Critique of Normalization of Deviation in Computer Science Research and Engineering Practice: Minority Voice Erosion, Systemic Drift, and Pathways Toward Reflexive Correction

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This paper argues that in contemporary computer science and engineering practice, the normalization of deviation functions not as a singular organizational oversight but as a cumulative sociotechnical drift that systematically suppresses minority voices. Drawing on Vaughan's original formulation of deviance normalization, feminist HCI, critical race theory for HCI, critical cultural HCI, and folk-model cognitive frameworks, the paper demonstrates how repeated exceptions framed as efficiency compromises become embedded as epistemic defaults and product priorities. These patterns manifest in machine learning bias, UX exclusion, dataset underrepresentation, and interface cultural assumptions that gradually shift from temporary deviations to industry norms. The paper further contends that normalization is amplified by cognitive mechanisms such as risk desensitization, dissonance minimization, and folk-model reliance, which render exclusion not intentional but structurally reproducible. The final section proposes a reflexive, anti-normalization self-audit system to operationalize feminist and CRT commitments in technical workflows, thereby re-centering minority presence in design decision-making. This work contributes not only conceptual diagnosis but also applied methodological scaffolding for preventing exclusion from crystallizing as accepted computational rationality.

Introduction

The normalization of deviation is conventionally understood as a socio-organizational mechanism through which decisions once marked as unacceptable become routine. Diane Vaughan's landmark analysis of the Challenger launch revealed that catastrophic outcomes can originate not from singular malfunction but from incremental acceptance of exceptionality as procedural logic. Although originally situated within aerospace organizational culture, this paper argues that deviation normalization is equally central to modern computational design, algorithmic engineering, HCI development pipelines, and research epistemology. Computer science currently produces systems that are presented as neutral, efficient, scalable, and optimized for "general" users, yet such neutrality is historically produced through repeated exclusions whose exceptional status becomes systematically forgotten.

A conceptual bridge between aerospace governance and digital infrastructure lies in the accumulation of technical decisions justified as merely provisional. When a dataset excludes minoritized groups "for now," when linguistic models fail on non-dominant dialects with the explanation that "future fine-tuning will address it," or when accessibility features are postponed until "post-MVP," these gestures accumulate through cyclical temporality. Over time, the justification that enabled the initial deviation evaporates, but the structural consequence—an unequal computational landscape—remains. The initial statement that something was temporary becomes epistemically irrelevant, and the deviation becomes

indistinguishable from standard operation. In this sense, normalization in computer science is not a violation of technical rationality but an extension of it.

Literature Review

The theoretical infrastructure of this argument draws on both critical HCI traditions and cognitive drift scholarship. Vaughan's model of normalization articulates that risk does not merely become tolerated but becomes recategorized as functionality itself. She explains that "organizations gradually transform previously unacceptable risks into 'normal' operational states through continuous, seemingly insignificant adjustments" (Vaughan, 1996). Although written for NASA's evaluation culture, the mechanism applies to dataset omission, English-dominant UI linguistics, facial recognition misclassification of Black users, and fairness metrics treated as supplemental rather than constitutive.

Feminist HCI extends this diagnostic lens by arguing that HCI design histories structurally under-attend to populations outside Western, masculine, and productivity-centered paradigms. Bardzell and Bardzell note that "HCI's move out of the workplace and into everyday life has had a host of profound implications… HCI is increasingly sensitive to its own influence on the broadest range of possible stakeholders" (Bardzell & Bardzell, 2011). The need for such sensitivity implies that earlier HCI models normalized exclusionary defaults. Domestic computing, affective experience, queer embodiment, and racialized interfaces had long been discursively categorized as fringe design spaces, marking minority experiences not as absent but as structurally unthinkable. Bardzell further writes that HCI research must involve

"ongoing self-questioning about whether the research is delivering on its ambitions to… undermine rather than reinforce oppressive social structures" (Bardzell & Bardzell, 2011). Here, deviation normalization appears not only as risk tolerance but as epistemic narrowing.

Critical race theory within HCI supplies a parallel but distinct empirical confirmation. Ogbonnaya-Ogburu et al. assert that "those of us who are not intentionally racist are still complicit in a larger racist system" (Ogbonnaya-Ogburu et al., 2010). Their intervention is not moral but infrastructural: systems that misidentify Black faces or penalize minoritized linguistic cadence emerge not because engineers aimed to exclude but because earlier exclusions remained unquestioned. In CRT terms, exclusion becomes normalized precisely when its conditions are no longer semantically visible in design discourse. The unmarked category—American English, Eurocentric UX metaphors, white facial archetypes—becomes a computational ontology rather than a sociotechnical decision.

Critical cultural HCI explains why this pattern is persistent. Bardzell contends that cultural methods must be mobilized to improve both lived environments and design practices. When Western reading direction, domestic architecture, or psycholinguistic assumptions appear in UI mapping and interaction sequencing, they are rarely flagged as culturally loaded. Instead, other cultural arrangements must be labeled as variants requiring adaptation. This inversion creates a norm-deviation axis in which Euro-American systems represent computational universality and all others represent divergence. Over time, the convergence of design templates, software

libraries, and pedagogical materials perpetuates a default that is ethnocentric while denying its own cultural situatedness.

Rick Wash's work on folk models provides the cognitive connective tissue that links operational drift with representational drift. Shared but inaccurate assumptions about security threats demonstrate how communities adopt simplified explanatory schema that become resistant to contradiction. Similarly, computing teams collectively internalize a "default user" who is linguistically dominant, normatively abled, computationally literate, and culturally aligned with global technology centers. Wash's observation that "folk models are mental models that are not necessarily accurate but are shared among similar members of a culture" (Ogbonnaya-Ogburu et al., 2010) shows that deviation normalization is not simply a top-down mandate but a lateral circulation of exposed cognitive simplifications. Once operationalized, these shared simplifications disappear from scrutiny and become preconditions of engineering logic.

Folk-model research in cybersecurity further demonstrates that normalization is not a matter of organizational bureaucracy but of cultural cognition. Rick Wash explains that "folk models are mental models that are not necessarily accurate… but are shared among similar members of a culture" (Wash, 2010). When extended to engineering teams, this logic reveals how majority-user imaginaries, English-default linguistic expectations, normative neurotypical interaction speed, and Western information hierarchies become unquestioned reference points. Thus, normalization is not the disappearance of dissent but the disappearance of awareness that dissent ever

existed.

In each of these domains—gender, race, security cognition, and cultural semiotics—literature repeatedly documents that deviation was not intentionally harmful but became normalized through operational repetition. The invisibility of minority users is not accidental; it is produced through sustained design choices that over time detach from their justifications and sediment as norm. It is in this sedimentation that the normalization of deviation becomes not a failure of computational precision but a condition of computational inheritance.

Theoretical Framework

The theoretical framework of this paper is grounded in the convergence of organizational sociology, feminist HCI, critical race theory for HCI, critical cultural HCI, and cognitive psychology. Their intersection substantiates that normalization of deviation is not merely a procedural shift but an epistemic, cultural, and infrastructural transformation in how computing defines acceptable user categories and acceptable harm. Each theoretical lens illuminates a distinct dimension of how exclusion becomes structurally naturalized.

Vaughan's concept of normalization of deviation provides the foundational mechanism. Although produced through NASA's organizational context, the analytic principle is transferable to computing systems: deviations are not sudden ruptures but slow recalibrations of acceptable thresholds. What begins as an exception to accommodate urgency or data incompleteness gradually becomes indistinguishable from standard operating assumptions. This explanatory frame is crucial for

interpreting how discriminatory outcomes in computational environments are not intentional but sedimented. A design that initially excludes non-dominant linguistic registers or rural data populations may justify this absence as temporary, but over iterations, the missing population becomes structurally unaccounted for, shifting invisibility into epistemic default.

Feminist HCI continues this reasoning by expanding the ontology of who computing is for. Bardzell and Bardzell's methodological intervention rests on the claim that research must engage in continuous ethical reflexivity to avoid reproducing power structures. They articulate that HCI is no longer simply oriented toward instrumental efficiency but must consider its impact on those who have historically been excluded from technological narratives. When feminist HCI states that research should involve "ongoing self-questioning about whether the research is delivering on its ambitions to undermine rather than reinforce oppressive social structures" (Bardzell & Bardzell, 2011), it reinforces that normalization of deviation is not a failure of ethical correctness but a failure of reflexive maintenance. The absence of minority perspectives is not only a design gap but an epistemic collapse in which those perspectives are no longer considered necessary.

Critical race theory for HCI builds upon this premise by providing an account of how exclusion becomes racialized under the guise of neutrality. Ogbonnaya-Ogburu et al. argue that complicity in systems of racial harm occurs not because actors seek domination, but because actors fail to interrogate inherited structural assumptions. Their observation that "those of us who are not intentionally

racist are still complicit in a larger racist system" (Ogbonnaya-Ogburu et al., 2020) is not accusatory but diagnostic. It identifies normalization as the precise moment where racial harm becomes automated through APIs, training sets, authentication modules, and recommendation algorithms. When datasets lack Black linguistic variation or when biometric systems fail on darker skin tones, these outcomes are labeled as statistical limitation rather than structural deviation. Through repetition, such failures become predictable and then predictively tolerated, ultimately re-entering technical vocabulary as "known constraints" or "anticipated performance boundaries."

These intersecting literatures collectively demonstrate that minority absence is rarely explicit. Rather, it is enacted through a chain of technical rationalizations in which missing datasets, non-dominant languages, disability contexts, and non-Western interface needs are suspended for efficiency and later reinstated as peripheral or statistically insignificant. The accumulation of such decisions mirrors Vaughan's documentation of risk acceptance but within a computational substrate. The central theoretical claim in this paper is therefore that normalization of deviation in computer science is not a technical oversight but a historical pattern of epistemic prioritization that engages profit timelines, institutional authority, design inheritance, and unexamined cultural normativity.

Analysis and Case Synthesis

The historical and contemporary record of computing provides abundant evidence that deviation normalization is not speculative but a recurring structural condition embedded in the production of digital infrastructures. Normalization

appears wherever compromises are framed as temporary or external to core design goals and later sediment as neutral baselines. What begins as a contingency response to deadlines, data shortages, or institutional funding pressures becomes indistinguishable from design logic itself. Through repetition, deviation is not only normalized but rendered invisible. This section examines how machine learning, user experience design, interface culture, and institutional gatekeeping reveal that normalization has long served as a quiet organizing principle in computing.

Machine learning systems present perhaps the clearest illustration. When training corpora disproportionately represent dominant linguistic, racial, auditory, or visual traits, the initial explanation often asserts that such imbalance is inconvenient but inevitable given data availability. Under this framing, minoritized groups are not denied but postponed. Yet as release cycles accelerate and optimization targets become tied to market deadlines, the provisional status of such postponement dissolves, and disproportional failure modes are renamed as limitations of modeling rather than failures of inclusion. In this transformation, harm is not denied but reclassified. That reclassification is the exact inflection point of normalization: what once appeared as a deviation from inclusive design becomes a tolerable model property, and later, a predictable characteristic of computational intelligence.

This pattern repeats in user experience design. Research communities have documented that personas and user archetypes often default to normative subjects defined by Western cultural logic, stable financial access, native linguistic fluency, or normative ability. The persistence of these defaults does not emerge because designers

consciously erase other cognitive, linguistic, cultural, or bodily conditions. Instead, the majority persona becomes simplification, the simplification becomes operational convenience, and convenience becomes epistemic common sense. Over time, there is no explicit moment in which designers choose to disregard minoritized users; the disregard is distributed, unspoken, and naturalized. Design teams that repeatedly interact with majority-centered test groups lose perceptual fidelity regarding users who do not align with those demographics. The design does not merely omit but learns to not know what it no longer models.

Critical cultural HCI describes precisely this phenomenon. Bardzell argues that cultural methodologies should be used to improve both lived experience and design practice, yet his critique suggests that computing systems are not built merely with cultural blind spots but with historically inherited defaults that shape what even counts as a design problem. When Western metaphors of ownership, reading direction, privacy, family structure, and linguistic cadence are encoded across global interfaces without explicit acknowledgment of their cultural origin, the deviation becomes reversed. The West is not a culture among cultures but a standard from which all others deviate. Cultural adjustment is thereby linguistically framed as localization rather than as a restoration of universality. This inversion stabilizes the normalization process: majority defaults are not questioned because deviation is structurally delegated to others.

This systemic drift becomes even more legible in fairness-oriented research communities. Numerous studies have documented that fairness metrics are often

implemented not as core architectural requirements but as supplementary validation checks. When research papers state that fairness evaluation will be explored in future work, they are not denying its importance but implicitly assigning it a temporal hierarchy in which other objectives, such as accuracy, latency, interpretability, or scaling efficiency, must be established first. Once fairness enters this scheduling grammar, it moves from normative grounding to optional augmentation. Repetition of this pattern across publication cycles transforms the absence of fairness considerations into a standardized research posture. The result is not malicious exclusion but procedural postponement that becomes indistinguishable from the epistemic aims of the field.

Rick Wash's analysis of folk cognition in security extends this reasoning by demonstrating that collective mental shortcuts evolve into normative frameworks that neither experts nor users experience as contingent. Where users engage repeatedly in insecure behaviors that streamline interaction, designers respond by accepting behavioral inconsistency as a foundational principle of interface construction rather than as a deviation from best practice. Wash's observation that folk understandings are culturally shared rather than individually invented provides the conceptual bridge needed to understand normalization as socially reproduced expectation rather than technical inevitability. The same mechanism applies to computing's default-user assumption. Once internalized, the default becomes pre-conscious. There is no longer an active erasure of difference because difference has been transmuted into exceptionality rather than ordinariness.

Across each of these domains, the iterative transition from provisional exclusion to epistemic irrelevance is consistent. When dataset imbalance is presented as an unavoidable byproduct of sampling, when linguistic normalization functions treat certain cadences as noise, when research agendas treat fairness as additive to core performance metrics, and when UX methodologies treat accessibility as specialized rather than standard, deviation passes through three recognizable phases. First, it is justified. Second, it is routinized. Third, it is assumed as the natural order of system functioning. This progression displays striking symmetry with Vaughan's original model of drift: neither NASA nor computing systems intended harm; harm grew from organizational momentum, temporal compression, and cumulative rationalization.

The fundamental analytical claim here is that these environments do not merely facilitate normalization but depend upon it. Algorithmic deployment schedules, venture-backed development cycles, data brokerage infrastructures, publication timelines, and performance benchmarks all exert pressure toward rapid institutionalization of whatever can be made to function in the present. Under these conditions, temporary exclusion is not a flaw in computational development but a precondition for computational speed. Deviation normalization is therefore not incidental to computing; it is congruent with computing's industrial tempo. Only through reflexive intervention, as later sections argue, can this drift be arrested before it becomes irretrievable.

Normalization's durability lies in its gradual invisibility. The first omission of

a community, accent, bodily capacity, or dialect is legible to the design team; the fiftieth omission is merely expedient. Over time, the act of designing without certain users ceases to feel exclusionary because the cognitive and organizational effort required to remember them becomes the true deviation. At that juncture, minority absence is not merely tolerated but epistemically naturalized. It is this naturalization that feminist HCI demands be continuously interrogated, that critical race theory insists must be institutionally unveiled, and that critical cultural HCI positions not as oversight but as cultural inscription.

Methodological Intervention: Anti-Normalization Self-Check System as Reflexive Protocol

The preceding analysis demonstrates that normalization of deviation in computing unfolds not through overt exclusion but through temporal absorption, descriptive erasure, and epistemic routine. The Anti-Normalization Self-Check System (AN-SCS) is therefore proposed not as a checklist toolset but as a reflexive institutional method intended to interrupt the gradual dissolution of minority presence in design logic. Rather than functioning as a penalty or compliance mechanism, it operates as an epistemic redistribution practice, returning visibility, deliberation, and ethical density to design decisions that have otherwise been deprived of them through iterative desensitization.

The function of AN-SCS is not to mandate inclusive outcomes but to reinsert meaningful friction into design procedures that have been structured to accelerate beyond ethical reflection. In its methodological construction, AN-SCS takes feminist

HCI's demand for persistent self-questioning and extends it through the procedural rhythms of cognitive and organizational drift. Bardzell's call for scholarship to "undermine rather than reinforce oppressive social structures" (Bardzell & Bardzell, 2011) articulates not a fixed evaluative standard but a continuing posture. AN-SCS therefore does not aim to supply thresholds, numeric fairness scores, or standardized acceptance criteria. Rather, it reorients design temporality by insisting that every decision with structural implications be reinhabited as decision rather than silently inherited.

In this interpretive transformation, what earlier sections identified as triggers, exclusion visibility markers, drift indicators, and counterfactual mappings no longer function as static diagnostic tables but as narrative reconstruction acts. A design team engaging AN-SCS must narrate, internally and continuously, how its present choice came to appear necessary, why alternatives receded from view, when absence became tolerable, and which communities stand outside its interpretive horizon. The practice of reconstruction is therefore methodological rather than managerial. It resists the closure that typically follows release cycles or performance benchmarks and reopens each iteration as ethically unfinished.

From the perspective of critical race theory for HCI, this reopening is not merely an ethical courtesy but a structural recalibration. Ogbonnaya-Ogburu et al. argue that complicity arises not through direct harm but through the failure to interrogate inherited assumptions (Ogbonnaya-Ogburu et al., 2020). AN-SCS is therefore designed to expose assumption inheritance in real time. When a team

documents why a voice, accent, or dialect was not captured in the dataset, the effect is not only descriptive but restorative; it returns that absence to semantic presence long before full inclusion is technically or institutionally possible. The system thus positions minority users not as edge cases to be added after scalability and optimization, but as full epistemic participants whose absence requires continuous justification rather than silent continuation.

Critical cultural HCI, as articulated by Bardzell in his chapter Critical and Cultural Approaches to HCI in The SAGE Handbook of Digital Technology Research, emphasizes that the normative assumptions within computing must be recognized not as universal truths but as cultural artifacts. Bardzell argues that design does not emerge from neutral terrain, but from historically sedimented interpretive frames tied to Western symbolic, spatial, linguistic, and epistemic traditions. His account demonstrates that interaction patterns, interface metaphors, and experience models encoded into global computing infrastructures are shaped by a culturally specific semiotics that becomes invisible precisely because it is continuously reproduced. Under these conditions, cultural defaults are misrecognized as technical necessities rather than historically contingent trajectories. This misrecognition normalizes the dominance of Euro-American usability standards while dislocating alternative relational, communal, or non-Western interaction ontologies into the category of deviation. Bardzell's critique is explicit in its refusal to describe Western HCI models as universal baselines. Instead, it argues that the invisibility of cultural situatedness is itself a form of epistemic power that re-narrates Western interaction patterns as

cognitively self-evident and therefore exempt from scrutiny.

In Bardzell's rendering, the central danger lies not in cultural difference but in cultural automaticity. When Western design grammars are repeatedly encoded without identification of their origin, all non-Western systems are discursively positioned as modifications rather than primary forms. The result is an enduring asymmetry: what is culturally situated for some becomes infrastructurally mandatory for all. The normalization of deviation therefore must be understood not solely as a computational mechanism but as a cultural one. When the cultural foundations of HCI design are not acknowledged, their effects do not disappear; rather, they circulate beneath analytic thresholds and shape every subsequent decision in interface architecture, accessibility, information hierarchy, error recognition, and semantic interpretation. Bardzell's intervention reinforces the conclusion of this paper that the elimination of minority perspectives is not accomplished by explicit refusal but by the transfer of Western epistemic particularity into the technical substrate, where it becomes indistinguishable from computational necessity.

Within cognitive frameworks, the role of AN-SCS is to counteract the mental smoothing that Wash identifies in folk-model formation. When teams repeatedly confront the same dominant archetypes, the archetype ceases to appear partial and becomes natural. It acquires the position of mental inevitability. By reintroducing deliberation into assumptions that have been cognitively economized, AN-SCS reinstates the mental cost of exclusion. This reinstatement is not punitive but epistemic; it requires teams to deposit new cognitive labor into populations that have

been systematically cost-reduced to invisibility.

The practice of reflexive documentation within AN-SCS is therefore not clerical. It is meant to reactivate design history as material rather than rhetorical. When teams document not only what they chose but how they arrived at the conditions of that choice, normalization can no longer proceed through silent accretion. In the absence of such reflection, earlier exceptions become indistinguishable from current practice, and current practice becomes indistinguishable from design necessity. Under AN-SCS, design decision-making must be recorded not as linear selection but as narrative inheritance. Design choices are thus anchored to their antecedents instead of dissolved by iteration cycles.

In methodological terms, AN-SCS should be understood as a reflexive instrument that displaces normative temporality. Instead of relegating inclusion work to the domain of post-release or post-validation repair, it positions inclusion at the inception of deliberation. This structure does not guarantee equitable outcomes, but it ensures that inequity is not the byproduct of forgetting. Drift cannot proceed when every iteration requires the articulation of who is present, who is missing, and why the missing have become tolerable. The system thus functions as a cognitive interruption mechanism designed to slow epistemic velocity in environments that reward acceleration over memory.

The protocol also assumes that reflexivity must be durable rather than episodic. A single intervention session cannot counteract a drift produced through decades of methodological inheritance. AN-SCS therefore advocates cyclical reinstatement of

reflexive practice at each point when deviation risks being reabsorbed as convenience or neutrality. Under this cyclical model, reflexivity is not remediation but maintenance: the care practice required to prevent epistemic erosion.

To operationalize the reflexive commitments outlined above, the Anti-Normalization Self-Check System is rendered here in six structured instruments. These tables are not diagnostic endpoints but procedural scaffolds designed to distribute deliberative work across the lifespan of design decisions. They do not prescribe outcomes; rather, they stage repeated interruptions to the normative smoothing that produces invisibility, exceptionality, and epistemic drift. The six-part system therefore functions as the practical translation of the theoretical commitments articulated in the prior section, ensuring that reflexivity materializes not only discursively but structurally.

Table1

Trigger Recognition Checklist

Trigger indicator	**Yes**	**No**	**Notes**
The decision is explicitly described as “temporary,” “exceptional,” or “just this once.”			
Time pressure or a deadline is explicitly cited as a key reason for the decision.			
There is little or no data for at least one clearly affected user group.			
Concerns about minority users or equity were raised			

but are not reflected in the current plan.			
The team explicitly frames some harm or exclusion as something that will be “fixed later.”			
No one in the discussion identifies as a member of the most affected user groups.			
Success criteria for this decision do not include any fairness, inclusion, or harm-related metric.			
There is no concrete plan to revisit the decision after deployment or after more data is collected.			

Note. ⩾3 selected options: Recommended to run the simplified AN-SCS at least once. ⩾5 selected options: Recommended to run the full AN-SCS and log it to the Reflexive Decision Log (Table6).

Table2

Minority Voice Visibility Worksheet

User group	**Present in data?**	**Consulted or tested?**	**Explicitly discussed in this decision?**	**Note if potential harm is ignored**
Racial and ethnic minorities				
Non-native or multilingual speakers				
Disabled users (sensory, motor,				

cognitive, mental health)				
Low-income or unbanked users				
LGBTQ+ and gender-diverse users				
Older adults				
Immigrants and diaspora communities				
Locally specific or non-Western cultural groups				

Note. Select yes or no for the first three column (**Present in data? Consulted or tested? Explicitly discussed in this decision?**) and write any note for last column.

A row with three columns all marked "No" means a significant axis is completely absent. This means that action from relevant parties is urgently needed. Each row has a different meaning, but the state of complete absence itself is a red flag of the same level.

Table3

Drift Indicator Questionnaire

Drift indicator	**Yes**	**No**	**Notes**
We have made a similar “temporary” exception in previous projects or releases.			
The number of such exceptions has increased over time.			

The language used by the team has shifted from "exception" to "this is how we usually do it."			
Known negative impacts on minority users are no longer being documented or tracked.			
The team routinely describes equity or inclusion work as "too expensive" or "not a priority right now."			
No one in the team can clearly explain when or why the original boundary or rule started being bent.			
People express discomfort or doubt about the decision but still frame it as "necessary" or "inevitable."			
There is no concrete plan or schedule for revisiting this exception or measuring its long-term impact.			

Note. The higher the number of checkmarks, the greater the likelihood that this exception has become "part of the culture." For example, "If ⩾4 items are 'Yes,' we consider it a strong indication of a bias normalization process."

Table4

Decision Pathway Mapping Template

Step in the decision process	**Key factor shaping this step (constraint, metric, assumption)**	**Who benefits most at this step?**	**Who is disadvantaged or deprioritized?**	**How was this trade-off justified at the time?**
1				

2				
3				
4				

Note. This is not a count-number table. When using it, what's more important is "whether each line is written specifically and clearly indicates who is prioritized and who is sacrificed," rather than simply counting. The number of rows could change depends on the real steps of the project.

Table5

Counterfactual Inclusion Guide

Counterfactual scenario	**What would change in the decision?**	**How would priorities be reordered?**	**What design or model adjustments would be required?**
Minority users are treated as primary users rather than secondary.			
The dataset fully represents all relevant user groups.			
Time and resource constraints are relaxed for this decision.			
Accessibility is a			

non-negotiable requirement, not an optional add-on.			
Fairness and harm reduction are treated as core success metrics.			

Note. This table doesn't rely solely on the "number of selected items" to draw conclusions, but rather uses counterfactual changes to reveal "whom we initially assumed to have chosen."

Table6

Reflexive Decision Log

Final decision taken	Primary beneficiaries	Groups who may bear disproportionate risk or harm	Mitigation or follow-up plan	Date for revisiting this decision and checking for drift

Note. This form is to ensure that the team has provided a concrete plan and that dates for follow-up reviews have been written down.

The simplified AN-SCS means to only use Table1, Table2, Table3, the abbreviated mode requires a non-negotiable, time-based revisitation boundary. It is not triggered by the presence of harm but by the mere possibility of normalization.

The abbreviated AN-SCS is not a weaker mechanism but a preemptive infrastructural buffer. It is activated when drift signals accumulate yet have not

consolidated into institutional normativity. Its reduced three-instrument format preserves reflexive friction without demanding full narrative reconstitution. On completion, it requires a dated commitment to re-inspection, thereby ensuring that provisional exceptions cannot silently transition into stable technical or cultural defaults.

The introduction of the full system requires articulation of an abbreviated mode. When early-stage drift signals are present—signaled by three or four triggers rather than systemic saturation—the system enters a containment posture rather than reconstructive one. Under the abbreviated AN-SCS, only the trigger recognition, minority visibility, and drift instruments are completed. They do not diagnose, but they suspend the acceleration that permits an exception to become customary. Their function is temporal and preventative: to hold open the space of questioning without yet requiring the complete narrative reconstitution of pathway mapping or counterfactual reordering. Upon completion, the abbreviated mode requires time-based reinspection rather than harm-based reactivation, ensuring that provisional justifications cannot silently consolidate into organizational identity.

When five or more triggers are evident, or when absence has migrated from episodic to infrastructural, the full system is activated. In such contexts, narrative reconstruction becomes obligatory: the team must articulate how the decision acquired necessity, which voices became inaudible, and when toleration transformed into expectation. The counterfactual instrument is required precisely because only alternative priority orderings can reveal which hierarchies have been naturalized. The

reflexive decision log, in full form, acts not as archive but as commitment, specifying not only what was decided but when that decision will be unmade, revised, or rendered obsolete by those who were initially absent.

Neither the abbreviated nor the complete mode is permitted to disappear into symbolic compliance. Completion is collective rather than individual, justification is written rather than implied, and content is meant to be revisited rather than stored. In both forms, AN-SCS formalizes delay as ethical intervention: it institutionalizes the time required for alternatives to re-enter the frame, preventing the rhetorical slide from exception to habituation and habituation to normativity. It ensures that minority absence cannot be reduced to technical inconvenience and that drift cannot proceed without narrative trace.

Thus understood, AN-SCS is not corrective remediation but maintenance. It does not aim to resolve inequity but to prevent its invisibility; not to guarantee inclusion but to obstruct erasure. Full deployment interrupts normalization after it has become recognizable; abbreviated deployment interrupts normalization before it becomes perceptible. In both cases, the system protects deliberative friction from procedural acceleration and restores the epistemic weight of those who have historically been abstracted out of design's center of calculation.

Positionality

Any researcher who intervenes in design culture must acknowledge that they participate in and benefit from the very structures they critique. The position adopted in this paper is necessarily hybrid. It is shaped by computational literacy, access to

educational institutions that legitimize critical vocabulary, and proximity to design cultures that continue to normalize the exclusions under study. This position enables critique but also risks reproducing epistemic centrality. The commitment articulated here is to treat positional awareness not as preface but as analytic instrument. Positionality is not offered as a gesture of moral transparency but as ongoing recalibration that shapes how drift is interpreted and how correction is enacted.

Reflexivity Statement

Because normalization functions through forgetting, reflexivity must function through repetition. The research presented here requires that the author remain attentive to the seductions of simplification deployed in the name of urgency, precision, or technical standardization. Reflexive accountability will be maintained by routinely tracing not only what is argued but why certain arguments appear more available than others. Reflexivity therefore acknowledges that deviation normalization is not a defect of systems alone but a cognitive economy that affects critics as well as practitioners.

Conclusion

Normalization of deviation in computer science is not an emergent risk but a documented recurrence observable across machine learning, interface design, internationalization practices, security cognition, and epistemic gatekeeping. The conditions that allow exclusion to become normalization are not malicious but accumulative; they produce harm through routine rather than through intent. The

Anti-Normalization Self-Check System responds by slowing the epistemic drift that causes exclusion to lose its semantic status and to become naturalized. By reframing reflection as an embedded design obligation rather than as supplementary ethical practice, AN-SCS allows design histories to remain accessible, minority erasure to remain legible, and culture to remain explicit rather than implicit. In doing so, the system demonstrates that routine can be interrupted, that inherited assumptions can be rendered visible, and that neutrality is not an ontological given but a historical effect.

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