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When Love Is Not Enough: Parental Gatekeeping and the Dynamics of Grandparent-Grandchild Closeness

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Abstract

Grandparents may experience substantially different levels of closeness with different grandchildren even when their underlying affection toward them is identical. This paper develops a dynamic model that distinguishes latent grandparental valuation from realized relational closeness, a composite of contact, intimacy, disclosure, and support. Closeness accumulates through costly grandparental relational investment, but the productivity of that investment depends on access to the grandchild and reciprocal engagement. The baseline optimal-control model shows that unequal observed closeness can arise without preference-based favoritism. We then introduce the quality of the grandparent's relationship with the intervening parent or child-in-law and show that this relationship can mediate access and magnify differences in realized closeness. Next, a reduced-form adaptive extension allows parental gatekeeping to respond to perceived closeness differences across grandchildren. This feedback system admits a critical gatekeeping-sensitivity threshold: below the threshold, symmetric closeness is locally stable, whereas above it the symmetric state loses stability. An autonomy extension shows that increasing grandchild independence attenuates the gatekeeping channel; under full autonomy, current parental access no longer affects effective access, although closeness differences inherited from earlier periods decay only gradually. Numerical analysis illustrates convergence, amplification, and asymmetric steady-state solutions. The results show why closeness alone cannot distinguish unequal affection from unequal relational opportunity and how the middle generation's influence changes over the grandchild's life course.

Keywords

Grandparent-Grandchild Relationships, Parental Gatekeeping, Children-in-Law, Perceived Favoritism, Intergenerational Solidarity, Relational Closeness, Dynamic Optimization

1. Introduction

Grandparent-grandchild relationships are an important component of contemporary family life. The intergenerational-solidarity tradition emphasizes that family relationships are multidimensional: affection, association, resource sharing, norms, consensus, and structural opportunities for interaction are related but distinct dimensions of intergenerational bonds (Bengtson & Roberts, 1991). A recent scoping review applying this framework to grandparent-grandchild relationships likewise shows that emotional closeness, contact, support, and structural conditions should not be treated as interchangeable features of a relationship (Duflos & Giraudeau, 2022).

This distinction motivates the present paper. A grandparent may care deeply about several grandchildren while maintaining substantially different levels of realized closeness with each of them. One grandchild may communicate frequently, disclose personal experiences, live nearby, and spend substantial time with the grandparent; another relationship may be warm and affectionate but concentrated in occasional family encounters. Geographic proximity is strongly associated with opportunities for intergenerational contact and exchange (Healy & Dunifon, 2025), while earlier research identifies geographic distance, time spent together, family relational dynamics, and relational investment as factors that can alter grandparent-grandchild closeness over time (Bangerter & Waldron, 2014; Hodgson, 1992).

The relationship is also not purely dyadic. The middle generation can affect the opportunities through which the grandparent-grandchild tie develops. Fingerman (2004) showed that offspring and children-in-law play an important role in grandparents' ties to grandchildren, and later research on in-law relationships emphasizes that such ties are triadic and can affect broader family relationships (Fingerman et al., 2012). Thus, a grandparent's relationship with the intervening parent may facilitate or constrain access even when the grandparent's underlying affection toward the grandchild remains unchanged.

A further complication is that family members observe realized closeness more readily than they observe the process that produced it. Recent within-family research documents adult grandchildren's perceptions of grandmothers' differential treatment and emotional closeness (Ogle et al., 2026). An observed difference in closeness may therefore be interpreted as evidence of favoritism even when it was generated by unequal access, reciprocity, distance, or accumulated interaction.

This paper develops a dynamic explanation for such relational asymmetry. Our central distinction is between underlying relational valuation, which captures how much the grandparent values the relationship, and realized closeness, which is an endogenous relational stock accumulated through repeated interaction. The grandparent chooses costly relational investment, but the effectiveness of that investment depends on access and reciprocal engagement. Operationally, realized closeness is interpreted as a composite relational stock reflected in recurring contact, emotional intimacy, disclosure, and supportive exchange rather than any single observed behavior.

We address four questions. First, can unequal grandparent-grandchild closeness arise when the grandparent values grandchildren equally? Second, how does the grandparent's relationship with the intervening parent or child-in-law affect realized closeness through access? Third, can perceived favoritism and parental gatekeeping create a self-reinforcing mechanism through which initially small relational differences persist or grow? Fourth, how does the grandchild's increasing autonomy with age alter the power of parental gatekeeping and the persistence of earlier relational differences?

The analysis produces four main results. First, in the baseline optimal-control problem, equal underlying valuation does not generally imply equal realized closeness: persistent differences in access or reciprocity generate different optimal investments and different steady-state closeness. Second, when access improves with the quality of the grandparent-parent or grandparent-in-law relationship, realized closeness is increasing in that relationship quality. Third, in a reduced-form adaptive extension, sufficiently strong feedback from observed closeness to parental access destabilizes the symmetric relationship configuration. Hence, observed favoritism can arise as a dynamic outcome rather than a primitive preference. Fourth, increasing grandchild autonomy attenuates the access-feedback channel; under full autonomy, parental gatekeeping no longer affects current effective access, although relational differences inherited from earlier periods decay only gradually.

The remainder of the paper is organized as follows. Section 2 reviews the conceptual background and related literature. Section 3 develops the baseline dynamic optimization model. Section 4 introduces the intervening-parent/in-law mediation effect. Section 5 develops a reduced-form adaptive gatekeeping system and derives its stability threshold. Section 6 introduces grandchild autonomy and derives its implications for gatekeeping power and inherited closeness. Section 7 presents numerical analysis of the adaptive system. Section 8 discusses implications, Section 9 concludes, and all formal proofs appear in Appendix A.

2. Conceptual Background and Related Literature

2.1. Intergenerational Solidarity and Relational Closeness

Bengtson & Roberts (1991) conceptualize intergenerational solidarity as a multidimensional construct rather than a single measure of family attachment. Their framework distinguishes affectual solidarity from association, functional exchange, norms, consensus, and structural opportunity. Duflos & Giraudeau

(2022) show that this framework has been productively applied to the grandparent-grandchild relationship and that different dimensions of solidarity need not coincide.

The distinction between affection and opportunity is especially important for the present model. Hodgson (1992) reports that geographic proximity and broader family relationships are associated with adult grandchild-grandparent bonds. Bangerter & Waldron (2014) identify changes in geographic distance, time together, family relational dynamics, and relational investment as turning points in long-distance grandparent-grandchild relationships. More recently, Healy & Dunifon (2025) document strong links between spatial proximity and intergenerational time transfers. These findings motivate treating closeness as a stock that evolves through interaction rather than as a fixed attribute of a dyad.

2.2. The Middle Generation and In-Law Relationships

The middle generation occupies a structurally important position between grandparents and grandchildren. Fingerman (2004) directly examined the role of offspring and children-in-law in grandparents' ties to grandchildren and found that these relationships are consequential for grandparent-grandchild ties. Fingerman et al. (2012) further emphasize that in-law relationships are triadic: they arise through a third party and can affect other family relationships. This literature motivates an explicit access channel in which the quality of the grandparent's relationship with the intervening parent or child-in-law affects the productivity of relational investment.

The model does not assume that a child-in-law necessarily restricts access. The same mechanism allows facilitation as well as gatekeeping. A positive relationship can increase opportunities for contact, information sharing, visits, and inclusion; a strained relationship can reduce them. The theoretical object of interest is therefore the intervening-parent relationship, of which daughter-in-law and son-in-law relationships are important cases.

2.3. Differential Closeness and Perceived Favoritism

Within-family relationships are heterogeneous. Ogle et al. (2026) show that adult grandchildren perceive differential treatment by grandmothers and that these perceptions are meaningful for well-being. Their work establishes the empirical relevance of differential treatment. Our theoretical question is complementary: does differential observed closeness necessarily reveal differential underlying preference?

We distinguish preference-based favoritism from emergent relational asymmetry. Preference-based favoritism means that the grandparent places intrinsically different values on relationships with different grandchildren. Emergent relational asymmetry means that underlying valuations may be identical while access, reciprocity, geography, or previous interaction differ. The model below isolates the latter mechanism.

2.4. Age, Autonomy, and the Changing Role of Parental Mediation

The middle generation's mediating role is not constant over the grandchild's life course. Research on adolescents shows that more frequent contact, greater grandparent involvement, and better parent-grandparent relationships are associated with stronger adolescent-grandparent ties, with parents explicitly described as gatekeepers of intergenerational exchange (Attar-Schwartz et al., 2009). Qualitative evidence likewise identifies visits, parental communication, and the absence of criticism as mechanisms through which parents mediate closeness (Holladay et al., 1997). Longitudinal evidence on the transition to adulthood shows both continuity and change in grandparent-grandchild closeness as grandchildren gain greater control over the relationship, while residential independence changes opportunities for contact and the middle generation's mediating role (Monserud, 2010; Wetzel & Hank, 2020). These findings motivate treating autonomy as age-related rather than assuming that parental gatekeeping has the same force throughout childhood, adolescence, and adulthood.

3. Baseline Dynamic Model

Consider a grandparent interacting with *n* grandchildren indexed by $i = 1, \cdots, n$. Let $G_i(t) \geq 0$ denote realized relational closeness with grandchild *i* at time *t*. The grandparent chooses relational investment $u_i(t) \geq 0$, where $u_i(t)$ represents costly time, attention, communication, practical assistance, and other relationship-maintaining activities. Let $A_i \in (0,1]$ denote effective access and $R_i \in (0,1]$ reciprocal engagement. In the baseline model both are exogenous and constant. Geographic proximity and the quality of surrounding family relationships are also treated as exogenous background determinants of relational opportunity in this baseline formulation. These assumptions deliberately isolate the access mechanism rather than represent the full family relationship process. Closeness evolves according to

$$\dot{G}_i(t) = \alpha_i A_i R_i u_i(t) - \delta_i G_i(t),$$

where $\alpha_i > 0$ is the productivity of relational investment and $\delta_i > 0$ is relational depreciation.

The grandparent chooses $\{u_i(t)\}_{i=1}^n$ to maximize

$$J = \int_0^\infty e^{-\rho t} \left[\sum_{i=1}^n \omega_i G_i(t) - \frac{c}{2} \sum_{i=1}^n u_i^2(t) \right] dt,$$

where $\rho > 0$ is the discount rate, $c > 0$ is the cost parameter, and $\omega_i > 0$ is the grandparent's underlying valuation of the relationship with grandchild *i*.

The distinction between ω_i and $G_i(t)$ is fundamental. The first is a primitive preference parameter; the second is an endogenous relational outcome. To isolate relational asymmetry without preference-based favoritism, the benchmark assumes

$$\omega_i = \omega \text{ for all } i.$$

Proposition **1 (*Equal Affection Does Not Imply Equal Closeness*).** *Under an* *interior optimum, the optimal relational investment and steady-state closeness for grandchild i are*

$$u_i^* = \frac{\alpha_i A_i R_i \omega_i}{c(\rho + \delta_i)}$$

and

$$G_i^* = \frac{\alpha_i^2 A_i^2 R_i^2 \omega_i}{c\delta_i(\rho + \delta_i)}.$$

Consequently, even when $\omega_i = \omega_j$*, persistent differences in effective access or reciprocal engagement can generate different optimal investments and different steady-state levels of realized closeness. Observed closeness alone therefore cannot distinguish unequal underlying affection from unequal relational opportunity; this is a theoretical observational-equivalence result rather than a claim of empirical causal identification.*

The result makes the identification problem transparent. Holding all other primitives fixed,

$$\frac{G_i^*}{G_j^*} = \left(\frac{A_i R_i}{A_j R_j}\right)^2.$$

Thus even modest persistent differences in the relational technology can generate larger differences in observed steady-state closeness.

4. The Intervening-Parent/In-Law Mediation Effect

We now make access depend on the quality of the grandparent's relationship with the parent who connects the grandparent to grandchild *i*. Let $D_i \in [0,1]$ denote the quality of this intervening relationship, where larger values indicate a more cooperative, inclusive, and communicative relationship. We write effective access as

$$A_i(D_i) = A_0 + \beta D_i,$$

with $A_0 > 0$, $\beta > 0$, and parameters restricted so that $A_i(D_i) \le 1$.

This specification is deliberately neutral about whether the intervening parent is the grandparent's daughter, son, daughter-in-law, or son-in-law. Its purpose is to isolate a general mediation mechanism documented in the family-relationships literature (Fingerman, 2004).

***Proposition* 2 (*The Intervening-Parent/In-Law Mediation Effect*).** *Holding underlying valuation, reciprocity, and other primitives fixed, steady-state grandparent-grandchild closeness is strictly increasing in the quality of the grandparent's relationship with the intervening parent or child-in-law:*

$$\frac{\partial G_i^*}{\partial D_i} > 0.$$

Moreover, under the linear access specification above, the marginal effect is increasing in D_i.

The proposition implies that two equally valued grandchildren may experience different realized relationships solely because the channels through which the grandparent can interact with them differ. The result does not require deliberate exclusion by the parent. Even small differences in invitations, communication, information sharing, or spontaneous access can accumulate dynamically (Figure 1).

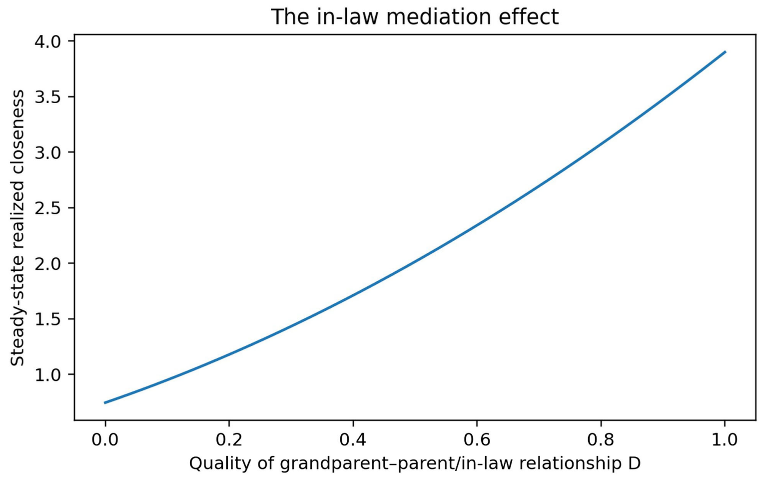

Figure 1. The in-law mediation effect.

5. Reduced-Form Adaptive Gatekeeping and Perceived Favoritism

Scope of the adaptive extension. Sections 5 - 7 do not re-solve the grandparent's full intertemporal optimal-control problem after access becomes endogenous. Instead, they use the stationary optimal-investment mapping derived under exogenous access as a quasi-static behavioral rule conditional on current access. A full optimal-control formulation with endogenous access would introduce additional costates because current closeness affects future access, and its policy rule need not coincide with the rule used below. Accordingly, Theorems 1 and 2 characterize the stability of the reduced-form adaptive system, not a fully anticipated optimal-control equilibrium. This separation is deliberate: it isolates the feedback mechanism while preserving analytical transparency.

The previous sections treat access as exogenous. We now study an adaptive extension in which access responds to observed relational differences. To obtain a transparent feedback system, consider two grandchildren with common α, R, ω, c, ρ, and δ. As the quasi-static behavioral rule described above, the stationary mapping from Proposition 1 gives, for a given current level of access.

Family-structure assumption. In this two-grandchild extension, each grandchild is linked to a separate access-setting parent, so the two access states can respond separately to observed closeness. If the grandchildren are siblings who share the same access-setting parent, access decisions would generally be jointly determined and would require a different specification.

$$u_i^*(A_i) = \frac{\alpha R \omega}{c(\rho+\delta)} A_i.$$

Substituting this rule into the closeness equation gives

$$\dot{G}_i = qA_i^2 - \delta G_i,$$

where

$$q \equiv \frac{\alpha^2 R^2 \omega}{c(\rho+\delta)} > 0.$$

Let $\bar{A} \in (0,1)$ denote the baseline level of access in the absence of perceived favoritism. Access follows

$$\dot{A}_i = \eta(\bar{A} - A_i) + \kappa A_i (1 - A_i)(G_i - G_j), \quad j \neq i,$$

where $\eta > 0$ captures restoration toward baseline access and $\kappa \geq 0$ measures the sensitivity of gatekeeping or facilitation to observed closeness differences. The factor $A_i(1-A_i)$ keeps the feedback bounded at the endpoints. When $G_i > G_j$, the parent associated with grandchild *i* is modeled as becoming relatively more facilitating; when $G_i < G_j$, access is reduced relative to baseline. The mechanism captures a self-reinforcing interpretation of perceived favoritism rather than asserting that all parents respond in this way. The reinforcing specification captures an attribution-driven response: a parent interprets an existing closeness advantage as evidence of a stronger or more valued relationship and facilitates further interaction, whereas the parent associated with the relatively weaker relationship restricts access. A compensatory response, in which parents act to offset closeness differences, would reverse the feedback and is outside the benchmark case analyzed here.

The access state is well defined on its natural domain. If $A_i(0)$ lies in [0, 1], then $A_i(t)$ remains in [0, 1] for all subsequent time: at $A_i = 0$ the drift is $\eta\bar{A} > 0$, whereas at $A_i = 1$ it is $\eta(\bar{A} - 1) < 0$. Thus the vector field points inward at both boundaries.

The system has a symmetric steady state

$$A_1^* = A_2^* = \bar{A},$$

$$G_1^* = G_2^* = \frac{q\bar{A}^2}{\delta}.$$

***Theorem* 1 (*Gatekeeping-Sensitivity Threshold*).** *The symmetric steady state is locally asymptotically stable if and only if*

$$\kappa < \kappa_c \equiv \frac{\delta\eta}{4q\bar{A}^2(1-\bar{A})}.$$

At $\kappa = \kappa_c$ one eigenvalue associated with asymmetric perturbations is zero. For $\kappa > \kappa_c$, the symmetric steady state is locally unstable to sufficiently small asymmetric perturbations.

Within the reduced-form adaptive system, the theorem identifies the central feedback mechanism. When gatekeeping sensitivity is low, small differences in closeness decay. When sensitivity is high, a small observed gap changes access strongly enough to amplify rather than correct the difference. The critical value increases with relational depreciation and baseline-restoration speed, but decreases with the productivity of access. These comparative-stability results concern the adaptive feedback system and should not be interpreted as the solution of a fully forward-looking control problem with endogenous access.

The theorem does not require ex ante favoritism: both grandchildren have identical preference parameters and identical baseline access. Instability is generated entirely by endogenous feedback from observed closeness to future access.

6. Age, Autonomy, and the Declining Power of Gatekeeping

The gatekeeping mechanism in Section 5 is most natural when the grandchild depends heavily on the parent for visits, communication, transportation, and information. As the grandchild matures, direct communication and independent mobility create an additional channel that is less controlled by the middle generation. Let $s(t)\in[0,1]$ denote the grandchild's autonomy, with $s(t)$ weakly increasing with age. The polar cases $s=0$ and $s=1$ represent complete parental mediation and full direct access, respectively.

Define effective access by

$$B_I(t)=s(t)+[1-s(t)]A_i(t)$$

Thus parental access A_i determines effective access when the grandchild is fully dependent, while $B_i=1$ under full autonomy. The reduced-form closeness dynamics become

$$\dot{G}_i=qB_i^2-\delta G_i.$$

The normalization $B_i=1$ under full autonomy represents a common direct-access benchmark rather than a claim that all practical constraints on interaction disappear. Any common positive direct-access level can be absorbed into the scale of q without changing the qualitative gatekeeping result.

$$\dot{G}_i=qB_i^2-\delta G_i.$$

For a fixed autonomy level s, the symmetric steady state is

$$A_1^*=A_2^*=\bar{A},\ G_1^*=G_2^*=\frac{q\bar{B}^2}{\delta},\ \bar{B}=s+(1-s)\bar{A}.$$

***Theorem* 2 (*Autonomy-Dependent Gatekeeping Threshold: Frozen-Autonomy System*).** *For a fixed autonomy level* $s<1$*, the symmetric steady state is locally asymptotically stable if and only if*

$$\kappa<\kappa_c(s)\equiv\frac{\delta\eta}{4q\bar{B}(1-s)\bar{A}(1-\bar{A})}.$$

Moreover, $\kappa_c(s)\to\infty$ *as* $s\to1$*. If* $\bar{A}\ge1/2$*, the critical threshold is strictly increasing in autonomy.*

The theorem is a frozen-autonomy local-stability result: it characterizes the autonomous system obtained by holding the autonomy level fixed. It therefore provides an age-related benchmark when autonomy changes gradually, rather than a stability theorem for an arbitrary time-varying autonomy path. The mechanism is nevertheless transparent. Increasing autonomy weakens the transmission from parental access to effective grandparent-grandchild access. When the grandchild becomes fully autonomous, current parental gatekeeping can no longer destabilize the symmetric relationship through the access channel modeled here. For baseline parental access of at least one half, the frozen-autonomy threshold is nondecreasing in autonomy and is strictly increasing once autonomy is positive (strict throughout when baseline access exceeds one half). Accordingly, the model does not characterize stability or life-course dynamics for rapidly changing autonomy paths; such nonautonomous transitions require a separate analysis.

Corollary **1 (*Inherited Closeness after Full Autonomy*).** *Suppose full autonomy is reached at age* T_a*, so that* $s(t)=1$ *for* $t \ge T_a$*. Then any closeness difference inherited at that date satisfies*

$$G_1(t)-G_2(t)=\left[G_1(T_a)-G_2(T_a)\right]\mathrm{e}^{-\delta(t-T_a)},\ t \ge T_a.$$

Hence earlier gatekeeping can continue to shape observed closeness after parental control of current access has disappeared, but in the present model the inherited difference decays over time rather than remaining permanently.

This corollary is important conceptually. Independence does not erase relational history instantaneously. Two young adults who acquire the same direct access to a grandparent can enter adulthood with different stocks of accumulated closeness because their childhood opportunities differed. The model therefore generates path dependence over a transitional horizon without assuming that an early disadvantage must persist forever. Permanent persistence would require an additional mechanism, such as state-dependent reciprocity or habit formation, and is left for future work.

7. Numerical Analysis

The numerical analysis illustrates the reduced-form adaptive mechanisms in Sections 5 and 6. The simulations are not presented as solutions to the full endogenous-access optimal-control problem; they trace trajectories and stationary solutions of the adaptive differential system. The benchmark parameters are

Parameter	Value	Interpretation
q	0.80	productivity of access in closeness accumulation
δ	0.30	relational depreciation
η	0.40	restoration toward baseline access
$\bar{A}$	0.60	baseline access

For these values,

$$\kappa_c = 0.2604.$$

7.1. Stable Symmetric Relationships

Figure 2 sets $\kappa = 0.18 < \kappa_c$ and introduces a small initial asymmetry. The two closeness trajectories converge. Hence an initially more developed relationship does not produce permanent inequality when parental access reacts only weakly to the observed gap.

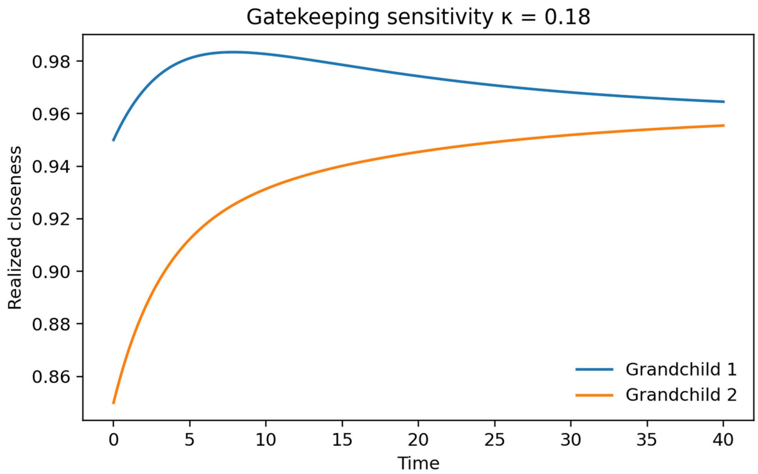

Figure 2. Stable convergence below the gatekeeping-sensitivity threshold.

7.2. Amplification above the Threshold

Figure 3 sets $\kappa = 0.45 > \kappa_c$. The same small initial asymmetry is amplified: the relationship that begins slightly ahead receives progressively greater effective access, while the other relationship loses access and closeness. Importantly, the grandchildren remain equally valued in the underlying objective.

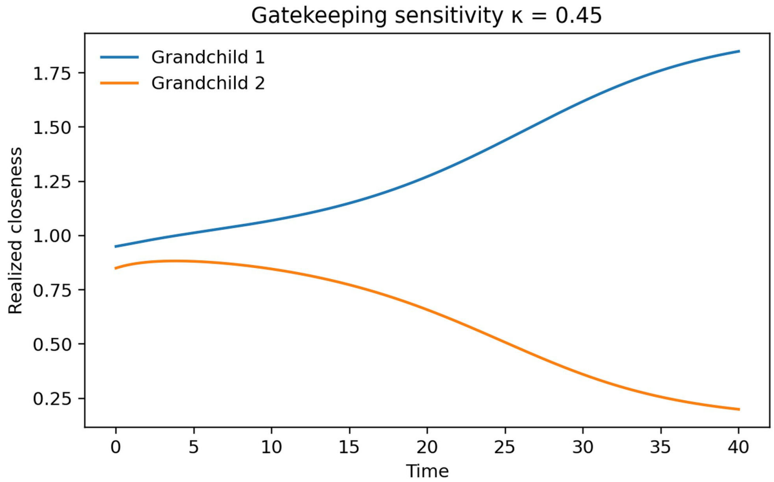

Figure 3. Amplification of a small relational asymmetry above the threshold.

7.3. Emergence of Asymmetric Steady States

Numerical solution of the stationary conditions over a grid of gatekeeping-sensitivity values reveals a symmetric branch and, beyond the analytical stability threshold, two mirror-image asymmetric branches. Figure 4 shows the steady-state closeness gap as κ varies. The resulting solution pattern is consistent with symmetry breaking: either grandchild can become the relatively closer one, even though the model is ex ante symmetric.

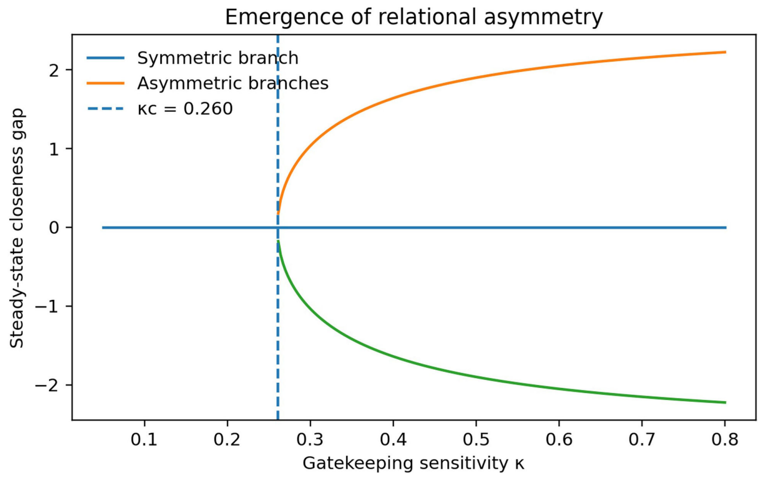

Figure 4. Numerical stationary solutions for the steady-state closeness gap as gatekeeping sensitivity varies.

Figure 4 should be interpreted as a numerical complement to Theorem 1 rather than as an additional analytical bifurcation theorem. The stationary conditions were solved over a parameter grid. The appearance of mirror-image asymmetric solution branches is suggestive of symmetry breaking, but a formal classification of the local bifurcation would require a higher-order expansion around the critical threshold.

7.4. Autonomy and the Gatekeeping Threshold

Figure 5 illustrates Theorem 2 using the benchmark parameters above. As autonomy rises, the critical gatekeeping sensitivity increases: a stronger parental response is required to destabilize symmetric closeness. The curve steepens as full autonomy is approached because the transmission from parental access to effective access vanishes.

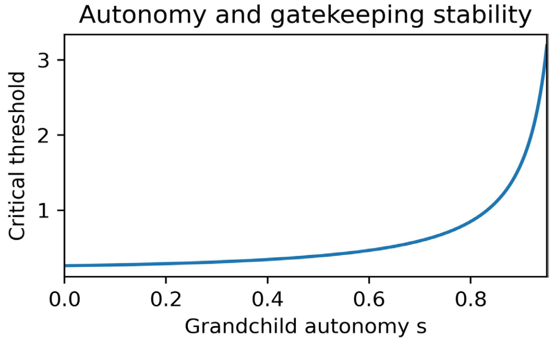

Figure 5. Increasing autonomy raises the gatekeeping-sensitivity threshold.

8. Discussion and Implications

The model separates three concepts that are often conflated in family interpretation: affection, effort, and realized closeness. Affection enters through the primitive relational valuation ω_i; effort is the grandparent's costly choice u_i; and realized closeness is the accumulated state G_i. Because the productivity of effort depends on access and reciprocity, equal affection need not generate equal effort or equal closeness.

This distinction has an important interpretive implication. A family member who observes that a grandparent speaks more often with, spends more time with, or knows more about one grandchild may infer unequal affection. Proposition 1 shows that the observed closeness outcome alone cannot distinguish unequal affection from unequal relational opportunity: both mechanisms can generate the same pattern. This is a statement of theoretical observational equivalence, not an empirical causal-identification result.

The intervening-parent result adds a second layer. The parent-child-in-law relationship can function as a relational multiplier. When that relationship is good, routine contact, invitations, information, and inclusion can make grandparental effort more productive. When the relationship is strained, the same amount of desired effort may produce less realized closeness. This mechanism is consistent with prior evidence that offspring and in-law relationships matter for grandparents' ties to grandchildren (Fingerman, 2004).

The reduced-form endogenous-gatekeeping extension adds a more subtle possibility: perceived favoritism can become self-confirming. If a parent responds to a relatively weaker grandparent-grandchild relationship by reducing access, the reduced access can weaken that relationship further. The resulting closeness gap may then appear to validate the original belief that the grandparent preferred the other grandchild. Theorem 1 shows precisely when such feedback is locally destabilizing within the adaptive system. The result is a mechanism result, not a claim that the grandparent optimally anticipates the future gatekeeping response.

The age extension adds a life-cycle qualification to the gatekeeping result. Parental mediation can be especially consequential when grandchildren depend on parents for access. As autonomy grows, the direct channel between grandparent and grandchild becomes more important and the destabilizing power of gatekeeping weakens. Yet autonomy does not reset the relationship: closeness accumulated, or not accumulated, earlier remains part of the initial condition for the next life stage. This prediction is consistent with longitudinal evidence that earlier grandparent-grandchild closeness is associated with later closeness even as young adults gain greater control over the relationship (Monserud, 2010).

The model also suggests an intervention principle. When relational inequality reflects access rather than underlying preference, demanding equal observed closeness may be ineffective. A more direct intervention is to improve the channels that produce closeness: access, opportunities for interaction, reciprocal communication, and the relationship between the grandparent and the middle generation. In the model, increasing η, the speed at which access returns toward a cooperative baseline, raises the critical sensitivity threshold and makes symmetric relationships more robust.

9. Conclusion

This paper develops a dynamic model of grandparent-grandchild closeness in which observed relational inequality need not originate in unequal affection. In the baseline optimal-control model, a grandparent who values grandchildren equally can nevertheless develop different relationships because relational investment is more productive where access and reciprocity are greater. The quality of the relationship with the intervening parent or child-in-law can further shape closeness by mediating access. A separate reduced-form adaptive extension shows how feedback from perceived closeness to parental access can either correct or amplify small initial differences depending on gatekeeping sensitivity. Extending that adaptive system over the life course shows that increasing grandchild autonomy weakens the gatekeeping channel and ultimately removes its effect on current access, while earlier relational differences remain temporarily embedded in the stock of closeness.

The central message is therefore simple but consequential: observed differences that appear to reflect favoritism need not imply unequal underlying affection. The same observed closeness pattern can arise from unequal relational opportunities generated within a dynamic family system. Future work could allow the grandchild to choose reciprocal engagement strategically, allow the parent to optimize gatekeeping behavior, distinguish maternal and paternal lineages, and test the model using longitudinal family data.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix A. Proofs

Proof of Proposition 1

For each grandchild *i*, the current-value Hamiltonian is

$$\mathcal{H}_i = \omega_i G_i - \frac{c}{2} u_i^2 + \lambda_i \left(\alpha_i A_i R_i u_i - \delta_i G_i \right).$$

The first-order condition for an interior optimum is

$$\frac{\partial \mathcal{H}_i}{\partial u_i} = -c u_i + \lambda_i \alpha_i A_i R_i = 0,$$

so that

$$u_i = \frac{\lambda_i \alpha_i A_i R_i}{c}.$$

The current-value costate equation is

$$\dot{\lambda}_i = \left(\rho + \delta_i \right) \lambda_i - \omega_i.$$

The bounded infinite-horizon solution satisfying the transversality condition is constant:

$$\lambda_i^* = \frac{\omega_i}{\rho + \delta_i}.$$

Substitution into the first-order condition yields

$$u_i^* = \frac{\alpha_i A_i R_i \omega_i}{c\left(\rho + \delta_i \right)}.$$

At a steady state, $\dot{G}_i = 0$, hence

$$G_i^* = \frac{\alpha_i A_i R_i}{\delta_i} u_i^* = \frac{\alpha_i^2 A_i^2 R_i^2 \omega_i}{c \delta_i \left(\rho + \delta_i \right)}.$$

Therefore equal values of ω_i do not imply equal u_i^* or G_i^* when access or reciprocity differs. This proves the proposition.

Proof of Proposition 2

Using Proposition 1 and $A_i\left(D_i\right) = A_0 + \beta D_i$,

$$G_i^*\left(D_i\right) = \frac{\alpha_i^2 R_i^2 \omega_i}{c \delta_i \left(\rho + \delta_i \right)} \left(A_0 + \beta D_i \right)^2.$$

Differentiating gives

$$\frac{\partial G_i^*}{\partial D_i} = \frac{2 \alpha_i^2 R_i^2 \omega_i \beta \left(A_0 + \beta D_i \right)}{c \delta_i \left(\rho + \delta_i \right)} > 0.$$

A second differentiation yields

$$\frac{\partial^2 G_i^*}{\partial D_i^2} = \frac{2 \alpha_i^2 R_i^2 \omega_i \beta^2}{c \delta_i \left(\rho + \delta_i \right)} > 0.$$

Thus steady-state closeness is increasing and convex in the quality of the intervening-parent relationship under the linear access specification.

Proof of Theorem 1

At the symmetric steady state,

$$A_1^* = A_2^* = \bar{A}, \; G_1^* = G_2^* = \frac{q\bar{A}^2}{\delta}.$$

Consider asymmetric perturbations

$$g = G_1 - G_2, \; a = A_1 - A_2.$$

Linearizing the difference system around the symmetric steady state gives

$$\begin{pmatrix} \dot{g} \\ \dot{a} \end{pmatrix} = \begin{pmatrix} -\delta & 2q\bar{A} \\ 2\kappa\bar{A}\left(1-\bar{A}\right) & -\eta \end{pmatrix} \begin{pmatrix} g \\ a \end{pmatrix}.$$

The trace is

$$-\left(\delta + \eta\right) < 0,$$

and the determinant is

$$\Delta = \delta\eta - 4q\kappa\bar{A}^2\left(1-\bar{A}\right).$$

The asymmetric subsystem is locally asymptotically stable if and only if $\Delta > 0$, which is equivalent to

$$\kappa < \frac{\delta\eta}{4q\bar{A}^2\left(1-\bar{A}\right)} \equiv \kappa_c.$$

At $\kappa = \kappa_c$, the determinant is zero and one eigenvalue is zero. For $\kappa > \kappa_c$, the determinant is negative, so the two eigenvalues have opposite signs and the symmetric steady state is unstable to asymmetric perturbations. Symmetric perturbations remain stable because the corresponding linearized block has eigenvalues $-\delta$ and $-\eta$. Hence the full symmetric steady state is locally asymptotically stable precisely when $\kappa < \kappa_c$.

Proof of Theorem 2

For fixed s, let $\bar{B} = s + (1-s)\bar{A}$. Around the symmetric steady state define $g = G_1 - G_2$ and $a = A_1 - A_2$. Since $B_1 - B_2 = (1-s)a$, linearization gives

$$\begin{pmatrix} \dot{g} \\ \dot{a} \end{pmatrix} = \begin{pmatrix} -\delta & 2q\bar{B}(1-s) \\ 2\kappa\bar{A}\left(1-\bar{A}\right) & -\eta \end{pmatrix} \begin{pmatrix} g \\ a \end{pmatrix}.$$

The trace is $-\left(\delta + \eta\right) < 0$ and the determinant is

$$\Delta_s = \delta\eta - 4q\kappa\bar{B}(1-s)\bar{A}\left(1-\bar{A}\right).$$

Hence local asymptotic stability is equivalent to $\Delta_s > 0$, yielding $\kappa < \kappa_c(s)$. Because $(1-s)\bar{B} \to 0$ as $s \to 1$, $\kappa_c(s) \to \infty$. Finally,

$$\frac{\mathrm{d}}{\mathrm{d}s}\left[(1-s)\bar{B}\right] = 1 - 2\bar{A} - 2s\left(1-\bar{A}\right).$$

If $\bar{A} \geq 1/2$, this derivative is strictly negative for $s > 0$ (and nonpositive at $s = 0$), so the denominator of $\kappa_c(s)$ decreases and the threshold increases with autonomy.

Proof of Corollary 1

For $t \ge T_a$, full autonomy implies $B_1 = B_2 = 1$. Therefore

$$\dot{G}_i = q - \delta G_i.$$

Subtracting the two equations gives $\dot{g} = -\delta g$. Solving from T_a yields

$$g(t) = g(T_a)\mathrm{e}^{-\delta(t-T_a)},$$

which proves the result.