
zone 4	4,07	3,40
zone 5	3,07	3,27
zone 6**	12,80	16,53

Table 1: fixations' number before and after in the cutting out in 6 zones \*\*  $p < 0.05$

C2/ Fixation mean duration: There is no significant difference between the six zones concerning the fixation mean duration.

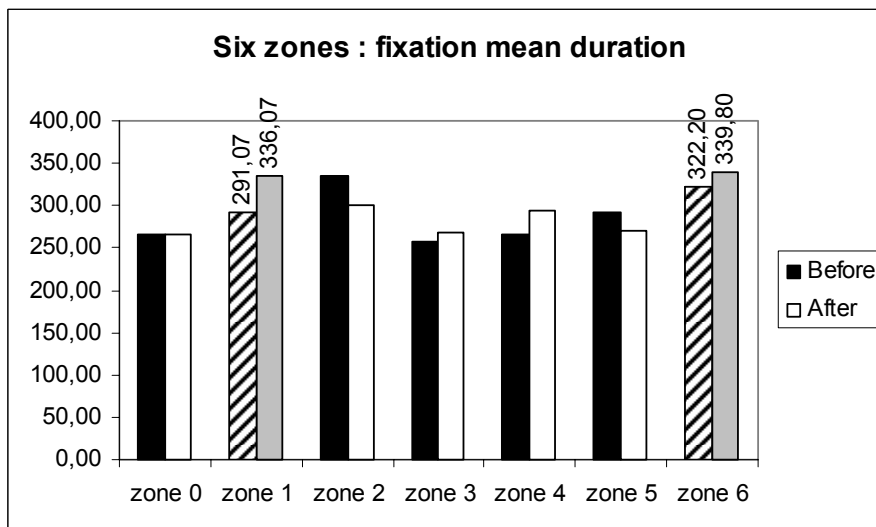


Fig. 11: Fixations mean duration cutting out in 6 zones.

Zone 1 and 6 before
  Zone 1 and 6 after

C3/ Access time: We studied the access time for each of the six zones. Before and after information, the zone 1 is always discovered first, but with a significant delay (413 ms vs 1527 ms  $p = 0.0007$ ). The access time for the zone 2 is delayed a lot after information (3060 ms vs 6073 ms  $p = 0.046$ ) (**fig. 12**). The sequence from one zone to another is altered by the information: before 1, 2, 6, 3, 4, and 5 (**Z aspect**), after 1, 3, 6, 2, 4 and 5 (**e aspect**) (**fig. 13**). Zone 6, after information, is always reached in third position: or after the zones 1 and 2 or after the zones 1 and 3.

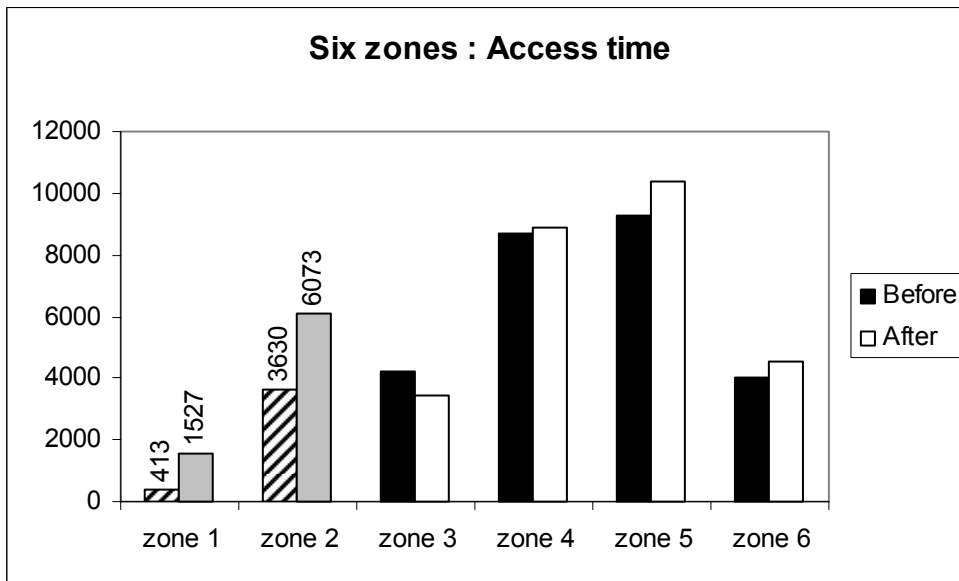


Fig. 12: Access time cutting out in 6 zones.

Zone 1 : \*\*  $p=0.0007$   $t = 3.92$  - Zone 2 : \*\*  $p=0.046$   $t = 1,8$



Fig. 13: Access time: order in discovery

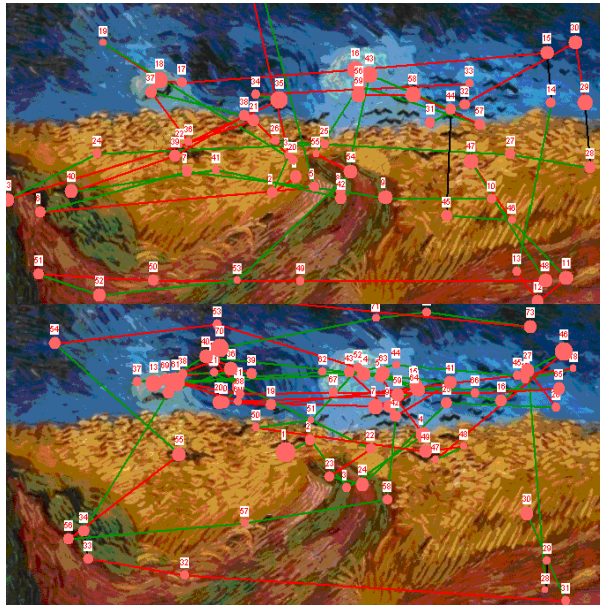
In summary, visual information for the last Van Gogh's painting leads the following modifications. (\*\*significant statistic results):

Two horizontals zones: Saccade's amplitude decrease in the sky zone, right saccades' decreased in the sky, the eye "moves" less in the zone "sky".

Two verticals zones: Fixations' number decreased in the left half, saccades' number decreased in the left half, right saccades' decreased on the left, the eye scrutinize less the left zone of the painting.

Six zones: Fixations' number decreased for the right crows\*\*, fixations' number increased for the left crows\*\*, left crows access time delayed but first of the six zones\*\*, delayed access for the central zone\*\*, access to the right crows equivalent\*\*.

The eye tips over in the right crows' zone (**fig. 14**).



*Before*

*After*

*Fig. 14: Fixations and saccades' repartition, subject 10*

### **Discussion:**

The results of this study show that the glance changes after general knowledge information about this work of art. Information has the ability to modify our visual strategy. We scrutinize in a precise manner the birds' flight. Did they play a trigger role in the painter's death? The eye seems, after information, to be inspecting the right zone of the painting, area which spontaneously can attract the glance, since it is a contrasted region [2], but also because there is an oblique, cutting the painting from left to right. (**Fig. 15**).

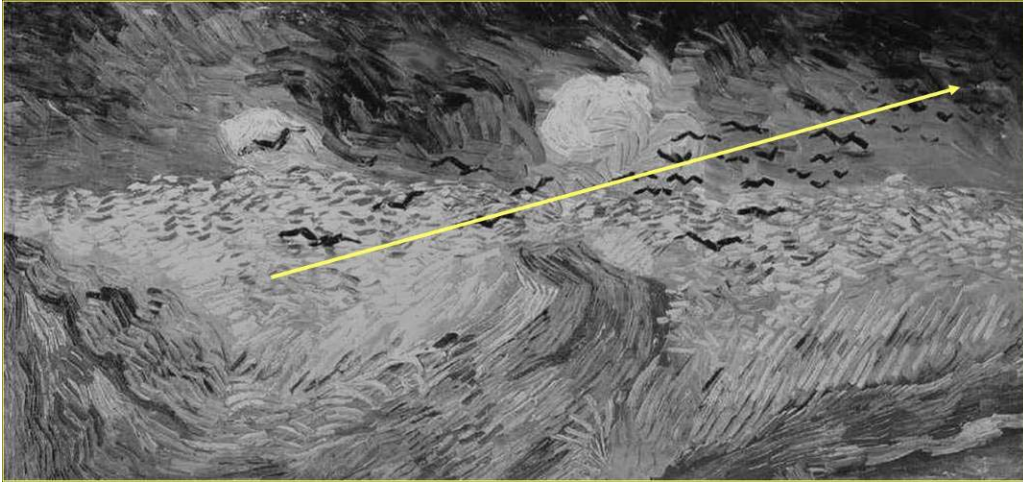


Fig. 15

As previous works' demonstrate [3, 4] the eye is attracted by complex areas, where saccades have lower amplitude and the fixations' number increase to collect as many information as possible.

The boundary zone between the sky and the wheat is intriguing for the eye, or the brain; it seems that the crows leave from the ripe wheat's crest. If we analyze closely the artistic work of Van Gogh, we notice that the birds are succinctly represented with two, three or four black brush strokes. It is the same graphic representation used for the top of the wheat, but this time using the ocher yellow instead of the black. It is this zone that the eye loves to look closely after information (**fig. 16**).



Fig. 16

Post-observation questionnaire confirms this notion since 9 out of 15 subjects recognize the fact that they are attracted to the crows after information (**Table 2**).

	Before	After
subject 1	Path	Crows
subject 2	Birds	Wheat
subject 3	Wheat	Crows
subject 4	Center	Crows, Arm
subject 5	Bright Colors	Wheat
subject 6	Whirlwinds	Crows



subject 7	Sky	Sky
subject 8	Colors	Crows
subject 9	Blue, center	Crows
subject 10	The blue color	Black, blue
subject 11	Wheat	Wheat
subject 12	The bottom, the path	Sky
subject 13	Yellow, field, path	Crows
subject 14	Sky, champ, colors	Crows
subject 15	Sky	Crows

*Table 2: What attracted your glance?*

Maybe the glance is attracted by the crows because these are the ones explicitly mention during the narration? This can be understood in a complex masterpiece, but the “wheat field with crows”, is a “simple” work of art, with 4 zones of interest: the sky, the wheat, the crows and the paths. It takes us 10 seconds to go around the painting as shown by the access times. After these 10 seconds, the eye “wanders around” the painting searching for an anchor point. We see that scan paths describe a circle movement between the four opsiemes (the smallest discrete unit that can be isolated in the visual chain): the sky, the wheat, the birds and the paths. However, no points will allow the spectator to settle down. Maybe we can, by the visual strategy’s study in this painting, discover in which state of mind was Vincent Van Gogh during this month of July 1890. Indeed we notice that this painting’s construction is unusual. Vincent Van Gogh knows very well perspective, that he described in one of his letters to his brother Theo, drawing the tool which helps him in the field to draw, placing his lines and others escape points (**fig. 17**).



Fig. 17

He will use this technique in many paintings such as “Van Gogh’s room in Arles” (**fig. 18**), or the « Terrace at night », or in his fields’ views « Flowers’ fields in Holland », « Poppies field at Saint-Remy », and also in another similar canvas to the one of our study.

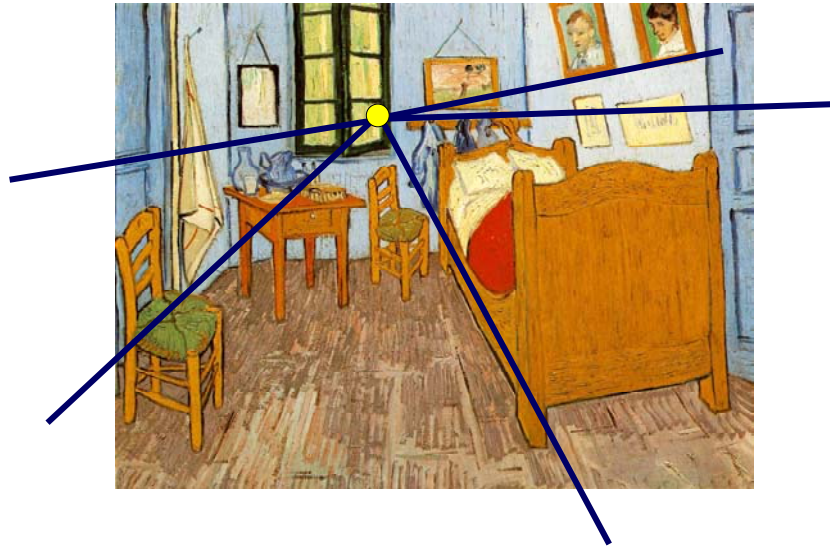


Fig. 18: Van Gogh’s room in Arles (1889)

In our painting the perspective is shockingly inversed! The escape point is not behind but in front of the field, exactly where the painter sets his easel. This inversed perspective certainly explain the nomad glance in the canvas between the field with the crest highly placed as a wave ready to run aground on us, the whirlwind’s sky and these three paths going nowhere, converging to the left bottom (**fig. 19**).

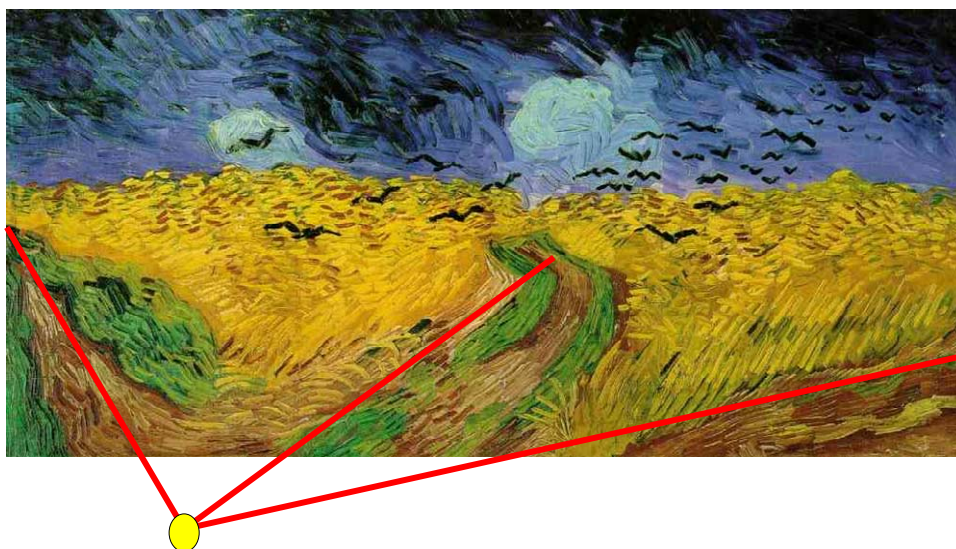


Fig. 19

So, it is two days before his suicidal act that Vincent Van Gogh paints in an abnormal way, "without perspective".

Van Gogh became an artist painter at the age of 27 (1880), and after renouncing to a carrier in the religious order. Vincent Van Gogh's all work is done during ten small years! He realizes during this period 900 paintings, 1100 diagrams and sketches. His art is not a merchant act, but more a sort of "breathing". His recurring comportment's troubles in Provence motivate his brother Theo to bring him back near Paris, in Auvers-sur-Oise where he will be under the attentive surveillance of Doctor Gachet. It is here on July 25th 1890 that he realizes this odd painting. The analysis of the overall circumstances during this month, may explain this curious arrangement. Vincent Van Gogh is psychologically weak, he fears a new "attack", and he insists in his letters for Theo to come visit him in Auvers (5). But this one is in conflict with his spouse Jo, young mother since the month of January 1890 and his relations with his employer are fragile, making him anxious about his future. Vincent certainly feels, at this specific moment, more abandoned than any other time in his life. Him, the second family child, who came, at least for the first name (Vincent Willem), to replace his older brother who died at age of six weeks. Indeed, one year later, on the same day (the 30 of March 1852 and the 30 of March 1853), Vincent Willem Van Gogh was born. Child, he used to cross on Sunday morning with his father, going to the church through the cemetery, the little grave with his name...and off by one digit, his birth date. During the beginning of the year 1890, on January 31st, Theo and Johanna had a boy. They decided to name him... Vincent Willem Van Gogh! Thus, between two Vincent Willem, the artist feels lonely and in front of this wheat too tall, in front of this tumultuous sky and in front of these three paths with no way out, the arrival of the crows is a bad sign and they surely announce bad news to the fragile mind of Vincent Van Gogh. His vision of the nature is troubled and the construction of his painting is disturbed. Thus the spectator in front of the canvas feels this discomfort, and his visual path will be nomad. It is at this juncture that the artistic information can guide the observer's glance with emotion.

## **Conclusion:**

In a simple artistic composition (wheat field, paths, sky and crows), informative narration don't radically change intrinsic characteristics of the ocular movements, but it steers the glance. In this particular painting, the visitor's eye will be lost because Van Gogh's mind is lost at that time. With an unusual construction, result of the psychological disease, the study of the visual strategy informs us of the helpfulness narration before the sighting. Maybe the spectator eye becomes condemning toward those bad sign's birds.

(1) RAYNER K., POLLATSEK A., «Eye Movements and Scene Perception», Canadian Journal of Psychology, 46, p. 342-376, 1992.

(2) YARBUS A.L., Eye Movement and Vision, Plenum Press, New-York, 1967.

(3) ZEKI, S. 1999. Inner Vision: An Exploration of Art and the Brain. Oxford University Press.

(4) LIVINGSTON M. The biology of seeing (p78). Harry N. Abrams, inc., publishers.

(5) Letter 649 Auvers 10 July 1890. Vincent Van Gogh, Correspondance générale Tome 3, p. 729. Gallimard.