

Hors dossier. Limitations in Experimental Method in Balzac's *La Peau de chagrin*

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When considering questions of epistemology or the theory of science in Balzac's *La Peau de chagrin*, it is tempting to focus on the text's many descriptions of science as an institutional artifact of Balzac's time period. A few examples will serve to briefly highlight this aspect of the text. As the main character Raphaël's despair increases in inverse proportion to his fateful skin's size, he resorts to a cross-section of practicing scientists in his quest to reverse the skin's progressive disappearance. His first step is a visit to a zoologist (*La Peau*, 230-235) whose "rhetorical overkill" complete with "empty explanations" (Thiher, 50) seems to track a number of the naturalist Buffon's ideas and verbose style. This initial meeting culminates in a referral to a professor of mechanics who, in conjunction with a colleague, vainly submits the skin to a compression device (*La Peau*, 245). In a final effort to alter the skin, Raphaël seeks out the help of a chemist, whose attempts to alter the skin either by razor or acid bath (*La Peau*, 247-248) prove just as fruitless as his predecessors' in the task. In a final parodic turn, the chemist is left only to ask Raphaël, "Gardons-nous bien de raconter cette aventure à l'Académie, nos collègues s'y moqueraient de nous" (*La Peau*, 248). The traditional sciences, then, seem both incapable of making the transition from the theoretical to the applied, and of escaping the rigors of an established institution that incentivizes the non-disclosure of anomalous results. This is science as historically-based, culturally-bound, and curiously, anti-scientific. It is also science in a struggle with the apparently supernatural as it would seem to fall beyond the materialist, empirical scope of the field (Goulet).

Raphaël's later consultations with four of the finest medical minds in Paris only serve to expand Balzac's parody of science. Three of the four physicians, the text clarifies, adhere to a medical *système*. Maugredie - whose name is a clear reference to the early experimental physician and mentor of Claude Bernard, Magendie - tracks his real-life model inasmuch as he "ne croyait qu'au scalpel" (*La Peau*, 256). Brisset and Caméristus each subscribe to different vitalist systems - the former, Bichat's[\[1\]](#), and the latter, Van Helmont's *archea*. Joining the three *système* physicians is Bianchon, a young colleague whose future career promises to build "le monument pour lequel les siècles précédents ont apporté tant de matériaux divers" (*La Peau*, 255). Yet despite the diversity of opinions and quantity of expertise, the doctors are no more effective than the theoretical scientists. After taking only "une apparence d'intérêt" (*La Peau*, 254) in their patient, they reach the fairly routine consensus that Raphaël requires treatment by leaches, a change in diet, and a stay at the baths in Auvergne or Savoie (*La Peau*, 261-62). Here, again, the practice of an ostensibly scientific field is shown to be quarrelsome as an institutional matter and feckless in its palliative charge. Even at this high level, Balzac's parody of the science of his times is clear[\[2\]](#).

Yet to focus solely on the parodic presentation of scientific practitioners in *La Peau de chagrin* is to ignore a deeper and more fruitful epistemological instability in the text.

This textual instability depends on a question that is never answered in the text – specifically, does the skin actually have an effect on its ill-fated owner? The most obvious response to this question is an affirmative one. Raphaël acquires a skin that clearly states the conditions of its ownership – the skin will realize any desire of its owners, but in so doing, will shrink in lockstep with the remaining days of the owner’s life. This serves as a statement-function, to use Popper’s language (52), which need only have a specific term – or here, person – inserted into its terms to become a statement that is at least theoretically falsifiable. One may argue over whether this categorization is the best fit under Popper’s theory, but the latter characteristic – falsifiability – is the more relevant criterion in an investigation of the efficacy of the titular *peau de chagrin*. And indeed, the remainder of *La Peau de chagrin* does not ostensibly seem to bring about such a falsification of the skin’s statement-function. Whenever and whatever Raphaël wishes seems to be granted to him – he initially desires a bacchanalian feast which happens almost exactly as he imagines it. He seeks monetary fortune and finds himself declared the sole legal heir to a deceased maternal uncle’s estate (*La Peau*, 194). He desires to win a duel when challenged at the baths where he is recovering, and wins the duel despite possessing supposedly poor aim and firing randomly (*La Peau*, 277). And with each of these desires granted, the skin seems to shrink. The terms of the contract at least appear fulfilled, or at the least, *not falsified*.

As Popper would be the first to note, however, *not falsified* is not the logical equivalent of *verified*, leaving another potential response to the question of the skin’s efficacy. It is equally possible – as Allen Thiher points out – that the skin has no effect whatsoever on Raphaël’s existence (48). Under this line of reasoning, each of the purportedly granted wishes above was merely the result of circumstances unrelated to the enchanted skin^[3]. Raphaël was alternately lucky to attend a wild party and inherit millions, and unlucky to die at a young age of an apparent case of tuberculosis. The skin may have shrunk during this time period, but it did so independently of anything that was happening to Raphael. This proposal would run counter to much of the science of Balzac’s time, which, according to Bachelard (*La formation*, generally), relied heavily on variety, conjecture, and coincidence rather than experimental method. Lending credibility, or at least, feasibility, to this reading skeptical of late XVIIIth and early XIXth century science are certain minor details. Even before Raphaël acquires the skin, his trip to the gambling house finds him in a sorry state of health that doctors “auraient sans doute attribué à des lésions au cœur ou à la poitrine le cercle jaune qui encadrerait les paupières, et la rougeur qui marquait les joues.” (*La Peau*, 14). Perhaps medical opinions are not worthy of full faith and credit in the text, as discussed above; but there is already evidence in this passage – before Raphaël’s first wish – of the very symptomology that the four physicians would later observe, if not cure. Hypothetically, the disease might have developed in exactly the same way in the absence of the skin. Still other timing curiosities call the efficacy of the skin into question. Immediately after Raphaël’s acquisition of the skin, he happens upon his friends who will take him to his desired party. Their almost immediate comment to Raphaël: “nous te cherchions” (*La Peau*, 47), allows us to think that the search for Raphaël could well have begun prior to Raphaël’s possession of the skin, meaning that the party that he was to attend

would have occurred independently of his wish to celebrate excessively. A similarly non-synchronized detail marks the announcement of Raphaël's inheritance, where the functionary delivering the news declares that he has sought Raphaël for fifteen days – undoubtedly far longer than the party that Raphaël has just attended immediately after acquiring the skin. So unless one is willing to grant the skin powers over Raphaël even before he knew that it existed, there is at least a feasible reading that the events of the story would have occurred in exactly the same way had Raphaël not acquired it. Raphaël simply would have pursued the final months of his life while the skin separately shrunk amid the *bric-à-brac* of a Parisian boutique.

Much like its primary character, the question of whether the skin has an effect seems to subsist in a liminal state of purgatory. But where Raphaël's existential limbo pits his apparent power over his surroundings against his will not to use such power, the skin's effect is relegated to a zone of falsifiability without actually being falsified. Either of the two interpretations of the skin, as causal factor or merely coincident phenomenon, remains a valid possibility. What is interesting about the skin's equivocal nature is *why* the question of causation or mere coincidence is never resolved. After all, Raphaël shows interest in observing the process of the skin's gradual disappearance. Perhaps his observations could have (or should have) led to a more scientific understanding of the skin's behavior. Yet such observations remain fruitless, a result due in part to Raphaël's insufficient approach to his role as a scientific experimenter or observer. To demonstrate such insufficiency, Raphaël's experimental technique may be compared, by way of anticipation, to Claude Bernard's later model of experimental medicine outlined in *Introduction à l'étude de la médecine expérimentale* (which first appeared in 1865). By this measuring stick – and others – like Bachelard's theory of *obstacles épistémologiques*, Raphaël's shortcomings as experimenter become clearer. Raphaël is hopelessly relegated to a space of experimental indeterminacy, where conflation between object and subject cannot help but lead to a Heisenbergian reading of Balzac's text.

Even upon his first attempt at experimentation in *La Peau de chagrin* – the initial encounter with the allegedly enchanted skin, Raphaël's surroundings already evoke Bachelardian epistemological obstacles consistent with the *esprit préscientifique*. Amid the *bric-à-brac* of the Parisian boutique, he is first shown the skin, but only after a lengthy tour of the store's curiosities, which draw their origins from seemingly all points of the globe and all time periods in human history. The items on display span pipes and weaponry; sculptures and paintings; random machines, slippers, and idols (*La Peau*, 23). The view of these spectacles cannot help but affect their spectator:

La vue de tant d'existences nationales ou individuelles, attestées par ces gages humains qui leur survivaient, acheva d'engourdir les sens du jeune homme, le désir qui l'avait poussé dans le magasin fut exaucé : il sortit de la vie réelle, monta par degrés vers un monde idéal, arriva dans les palais enchantés de l'extase où l'univers lui apparut par bribes et en traits de feu, comme l'avenir passa jadis flamboyant aux yeux de saint Jean dans Pathmos. (*La Peau*, 24-25)

Here is a moment that simultaneously encapsulates numerous hindrances to the

development of scientifically based knowledge[4]. The first is the distinction between *variety* and *variation* (Bachelard, *La formation*, 36). Where the latter is the proper object of scientific inquiry within the bounds of a single set of related phenomena, the *tant d'existences* evidenced by the artifacts surrounding Raphaël suggest the former only – an overflowing, turbulent pre-scientific variety that prizes excess over precision. Such variety is not the target of objective study, but the site of concentrated interest. That the *existences nationales ou individuelles* are attested by so many *gages humains* only supplements the play of variety here. Access to the historical moment and place of the creators of these artifacts is strictly forbidden; a speculative leap of the imagination alone can bridge the gap between object and prior existence. The initial variety in the artifacts themselves thus feeds an additional cycle of generative variety, at a level even farther removed from the concrete and observable. The text terms the décor of the boutique a *chaos d'antiquités* (*La Peau*, 24), but such chaos is far from consonant with a post-thermodynamic sort of chaos. Chaos in the latter sense means a noisy channel propagating error and an associated passage to a state of disordered equilibrium – similar to a sort of chaos underpinning David Bell's description of *le hasard* as the unstructured sort of chance limiting knowability in Balzac's texts (156-57). While Bell's point is fundamentally applicable here in that the specter of pure, irreducible randomness could present an alternative explanation for Raphaël's ultimate failure as experimenter, chaos in this specific case means something very different. Here is the continual generation of information without payment in energy – Carnot's or Clausius's burning of an imperfectly efficient energy source (Duhem, *L'évolution*, 411) recast (or pre-cast) as an entire universe seen in strokes of fire. The probability-based, tripartite structure of cloud/dike/downpour that characterizes a cataract's fall (Mehlman, 22) is supplanted by a progressive flaming climb *par degrés* to a higher state of energy and consciousness.

There is, however, a temptation to view this progressive internal climb as a sort of metaphor for the advancement of knowledge. In this respect, one might evoke François Jacob's image of science as "*partiel[le]*" and "*provisoire*" (11) or Bernard's view that even if phenomena are subject to rigorous determinism, the theories describing them are not so assured (371). These images directly index the limits of human knowledge in developing theoretical constructs, but they implicitly speak to the continual possibility of advancement and improvement in a particular construct. As Bernard states, theories are "*toujours mobiles*" and "*toujours perfectibles*" (371). Bernard emphasizes this point when proposing an ostensibly Comtean or positivist set of three ages that characterize the evolution of medicine. Where Comte proposes the theological, metaphysical, and positivist ages (59), Bernard offers the Hippocratic, the passive empirical, and the active experimental (355, for example). In each system, it is the third age that represents the most perfected stage in an evolutionary process. This perfected period marks a passage from the speculation of metaphysics or the *système* of the empiricist to the *monde idéal* of order and progress for Comte and perfected experimental method for Bernard. At its asymptotic limit, the latter development moves from mere medical practice to the absolute and certain description of a real phenomenon. This final stage surpasses an artificial boundary where theoretical science is no more than a rationalist construct that reflects its human creators more than its natural objects (Bachelard, *Le*

nouvel esprit, 5-7). With Bernard, experimental medicine's accurate knowledge of determined phenomena reflects something like Duhem's "*classification naturelle*" (*La théorie physique*, 53-54) or Lamarck's "*ordre naturel*" (241, for example)[5]. When revelations of this order are reached – in a curious combination of logic, observation, and faith – a metaphorical curtain is pulled back, and the universe begins to appear, just as in Raphaël's case, where "l'univers lui apparut par bribes." Supplementing this similarity is a passage from the present to the future for both Raphaël and the experimental scientist. For one and the other, the future shifts from the indeterminate to the knowable and predictable, be it in Raphaël's flames or Bernard's absolute certainty in a cure. Through these parallels between Raphaël's internal reaction to the boutique and certain models of scientific progress, what might be cast as pure reverie in the former case would actually seem to offer a potential reflection of the latter.

A more compelling argument rejects such similarities between Raphaël's boutique experience and perfected, realist scientific modeling, however. It may be noted in this respect that Lamarck's *ordre naturel* and Duhem's *classification naturelle* each function in a marginal space informed as much by theology as scientific inquiry. For Lamarck's construct, there is never a question that it owes its origin to a "*Sublime Auteur*" (650); Newton generally retained a deity in his scientific edifice both because a deity was needed to regulate the energy of the universe and lest he be seen as seeking final causes rather than scientific relations (Koyré, 273-276, 285). Duhem, for his part, is compelled to go to great lengths to prove that his theory of physics is entirely unrelated to his personal Catholic faith (*La théorie physique*, 373-423). Still Duhem acknowledges that the existence of a *classification naturelle* is a matter of faith for the practicing physicist. Raphaël's vision and ecstasy in the boutique falls in this same liminal space, where an evocation of Saint John of Patmos, the author of the Biblical book of Revelation, informs, and perhaps overwhelms, the development of empirical knowledge. This is, indeed, a *revelation*, and not a mere *observation*. Yet the relationship between legitimate scientific inquiry and Raphaël's ecstasy in the boutique is more than a simple matter of theologically-tinged worldview. Again, traces of Bachelard's epistemological obstacles may be observed here in a direct similarity between Raphaël's ecstasy and the traditional practice of alchemy. For the alchemist – and Balzac separately describes the life of one in *La recherche de l'absolu* – the synthesis of precious metals was only one part of experimental practice. Bachelard observes that alchemy is as much an initiation to an order with its own ritualistic structure (*La formation*, 56-59). This structure is based on a profound equivalence between the internal meditations of the alchemist and the set of symbols that can be applied to the external world. A realization of the alchemist's goal is not only possible; it is ever realized by virtue of the alchemist's participation in the symbolism and process of alchemy. In this way, the alchemist is at all times both unsuccessful due to an expectation that may never be achieved[6], and successful precisely because that hopeful expectation is a necessary aspect of alchemy. Assisting the alchemist in navigating these poles is a scale of symbols advancing in perfection that serve as a double for a series of intimate meditations. In view of this background, Raphaël's moment of ecstasy in the boutique is less a tribute to the perfectibility of scientific knowledge and more the result of a collapsed process of alchemy. The set of external

symbols surrounding Raphaël in the boutique numb (*engourdir*) his empirical senses and trigger a turn inward, where the increasing complexity and variety of the artifacts parallels the increasing perfection of the *degrés vers un monde idéal*. Here is the internal scale that each alchemist must climb, the necessary state that is at once process and realization, or for Raphaël, ascent and pinnacle. Truth, for the alchemist as for Raphaël in this passage, is a reconciliation of his own nature and the nature of the universe (Bachelard, *La formation*, 60). The evocation of that universe seen in fire only heightens the parallel in view of the importance of the fiery “element” to the alchemist’s process.

As a catalyst for a figurative move upward in his scientific revelation, the turn inward for Raphaël, away from the empirical, recalls an important potential dichotomy in Balzac’s texts, between realism and romanticism, explored by a number of commentators. Andrea Goulet, for example, has argued that Balzac’s texts straddle these opposing tendencies, with the scientific side of Balzac captured in a progressive move to the empirical, materialist, and realist, away from the visionary, supernatural, and intangibly abstract that remains beyond the scope of scientific inquiry. If Balzac’s texts exceed the space of realism, those points of excess are necessarily outside the space of scientific inquiry, and can even be likened to “mumbo-jumbo” (Goulet, 48). Other commentators have persuasively questioned this strict dichotomy. Thomas Klinkert, for example, views Balzac’s work in *Louis Lambert* and *La Peau de chagrin* as organizing a triangular relation between science, poetry, and mysticism, with the former two combining synthetically to produce the third. Mysticism associated with visionary romanticism is not a non-scientific space, it is an outgrowth of science itself. In fact, Klinkert probably does not go far enough in his characterization, as Balzacian science is not merely a generative counterpoint to poetry feeding towards mysticism. Balzacian science often seems to surpass the limits of traditional scientific or experimental method to espouse a mystical or animist view of the epistemological quest, *within the bounds of science*. This is precisely Göran Blix’s view, which explicitly rejects Goulet’s dichotomy in favor of just such an inclusion of the apparently supernatural as a proper element of scientific inquiry. To this point, Blix cites *Ursule Mirouët* as an example of the normalization of the supernatural, where a Mesmerist séance leads to a description by a seer, at a distance, of empirically verifiable facts, not Swedenborgian visions of angels and demons (268). The very concept of a séance yielding tangible results supports Blix’s arguments in a manner which he does not directly highlight – if Bergson argued in *L’énergie spirituelle* that scientific skepticism regarding paranormal activity was misplaced due to such activity’s falling outside the bounds of scientific testability, Balzac in *Ursule Mirouët* would propose that Mesmerism actually renders the supernatural testable. Balzac’s texts do not reflect a dichotomy between the realist-scientific and the romantic-unscientific; science is capable of an all-encompassing view, even if scientifically observable and verifiable phenomena remain difficult to explain, couched in the language of imponderable magnetic fluids.

Raphaël’s decision to apply scientific techniques to a purportedly enchanted skin, then, is not misplaced. The achievement of that epistemological goal is complicated, however, both by the object of experimentation and by Raphaël’s mental state, which,

as he first approaches the skin, is entirely consonant with the *esprit préscientifique*. That state only persists as he conducts his first experimental activities on the skin. When first confronting the skin, Raphaël is immediately struck by its seemingly supernatural luminosity in the midst of a boutique then darkened in dying twilight. This provokes an initial examination of the skin:

Cependant, animé d'une curiosité bien légitime, il se pencha pour la regarder alternativement sous toutes les faces, et découvrit bientôt une cause naturelle à cette singulière lucidité : les grains noirs du chagrin étaient si soigneusement polis et si bien brunis, les rayures capricieuses en étaient si propres et si nettes que, pareilles à des facettes de grenat, les aspérités de ce cuir oriental formaient autant de petits foyers qui réfléchissaient vivement la lumière. Il démontra mathématiquement la raison de ce phénomène au vieillard, qui, pour toute réponse, sourit avec malice. Ce sourire de supériorité fit croire au jeune savant qu'il était dupe en ce moment de quelque charlatanisme. (Balzac, *La Peau* 39)

This indeed seems *légitime*, both as a matter of the curiosity provoked by the skin and the method by which Raphaël analyzes it. If Bernard's challenge, as a successor of Newton's, was to reduce all phenomena to the predictable due to their inherent determinism, Raphaël would seem his forerunner in this scene. The skin's unusual luminosity is an unknown at first; but upon closer inspection of the tissue, Raphaël is able to reduce it to a sort of *if x, then y* functional or deductive relationship, a scientific normalization of the purportedly supernatural. If, among other things, a skin has a particular texture and has been polished in a particular way, then the skin's ability to capture and reflect light is a certainty that can be demonstrated *mathématiquement*. This much can be shown without violating one of the central tenets of scientific inquiry – the prohibition on seeking the final causes of a given phenomenon (see generally Duhem, *Sauver les apparences*). Raphaël thereby avoids treating the curiosity of the skin either as an aspect of the tissue somehow exceeding experimentation or as motivation to discern some divine or diabolical intervention.

Yet the last two sentences of this passage fundamentally invert this initial appeal to experimental normality. This observation first turns on the text's use of the word *mathématiquement*. Raphaël's demonstration does not result in a chemical, physical, biological, or mechanical certainty; it is a mathematical certainty. The reduction of a phenomenon to mathematical proof underscores the connection between Raphaël's methodology and the philosophy of Descartes. It may be recalled in this respect that Descartes' foundation in proposing the *cogito* is a profound doubt as to the nature of his existence and surroundings. The text alludes precisely to this doubt when Raphaël first encounters the elderly shopkeeper who will show him the skin, "pendant le rapide intervalle qui sépara sa vie somnambulique de sa vie réelle, il demeura dans le doute philosophique recommandé par Descartes" (*La Peau* 33). Even without going too deeply into Descartes' interpretation of sleep versus waking states (let alone an interval between the two states), it may be argued that Cartesian doubt is as much a touchstone for Balzac in *La Peau de chagrin* as it was for Descartes himself. Precisely because Descartes possessed this doubt, he could readily prove to himself that he at the very least existed (*La recherche*, 90-91). Having established his existence through doubt,

Descartes was able to move beyond this point, thanks to divine intervention, to prove to his own satisfaction that the material world surrounding him was not presented in error. That Raphaël remains [*demeura*] in a state of doubt begins to highlight the impossibility of such a transition to certainty. Even here, the chain of Cartesian logic is broken, some tie to the empirical is needed, as Goulet would highlight, and may be missing. Returning to the use of the word *mathématiquement* to describe Raphaël's initial proof of the skin's luminosity, the initial break in the chain later proves a more fundamental inversion of the Cartesian progression. As the Fifth Meditation highlights, Descartes's doubt had its limits, most notably as regards what Descartes deemed immutable truths. Figuring prominently among such truths are mathematical formulae and geometric relations (*Méditations* 159-161). So when Raphaël is able to make a mathematical showing as to the character of the skin, he is proposing an immutable, abstract truth not limited by the instabilities of the chemical or the mechanical. He is initially able to pass from doubt to certainty in the same manner as Descartes. Yet the next sentence flips the polarity of this relation, as Raphaël worries "qu'il était dupe en ce moment de quelque charlatanisme." This sentence sounds a retreat to original doubt. Perhaps a simultaneous shift from an abstract truth to a concrete illusion, and from the mathematical to the chemical or mechanical, explains this retreat. Yet mathematical proofs in Descartes' view should not be susceptible to such shifts, least of all due to some charlatanism, and all, in Descartes' view was susceptible to quantification and reduction to very few essential characteristics like *figure*, *division*, and *movement* (*Œuvres*, 179). The better reading of this passage, instead, is a chiasmatic inversion of Cartesian thought. Where Descartes moves from profound doubt to abstract mathematical certainty and truth, Raphaël moves from abstract mathematical certainty and truth to profound doubt. Coincident with the initial appearance of the skin, the text undermines the very foundations of experimental and scientific logic and method.

If the initial encounter with the skin effects a fundamental inversion in Cartesian methodological practice, Raphaël's experimental attempts, once he has the skin in his possession, tend to illustrate further limitations in his method. This much may be shown as early as his first attempt to observe empirically the purported effect that his desires have on the skin's surface area. At that moment, Raphaël has enjoyed a long night of celebration – possibly the very party that he had wished for – and expansively recounted his earlier life to his friend Émile. As he and Émile express an interest in observing the possible shrinking of the skin as a reply to Raphaël's desire for monetary fortune, Raphaël:

animé d'une adresse de singe, grâce à cette singulière lucidité dont les phénomènes contrastent parfois chez les ivrognes avec les obtuses visions de l'ivresse, sut trouver une écritoire et une serviette, en répétant toujours : — Prenons la mesure ! Prenons la mesure !

— Eh ! bien, oui, reprit Émile, prenons la mesure !

Les deux amis étendirent la serviette et y superposèrent la Peau de chagrin. Émile, dont la main semblait être plus assurée que celle de Raphaël, décrivit à la plume, par une ligne d'encre, les contours du talisman, pendant que son ami lui disait : — J'ai souhaité deux cent mille livres de rente, n'est-il pas vrai ? Eh bien, quand je les

aurai, tu verras la diminution de tout mon chagrin. (*La Peau*, 189-90)

As with Raphaël's initial inquiry into the unusual luminosity of the skin, Raphaël's technique when attempting to discern the behavior of the skin here seems to withstand at least cursory scrutiny. To draw these two experimental scenes together does not seem misplaced, due to a critical equivalence between the scenes – each repeats the particular phrase “*singulière lucidité*.” While we shall return to this unusual equivalence below, we may begin by observing again how Raphaël's method superficially compares favorably to Bernardian experimental technique. For Bernard, experiments structure around a passage from sentiment to reason to experiment (74). The first of these three steps precedes any testing itself, and reflects the mere development of a more emotional or intuitive *idée préconçue* (Bernard, 57, for example). It is this idea or hypothesis that serves not as a rigid frame into which experimental results are to be forced, but as a baseline to be measured in view of observed experimental results. So far, so good for Raphaël at the outset of this passage, as he comes in with just such an *idée préconçue* – the idea that the skin will shrink while granting his wishes. The next step for Bernard is the application of reason in the development of the hypothesis and its related experiment. Depending on the scope of the latter, very little “reason” may be needed. Bernard favorably notes an experiment conducted by Pascal involving no more than two barometric measurements taken at the top and bottom of the Tour Saint-Jacques (57). Such limited observation may suffice to begin to demonstrate the set of relations between the objects and phenomena that form the basis of the experiment. Once again, Raphaël's technique here is in line with this experimental design as a matter of reason. If it is believed that the realization of a desire will somehow cause a skin to shrink, it is reasonable to follow Pascal's lead and take two measures – for Raphaël, one before realization of the wish and another following.

Yet with the shift to the third stage of Bernardian experimental technique, the experiment itself, the fissures in Raphaël's approach begin to show. For it is not Raphaël, but his friend Émile who traces the initial plot of the skin. He might be a less partial observer with a steadier hand; but the image of this latter hand, disembodied as it were in its own clause above, suggests yet another of Bachelard's obstacles, the unconscious. An undue focus on symbols associated with the unconscious – precious metals or disembodied hands – may speak to an inability on Raphaël's part to conduct an empirical observation. Only amplifying the force of Émile's hand tracing the skin is its likeness to the Biblical image of the hand applying the fatal inscription to Belshazzar's wall^[7]. The *idée préconçue* for Raphaël is not a baseline to be accepted or rejected according to empirical results or application of the experimental method; it is the fatal commitment of a hypothesis to ink-bound, immutable truth. The third experimental stage is not an experiment at all, but a resignation to predetermined future events. Raphaël's comment at the end of the passage reinforces this – a summary of the wish and a sentence using two future tense verbs – *aurai* and *verras* – to cast the mechanism of the skin as a necessarily closing loop.

To whatever extent a judgment might even be possible when assessing the outcome of Raphaël's experiment, such a judgment necessarily will suffer from another critical

limitation – the lack of *experimentum crucis*. The latter is an experiment that will serve as an additional and final proof of a hypothesis. Such experiments will often take the form of a process of elimination that sieves the universe of hypotheses until only one remains (Duhem, *La théorie physique*, 263-266). Bernard proposes such an elimination by resort to a *contre-épreuve*, a scenario where the change in a critical experimental condition brings a corresponding change in experimental outcome (114-15). The findings of the original experiment are, in Bernard's estimation, thereby proven as the changed phenomenon is responsible for the changed outcome. This is a particularly potent technique in cases where the number of hypotheses is limited. If we imagine that a given experiment admits only two hypotheses, for example, two experiments would suffice to establish a *contre-épreuve* and resolve all unknowns. Interestingly, perhaps, this theory reduces actual experiment in a science like physics or chemistry to the mere mathematical question of solving a system of equations – as long as there are more experiments (or in the algebraic case, equations) than unknowns, all unknowns can be discovered (or the system can be shown to have either *no* or *infinite* solutions). If Duhem and Bernard notably disagree on the very possibility that an *experimentum crucis* might occur, Duhem seems to have theory in his favor in holding that such an experiment is impossible outside of pure mathematics. Where a certain number of mathematical equations will always suffice to solve (or demonstrate that there is either *no* or an *infinite* solution) for the same number of variables, physical, chemical and biological conditions are not so easily reduced to a limited number of rigid interactions due to the fundamentally stochastic nature of what is measured. In Duhem's view, hypotheses related to real-world phenomena can be multiplied *ad infinitum*, so the elimination of one or many will never lead to a single remaining truth to the exclusion of all others (Duhem, *La théorie physique*, 265-66). Under either Duhem's or Bernard's view of the *experimentum crucis*, Raphaël's technique promises no absolute results. Taking Bernard's view, it would be necessary for Raphaël to change an experimental condition that would change the experimental outcome. This would require the impossible – the complete removal of the skin from his life. To be probative, this would require a parallel, non-existent Raphaël to refuse the skin initially and continue to live his life (that is, not commit suicide after leaving the boutique) in the skin's absence. It would then be possible, under this Bernardian *experimentum crucis*, to determine if Raphaël's premature aging and demise are the result of the skin. Even in this view though, Raphaël's experimentation will not lead to certain results. Yet we might also reject the possibility of an *experimentum crucis* more generally in light of Duhem's view. The necessary complexity of the two systems involved – Raphaël's physiology and the bizarrely luminescent, ever-shrinking skin – make for highly indeterminate and changing conditions that would seem to surpass any distillation to two simple hypotheses. And as in the introduction above, if those hypotheses posit either a causal or a coincidental relation between the skin's behavior and Raphaël's existence, there remain a near infinite number of possible combinations and permutations of relations to supplement these two over-general possibilities. By accepting the possibility of an ever-growing series of hypotheses, no *experimentum crucis* would ever be possible for Raphaël, even in the Bernardian sense of the term.

Still other complications prevent Raphaël from conducting effective experimentation on

the skin and his relation to it. One is Raphaël's continual passage from the exercise of a particular type of human reason to behavior consistent with other categories in zoological taxonomy^[8]. In the scene above, he behaves with an *adresse de singe*, thereby shifting from the group *bimane* to the group *quadrumane*, according to Lamarck's taxonomy (297-98). Even for the latter zoologist, who as a precursor to Darwin was favorable to the possibility that humans could have descended from other primates (298-300), there appears to remain a substantial gulf between these two categories. So in transitioning from man to monkey, Raphaël has plainly surrendered his ability to reason experimentally. An application of Buffon's concept of the *homo duplex* - of which Balzac was particularly fond - only reinforces this point of surrender within the single taxonomical group of humans. The *homo duplex*, Buffon posits, is a construct by which all humans contain two interior principles (133). One principle, associated with the soul, is the source of all science, reason, and wisdom ("*la science, la raison, la sagesse*," 134). A contrasting principle, associated with the animal, is tempestuous, and brings about only passion and error (134). This oppositional dichotomy is an entirely appropriate tool to apply to the works of Balzac generally, not just because of Balzac's personal interest in it. The entire arc of Lucien de Rubempré in *Illusions perdues* is a long meditation on the young *arriviste*'s tendency to obey his material and error-prone animal instincts in abdication of the pure spirituality offered by a life of work and symbolized by the Cénacle. Much the same structure overlays neatly on the rise of the soulless and ambitious poet Canalis in *Modeste Mignon*, Benassis' confession and redemption in *Le Médecin de campagne*, or Rastignac more generally in *Le Père Goriot* (and elsewhere throughout *La Comédie humaine*). In these latter two texts, however, the prevailing side of the *homo duplex* differs, with Benassis obeying the spiritual role of physician and community developer while Rastignac squanders his inheritance and amasses debts by spending on fleeting whims. Balzacian texts were frequent in their reliance on the *homo duplex*, and Raphaël is no exception to this. In the passage above, the word *souhaité* serves as a reminder that Raphaël's life, upon acquisition of the skin, reduces to a series of wishes and desires - first, the grandiose desires *souhaités*, and then the desire not to desire that dominates his existence once he believes that the skin is effective. This is doubly problematic for an experimenter. First, to behave in a manner consistent with the animal half of Buffonian dichotomy translates to an existence of not only passion, but error. The Raphaël who abandons his treatise on human will and the "soul" associated with that activity cannot possibly analyze his own existence without error, even if potentially supernatural aspects of that existence might hypothetically remain within the purview of scientific inquiry. Further, the complex struggle pitting desire and the desire not to desire for Raphaël only re-stages the issue of fatality already discussed. If Raphaël desires not to desire, it is because he has already concluded that the skin performs as advertised on its face. He is not capable of testing an *idée préconçue* as an objective observer would.

Raphaël's limits as an experimenter - summarized well by an abortive desire to know ceding in the face of fatalistic resignation - has one final critical dimension. This dimension flows from the repetition of the phrase *singulière lucidité* in both the scene when Raphaël first encounters the skin and in the scene where he first attempts to observe the skin's shrinking. Not only does the re-use of this phrase underscore a point

of resonance between the scenes, it underscores an equivalence between elements in the scenes. In the first scene, the *singulière lucidité* is characteristic of the skin itself. In the second scene, it is associated with Raphaël. Once Raphaël possesses the skin, then, he and the skin become, to a certain extent, one and the same. In view of this equivalence, any attempt by Raphaël to experiment on the skin runs into the limits of the Heisenberg uncertainty principle, which Balzac could be said to foreshadow here. This principle dictates the impossibility of simultaneously knowing an electron's precise position and exact velocity. This limit follows from the idea that in attempting to detect these characteristics of an electron (or electron beam), the experimenter necessarily exercises an influence on the very electron or electrons being tested, thereby disturbing the examined system (Popper, 233). Popper argues against the rigidity of Heisenberg's principle as a general matter (234), as he viewed its limit as a reflection on the limits of then-current human technique, and not experimental technique as an absolute matter. The specific case of Raphaël and the skin has no such escape from the rigors of Heisenberg. In part, this is because Raphaël himself serves as both experimenter and experimentee, object and subject. When acting in one capacity, he fundamentally alters the observations or realities of the other. This view only complicates when expanded to include the skin. For if one of the two sites of *singulière lucidité* is affected at a given time, it would follow that the other site would undergo a corresponding effect. When Raphaël desires to know about the skin, his desire should work a change in the skin itself if the skin in fact functions as advertised. Here is the would-be scientist facing a phenomenon ever recoiling from the span of his calipers. This is experimental method as a downward spiral, a cycle of recursion where the base case is not knowledge, but death.

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[1] The connections between Balzac and Bichat have been highlighted well by Anne Vila. Without unduly anticipating the argument here, her reading of *Louis Lambert* posits that the titular character in that text reflected a pathological inversion of Bichat's organic/animal hierarchy to be destroyed at the conclusion of the text in a return to the normative. As *Louis Lambert* is closely linked to *La peau de chagrin* by story arc, including the philosophical works on human will undertaken by the main character in each text, Vila's reading resonates here insofar as the unknowability contained *within* Bichat's vitalist system reflects the argument proposed here that science in Balzac includes unknowability within its boundaries.

[2] This raises a secondary question - "what to make of this parody?" One possible response is that Balzac is admitting to his own shortcomings as a scientific author. While this seems reasonable, I believe that the better argument is that adopted by Thiher - that is, that Balzac viewed his attempts at scientific advancement through textuality *better* than anything that science could do in the early XIXth century. ("Only through successful competition with science, or so believed Balzac and a good many of his successors, could the novel justify its claims to offer access to reality in ways that might even be *superior* to scientific discourses with their claim to represent the totality of knowledge." Thiher, 39, emphasis added.)

[3] In this respect, the skin's efficacy sits in a space of limbo, like the famous thought experiment of Schrödinger's cat.

[4] And perhaps, to the development of *La Comédie humaine* project in its scientific aims. Yet as already noted, it may equally be contended that Balzac viewed his own work as exempt from such hindrances.

[5] Foucault would deny the completeness of concepts like these, at least as a matter of a totalizing discursive strategy - "Il n'y a pas une taxinomie naturelle qui aurait été exacte, au fixisme près" (97).

[6] It should be recalled in this respect that in Balzac's *La recherche de l'absolu*, Balthasar Claës dies immediately after reaching his εὕρηκα moment.

[7] This image, it should be noted, is referenced elsewhere in *La Peau de chagrin*, when Raphaël finally decides to seek the counsel of the scientific community: "Quoi ! s'écria Raphaël quand il fut seul, dans un siècle de lumières où nous avons appris que les diamants sont les cristaux du carbone, à une époque où tout s'explique, où la police traduirait un nouveau Messie devant les tribunaux et soumettrait ses miracles à l'Académie des Sciences, dans un temps où nous ne croyons plus qu'aux paraphes des notaires, je croirais, moi ! à une espèce de *Mané, Thekel, Pharès* ?" (*La Peau*, 230-31).

[8] It should be recalled, in this respect, that Balzac's *Avant-Propos de la Comédie Humaine* promised a zoological classification of the members of contemporary human society.

