The Perspective System Underlying the Low Relief of Sansovino’s Annunciation. For a Narration of the Illusory Space of the Scene †

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Abstract: During the Renaissance, low-relief sculpture addressed the concept of organizing pictures and scenes in narrative sequences, creating real visual objects that aim to transmit a message by constructing an illusory physical space that embraces and accompanies the emblematic episode being narrated. The article presents a procedure and the results of research centred on the work of the Annunciation by Andrea Sansovino placed on the west face of the Holy House in Loreto. The ultimate goal is to identify a means of visual communication capable of rendering geometrical/proportional systems, the underlying perspective structure, and the relationship between the time when the work is viewed and the time represented in the work by reconstructing the depicted space in three dimensions.

Keywords: cultural heritage; integrated survey; cognitive drawing; perspective rendering; 3D reconstruction; virtual narration of space; visual storytelling

1. Introduction: Historical/Thematic Context, Case of Study and Objectives of the Research

The human mind has always favoured visual content. Images were the first means with which humans began to communicate and, in particular, ‘telling stories with images’ has very ancient origins. Starting with rock carvings, then evolving into the so-called ‘figurative arts’, and finally arriving at today’s digital means, this form of communication has accompanied the history of human culture and its expressions, responding to different needs: sharing inner or outer experiences, transmitting social, religious, or cultural identity values, promoting messages or products, entertaining, explaining phenomena, talking about spaces or people. In any case, no matter the historical period or the motivation underlying the images, they are always ‘bodies’ designed to be exhibited, to support a system of observation [1].

Starting with these reflections, the studies presented here focus on the cycle of images sculpted in low/high relief on the upper portion on the sides of the Holy House situated within the Basilica of Loreto.

In 1513, Pope Leo X summoned Andrea Contucci, known as the Sansovino, to Loreto to oversee the construction of the Sanctuary. With this appointment, he was tasked with different responsibilities: the progression and completion of the works on the Basilica and the Apostolic Palace and the decoration of the Holy House. In carrying out these tasks, Sansovino found himself directing the works and interventions begun by Donato Bramante. That is, he had to work with canons and a language that was different from his usual expressive/content choices, or rather, he aimed for a strong interaction between sculpted and architectural space [2].
Archival data and historical studies show that the different interventions made by Andrea Sansovino at Loreto took place between 1514 and 1527. Over the course of about thirteen years of activity, it seems that those in which he could dedicate himself specifically and exclusively to the sculpted decoration of the Holy House began in 1518 [3].

To realize these sculpted surfaces, even if not constrained to following Bramante’s designs, the artist worked to insert different elements into the well-defined partitions present in Bramante’s project. The entire marble surface, in fact, is divided into parts by sixteen Corinthian half columns. Situated at the corners and at specific intervals along the four faces, they divide the elevations based on the alternation of two different intercolumniations. In particular, the major ones were identified as spaces destined for a theme that, knowingly divided again, united all the faces of the structure in a single objective: starting from the north facade, eight panels—six large ones and two smaller ones—narrate the important events in the earthly history of Mary. One last panel, situated in the lower part of the east facade and constituting a panel in itself, is dedicated to the events of the subsequent relocation of the Holy House.

Sansovino was succeeded by Raniero Nerucci and then by Antonio da Sangallo the Younger. Work ended in 1538, even if the statues of the sibyls and the Major Prophets were later placed within the double order of niches present between the columns at the corners and the centre of the longer sides of the structure [4].

The sculpted decoration of the entire house can certainly be defined by making a rigorous plastic/decorative interpretation of the architectural scans of the object. There is no doubt, however, that the key characteristic of this sculpted project, making it a unique work of its type, consists of the low-relief Marian cycle aimed at sculpting the life of Mary in stone.

From these decorations, it seems that Sansovino personally realized the low reliefs of the Annunciation, the Adoration of the Shepherds, and the Marriage of the Virgin, setting the scenes in perspective view and using a soft, ethereal style. The other panels (Birth of Mary to the north, Visit to Elizabeth and Joseph’s registering in the census to the west, Adoration of the Magi to the south, and Assumption of Mary to the east), in which the artist’s contribution is also perhaps partially present, were realized in the following years and were prevalently the work of assistants and sculptors in his circle. These included Niccolò Pericoli called Il Tribolo, Raffaele da Montelupo, Girolamo Lombardo, and Francesco da Sangallo. [5].

What is significant is that this set of works, in a series of eight panels of substantial size, determines a real temporal and visual narrative path. Each individual relief creates a particular narrative space that aims to involve the observer’s look in the sculpted scene, progressively telling a salient episode (Figure 1).

During the Renaissance, therefore, low-relief sculpture, like painting, addressed the theme of light and space, i.e., the rendering of spatial depth and the organization of tableaux and scenes in narrative sequence. The technique of perspective, together with a skilful dose of relief is applied precisely to obtain the desired effect of spatial depth, thereby playing the role of narrative expedient in order to immerse the observer within the spaces imagined in the sculpted scenes.
Designed thus, the low reliefs create visual artefacts that depict not only the imagined space of the artist and his personal vision, but also aim to interpret or construct the collective imagination to transmit a message through the illusory physical space of the emblematic episode being narrated. One can therefore say that these are ‘images’ in which two questions overlap: the perceptual means underlying the perspective construction of the space, and the relationship between the time represented in the image and the time when it is viewed.

In the research presented here, the choice was made to focus the studies on the low relief of the Annunciation by Sansovino on the forward side of the Holy House and therefore positioned above the altar facing the nave of the Basilica (Figure 1). However, since the sculpted panel forms an integral part of the unifying communicational intent, it was absolutely necessary to start from the brief introductory notes above. Not only do they consist of indispensable studies and considerations to correctly frame the topic of interest, they also focus on and highlight the most useful aspects underlying the intentions of this work.

That being said, with respect to the specific work under study, three correlated and interconnected objectives were identified. The plan of investigation was the following:

- First, investigate the space depicted in the low relief, analyzing the proportional geometric relationships and the structure of perspective used in the scene.
- Next, create a three-dimensional virtual reconstruction of the space depicted in the low-relief.
- Finally—not in order of importance, but rather intended as the final goal—identify an adequate means of communication that allows the results obtained to be practicable and understandable by all.

The significance attributed to this research lies in rendering the illusory reality of the scene represented and sculpted in perspective, implementing some specific cognitive and narrative methods, appropriating the imagined space, and trying to explain it by tracing the spatial/temporal intentions. The desired added value identified in this experience was therefore to make observers able to experience the space, allow them to be within and look within the scene, by constructing images that dynamically strengthen the narration according to the time when it is viewed.

2. Activities, Methods, and Tools for the Research: The Survey and Geometrical/Perspective Studies

This program of investigation, based on the given series of objectives, also required focused activities to be determined. This includes the tools to use and the most appropriate methods to adopt in order achieve results related to the established goals.

It is therefore clear that in order to carry out the investigations identified in the first two objectives, the first necessary step could only consist in making a survey campaign as accurately as possible. To this end, two different problems were immediately evident, for which it was necessary to identify the most appropriate solutions.

The first aspect, while essentially technical/organizational in nature regarded, so to speak, the ‘conditions of use’ of the Holy House. In fact, the object, by virtue both of its uniqueness and its significance as a supposed portion of Mary’s house, is a destination open daily for twelve consecutive hours for hundreds of visitors that make their way either for cultural interests or to pray as pilgrims devoted to Mary. These circumstances were unacceptable for making a survey that, on the contrary, required the absolute absence of visitors. In order to satisfy this requirement, a request was made to the Pontifical Delegate of the sanctuary, who allowed us to operate ‘at night’ with the basilica completely empty, an ideal as well as suggestive condition.

The second aspect, this time closely related to the complex decorative characterization of the relic, pertained instead to the most appropriate technical/methodological choices to make for the survey. First, due to the strong formal organization of the architectural/sculpted surfaces, modern digital technologies reality-based that consent a contactless data-acquisition were used. In particular was chose an integration methodology of 3D digital surveying techniques by combining laser scanning and photogrammetry acquisitions.
In reference to the considerations underlined in the premise regarding the intention for the strong interaction between sculpture and architecture sought by Sansovino, the decision was made to acquire the entire face on which the specific work of the Annunciation was located. Furthermore, it is also important to highlight some severe restrictions in the campaign phase. These include the spatial characteristics of the place, such as the restricted space, the height where the Holy House is located on a plane raised by 68 cm and the presence of the altar situated against the front on which the sculpted work under study is located. These restrictions effectively reduced the working margins in terms of distance, position, and angle of the stations both for the laser scanner and for the photography.

For the range-based survey three scans were made of the west face, operating with high values both for resolution and for the quality of the digital data acquired. For the image-based survey, was used a large-angle Nikon 24 mm f/2.8 D AF lens. This photogrammetric analysis serves a double intent. On the one hand, is useful for filling gaps in the laser-scanner survey data of the sculpted device due to the inevitable generation of shadow cones. On the other hand, it contains data that could then allow the material character of what was surveyed to be rendered (Figure 2).

Starting with the results of the survey, the second phase of the research aimed to identify the appropriate tools and methods to analyze the space depicted in low relief. To this end, the following were considered and evaluated as a whole: measurement systems, applications of perspective and use of the golden ratio in the field of figurative arts in relation to the historical era considered.

It is not easy to say how much Sansovino respected Bramante’s project, that is, to say with certainty what measurement system underlay the project. Getting to the heart of this question would mean opening another wide line of research, which, however, goes beyond the scope of the studies presented here.

Moreover, the concept of measurement, from its origins and particularly in the Renaissance, pertained not only to the practical expedient that defines physical sizes as a unit of reference with which to initiate procedures; it also establishes a relationship with the eye and the phenomenon of perception. In addition, and particularly in the figurative arts, measures were often expressed in geometrical ratios and hint at the golden ratio. More in general, the fact that measurement systems were based for centuries on the human scale, anthropometric ratios, or proportions, reflected wider meaning in the sense of order. They reflected the nexus between things and relationships between the parts and referred to the ratio between the finiteness of humans and their desire for an idea of perfection that approached the supernatural, non-measurable infinite.

Following these considerations, the subsequent investigations made on the low relief of the Annunciation led, on the one hand, to verifying if there were underlying regulating traces
making use of geometric ratios and golden ratios and, on the other hand, to reconstructing the perspective system of the composition.

In particular, by following procedures and methods for perspective rendering and by constructing ‘images’ of cognitive design, the goal was to interpret and translate the geometric and formal qualities of the scene represented in the sculpted image, that is, to reconstruct the supporting spatial system. With regard to this last aspect of the investigations, due consideration was made not only of what Sansovino’s knowledge regarding perspective might have been, but also of interesting interdisciplinary research carried out recently whose studies focused precisely on the realization of architectural perspective in art [6–8].

In the era when Sansovino was working on the sculpture of the Annunciation, different Treatises had already been published on the figurative arts such as, for example, *De Pictura* and *De Statua* by Leon Battista Alberti, and *De Prospectiva Pingendi* by Piero della Francesca. In addition, Sansovino was friends with Raphael and presumably knew much of the work on architectural perspective in painting and sculpture made by his predecessors and peers. Having said this, the analysis conducted on the work revealed elements echoing the results of the latest studies mentioned above. These include, in particular, ways of violating the rules, that is, exceptions to the precepts of their unimaginative application, which could be referred to a willingness to obtain the perceptual effects identified.

Based on the results of the geometrical/perspective investigations, it was therefore possible to obtain a 3D reconstruction through NURBS modelling of the space represented in low relief. This intent aimed to verify how the set of different elements present within the scene (figures, objects, architectural scenery) unite to represent a unifying narrative plan that identifies the time of the story.

As stated in the introduction, the ultimate aim of the research was to obtain a three-dimensional reconstruction of the illusory reality represented in the sculpted work that could render both the underlying structures and the narrative space-time intentions in a comprehensible way. Since responding to this objective meant identifying a means of communication that was both involving and explanatory, it was deemed methodologically effective to start by posing ourselves the following questions: in a culture increasingly organized on systems of visual communication, what possibilities do new technologies offer to continue to tell stories? What is the modern equivalent of the ancient art of narrating with images? In reality, one would say that today there are many answers, especially if the ‘product’ on which communication is built is a 3D model. That being said, and not denying the possibilities offered by tools of visualization in Augmented Reality or immersive virtual navigation, the communication system responding best to the original questions was what is known as ‘visual storytelling’. This is a narrative technique in which a video composed of an appropriate mix of fixed and moving images allows associations to be activated that are simultaneously cognitive and emotional [9].

3. Results of the Investigations: Interpretive and Reconstructive Hypotheses of the Space

By processing the data acquired through the surveying campaign, a single point cloud was obtained by combining the data acquired with the laser scanner and the photogrammetric results of the snapshots. The procedure to align and combine the point clouds was made considering a series of identified, well-distributed, recognizable points on the relief. The coordinates of the points obtained from the laser-scanner cloud were inserted as markers in the cloud returned by automatic processing of the snapshots, which were first scaled appropriately. This allowed the presence of gaps in the data to be compensated for or reduced. Following this, an operation to reproject the snapshots was obtained by further processing the complete cloud from the RGB data and therefore a texturized mesh model of the sculpted panel. Finally, the orthographic projection of the texturized model was obtained in real scale, i.e., a rendering appropriate for the goals of the research (Figure 3).

The entire relief consists of two panels whose junction is knowingly hidden by the composition of the different sculpted elements constituting the narration of the announcement as a succession of three scenes or space-time moments. Specifically, the junction was made to coincide with the architectural background, i.e., the wall, which physically as well as symbolically divides
the external open (divine) space where the angel is from the internal, intimate (human) space of Mary’s house.

![Figure 3. Processing of the survey made on the sculpted panel of the Annunciation: (a) union of the point clouds obtained from the survey (laser scanner data in green, photogrammetric data in red), (b) orthographic projection of the texturized mesh resulting from the integrated survey.](image)

The composition contains many symbolic elements typical of religious iconography. These are also present in many other figurative works that, over the centuries, have represented the episode of the Annunciation.

Speaking from the point of view of the observer, the story develops from left to right. Therefore in the first part of the composition, that is, the part to the left, the upper corner contains a group of cherubs among which God himself is present. It is from him, in fact, that the materialization like a divine lightning bolt departs, pointing towards the figure of Mary; a dove is represented sitting atop this very visible element, which symbolizes the coming of the Holy Spirit. Directly below the dove, i.e., in the second half of the spatial layout, the figure of the kneeling angel Gabriel dominates, bearing in homage a bouquet of lilies, a symbol of Mary’s purity. Three of these have bloomed, presumably with the aim of also echoing the mystery of the Holy Trinity. A unifying background for the figures present in this initial scenic environment consists of a spacious architectural background composed of a portico in which the theme of the Trinity returns in the number of arcades recognizable on the main side. For physical and symbolic closure of this first scene in the narration, Sansovino creates the high, blind wall of Mary’s house: a true scenic flat, beyond which is represented the second scene in the narration, that is, Mary’s response. The wall also highlights the spatial step into the environment of Mary’s home that is, in contrast, small, cosy, and solitary. The dynamic plasticity of this figure is demonstrated by the twisting of the woman’s body; she turns her face towards the angel, but looks down. Her attitude is shy, shaken, taken by surprise in a moment of intimate prayer symbolized by the missal she holds in her left hand. Here the scenic backdrop is that of the closed environment of a private room represented in the low relief by the canopy curtains located above Mary’s shoulders. The episode closes with a third scenic space that is separated from the former by a second wall, beyond which lies a garden-like space. Here Sansovino, in addition to repeating the symbolism of the divine with the presence of cupids as well as purity with lilies—this time in a vase—also sculpts a cat (to be used later by Lorenzo Lotto), which turns and stops to look at what is happening. For centuries, this animal has symbolized the figure of the demon, so while the artist represents it in an apparently calm attitude of the domestic cat, its presence seems to suggest something unsettling.

The overall dimensions of the low relief are 3.67 m × 1.76 m. These measures, together with those of the careful observation described above and the analysis of the elements constituting the work, guided the subsequent geometric investigations, which led to the formulation of some hypotheses related to the dimensional ratios on which the entire composition seems to rest.

In fact, the combination of a series of golden rectangles placed side by side in different ways has been traced as a possible support to divide the three scenic spaces in the sculpted representation: two golden rectangles situated upright and next to each other along their long side define the proportions of the first scenic space, while the two following scenes in the story are composed within two other
golden rectangles placed horizontally one above the other. These second proportions ensure that the space delimited between the two flats defining Mary’s house are built upon two overlapping squares and therefore the third and last space is in turn composed again of two golden rectangles, this time abutting along a shorter side (Figure 4 upper left).

Furthermore, focusing on the main figures of the composition, further particular proportions were found. The first pertains to the figural ratio between Mary and the angel: the distance between Mary, who turns her face towards the angel, and the angel himself corresponds to the longer side of a golden rectangle within which the posture of the angel follows the slope deriving from the construction of a golden triangle whose vertex points towards Mary’s womb (Figure 4 upper right). The second relationship regards the figures of God and Mary: the inclination of the lightning bolt that materializes the divine transmission of the Holy Spirit to Mary corresponds to one side of the golden triangle (Figure 4 lower left).

Finally, overlapping an image of the entire low relief on the plan of the Holy House led to some interesting observations: the length and height of the sculpted work seem to correspond to those of the depth and width of the internal spaces of the chapel, but it could also be said that the figural partition of the three scenic spaces in the low relief is comparable to the division of the spaces within the Holy House. These are composed of the prayer area, the altar area identified starting from the steps that raise its position, and the environment of the sacred hearth placed behind (Figure 4 lower right).

![Figure 4. The golden ratios found in the low relief of the Annunciation. Upper left: the proportions of the entire panel defined according to four golden rectangles; upper right: rectangle and golden triangle that frame the figures of the angel and Mary, and God and Mary; lower left: the golden triangle that defines the God/Mary ratio (slope of the side); lower right: superposition of the panel with the plan of the Holy House, in which the comparison of the division of the spaces is clear.](image)

The representation of the scenes present in the low relief (backgrounds and architectural flats as well as other elements) is clearly set in accidental perspective. Given the definite objective of a three-dimensional reconstruction of the spaces depicted in the scenes, the next step in the analysis involved investigating the perspective structure used. In other words, inverse processes were used to find the underlying conditions of projection (the elements defining the perspective model) with respect to which a ‘true form’ rendering of the space could be obtained.

The positions of the horizontal lines and the centre of vision as well as the determination of the circle of view were traced using perspective rendering procedures that use right angles lying on horizontal planes (definition of two vanishing points). This necessarily required some assumptions to be made, that is, identifying which elements in the scene could be used to define right angles. To this end, the following elements were analyzed: the bases of the pillars of the portico that form the background for the first scene in the representation and some decorative elements present
in the two following scenes (the base of Mary’s kneeler and the small piece of furniture placed against the wall separating Mary’s house from the outside scene on the far right of the relief). The ground line was made to coincide with the lower limit of the relief, that is, with the horizontal plane whose sculpted protrusion is easily visible; this serves as a unifying element of the space-time partitions that create the overall scene. Finally, using the homologous ratios (mirror homology), a real reconstruction of the ‘true form of the space’ was obtained, that is, a rendering of the ratios, plans, and elevations of the architectural elements (or similar) that constitute the representation (Figure 5 upper left).

However, reiterating the application of the procedures above highlighted some singularities that could be better defined as formal anomalous deformations of some elements precisely where it was obvious to assume that forms built on right angles would be obtained. These results led to some important considerations. First, it showed that the pure, simple use of inverse rendering methods would not be enough to define and explain the composition of the spaces comprising the system of the low-relief scene and that it was therefore necessary to find other factors that could be used to propose a possible explanation for the formal deformations.

Among the elements that present this formal alteration, the particular element drawing notice, which guided the formulation of the subsequent deductions, was the protruding corbel located almost in the middle of the upper edge of the relief which highlights the angle formed between the two sides of the arched portico constituting the backdrop of the angel’s descent. The architectural/structural recognizability of this element ensures that its form can be assumed to derive from a rectangular parallelepiped. Consequently, following this reasoning, what was obtained by applying the inverse projection procedures was considered to be the product of a deformation attributed to the artist’s allowing an exception to the rule for correctly applying perspective. In other words, following this reasoning, in the space imagined by Sansovino, this corbel and the other elements of the scene in which the same alteration can be seen were not designed to be formally deformed, but rather to be composed of right angles (Figure 5 upper right).
Following these considerations, we wanted to rule out that these aberrations were due to the artist’s incorrect use of the perspective method. Reflection was instead focused on the role of the observer and his movements with respect to the face on which the low relief is situated. The interpretation developed is basically that the perspective deformations found were in some way related to the artist’s desire to consider the possible movements of the observer; that is, to use the dynamic factor of time necessary to understand both the specific composition of the Annunciation, and, more generally, the progressive viewing of the entire Marian cycle of the eight sculpted panels starting from the north face of the structure. According to this reasoning, these elements are represented with perspective deformations as if to follow the observer, who, beginning to look at the scenic composition of the low relief from the left, moves to the centre and then to the right. In this sense, the corbel seems to serve as the tip of the hinge with respect to which Sansovino, while imposing a perspective with a unique point of view, also imposes a rotation of the three-dimensional space imagined as a function of the observer’s progressive movement, which follows the time development of the narration from left to right (Figure 5 below).

The subsequent reconstruction of the three-dimensional space encompassing the elements in the scenic flats of the entire episode of the Annunciation is therefore based on the interpretation described above, that is, the summation of the results of all the analyses made. Without betraying the concept of image, the resulting 3D model was designed to activate a dynamic path that, expanding the visual perception of the space, facilitated its interpretation. In this sense, the choice to reconstruct and virtually simulate the scenographic environment imagined by Sansovino does not diminish the greatness of the work, but rather offers the possibility of weaving a story in which communication is intertwined with the perceptual connotation of the space (Figure 6).

![Figure 6. Views of the three-dimensional reconstruction of the space of the scenes represented in the relief according to the proposed interpretation.](Image)

4. Communicating the Results of the Research: The Visual Storytelling of the Space

In line with the conclusive aims of the research, a form of narration was made available that was not limited to visualizing the 3D reconstruction of the scenic setup of the Annunciation, but also tried to indicate the procedures that guided its realization. In particular, a ‘visual storytelling’ was offered by the digital display, the communicational means most adequate to presenting the results of the research. The adoption of this narrative technique resulted in a video that illustrated the entire path, that is, the different analytical steps constituting the entire investigation and the different results.

By constructing an appropriate sequence of adequate fixed and moving images, this expedient aimed to show both the geometrical/proportional system behind the organic organization of the spaces and elements constituting the representation and the perspective structure underlying the
scenic composition of the low relief. The ultimate goal was to facilitate and amplify understanding, simultaneously activating cognitive and emotional associations in order to make the concepts and procedures of composing and representing the space intelligible even to those who are not familiar with it.

It is clear that trying to describe the content of a video in writing is certainly not the most appropriate way to understand the intentions and give the sense of the project. The reader is therefore referred to the compendium of images introduced in this text, hoping that they render as much as possible the idea of the propositions pursued and results achieved in this work (Figure 7).

![Storyboard](image)

**Figure 7.** Storyboard. Sequence of images drawn from the visual storytelling that retraces and explains the organization of the analytical process that led to the reconstruction of the scenic space depicted in the Annunciation.

However, it is anyway necessary to reiterate that the sense of the visual narration found herein does not exclusively consist of a simple visual exploration of the 3D reconstructed space, but rather shows the organization of the logical process of analyzing the space depicted in the Annunciation. In this sense, the narrative expedient of visual storytelling is intended to act as a cognitive tool capable to offering keys to decipher the abstract, complex concepts around which it was designed the sculptural work.

5. Conclusions

The work presented here, and therefore the realization of the objectives on which it was based, clearly lie in the area of research aimed at enhancing Cultural Heritage [10]. By reason of this, the reasoning that guided each step was merely to obtain effects to make a spectacle of the sculptural work, but rather to activate new means of mediation for users of the specific cultural resource. The goal was to identify updated forms of visual narration wherein the observer’s look does not aspire only to view the sculptural work, but expects to be ‘appropriated’ in some way by the work of art, expressing the dialoguing nature of emotional response.
One could say that what was pursued is a ‘staging’ that is not purely for entertainment, but as a form of exposing a theme, emphasizing particularities and identities of the work under study by correctly transmitting information. It is an act of communication made through images that, in an attempt to indicate a possible visual approach to the spatial intuition of the work, aims to communicate notions and meanings, also making use of the explanatory function of emotional responses aroused by the images.

In conclusion and more in general, preparing a means of narration based on exhibiting different visual specifics characterizing a cultural resource, e.g., the object of study, not only reaffirms the importance of the image, but also aspires to identify strategies capable of rendering the complex value of the specific cultural resource in the present. As well, it creates a bridge between the artworks of the past and the expectations of contemporary users, maintaining that just balance in communication between scientific rigor and emotional involvement.

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References


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